"STRATEGIES ON PREVENTING FURTHER LOSSES OF LIVES AND DAMAGES TO PROPERTIES DURING EARTHQUAKES AND OTHER COMPLEX EMERGENCIES:

LEARNING THE JAPANESE EXPERIENCE"

A paper submitted to the
ASIAN DISASTER REDUCTION CENTER

by:

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It was said that “Any great achievement is preceded by many difficulties and lessons; great achievements are not possible without them.” With that, her profound and heartfelt gratitude to all of you!

JMP

DEDICATION

This study is dedicated to:

My dearest husband and prayer partner, Ricky, and my children Enrico Gabriel, Eliana Mari and Ethan Liam who are the sources of my inspiration, endurance and motivation;

My Parents Papa Gregorio & Mama Marietta and Tatay Felipe;

My brothers Boyet, Erwin and Thadeau Jude and sister Shiela Mae;

My Brothers and Sisters in Christ; and,

Above all, to my Almighty Father.

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Chapter 1

INTRODUCTION

Background of the Study

The Philippines is geographically situated along the highly-seismic Pacific Ring of Fire, the area where the Philippine Sea and Eurasian Tectonic Plates meet. For this reason, the Philippines is prone to occurrences of earthquakes, tsunamis and volcanic eruptions. In fact, it has three hundred (300) volcanoes in the country and twenty four (24) are active, per latest figures from the Philippine Institute of Volcanology and Seismology (PHIVOLCS).

Aside from being situated in the Pacific Ring of Fire, Philippines is also located along the Pacific Typhoon Belt. This explains the occurrences of different weather disturbances such as typhoons. Floods and storm surges are also inevitable. In fact, the Filipinos experience an average of twenty (20) typhoons per year according to Philippine Atmospheric, Geophysical and Astronomical Services Administration (PAGASA).

Other complex emergencies that may occur as a consequence of these hazards may be mentioned like fire, urban/flash flooding, epidemics and landslides.

Learning from the past disaster and devastating effects of Typhoon Ondoy (international name “Ketsana”) in 2009 led to the enactment of the Republic Act no. 10121 or the “Philippine Disaster Risk Reduction and Management (DRRM) Act of 2010”, which transforms the paradigm shift from response or “reactive” to “proactive” approaches on disaster risk reduction. Through RA 10121, the National Disaster Coordinating Council or NDCC was transformed into National Disaster Risk Reduction and Management Council or NDRRMC. The DRRM law grants the NDRRMC with the overall policy-making, coordination, integration, supervision, monitoring and evaluation functions focusing on DRRM. It is further provided for in the law that the NDRRMC shall establish an Operations Center. This is the 24/7 facility for monitoring and coordination of the forty-five (45) member agencies chaired by the Secretary of

National Defense. By law, the Office of Civil Defense (OCD), being the secretariat and executive arm of the National Disaster Risk Reduction and Management Council (NDRRMC) functions operationally through the manning of the National Disaster Risk Reduction and Management Emergency Operations Center (NDRRMOC) where it disseminates situation reports, alerts and communications to all Council members and various stakeholders.

As seen on the following tables below are the consolidated data on hazards that occurred for the past five years and disasters statistics gathered and evaluated by the NDRRMOC to be submitted to the Council on a yearly basis as a tool to facilitate effective management of the consequences of disasters.

For the period CY 2014 to CY 2018, a total of 398 natural and 1057 human-induced incidents were monitored by the NDRRMOC, declaring on emergency condition for a total 726 days or 40%[1], as seen on Figure 1 below:

