Trilateral Cooperation Secretariat

UNDRR
UN Office for Disaster Risk Reduction

Trilateral Best Practices Report

Tools and Technologies for Earthquake Risk Management: Sharing Experience from Northeast Asia

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TCS

The Trilateral Cooperation Secretariat (TCS) is an international organization established with a vision to promote peace and common prosperity among the People's Republic of China, Japan, and the Republic of Korea. Upon the agreement signed and ratified by each of the three governments, the TCS was officially inaugurated in Seoul in September 2011.

UNDRR ONEA & GETI

The UNDRR Office in Incheon for Northeast Asia (ONEA) and Global Education and Training Institute (GETI) was established in 2010 with the support of the Ministry of the Interior and Safety of the Republic of Korea and Incheon Metropolitan City to develop a new cadre of professionals in disaster risk reduction and climate change adaptation to build disaster resilient societies. ONEA supports five countries: Republic of Korea, China, Japan, Mongolia and DPR Korea specifically to reduce disaster loss and risk and to ensure Sendai Framework for Disaster Risk Reduction 2015-2030 implementation. GETI has a global mandate to provide capacity building support to mainstream disaster risk reduction and climate change adaptation into sustainable development; convene and support inter-city learning to strengthen resilience; and to provide capacity building and best practice sharing support to national training institutions working on resilience issues. Based in Incheon, the Republic of Korea, UNDRR GETI is also the global secretariat of the MCR2030.

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Preface

Trilateral Cooperation Secretariat

2024 is the landmark year of the 25th anniversary of trilateral cooperation between the People's Republic of China, Japan and the Republic of Korea. With this opportunity, I am delighted to present to you the brochure "Tools and Technologies for Earthquake Risk Management: Sharing Experience from Northeast Asia". It was compiled by Trilateral Cooperation Secretariat (TCS) and UNDRR Office for Northeast Asia and Global Education and Training Institute (UNDRR ONEA & GETI) in collaboration with the National Disaster Reduction Center of China (NDRCC), the Asian Disaster Reduction Center (ADRC) in Japan, the National Disaster Management Research Institute in the ROK, and the National Emergency Management Agency in Mongolia. I am honored to present the second report following the previous "Trilateral Best Practices: Application of Technology for reducing Disaster Risks in China, Japan and Korea" published in 2021. The brochure was created as a follow-up to the workshop held on 2nd August, 2023 organized by TCS and UNDRR ONEA & GETI under the same theme as this brochure. It includes best practices, impacts and results, lessons as well as relevant challenges learned from earthquake experiences in four countries, China, Japan, Korea and Mongolia. This time we invited Mongolia as another earthquake-prone country in Northeast Asia, given the country's increasing focus on earthquake risks, and as part of UNDRR and TCS's efforts to promote exchange of expertise between neighbouring countries.

Due to climate change and urbanization, China, Japan, and ROK have been encountering more threats and challenges caused by disasters. In 2009, the three countries established the Trilateral Ministerial Meeting on Disaster Management (TMMDM). Under the guidance adopted in the meetings, the officials and the experts of government agencies and relevant institutes on disaster management have been exchanging views on cooperative measures to further strengthen the capacities of disaster prevention and reduction. This mechanism of TMMDM can also be regarded as a promotor of “Trilateral+X" cooperation advocated by leaders of the three countries. The governments and societies of the three countries have shared and accumulated plenty of experience and knowledge in disaster prevention and reduction through the TMMDM mechanism. The three countries are now required to reach out to other regions and share experience, learn from each other and further develop the capacities to better implement the ‘Sendai Framework for Disaster Risk Reduction 2015-2030'.

As an international organization established by the governments of China, Japan, and the ROK in 2011, the TCS has been supporting and facilitating the trilateral cooperation mechanisms in various areas among the three countries and beyond. We hope this brochure could further promote the exchange among stakeholders.

Secretary-General of Trilateral Cooperation Secretariat

LEE Hee-Sup

January 2024

United Nations Office for Disaster Risk Reduction

Globally, earthquakes cause the deadliest disasters, accounting for 58% of the total deaths from natural hazards between 2000-2019. Asia and the Pacific is the world's most seismically active region, with Northeast Asia alone exceeding USD403 billion in related economic losses over the last 20 years.

The Political Declaration of the High-Level Meeting on the Midterm Review of the Sendai Framework for Disaster Risk Reduction 2015-2030, adopted by the UN General Assembly in May 2023, notes the instrumental role that science, technology and innovation play in preventing and reducing disaster risk. It also calls for greater cooperation and enhanced technology transfer, as well as the exchange of experiences and good practices between countries to improve the understanding of risk, strengthen disaster risk governance and enhance disaster preparedness.

The countries of Northeast Asia have amassed considerable expertise in disaster risk reduction and have developed some of the most advanced and innovative solutions for earthquake risk management. Their experiences clearly demonstrate that technology can play a critical role in all areas of disaster risk reduction - from understanding and assessing risk, to protecting critical infrastructure and to ensuring the dissemination of early warning messages to populations at risk.

The report brings together best practices from the People's Republic of China, Japan and the Republic of Korea, in addition to Mongolia, in the spirit of cooperation and knowledge exchange. It is based on the outcomes of a regional online workshop organized by the Trilateral Cooperation Secretariat (TCS) and the United Nations Office for Disaster Risk Reduction (UNDRR) as part of a collaboration between education and training institutes on disaster management. It also builds on the outcomes of the Northeast Asia Leaders Roundtable at the International Disaster Resilience Leaders Forum Incheon 2023, jointly organized by UNDRR, Incheon Metropolitan City, Incheon Institute and the Ministry of the Interior and Safety of the Republic of Korea in cooperation with TCS. The report offers some recommendations for further capacity development for disaster risk reduction in technology application and transfer, particularly in the context of earthquake risk.

I hope these examples will inform and inspire many other countries prone to seismic risk and will contribute to further regional and international collaboration on disaster risk reduction. I cannot stress enough the value of best practice-sharing initiatives, and I would like to thank the Governments of the participating countries and the Trilateral Cooperation Secretariat for their continued efforts to promote cooperation on disaster risk reduction in Northeast Asia and beyond.

Acting Special Representative of the UN Secretary-General for Disaster Risk Reduction

Ms. Paola Albrito

January 2024

Acknowledgements

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Publisher

Trilateral Cooperation Secretariat (TCS)
UNDRR Office for the Northeast Asia & Global Education and Training Institute (UNDRR ONEA & GETI)

The workshop and the preparation of the report were conducted in collaboration with the Ministry of Emergency Management of the People's Republic of China (MEM), the Cabinet Office of the Government of Japan (CAO) and the Ministry of the Interior and Safety of the Republic of Korea (MOIS).

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1. Introduction and Background

On 2 August 2023, the Trilateral Cooperation Secretariat (TCS), UNDRR ONEA & GETI in collaboration with Incheon Metropolitan City and the Ministry of the Interior and Safety (MOIS) of the Republic of Korea, the Asian Disaster Reduction Center (ADRC), and the National Disaster Reduction Center of China (NDRCC) organized the Online Workshop of the CJK[1] Education and Training Institutes on "Tools and Technologies for Earthquake Risk Management: Sharing Experience from Northeast Asia".

The exchange was organized as part of the long-standing trilateral cooperation on disaster management and disaster risk reduction between China, Japan and the Republic of Korea, building on the outcomes of meetings and consultations organized between the three countries since 2017, and more recently on the results of the 7th Trilateral Ministerial Meeting on Disaster Management held in July 2022. The Joint Statement adopted at the 7th Trilateral Ministerial Meeting reaffirmed the three countries' commitment to promote and expand capacity development efforts for disaster risk reduction through a series of joint activities of the three designated education and training institutes on disaster management – NDRCC in China, ADRC in Japan, and UNDRR ONEA & GETI in the Republic of Korea.

The online workshop on "Tools and Technologies for Earthquake Risk Management: Sharing Experience from Northeast Asia" in August 2023 was part of the collaborative efforts of the three education and training institutes to support knowledge sharing among the three countries for capacity development on disaster risk reduction and to promote training opportunities for developing countries.

As 2023 brought several devastating earthquakes globally, the objective of the workshop was to share Northeast Asia's extensive expertise in earthquake risk management with other countries in the region and beyond. The workshop provided an opportunity for disaster risk reduction practitioners around the world to learn about effective practices from China, Japan and the Republic of Korea in earthquake risk reduction. Experts from the three countries shared their latest technologies in earthquake risk assessment and early warning, as well as community-level capacity development and infrastructure resilience measures. The session was joined by the National Emergency Management Agency of Mongolia, which shared its most recent experience as well as capacity development needs in the area of earthquake risk management. Around 550 participants from 83 countries and territories attended the online workshop.