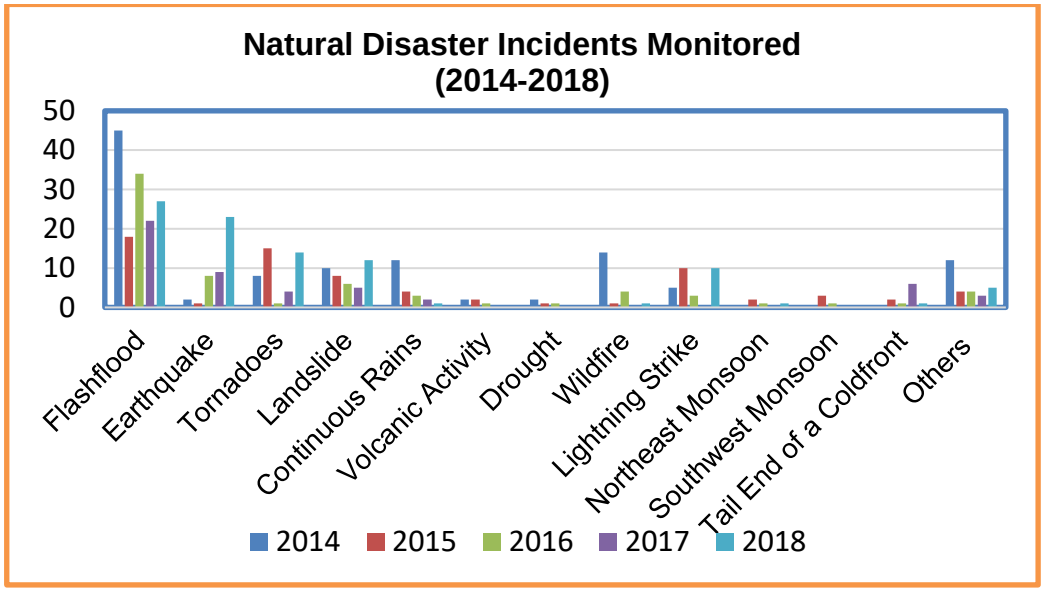


Figure 1. Natural incidents monitored for CY2014-2018

Of the natural incidents monitored, flashfloods topped the list with 146 or 36.77% incidents followed by earthquake with 43 or 10.83% and tornado with 43 or

[1] Percentage of the total actual calendar days from CY2014-2018

10.58%. For natural incidents, others include the following: sinkholes, LPA, sea swelling, disease outbreak, coastal erosion, El Nino, ground movement and big waves.

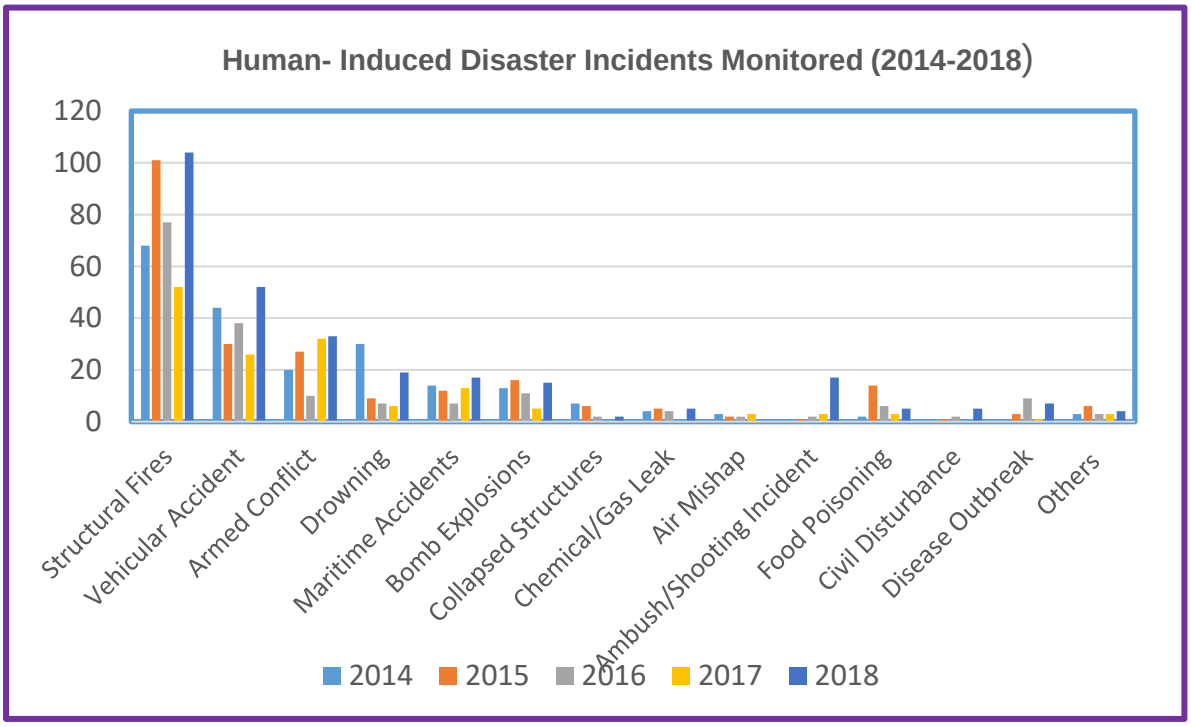


Figure 2. Human-induced incidents monitored for CY2014-2018

Meanwhile, as shown on Figure 2 above, of the human-induced monitored, structural fire had a record high of 402 or 38.0% incidents, followed by vehicular accidents with 190 or 18.0% and armed conflict with 122 or 11.5%. For human-induced, others include the following: missing person, vehicular fire, caving accident, electrucotion, Hostage taking, mining and train accident, pest infestation, burning soil, fish kill and water tank explosion.

Effects of Disasters

For the period CY 2015 to CY 2018, a total of 3,296 casualties were recorded due to natural incidents as shown on Figure 3. *(Note: Data is not per 100,000 population).* Statistics show that 32% involves death, 49% injuries, and 20% missing. The apparent cause of the high quantity of injuries in CY 2017 was due to several earthquakes happened in that year.

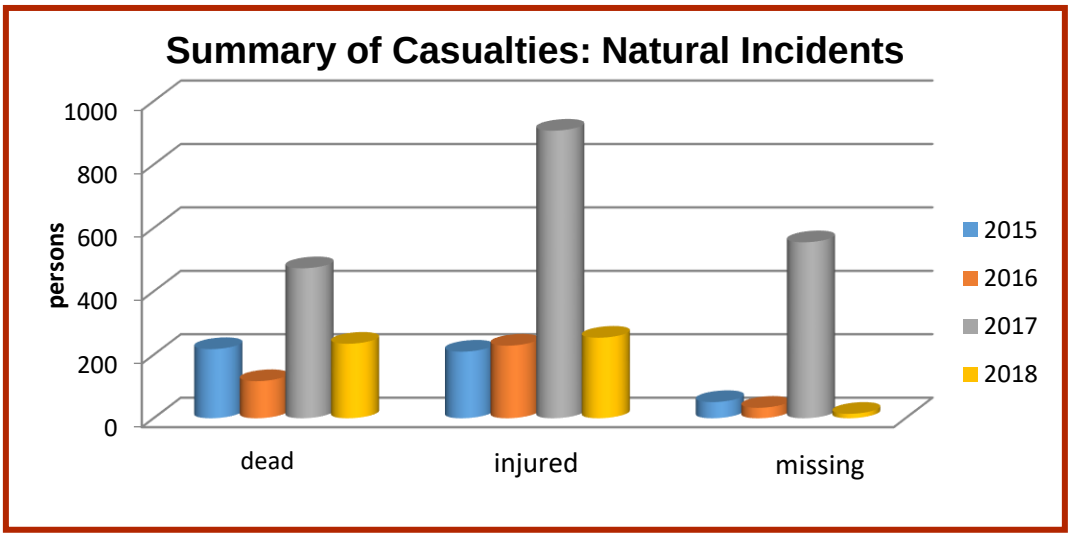


Figure 3. Summary of Casualties for Natural Incidents for CY2015 - 2018

Shown on Figure 4 is a total of 13,348 casualties monitored due to human-induced incidents for CY 2015 to CY 2018 of which, 1,061 or 8% are deaths; 12,158 or 91% are injuries; and 129 or 1% are missing persons. Due to the notable increase of human-induced casualties in CY 2015 and CY 2016, recommend the conduct of regular public information drives to notify and alert the populace of the evolving situation for them to take necessary precautionary measures.