This exchange of best practices served to inform discussions at the International Disaster Resilience Leaders Forum 2023 held in Incheon, Republic of Korea on 18-19 September 2023, which included a roundtable of Northeast Asia Leaders focusing on Earthquake Research and Joint Response Measures in Northeast Asia.

The present report brings together examples of best practices presented at the CJK Education and Training Institutes Online Workshop, along with some recommendations for strengthening earthquake risk management and supporting countries and stakeholders involved in resilience building efforts in the context of earthquake risk. Additional materials and video recordings of the workshop are available online.[2]

[1] China, Japan and the Republic of Korea (CJK).
[2] CJK Online Workshop webpage: https://www.undrr.org/event/undrr-tcs-CJKEarthquake

2. Best Practices from CJK

Best Practices from China

Background

Rapid urbanization has led to the emergence of megacities in China, which account for 24% of the world's megacities (cities with a population exceeding 5 million people). However, due to the absence of major earthquakes in China over the past 40 years, many of these cities have had limited experience in emergency response in the context of earthquakes, and efforts are currently underway to strengthen earthquake disaster preparedness. These case studies introduce China's efforts to assess, predict and mitigate potential casualties, infrastructure damage, and functional losses, while also presenting effective practices for post-disaster assessment and early warning measures in the context of earthquakes. These case studies and new technologies reflect the country's shifting priorities from relief to prevention; from divided efforts to comprehensive preparation; and from reducing damage to addressing risks. These efforts are aligned with a number of national laws, regulations and plans governing disaster risk management in China, including the Emergency Response Law of the PRC; the Regulation on the Relief of National Disasters (2019 Revision); the National Emergency System Plan for the 14th Five Year Plan (2021-2025); and the National Comprehensive Disaster Prevention and Reduction Plan for the 14th Five Year Plan (2021-2025).

Case Study 1: Virtual Digital City and Urban Seismic Resilience[3]

Good Practice

The Institute of Engineering Mechanics within the China Earthquake Administration is currently engaged in the development of an urban earthquake disaster simulation platform called YouSimulator. This platform is designed to provide a comprehensive understanding of the damage mechanisms in the event of a disaster on a city-level, particularly with respect to the interconnected engineering systems within cities that manage critical infrastructure facilities. YouSimulator employs advanced automatic physics-based nonlinear modeling and modern scalable simulation techniques to assess and visualize the seismic behavior of cities. Notably, this innovative approach employs digital twin technology along with disaster scenario construction, offering advanced capabilities in model generation, computational efficiency, and accuracy. The platform comprises five fundamental modules: automatic modeling, response computation, results analysis, 3D visualization, and fire spread. YouSimulator is capable of delivering detailed seismic responses for large Chinese cities. Its practical applications include rapid damage evaluation for earthquake emergency responses, earthquake disaster scenario simulations, shelter planning for new urban developments, and path planning for emergency rescue operations.

Stakeholders

China Earthquake Administration, local governments, and practitioners

[3] Based on the presentation made by Mr. Tao WANG, Deputy Director-General, Researcher of the Institute of Engineering Mechanics, China Earthquake Administration. Reviewed by Mr. Tao WANG and Mr. Xuchuan LIN.

Impacts and Results

The simulation platform has successfully integrated digital-physical hybrid twin technology to tackle the complexities of earthquake disaster management in China's large cities. This technology significantly contributes to urban disaster prevention planning, urban renewal projects, and effective disaster emergency management, leading to resilient cities.

Lessons Learned

- **Success Factors**
    - The success of the simulation platform in modeling, assessing, and visualizing earthquake disasters at the city level can be attributed to a combination of factors. These factors include key data acquisition, the establishment of seismic reliability analyses of infrastructure networks, and their incorporation into urban earthquake disaster simulations. The platform has been verified using earthquake disaster data and has demonstrated its robustness by accurately portraying building damage states and global damage indexes through simulation when compared to real field surveys.
- **Challenges**
    - Cities in China have evolved into complex urban environments, characterized by dense populations, diverse and intensive infrastructure, and buildings of varying ages with different levels of disaster resilience. One of the major challenges lies in accurately modeling these intricate urban factors and integrating them with numerical simulation techniques to reproduce the disaster development of complex city systems.

Future Development

Further development efforts will be focused on enhancing the completeness of urban data and addressing the interdependence among city engineering systems. The ultimate goal is to create a comprehensive digital twin of a city, thereby elevating the accuracy of simulations. However, gathering urban data remains a challenge due to its distribution across various city departments, complicating the task of completing the database. Detailed data is essential for calibrating various assessment methods within the simulation. Furthermore, there is a need to enhance the analysis of seismic reliability in infrastructure networks, such as water supply systems, to accurately represent the interdependencies within the city engineering systems in the simulation. These enhancements will transform the platform into a promising tool for large-scale simulations, ultimately bolstering earthquake resilience assessments in urban areas and cities.

Potential for Replication

The urban earthquake disaster simulation platform has undergone verification and calibration using a wide range of earthquake disaster data from around the world. This includes data from a series of earthquakes in Christchurch, New Zealand, between 2010 and 2011, the Ludian Earthquake in 2014, the Yangbi earthquake in 2021, etc. Expanding the application of this simulation to other disaster-prone regions is feasible by incorporating new urban data to ensure accurate replication and scalability. This will enable other regions to establish effective disaster preparedness measures.

Case Study 2: Earthquake Disaster Loss Assessment[4]

Good Practice

To support earthquake loss assessment and ensure effective emergency response following earthquakes, China has developed a two-level Earthquake Losses Assessment System, which includes rapid assessment of earthquake losses, and a comprehensive loss assessment.

- **Losses Rapid Assessment:** This type of rapid assessment combines intensity zone generation (V degree and above); seismic zone information (natural and socio-economic conditions and historical earthquake data); and damage assessment (house collapse, casualties, etc.).

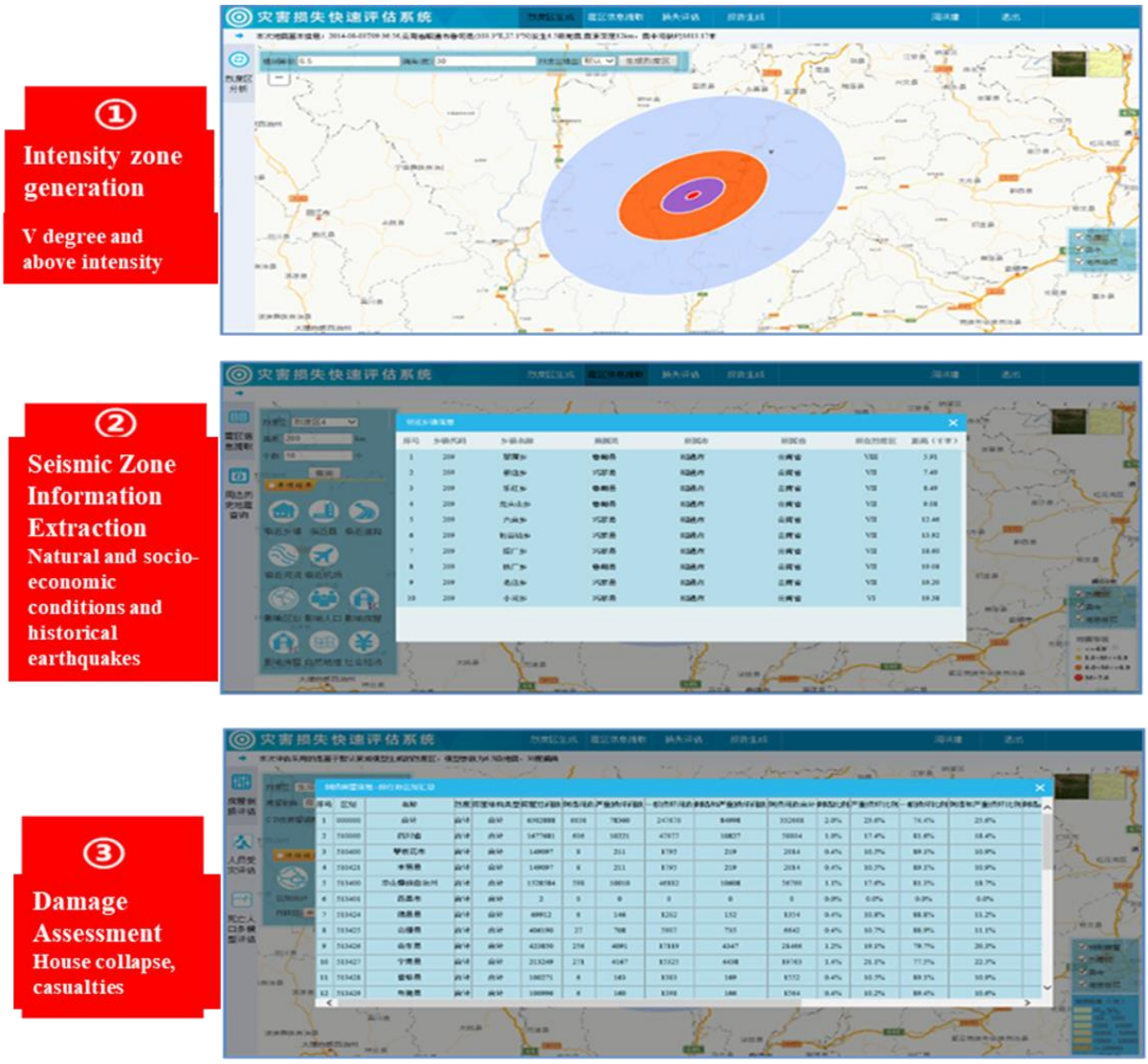

Figure 1: Losses Rapid Assessment

- **Losses Comprehensive Assessment:** This type of comprehensive assessment encompasses Disaster Scope Assessment, Damaged Physical Quantity Assessment and Direct Economic

[4] Based on the presentation made by Mr. Wei WU, Director of the Disaster Assessment Department of the National Disaster Reduction Center of China.

Loss Assessment. The Disaster Scope Assessment takes the assessment unit as the basic unit and selects key indicators to construct comprehensive disaster indices. It then divides a disaster-stricken area according to the varying intensities of the earthquake in the area, with the help of the comprehensive disaster indicators. The Damaged Physical Quantity Assessment makes full use of various methods, such as on-the-spot investigation, empirical models, local statistics reports, and remote sensing interpretation, to assess the damaged physical quantities like damaged houses, crops losses, industrial losses, and infrastructure losses. The Direct Economic Loss Assessment is based on the physical quantity loss assessment, integrating the disaster loss data reported by local governments, to calculate the direct economic loss through the unit replacement cost for individual disaster-affected entities such as houses, roads, etc.

县（市、区）	行政区划代码	一、农村家庭财产				
		受灾家庭户数	受损生产性固定资产经济损失	受损耐用消费品经济损失	受损其他财产损失	农村家庭财产损失小计
		（户）	（万元）			
		01	02	03	04	05

Figure 2: Direct Economic Loss Assessment

- **Verification and Evaluation:** After the disaster, on-site investigations are carried out to assess the actual loss caused by the earthquake according to the reported loss statistics. Comprehensive use of various assessment methods is made to evaluate the losses (number of collapsed and damaged houses, infrastructure loss, crop loss, public service facilities loss, direct economic loss, etc.).

Stakeholders

State Council, Ministry of Emergency Management, National Disaster Reduction Center of China, local governments, emergency management departments/bureaus, and local communities, etc.

Impacts and Results and Lessons Learned

The systematic evaluation of losses following earthquakes has effectively prevented major safety risks and minimized casualties and property losses caused by disasters. Comprehensively summarizing the experience and lessons of disaster response activities from disasters that occurred before, can promote the completion of shortcomings in relevant legal systems and mechanisms, support relevant parties to better implement disaster prevention and control responsibilities, and improve the comprehensive prevention capabilities of the whole society against earthquake disasters.

It has also enabled efficient resource allocation and effective response efforts. By focusing on early-stage earthquake effects, core impacted areas, and the well-being of people and buildings, China has

improved its disaster management. The accessibility of evaluation results by relevant stakeholders encourages transparency, collaboration, and better-informed decision-making, ultimately leading to more resilient communities.

Challenges and Future Development

- **Improve the workflow and technical specifications for earthquake disaster assessment.** To meet the actual needs of emergency management, optimize the technical process to improve the accuracy and timeliness of earthquake loss assessment. Improve the technical standards for earthquake disaster loss assessment.
- **Strengthen the research on earthquake disaster loss assessment methods.** Strengthen the research on loss assessment methods caused by earthquake geological disaster chains. Continuously expanding the indicators for earthquake disaster assessment and enhancing research on indirect loss assessment of earthquake disasters.
- **Strengthen the construction of the loss assessment system and supporting data.** Promote the construction and improvement of earthquake disaster loss assessment system, and improve the automation, intelligence, and visualization level of earthquake disaster loss assessment products and services. Improve the ability to obtain data from remote sensing, networking, on-site investigations, and other related fields, and ensure the stability of system operation.

Potential for Replication

Earthquake management strategies implemented in China offer a potential model for replication in other earthquake-prone regions worldwide. The standardized assessment techniques, comprehensive disaster management approach, and advancements in technology can be adapted and scaled to suit different contexts. Investment in research, technology, and data infrastructure is essential for successful replication and scaling, making it possible for other regions to enhance their disaster management capabilities and increase resilience.

Case Study 3: Early Warnings for All MHEWS Makes a Safer World[5]

Good Practice

Institute of Care-Life, China (ICL) has developed an earthquake early warning (EEW) and Multi-Hazard Early Warning (MHEW) system, which offers rapid and accurate alerts for various disasters, including earthquakes, landslides, and more. The EEW Network, developed from 2010 to 2014, covers an area of 2.4 million square kilometers and will expand along the Sichuan Tibet Railway line in 2021. It comprises 85,000 monitoring stations covering an area of 2.4 million square kilometers, detecting and providing alerts for earthquakes and reaching 90% of the population in earthquake-prone regions. ICL established a multi-disaster early warning technology system based on more than 40 data sources from the atmosphere, on land, and underground. China also shares its technology with other countries and organizations, such as Indonesia, Türkiye, and UNESCO.

Stakeholders

Institute of Care-Life, China (ICL), China Chengdu Research Center of EEW, the China Earthquake Administration (CEA)

[5] Based on the presentation made by Mr. Tun WANG, Director, Institute of Care-Life, China (ICL).

Impacts and Results

On July 16, 2020, at around 6:00 p.m., a landslide occurred in Queshe Village, Huofeng Township, Gaoping District, Nanchong City, with a successful early warning issued 24 hours in advance. Moreover, on September 5, 2022, a 6.8 magnitude earthquake warning was issued in Sichuan, Yunnan, Chongqing, and Shaanxi, with alerts sent to mobile phones and through TV channels, with over 40 million people receiving the warning for emergency evacuation. Early warning was also provided to the Xichang Satellite Launch Center, Chengdu Railway Bureau, nuclear reactor, Chengdu Metro, and other major projects.

Lessons Learned

- **Success Factors**
    - The core technology of the earthquake warning system is internationally advanced. The ability to transmit warning information through various channels, including television, mobile phones, and dedicated receiving terminals, is a key success factor in reaching a wide audience quickly.
- **Challenges**
    - One challenge is to continuously expand the coverage of the early warning system to ensure all areas prone to disasters are adequately protected. Furthermore, maintaining the stability and reliability of the system, especially during large-scale disasters, is an ongoing challenge.

Future Development

Future development efforts should focus on optimizing workflow and technical specifications to increase the accuracy and timeliness of alerts. The capacity of the system should also be expanded in the delivery of warnings and data collection. International cooperation with various countries as well as international organizations should be further strengthened.

Potential for Replication

ICL's EEW and MHEW system presents a model that can be replicated in other regions prone to disasters. The use of advanced technology, international collaboration, and a comprehensive network of monitoring stations can be adapted to create effective early warning systems in various parts of the world, potentially saving lives and reducing the impact of disasters.

Best Practices from Japan[6]

Background

Japan is located on four tectonic plates and is one of the countries at high risk of earthquakes. In the history of Japan, several tragic earthquakes occurred, such as the 1923 Great Kanto Earthquake, the 1946 Showa-Nankai Earthquake, the 1995 Great Hanshin-Awaji Earthquake, and the 2011 Great East Japan Earthquake. Furthermore, Japan is at risk of large-scale disasters in the future, such as the Tokyo Inland Earthquake which could occur in the Kanto region including Tokyo, and the Nankai Trough Earthquake which will hit in the Pacific coastal area of Japan. Therefore, Japan has developed many kinds of laws and regulations related to disaster risk reduction (DRR). For example, the first law on disaster reduction "Basic Act on Disaster Management" was enacted in 1961. Then, the "Basic Disaster Management Plan", which is the master plan and the basis of DRR activities in Japan, was also established in 1963. It is prepared by the Central Disaster Management Council in accordance with the "Basic Act on Disaster Management". The "Basic Disaster Management Plan" clarifies the duties of the central government, public corporations, and local governments regarding implementing measures.