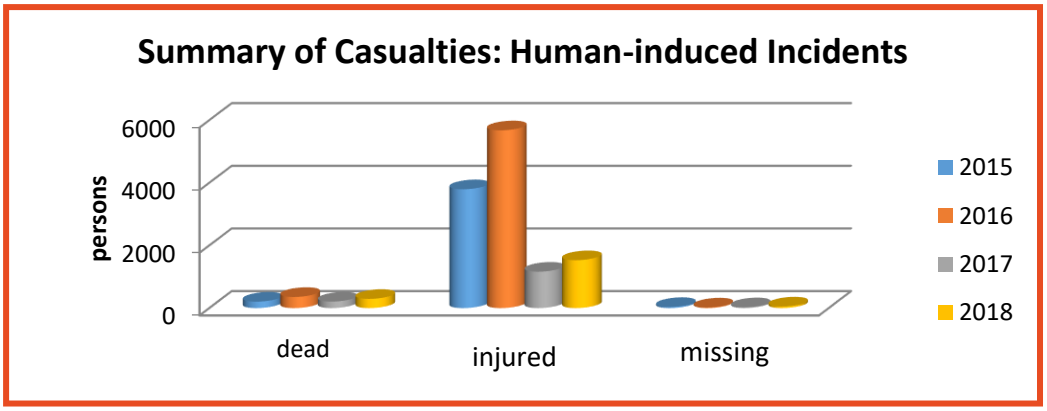


Figure 4. Summary of Casualties for Human-induced Incidents for CY2015-2018

Shown on Figure 5 that for CY 2015 to CY 2018, a total of Php 78,368.391 Million properties were damaged due to natural and human-induced incidents. As shown, damage on agriculture registered the highest with a total of Php 62,898.427 Million. Meanwhile, damage to infrastructure comes second with the amount of Php 14,278.940 Million. The major damages were contributed much in CY 2018 due to several typhoons such as Ompong and Usman and structural fire incidents.

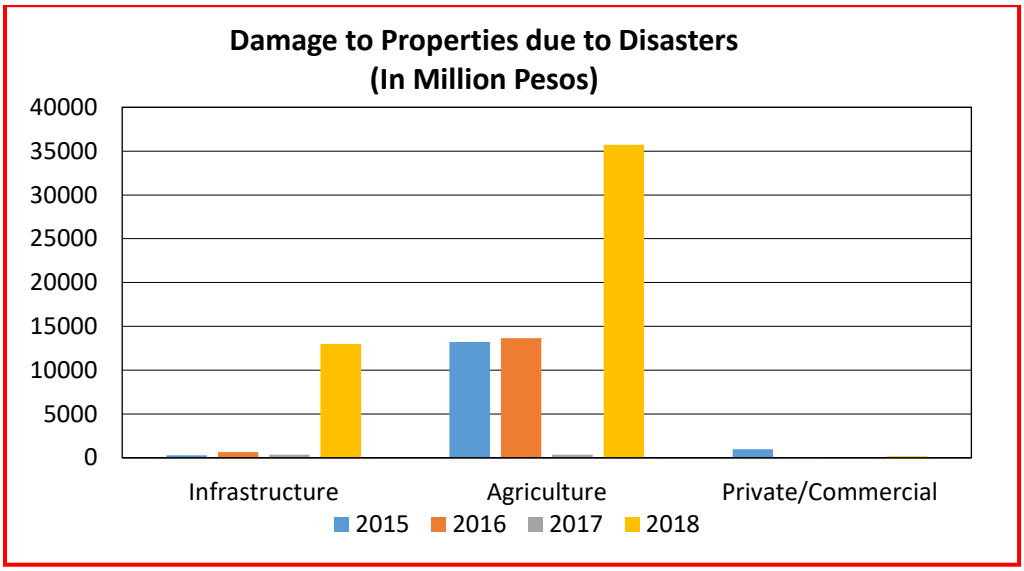


Figure 5. Summary of damage to properties due to disasters for CY2015-2018

As shown on Figure 6 is the data on affected families, displaced families and damaged houses due to major disasters in CY 2016 and 2018, such as tropical cyclones, earthquake, monsoon rains, inter-tropical convergence zone, and the armed conflict in Marawi City. It shows that 70% or 1,215,327 out of 1,746,327 displaced families in the major disasters are served outside the evacuation centers.