In addition to disaster laws, various disaster countermeasures are being taken in Japan. This includes the J-Alert System (Nationwide Warning System) and community based DRR activities.

Case Study 4: Information Sharing - National Early Warning System (J-Alert)

Good Practice

For the appropriate evacuation at the time of disaster, it is important that accurate information be promptly shared to residents. The Fire and Disaster Management Agency in cooperation with local governments is promoting the development of a nationwide instantaneous warning system, named "National Early Warning System (J-Alert)". "J-Alert" transmits emergency information such as earthquake early warnings, tsunami warnings, and weather warnings to local governments of Japan. This system is an instant transmission information system to residents without human intervention. Although there are many routes for the transmission of information via local governments, J-Alert information distributed from the national government to mobile phone companies is now also transmitted to individual mobile phone users via e-mail (Area mails/ Emergency mails). In addition, community radio systems installed at local level are automatically activated to instantly transmit emergency information in case of urgent matter.

[6] Based on the presentations made by Mr. Makoto IKEDA, Senior Researcher, Asian Disaster Reduction Center (ADRC), Japan.

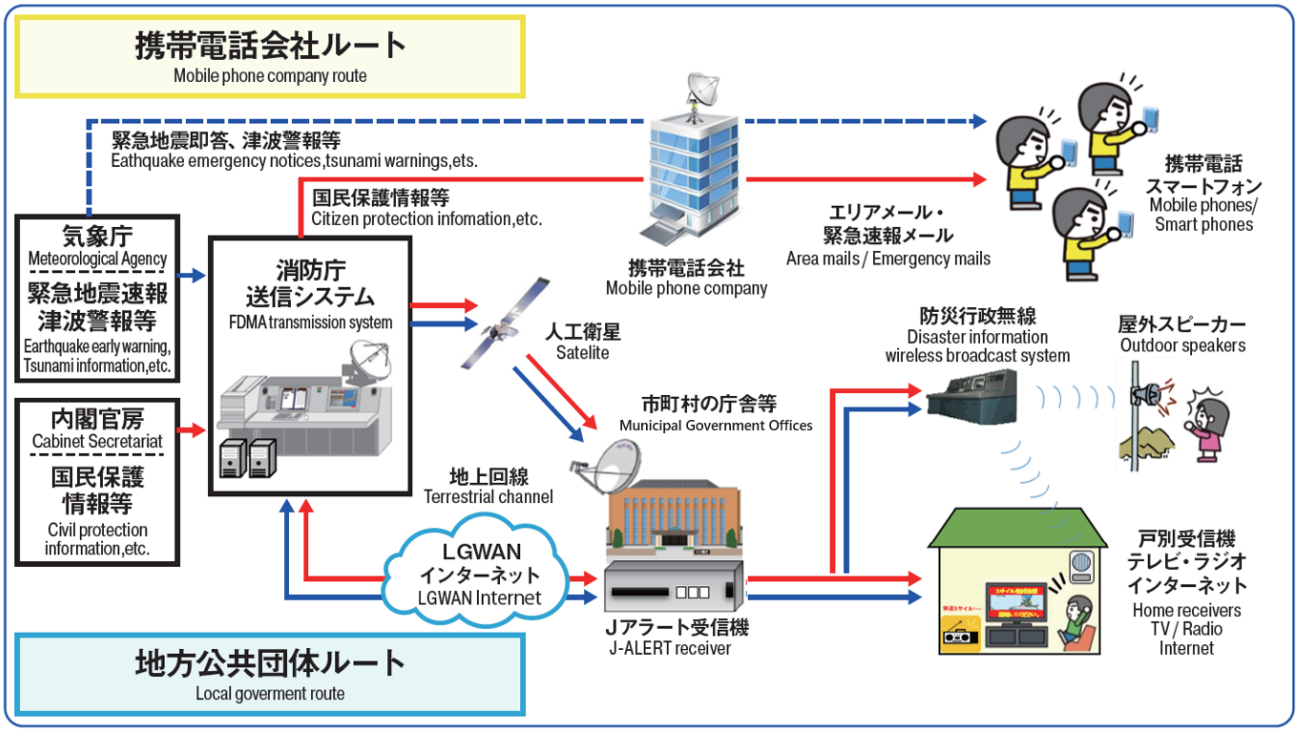

Figure 3: Structure of the National Early Warning System (J-Alert)

Stakeholders

Meteorological Agency, Cabinet Secretariat, Fire and Disaster Management Agency (FDMA), Mobile phone company, and municipal governments offices

Impacts and Results

The use of J-Alert in the Great East Japan Earthquake demonstrated its effectiveness as follows;

- In the chaotic situation right after the main earthquake, J-Alert automatically activated the Disaster Prevention and Management Radio to broadcast the first report of the major tsunami warning, which was extremely effective in helping residents to evacuate.
- The J-Alert system automatically transmitted the tsunami warning via Disaster Prevention and Management Radio and internal broadcasts, enabling the Disaster Control Headquarters to smoothly guide evacuation staff and save the lives of residents.
- The first report of the tsunami warning was automatically broadcasted by J-Alert, and some residents said that they immediately recognized the unusual situation because of the unusual voice.

Lessons Learned

- **Success Factors:** During the Great East Japan Earthquake in 2011, despite the chaotic situation of an unprecedented disaster where it was difficult to grasp the situation, the system of automatic emergency information dissemination was of great help for prompt initial response.
- **Challenges:** In several Asian countries, there are already established disaster information systems in case of disasters. However, large-scale disasters sometimes cross national borders, and it is necessary to consider collecting and providing disaster information among neighboring countries.

Future Development, and Potential for Replication

While J-Alert is a system developed for use in Japan, its institutional setup and modus operandi may be instrumental in planning emergency information and communication systems in other countries.

For further information

J-Alert Overview (only in Japanese): https://www.fdma.go.jp/about/organization/post-18.html

Case Study 5: DRR Activities at Community Level in Hirono-Town of Iwate Prefecture

Good Practice

In Hirono-Town of Iwate prefecture, which was affected by the Great East Japan Earthquake in 2011, DRR activities are actively promoted at the community level. For example, disaster drills are conducted in cooperation with the local government, fire department, police, and residents. These DRR activities are not limited to Hirono-Town, but implemented in many municipalities in Japan that faces the challenges of aging population. Hirono-Town has developed its own hazard maps and evacuation routes to help as mutual support in case of disasters. DRR activities that take account of the past disaster experiences and geographic features of each municipality are important to reduce the damage of disasters.

Photo: Evacuation route in Hirono-Town, Japan

Stakeholders

Iwate prefecture, Hirono-Town, and residents

Impacts and Results

Due to sufficient DRR activities before the Great East Japan Earthquake, there were no fatalities in Hirono-Town during the 2011 disaster.

Lessons Learned

Resident-led disaster reduction activities during normal times were effective enough in actual disasters.

- **Success Factors:**
  - Cooperation with local government
  - Disaster prevention activities were conducted not only by residents, but also in cooperation with firefighters and police officers
  - Local hazard maps were prepared, and residents were familiar with the evacuation sites
- **Challenges:**
  - The population of the Hirono-Town is rapidly aging
  - It is important to ensure mutual support of citizens in the event of a disaster

Future Development

Disaster risk reduction activities will be continuously promoted at community level. Another priority will be to pass on the experience of the Great East Japan Earthquake to the next generation.

Potential for Replication

Community Based Disaster Risk Management (CBDRM) activities are being promoted not only in Japan but also in Asia and other countries around the world. Many of these activities are based on local characteristics including geographic features. Therefore, there are many things to learn from the case of Hirono-Town which experienced the Great East Japan Earthquake. Also, information sharing with other communities is an effective way to strengthen understanding of risk and share good practices in DRR.

For further information

Report of the Great East Japan Earthquake and Tsunami in Hirono-town (only in Japanese): https://iwate-archive.pref.iwate.jp/wp/wp-content/uploads/2017/02/R0000106M011R0000001.pdf

Box 1: Public awareness and capacity building measures in Japan

Disaster knowledge and experience must be passed on to the next generation. The use of museums is an effective way to do this. The following is a list of representative disaster institutions and museums in Japan.