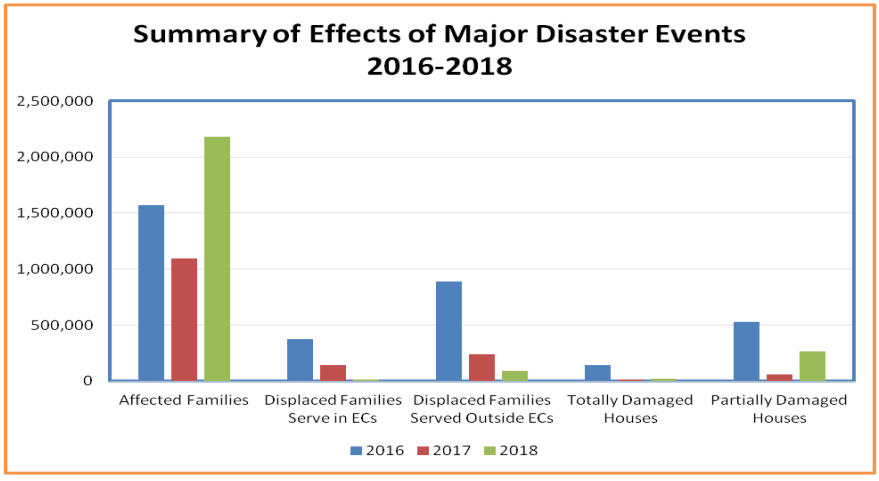


Figure 6. Summary of effects of major disaster events for CY2016-2018

Government efforts

Individuals and families, especially in marginalized sectors, are often the most vulnerable to all forms of risks and shocks – economic instability, weather disturbances,

health-related shocks, political disruptions, among others. Building their socioeconomic resilience by reducing their exposure to risks and increasing their adaptive capacities is the focus of Chapter 11 of the Philippine Development Plan (PDP) 2017-2022. Collaborative efforts were made by the government and other organizations to align the PDP to the Sendai Framework for DRR 2015-2030.

There are certain individuals and groups that have inherent vulnerabilities, these are: the poor and transient poor, children, women, persons with disabilities, indigenous peoples, overseas Filipinos and their families, farmers and landless rural workers, solo parents, workers in the informal sector, victims of disasters and calamities and senior citizens, among others. Non-vulnerable individuals and groups are also exposed to risks such as low and irregular incomes, and financial and economic crises.

Although significant steps were made in reducing the vulnerability and building the socioeconomic resilience of Filipinos, several challenges in terms of mitigating the risks still need to be addressed. These include: 1) continuous innovation on structural and non-structural measures in DRRM; 2) prioritization of the DRRM in all walks of life; 3) resources available from the government; and, 4) cooperation and buy-in of our stakeholders. Also, there is a need to correct the notion that DRRM is only a government concern. Rather, it requires the whole-of-society approach including the community.

Following the occurrences of major disasters after 2010, particularly Typhoons Sendong, Pablo, Yolanda, Ruby and Glenda, and all the other disasters that wreaked havoc in the country afterwards, the global call to be more proactive became louder. The international community worked together to enhance and review the existing approaches and strategies to come up with a more responsive, climate-change adaptive and resiliency-focused plans and frameworks. The Sendai Framework for Action, for one, shifted much of the focus on the prevention and mitigation of hazards, and has prioritized understanding of disaster risks, strengthening of disaster risk governance, and investing in disaster risk reduction for resilience. The other plans and policies crafted after 2015 are all geared towards the same purpose.

In this note, Japan, as compared with the Philippines as being a disaster prone country, has a lot to showcase their great efforts to prevent and mitigate the risks and vulnerabilities brought about by the climate change, progressive society and increase of human and ageing population.

Statement of the Problem

This study aims to provide information on the various specific strategies, mechanisms and disaster countermeasures on Japan's adaptive capacities on the strengthening of disaster risk reduction and management.

Specifically, it sought answers to the following questions:

1. What are the scenarios on the future disasters being undertaken by Japan and Philippines?

2. To what extent can these scenarios on the future disasters cause possible damages to properties, economic losses and losses of lives?

3. What are the innovations of disaster risk reduction strategies and countermeasures in terms of the following:

    3.1 Non-structural measures; and,
    3.2 Structural measures.

4. What are the best practices of Japan's learning experience from past disasters that can best replicate from a developing country?

5. What are the challenges faced by the government and community on future disaster risk management?

6. What are the goals and approaches on disaster risk reduction for the above-mentioned hazards?

Significance of the Study

This paper will give discussions on the various strategies and best practices of Japan's almost-a-decade-old learning experience on disaster risk management (DRM) system and how these contribute in mitigating measures to further reduce the effects of losses of lives and damages to properties caused by the consequences of the natural hazards. Thru this paper, the findings may give clear view or better appreciation on the importance of the non-structural and structural measures which is primordial reason of all the government efforts to attain a whole-of-society approach at the global context to be localized and replicated to other countries like the Philippines. The examples of the non-structural and structural measures will be emphasized on how it contributed to the prevention and mitigation approaches from the past disasters recorded. This will help demonstrate the importance of the achievement and replication of these strategies and innovation and subsequently come-up with policy enhancements, more extensive approach on risk assessments and recommendations for the improvement of the Philippines' DRRM system.

The findings of this study could benefit the DRR experts and institutions, Governments of Japan (thru the Asian Disaster Reduction Center) and the Philippines (thru the Office of Civil Defense), as the researcher will endeavor to come up with proposals on addressing challenges and approaches in promoting disaster risk governance and investment in DRR. It also helps future researchers by providing validated data on similar subject.

Scope and Limitations of the Study

The government of Japan and other public and private organizations have exerted great efforts in combating the great loss of people's lives and properties due to natural disasters. Until the second half of 1950s, large-scale typhoons and earthquakes caused extensive damage and thousands of casualties.

Thereafter, Japan's capabilities to respond disasters and mitigate vulnerabilities to disasters are very much evident world-wide. The country has continuously developing its disaster management systems, promoting national land conservation, improve weather forecasting technologies and upgrading disaster information communication systems, public awareness and DRR education, among others.

In this note, the researcher limits the study on the effects of disasters due to the occurrence of typhoons and earthquakes and the consequences of these hazards such as structural fires, storm surges, ground shaking, ground rupture, landslides, and tsunami for the recent years.

The research enumerates the best practices and the recent innovations focusing on prevention and mitigation measures currently being undertaken by Japan in terms of structural and non-structural measures. Scenarios for the preparation of the future disaster to come are limited to the Nankai Trough earthquake throughout central to west Japan and Tokyo Inland Quake as well as the Philippine scenario on the magnitude 7.2 earthquake resulting from the movement of the West Valley Fault (WVF) or we simply call "The Big One". The scenario may yield a PHIVOLCS Earthquake Intensity Scale (PEIS) of VIII that will affect not only Metro Manila, but also the nearby regions of Central Luzon and CALABARZON.

The discussion is limited only to the accounts of actual experiences and learning that the researcher has encountered in the various study tours all over Japan, seminars, lectures and conferences with local and international experts, and personal readings of reference materials provided during the term under the Visiting Researcher Program of the Asian Disaster Reduction Center for the period January 09 to April 05, 2019.

CHAPTER 2

REVIEW OF RELATED LITERATURE AND STUDIES

This chapter presents a review of related literature and studies to include summaries of books, journals and other forms of publication that provide information relevant to this study, both from international and local sources. Research findings of the studies related and relevant to the current study were presented in summarized form, and conceptualized in a paradigm.

Foreign

According to Sakiko Kanbara (2016) on his article, “Operational Definition of Disaster Risk Reduction Literacy”, he defined “disaster prevention” or “bousai” and “gensai” in Japanese, as a legal plan outlined on the basis of natural scientific measurements. Disaster prevention emphasizes both the saving of lives after an event and structural countermeasures such as reconstruction and restoration. It is also defined as “prevention against disasters” and “every type of initiative, action, and policy aimed at taking precautions to prevent disaster.” He further cited that citizens demanded initiatives for independent “disaster prevention actions” (Fire and Disaster Management Agency, 2011). Moreover, the government’s Reconstruction Design Council, which was established immediately after the Great East Japan Earthquake of 2011, declared that “a way of thinking that incorporates ‘disaster reduction’ is very important for the future.” Thus, the key word for thinking about countermeasures for disaster in Japan shifted from disaster prevention (“bousai”) to disaster reduction or mitigation (“gensai”).