1) *Disaster Reduction and Human Renovation Institution*

   It was established in Kobe city of Hyogo prefecture in April 2002. The purpose is to spread the story of the vital phase of local history and ensure that the lessons of the Great Hanshin-Awaji Earthquake in 1995. Visitors can view films, exhibits, and talk to a storyteller to learn about DRR. (https://www.dri.ne.jp/en/)

2) *Nojima Fault Preservation Museum*

   It was established in Awaji-island of Hyogo prefecture, in 1998. Visitors can observe various topographical changes caused by faults. (https://www.nojima-danso.co.jp/nojima/)

3) *Ruins of the Great East Japan Earthquake Kesennuma City Memorial Museum*

   It was established in Kesennuma city of Miyagi prefecture, in March 2019. The goal of this museum is to preserve the memories and lessons from the Great East Japan Earthquake in 2011. (https://www.kesennuma-memorial.jp/english/)

Best Practices from the Republic of Korea

Background

The Republic of Korea, located in a zone with low seismic risk, has long been considered as safe from earthquakes. However, historical records show that there were earthquakes even during the Joseon Dynasty. Recent earthquakes in Gyeongju in 2016 and Pohang in 2017 created disruption and underscored the vital importance of effective earthquake management strategies in the country. In response to this seismic activity, Korea has been reevaluating its earthquake preparedness measures and refining its seismic response strategies. The seismic vulnerabilities exposed by the Gyeongju and Pohang earthquakes have led to the development of seismic risk assessment and hazard detection technologies. Through these advancements, Korea aims to strengthen its resilience in the face of future seismic events, acknowledging that earthquake management is an evolving field demanding continuous innovation.

Case Study 6: Development of Earthquake Risk Assessment Technology and Establishment of Earthquake Disaster Prevention Measurements in Korea[7]

Good Practice

Sejong University and several universities are collaborating to develop the Earthquake Risk Assessment technology. This collaborative initiative, taking place from 2022 to 2025, is centered around the advancement of a new earthquake risk assessment framework, which is based on the understanding that earthquake disaster risk management must consider two elements: earthquake risk and institutional and societal capability. The initiative involves the creation of a comprehensive "Map of Probabilities of Building Collapse" targeting key areas within Pohang City, which experienced an earthquake in 2017. This map represents regions with varying degrees of risk, allowing for easy identification of high-priority areas. In addition to identifying risk-prone areas and assessing infrastructure resilience, the indicator-based framework seeks to assess institutional capacities for disaster risk reduction, response, population protection and recovery capacity.

Stakeholders

Stakeholders involved in earthquake preparedness and response in Korea include government officials, policymakers, emergency responders, public safety organizations, and the general public.

Impacts and Results

By assessing risk, existing disaster prevention measures, and community vulnerability, the new earthquake risk assessment framework could shed light on the challenges and limitations of current earthquake preparedness and offer valuable insights into optimizing preventive measures. The ultimate objective of the new earthquake risk assessment framework is to strengthen the resilience of earthquake risk prone areas based on risk assessment results, estimate potential damage in advance, and strengthen institutional and community response capacity accordingly.

[7] Based on the presentation made by Dr. Hye Won KIM, Senior Research Officer, National Disaster Management Research Institute, Republic of Korea.

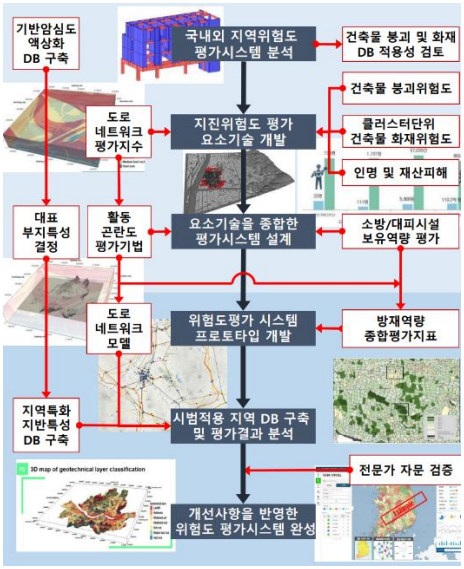

Figure 4: Earthquake Risk Assessment Technology

Capability	Haenam -gun	Miryang -si	Ulsan Buk -gu	Pohang -si	Aver.
C1 : Reduction	34.1	61.6	40.0	80.8	56.1
C2 : Operation management	49.6	59.2	85.4	76.3	67.6
C3 : Protection of the Civilian population	39.5	59.5	75.4	70.5	61.2
C4 : Augmentation of Emergency resources	18.3	66.7	60.8	48.8	48.7
C5 : Recovery	24.2	46.3	45.8	80.0	49.1
Aver.	33.1	58.6	61.5	71.3	

Figure 5: Four regions of Earthquake Capability Assessment in the Republic of Korea

The application of this framework showed that earthquake experience in Pohang-si has led to the enhancement of its response capabilities. The evaluation of earthquake capabilities of four regions in the Republic of Korea across five components (from earthquake risk reduction, operation management, to civilian protection, emergency resources increase and recovery, C1-C5) revealed that Pohang-si's earthquake capability is higher than other regions that have never experienced an earthquake.

Lessons Learned

- **Success Factors**
  - Multi-stakeholder collaboration has been key in ensuring the success of the initiative, by bridging the science-policy divide and bringing together the local government, research institutes and the community.
  - One of the key lessons learned from Korea's earthquake preparedness and response efforts is the importance of community resilience. By involving the community in earthquake preparedness and response efforts, officials can ensure that residents are aware of the risks and know how to respond in the event of an earthquake.
  - Systematic, regular reassessment of risks effectively supports long-term enhancement of earthquake preparedness and response capabilities.

- **Challenges**
    - Precise prediction of the timing and location of earthquakes remains beyond the capabilities of existing scientific tools. As a result, preparedness-oriented strategies remain the main approach to managing seismic risk. Nonetheless, it is important to acknowledge that while preparedness measures can significantly mitigate the impact of earthquakes, they might not be able to safeguard every single property.

Future Development

The future of earthquake emergency management in Korea is focused on leveraging risk assessment to target vulnerable areas, estimating damage based on these assessments, and enhancing response capabilities through core competency analysis. This approach also involves strengthening community resilience and emergency readiness by establishing a regular risk assessment system. Simultaneously, the emphasis on risk assessment continues through community risk evaluations to effectively manage earthquake consequences and reduce overall risk.

Potential for Replication

The methodology and multi-stakeholder approach for developing the earthquake risk assessment framework in the Republic of Korea can be used as a model for countries seeking to strengthen their own earthquake readiness. Advance planning based on comprehensive risk and damage assessment (including institutional and community capacity and preparedness assessment) conducted on a regular basis can effectively support earthquake risk management and improve local resilience.

Case Study 7: Application and Improvement of Post-Earthquake Rapid Inspection Technique and Scheme of Buildings in Korea[8]

Good Practice

In 2013, the Republic of Korea introduced new post-earthquake rapid inspection techniques and related standardized evaluation guidelines for local governments. The rapid inspection technique consists of two phases: the first phase is based on a broad evaluation of external appearances, identification of dangerous conditions and their categorization as safe or in need of further inspection. The second phase involves comprehensive assessments of both interior and exterior aspects of buildings, focusing on structural component damage. After the Pohang earthquake in 2017, these guidelines were revised in 2019 and further improved in 2023, incorporating experiential insights into technological development. The first phase was modified into a checklist format, and the second phase adopted a customized approach considering the structural characteristics for different building structure types such as wooden, steel, reinforced and unreinforced masonry structures.

[8] Based on the presentation made by Dr. Jung Han LEE, Senior Research Officer, National Disaster Management Research Institute, Republic of Korea.

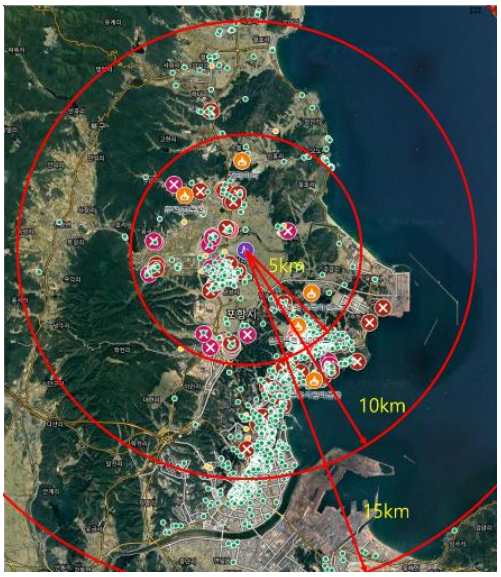

Figure 6: Map of post-earthquake rapid inspection results in 2017 Pohang Earthquake

Stakeholders

Ministry of the Interior and Safety, Local Government, National Disaster Management Research Institute

Impacts and Results

The implementation of comprehensive post-earthquake rapid inspection techniques following recent earthquakes resulted in better building safety evaluation, reduced casualties, and improved disaster response strategies in the Republic of Korea. Local governments, supported by the Ministry of the Interior and Safety, conducted inspections in seismic-hit areas such as Gyeongju and Pohang. In 2016, 1289 buildings were inspected in Gyeongju, leading to 216 restrictions and 63 declared unsafe. In 2017, Pohang saw 2045 inspections, with 135 restricted and 117 declared unsafe.

Lessons Learned

- **Success Factors**
  - Digital recording and advanced seismic detection technology improved earthquake tracking.
  - Multi-phase inspection techniques ensured comprehensive assessment.
  - Collaboration among ministries and institutes expedited response.
  - Regular revision and reinforcement of relevant legislation and guidelines contributed to strengthening local-level risk assessment.
- **Challenges**
  - Lack of experience of large-scale earthquake damage and limited detailed assessment results from historical events makes it difficult to accurately predict damage from a potential large-scale earthquake.
  - Rapid assessments may yield inaccurate results and should therefore be complemented with more advanced in-depth damage assessment techniques.

Future Development

Current research is focused on refining earthquake damage estimation technology by integrating GIS information, building data, and seismic fragility functions. Improved estimation techniques are being developed to predict not only the location of seismic events but also the buildings at risk.

Figure 7: Examples of GIS display screen of earthquake damage estimation results

Potential for Replication

The model of integrating seismic damage estimation technology into disaster response systems could be replicated in other earthquake-prone regions, enhancing preparedness and minimizing casualties.

Box 2: Capacity building tools for earthquake risk management

To support the implementation of the Sendai Framework for Disaster Risk Reduction 2015-2030, several tools have been developed by international stakeholders to help strengthen national and local level capacity for disaster risk reduction and resilience. These tools can also support governments to identify gaps and support disaster risk reduction planning in the context of earthquake risk.

One of the key tools to support local level resilience is the **Disaster Resilience Scorecard for Cities** developed by UNDRR with the support of USAID, European Commission, IBM, AECOM and other partners. This tool offers a set of indicators across key areas of urban planning and governance to help municipalities and other local stakeholders assess their level of resilience and identify gaps in order to inform local disaster risk reduction planning. In addition to the Disaster Resilience Scorecard for Cities, a number of thematic annexes allow to explore certain issues in more depth, such as the resilience of the public health sector, food systems, cultural heritage, or inclusion of persons with disabilities. New thematic tools are also being developed to cover gender and early warning. All these tools offer some indicators that can be useful to consider when assessing the resilience of a city or a specific sector, including in the context of earthquake risk. For example, indicators in the Cultural Heritage Addendum to the Scorecard help to assess the level of resilience of traditional structures and heritage buildings to earthquakes.

A separate **Scorecard for Industrial and Commercial Buildings** developed by the Private Sector Alliance for Disaster Resilient Societies (ARISE) includes several specific indicators for earthquake risk, which help to identify the level of exposure of buildings to earthquake risk, compliance with building codes, or resilience of building design. The tool can be applied for any type of building (commercial, multi-residential, office buildings) by owners, relevant public entities, or private actors.

Another useful tool to support capacity development of governments and other stakeholders for earthquake risk management is **PreventionWeb**, a global knowledge sharing platform for disaster risk reduction and resilience which brings together the latest research, guidance, policies, lessons learned from past disasters and examples of good practices from countries and cities around the world, including in the area of earthquake risk management.

Useful links:

- Disaster Resilience Scorecard for Cities and its thematic addenda: https://mcr2030.undrr.org/disaster-resilience-scorecard-cities
- Scorecard for Industrial and Commercial Buildings: https://www.preventionweb.net/publication/disaster-resilience-scorecard-industrial-and-commercial-buildings-use-building-owners?a=email
- PreventionWeb: https://www.preventionweb.net/

3. Experience from Mongolia[9]

Background

The seismic activity in Mongolia over the years has seen an increase in earthquake occurrences and intensity. Since 1900, there have been four earthquakes with magnitudes exceeding 8, along with over 20 occurrences with a magnitude of 7 or more. From 2011 to 2022, a total of 327,576 earthquakes were recorded. These included three earthquakes with M6.0-M6.9 which occurred in 2021 and 2022 in low-density populated places of Northern Mongolia. These events resulted in no casualties; however, they caused noticeable damage to buildings and infrastructure, including schools. This ongoing seismic activity prompted concerns about the stability of the environment and underlined structural vulnerabilities and potential risks posed by seismic events in the region.

Case Study: Mitigation and Preparedness Measures in the Face of Increasing Earthquake Risk

Good Practice

The key aspect of earthquake prevention in Mongolia is the building code in Ulaanbaatar Capital City. The city has implemented a strict building code since 2011 that requires all new buildings to be constructed to withstand earthquakes.

In addition, Mongolia prioritizes community awareness and preparedness through such measures as the annual Earthquake Awareness Day (4th Wednesday of March) implemented since 2017 and Disaster Warning Signal Day (4th Thursday of March) since 2012. The National Emergency Management Agency (NEMA) also conducts routine earthquake drills and training exercises to related stakeholders, including communities for the country's readiness for seismic events.

Stakeholders

National Emergency Management Agency (NEMA), Ministry of Environment and Tourism, the Ministry of Construction and Urban Development, Ministry of Health, Ministry of Education and Science, National Agency for Meteorology and Environmental Monitoring, Institute of Astronomy and Geophysics, Red Cross Society of Mongolia, and various local governments and communities

Impacts and Results

Improved resilience of buildings in Ulaanbaatar has been achieved through the introduction of earthquake-resistant materials and construction techniques, as well as the implementation of strict building codes and regulations since 2011.

Mongolia was able to achieve the inspection of building codes to earthquake resilience and 51% of all planned building had been inspected as of 2022, dropping from 1844 to 944. As a result, 36.4% (344 buildings) have been assessed as not earthquake-resistant and need to be demolished in Ulaanbaatar.

Mongolia also invested in early warning systems to help mitigate the impact of earthquakes about 10 years ago. To achieve this, the Emergency Operation and Warning Center was established in 2013 under NEMA. The country has established a network of seismic monitoring stations that can detect earthquakes and provide early warning to communities at risk.

[9] Based on the presentation made by Ms. Bazarragchaa DUUDGAI, Head of Disaster Risk Management and Assessment Division, Risk Management Department, National Emergency Management Agency of Mongolia.

Lessons Learned

- **Success Factors:**
    - Strong legislation and enforcement: the strict building code implemented in Ulaanbaatar played a pivotal role in reducing vulnerabilities.
    - Mandatory budget allocation to disaster risk reduction: The 2017 Law on Disaster Protection ensures the allocation by all administrative and territorial units and government organizations of a percentage of annual budgets for disaster protection and risk reduction.
    - Community engagement: The engagement of communities in preparedness and prevention activities has been instrumental in enhancing their understanding of seismic risks and response measures.
- **Challenges:**
    - Technological Advancement: Existing early warning systems in Mongolia need to be upgraded, including integrating technological advancements such as the emergence of 4G and 5G, and to ensure that disaster warning information reaches the entire population. Such upgrades would require increased investment and access to the latest technologies.
    - Infrastructure Vulnerabilities: Despite successes, the aftermath of the M6.7 earthquake in 2021 highlighted vulnerabilities in infrastructure. The need to assess and reinforce existing structures to ensure their seismic resilience remains an ongoing challenge.

Future Development

Several future developments for earthquake management in Mongolia have been identified. These include increasing the use of technology and innovation, particularly early warning systems, to improve earthquake management. Another objective is to enhance sector coordination and international cooperation to improve earthquake management in Mongolia. Additionally, increased financial investment is required to support disaster prevention and preparedness, particularly risk assessments, building inspections, retrofitting, and infrastructure replacement. Achieving these objectives requires increased human resource capacity, particularly in the area of disaster risk analysis; strengthened DRR legal frameworks and standards; and enhanced community participation. Finally, exchange of technology and joint research on earthquake risk at the regional level, complemented by technical assistance to boost community resilience against seismic threats, can further improve earthquake management in the country. The buildings that were assessed not to be earthquake-resistant need more investment to retrofit and rebuild.

Potential for Replication

Earthquake management strategies successfully employed in Mongolia present a replicable model for other earthquake-prone regions worldwide. Establishing a network of seismic monitoring stations under a centralized Emergency Operation and Warning Center can be an effective first step to improve early identification, warning and risk communication. Countries facing seismic risks can also adopt similar approaches to bolster community resilience, emphasizing risk awareness and understanding, and active community participation in risk assessments and preparedness training. Similarly, applying the model of Mongolia's legislation-based financial allocation strategy in support of comprehensive risk assessments, building inspections and upgrading, can greatly enhance disaster prevention and preparedness efforts in earthquake-prone countries.

4. Opportunities and Recommendations for Capacity Development

The exchange generated several recommendations for further capacity development in the area of technology development, application and transfer in support of disaster risk reduction, particularly in the context of earthquake risk. Key recommendations include:

1. **Technical cooperation:**
   - Strengthen international, regional and bilateral technical cooperation to support disaster risk reduction efforts. Such cooperation is particularly beneficial between neighboring countries that may experience similar types of risks. Collaboration could include joint efforts to prevent disasters; joint earthquake risk assessments and research; joint data sharing and management.
2. **Knowledge sharing:**
   - Regular international and regional seminars or online exchanges between experts in different countries can facilitate knowledge exchange on new technologies and their application for earthquake risk reduction, as well as experience sharing regarding associated challenges and possible solutions to overcome them.
3. **Strengthening data and understanding of risk:**
   - To facilitate technology transfer from one country to another, acquiring precise and comprehensive data about the country's context and risk drivers, including socio-economic data, is crucial. Risk assessments must be tailored to specific countries based on the geographic, social structure, and demographic features, which requires data collection, sharing and interoperability across different departments. An understanding of the local context and needs and learning from past examples of application of different technologies and tools can help to identify the most suitable technologies for application in a specific country's context.
   - In the context of earthquake risk, experience and lessons from past disasters are particularly important and should be systematically collected and considered when designing future risk scenarios. This includes passing on historical knowledge, experience, and lessons learned at community level across generations.
   - Areas for further research efforts include expanding indicators for earthquake loss assessment, including to improve assessment of indirect losses.
4. **Technology advances and approaches:**
   - As early earthquake prediction remains difficult, simulations models constitute an important technological tool to support disaster risk reduction risk assessment and planning in the context of earthquake risk. Further advancement of simulation tools is necessary to improve the accuracy of scenarios and damage prediction, including through further research and incorporation of socio-economic risk and human behavior data. Utilizing past earthquake data and simulations can also support the development of earthquake fragility functions and damage assessments.
   - Additional research and investments could support improvements of earthquake alert systems in terms of speed and timeliness of the delivery of warning messages to populations at risk, and further strengthening last-mile communication.
   - Remote sensing technology plays an important role in earthquake damage assessment. Further advancements in the spatial and temporal capabilities of satellite remote sensing

should be explored. This could include expanding the potential and application of lidar technology for rapid deployment and high-quality imaging.

- Combining multiple methods and ICT technologies has the potential to enhance the accuracy of earthquake damage assessments and support disaster risk reduction efforts in the context of earthquake risk. Further research could support the understanding of complementarities between existing technologies, and capacities could be strengthened to combine different methods and technologies effectively for earthquake risk assessment and management.

5. **Multi-stakeholder engagement:**

    - To support the development of technologies that can efficiently support disaster risk reduction tailored to the risks and needs that countries and communities are facing, it is important for governments to engage with a wide range of stakeholders with expertise and resources in that area, including the academia and the private sector. The establishment of dedicated national university networks could institutionalize such engagement and encourage scientific research in support of national and local disaster risk reduction efforts. To enable further innovation and research on technology application for disaster risk reduction, specialized university research and education programmes could be encouraged, coupled with direct collaboration opportunities between universities and governmental departments to support practical application of research.

6. **Preparedness measures:**

    - While technological advancements can greatly support the understanding and assessment of earthquake risk and associated potential losses and damages, preparedness-oriented strategies at country and community level remain the main approach to mitigate the impact of earthquakes and reduce losses of lives and damage to property, infrastructure and key assets. Governments in earthquake-prone areas should continue strengthening earthquake preparedness and response capacities across all levels of society.

Annex 1 – Workshop Concept Note and Agenda

TCS, UNDRR

CJK Education and Training Institutes Online Workshop

"Tools and Technologies for Earthquake Risk Management: Sharing Experience from Northeast Asia"

Wednesday, 2 August 2023

14:00 – 17:30 KST

Online (Zoom)

Background:

Earthquake risk and disaster risk reduction in Northeast Asia and Asia Pacific

Asia Pacific is the world's most seismically active region, located along the Pacific Ring of Fire. Over two thirds of earthquakes which occurred in 2022 took place in the region, affecting over 3.6 million people across Northeast, Southeast and Southern Asia. In Northeast Asia alone, economic losses from earthquakes exceeded USD 403 billion over the last 20 years, with over 60 million people affected.[1] As the devastating earthquake which hit Türkiye and Syria in February 2023 tragically illustrates, earthquakes remain among the deadliest natural hazards and result in significant economic loss and major damage to infrastructure, livelihoods and health. It is therefore key for countries located in earthquake-prone regions to improve their understanding of risk and of solutions and to invest in disaster risk reduction measures, including infrastructure and technology-based tools for resilience in the context of seismic risk.

Northeast Asia Experience and Trilateral Cooperation on Disaster Management

Given advanced experience in earthquake risk reduction in Northeast Asian countries, the webinar aims to share the expertise and examples of effective practices from China, Japan and the Republic of Korea (ROK), including through application of technology, infrastructure resilience measures and sustainable and risk-informed recovery and build-back-better approaches.

The webinar is organized as part of the trilateral cooperation on disaster management and disaster risk reduction, building on the outcomes of the 5th Trilateral Ministerial Meeting on Disaster Management in 2017, the 2018 Trilateral Working-Level Consultation Meeting on Disaster Management among the relevant ministries from China, Japan and the ROK, and the 2019 Meeting of the designated Education and Training Institutes on Disaster Management of the three countries[2] which defined a series of joint activities between the three institutes to support experience sharing for capacity development on disaster risk reduction among the three countries as well as to provide training opportunities for developing countries.

[11] EM-DAT: The Emergency Events Database -Université Catholique de Louvain (UCL) -CRED, www.emdat.be, Brussels, Belgium, earthquake loss data for 2002-2022 for China, Japan and the Republic of Korea.
[2] The National Disaster Reduction Center of China (NDRCC) in China, the Asian Disaster Reduction Center (ADRC) in Japan, and the United Nations Office for Disaster Risk Reduction Office in Northeast Asia and Global Education and Training Institute (UNDRR ONEA & GETI) in the ROK.

Session Objective:

This session aims to:

a) Increase the understanding of existing tools, technologies and effective practices for risk reduction among countries prone to earthquakes, in relation to such areas as risk assessment, early warning, building and infrastructure resilience measures and sustainable recovery;
b) Share the experience of Northeast Asia countries in earthquake risk reduction with other countries exposed to seismic risks;
c) Promote collaboration for capacity development for earthquake risk reduction between Northeast Asia and other countries/regions.

Expected outcomes:

1. Participants learn about available tools and technologies for earthquake risk reduction;
2. Opportunities for collaboration for capacity development on earthquake prevention between Northeast Asia and other countries/regions discussed.

Participants:

Experts from China, Japan and the ROK from national level government, education and training institutes or any other resource persons recommended by the CJK education and training institutes. Government officials from Mongolia and other countries in Asia will be invited to attend.

Targeted Audience:

Government officials from China, Japan and the ROK, Mongolia and other countries in Asia prone to earthquakes.

Date & Time:

Wednesday, 2 August 2023

14:00 – 17:30 KST

Venue: Online (Zoom)

Workshop Language: Chinese, Japanese, Korean, Mongolian and English, with simultaneous interpretation

Organizers:

- Trilateral Cooperation Secretariat (TCS)
- UN Office for Disaster Risk Reduction (UNDRR) Global Education and Training Institute (GETI) in collaboration with Incheon Metropolitan City and the Ministry of the Interior and Safety (MOIS) of the Republic of Korea
- Asian Disaster Reduction Center (ADRC)
- National Disaster Reduction Center of China (NDRCC)

Provisional Agenda:

Time	Topic	Session outline
14:00 – 14:25	**Welcome and Opening Remarks** (in CJK order)	• Welcome and Opening remarks (20min) ○ **Mr. Bumhym BEK**, Deputy Secretary-General, TCS ○ **Mr. Guangyuan WANG**, Deputy-Director of Bilateral Division of Department of International Cooperation and Rescue, MEM ○ **Mr. Takeo MURAKAMI**, Director of International Cooperation Division, Disaster management Bureau, CAO ○ **Mr. Sung Woo WOO**, Director of Earthquake Disaster Policy Division, MOIS
14:25 – 14:30	**Introduction to the workshop and speakers**	• Introduction of contents of the session and of the speakers by **Mr. Saeseung KIM**, Program Officer, Political Affairs, TCS (5 min)
14:30 – 15:05	**Experience from China**	• Best practices, technologies and capacity development tools for earthquake risk reduction from China (30min) ○ **Dr. Tao WANG**, Deputy Director-General, Researcher of Institute of Engineering Mechanics, China Earthquake Administration ○ **Dr. Wei WU**, Director of the Disaster Assessment Department of National Disaster Reduction Center of China • Q&A (5min)
15:05 – 15:40	**Experience from Japan**	• Best practices, technologies and capacity development tools for earthquake risk reduction from Japan (30min) ○ **Dr. Makoto IKEDA**, Senior Researcher, Asian Disaster Reduction Center • Q&A (5min)
15:40 – 16:15	**Experience from the Republic of Korea**	• Best practices, technologies and capacity development tools for earthquake risk reduction from ROK (30min) ○ **Dr. Hye Won KIM**, Senior Research Officer, National Disaster Management Research Institute ○ **Dr. Jung Han LEE**, Senior Research Officer, National Disaster Management Research Institute • Q&A (5min)
16:15 – 16:40	**Moderated discussion: experience and capacity development needs for seismic risk management in the Asia Pacific region**	• Experience of Mongolia (10min) ○ **Ms. Bazarragchaa DUUDGAI**, Head of Disaster Risk Management and

		Assessment Division, Risk Management Department, NEMA • Other interventions from the floor (15min)
16:40 – 17:20	**Opportunities and tools for capacity development for earthquake risk reduction**	• NDRCC: capacity development tools for earthquake risk (10-12 min) ○ **Dr. Tun WANG**, Director of Institute of Care-life
		• ADRC: capacity development tools for earthquake risk (10-12 min) ○ **Dr. Makoto IKEDA**, Senior Researcher, Asian Disaster Reduction Center
		• UNDRR ONEA & GETI: capacity development tools for earthquake risk (10-12 min) ○ **Ms. Daria MOKHNACHEVA**, Programme Management Officer, UNDRR ONEA & GETI
17:20 – 17:30	**Closing**	• UNDRR ONEA & GETI and TCS closing remarks ○ **Mr. Sanjaya BHATIA**, Head of UNDRR ONEA & GETI ○ **Mr. Bumhym BEK**, Deputy Secretary-General, TCS

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TCS

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About the organizers:

The **Trilateral Cooperation Secretariat (TCS)** is an international organization established with a vision to promote peace and common prosperity among the People's Republic of China, Japan, and the Republic of Korea established in 2011 in Seoul, Republic of Korea. The objectives and functions of TCS are to provide support for trilateral consultative mechanisms, to explore and facilitate cooperative projects, to promote the understanding of trilateral cooperation, to network with other international organizations, and to conduct research.

The **United Nations Office for Disaster Risk Reduction (UNDRR) Office for Northeast Asia & Global Education and Training Institute (UNDRR ONEA & GETI)** was established in 2010 in Incheon, Republic of Korea, to develop a new cadre of professionals in disaster risk reduction and climate change adaptation to build disaster resilient societies. ONEA & GETI also hosts the Global Secretariat for the Making Cities Resilient 2030 (MCR2030). UNDRR Office for Northeast Asia (ONEA) supports five countries: Republic of Korea, China, Japan, Mongolia and DPR Korea specifically to reduce disaster loss and risk and to ensure Sendai Framework for Disaster Risk Reduction 2015-2030 implementation. The Global Education and Training Institute (GETI) has a global mandate to provide capacity building support to mainstream disaster risk reduction and climate change adaptation into sustainable development; convene and support inter-city learning to strengthen resilience (Making Cities Resilient); and to provide capacity building and best practice sharing support to national training institutions working on resilience issues.

The **Asian Disaster Reduction Center** (ADRC) was established in Kobe, Hyogo prefecture, in 1998 with the mission of enhancing the disaster resilience of its member countries, building safe communities, and creating a society where sustainable development is attainable. ADRC works to build disaster-resilient communities and to establish networks among countries through personnel exchanges and a variety of other programs. With support by its 31 member countries, ADRC has been collecting information on systems, plans, and policy measures of individual countries' disaster risk reduction as well as the situation of natural disasters. ADRC has also been collecting information from related materials, various countries/organizations and through Visiting Researchers (VRs) from the ADRC member countries and the United Nations Office for the Coordination of Humanitarian Affairs (UNOCHA). ADRC will continue collecting and sharing with member countries information on the following items, in particular: 1) Disaster management systems (legal and institutional frameworks, disaster management plans, and manuals), 2) Disaster response and recovery activities (emergency response activities in affected area/country), and 3) Natural disaster events (descriptions of natural disasters such as earthquakes, floods, cyclones, and so on, and the damages).

The **National Disaster Reduction Center of China** (NDRCC) was established in April 2002 and put into official operation in May 2003, inaugurated as "Satellite Application Center for Disaster Reduction of the Ministry of Civil Affairs" in 2009, and transferred to the Ministry of Emergency Management in April 2018. The mandate includes natural disaster risk monitoring and early warning, risk assessment, satellite emergency applications, data and information management, research on S&T and regulations and standards, international exchange and cooperation, etc., and the center fulfills the functions of the national center for integrated natural disaster risk monitoring and early warning and the space technology disaster reduction applications. NDRCC expects to have 135 authorized staff and now the full-time staff are104 persons. There are 90 staff with master's degree or above, accounting for 87% (including 28 with doctoral degree); and 38 staff with senior professional and technical qualifications, accounting for 42%. NDRCC has developed the following eight capabilities:

1) "Space-air-ground" integrated natural disaster risk monitoring and early warning capabilities. NDRCC is dedicated to building an integrated natural disaster risk monitoring and early warning center; 2) Natural disaster information acquisition and analysis capabilities. NDRCC operates a six-level disaster reporting system at national, provincial, municipal, county, township and village levels, and timely acquires disaster information relying on 840,000 disaster informants nationwide; 3) Air-space integrated remote sensing monitoring and early warning capabilities; 4) Disaster risk and loss assessment capabilities.; 5) Disaster reduction and relief policy research and standard-setting capabilities. NDRCC has participated in the preparation of natural disaster relief regulations, institutional reform opinions, national integrated disaster prevention and reduction plans, and talents development plans, etc., and works as the Secretariat of the National Committee for Standardization of Disaster Reduction and Relief, and the Secretariat of the Expert Committee of the National Committee for Disaster Reduction; 6) Disaster reduction and relief publicity and education

capabilities.; 7) Capabilities for international exchange and cooperation in disaster reduction and relief.; 8) Major S&T research and application capabilities.

As the national disaster prevention, reduction and relief decision support agency, NDRCC has provided vital technical and intellectual support for the formulation of natural disaster relief regulations, institutional reform recommendation, national integrated disaster prevention and reduction plans, and talents development plans based on the needs and requirements of enhancing national natural disaster risk governance capabilities. Disaster risk financing is one of the major measures for risk communication and risk transfer. Further research on the role and on-the-ground effectiveness of financial instruments and measures in promoting risk transfer in the post-epidemic era, will contribute to disaster reduction efforts, and is of great significance. Therefore, through the ADB TA project, we will draw on and refer to existing practices of international risk financing, and promote the integration and role of financial risk concepts, instruments, and practices in disaster reduction efforts in the context of domestic financial and insurance markets.

Annex 2 – Workshop Materials and Presentations

Presentations, materials as well as video recordings from the Online Workshop of the CJK Education and Training Institutes on "Tools and Technologies for Earthquake Risk Management: Sharing Experience from Northeast Asia" can be accessed online: https://www.undrr.org/event/undrr-tcs-CJKEarthquake.

Acronyms

ADRC	Asian Disaster Reduction Center
ARISE	Private Sector Alliance for Disaster Resilient Societies
CJK	China, Japan, Korea (Republic of)
DRR	Disaster Risk Reduction
EEW	Earthquake Early Warning
MHEWS	Multi-Hazard Early Warning System
NDRCC	National Disaster Reduction Center of China
NEMA	National Emergency Management Agency of Mongolia
ONEA & GETI	UNDRR Office for Northeast Asia and Global Education and Training Institute
ROK	Republic of Korea
TCS	Trilateral Cooperation Secretariat
TMMDM	Trilateral Ministerial Meeting on Disaster Management
UNDRR	United Nations Office for Disaster Risk Reduction
USAID	United States Agency for International Development