Disaster risk reduction, as defined by the United Nations Office for Disaster Risk Reduction (UNISDR, 2007), is the concept and practice of reducing disaster risks through systematic efforts to analyze and reduce the causal factors of disasters. Reducing exposure to hazards, lessening vulnerability of people and property, wise management of land and the environment, and improving preparedness and early

warning for adverse events are all examples of disaster risk reduction. It includes disciplines like disaster management, disaster mitigation and disaster preparedness, but DRR is also a part of sustainable development. In order for development activities to be sustainable, they must also reduce disaster risk.

In fact, the Sendai Framework is a 15-year, voluntary, non-binding agreement which recognizes that the State has the primary role to reduce disaster risk but that responsibility should be shared with other stakeholders including local government, the private sector and other stakeholders. It aims for the following outcome:

The substantial reduction of disaster risk and losses in lives, livelihoods and health and in the economic, physical, social, cultural and environmental assets of persons, businesses, communities and countries.

The Sendai Framework is the successor instrument to the Hyogo Framework for Action (HFA) 2005-2015: Building the Resilience of Nations and Communities to Disasters. It is the outcome of stakeholder consultations initiated in March 2012 and inter-governmental negotiations held from July 2014 to March 2015, which were supported by the UNISDR upon the request of the UN General Assembly.
UNISDR has been tasked to support the implementation, follow-up and review of the Sendai Framework.

Among the four (4) priorities under the first goal on preventing new and emerging risk and reducing existing risk include Priority 2: strengthening disaster risk governance which means having a clear strategy, strong institutions, laws and budget to ensure the efficient management of disaster risk; and Priority 3: investing in disaster risk reduction for resilience which includes public and private investment and measures which would prevent and reduce disaster losses.

According to Jan C. Vermeiren, in his article, *"Disaster Risk Reduction as a Development Strategy",* hazard mitigation is defined as any action taken to permanently eliminate or reduce the long-term risk to life and property from natural and technological hazards. The wide variety of actions that fall under this definition

can usefully be categorized as risk avoidance measures—primarily of a nonstructural nature—risk spreading measures, and structural vulnerability reduction measures.

In his paper, he discussed about how structural and non-structural measures can be selected to complement each other, and can be effectively integrated in a multi-sectoral or area-wide disaster mitigation plan.

Hazard Mitigation Options

Risk Avoidance Measures (Non-structural measures)
Discourage location of settlements, infrastructure and economic activities in known hazardous areas through:

- Land-use regulations, ordinances
- Financial incentives or penalties
- Disclosure of risk information
- Public infrastructure policy
- Natural resource management policy

Risk Spreading Measures

- Property damage and revenue loss insurance
- Crop diversification
- Redundancy in lifeline systems

Vulnerability Reduction Measures (Structural measures)
Physical measures designed to enhance natural hazard impacts:

- Retrofitting of existing structures
- Use of appropriate building standards
- Reducing hazard proneness of site (dams, retaining walls, windbreaks)

He further added that opportunities for natural hazard mitigation can be found anywhere where population, infrastructure or economic activities are at risk of disruption or destruction from extreme natural events. In selecting opportunities for hazard mitigation it is essential to remember that the most effective approach to reducing the long-term impact of natural hazards is to incorporate hazard assessment and mitigation activities into the process of integrated development planning and investment project formulation and implementation as illustrated on the table below.

Targets for Vulnerability Reduction

Family Shelter • Self-help retrofitting • Local-level hazard mapping • Protection vs. relocation • Safe areas for expansion	Community Infrastructure • Community-based hazard assessment • Participation in monitoring and maintenance • Back-up systems • Standards for critical facilities
Productive Sector • Assets and Infrastructure • Stimulate private sector initiatives	National Infrastructure and Utilities • Systematic vulnerability analysis • Retrofitting

• Zoning and standards • Incentives for mitigation • Insurance premium credits for mitigation	• Standards for new construction • Sound capitalization

Local

According to Republic Act 10121 or "*An Act Strengthening the Philippine Disaster Risk Reduction and Management System, Providing for the National Disaster Risk Reduction and Management Framework and Institutionalizing the National Disaster Risk Reduction and Management Plan, Appropriating Funds Therefore and for Other Purposes"* defined "disaster risk reduction" as the concept and practice of reducing disaster risks through systematic efforts to analyze and manage the causal factors of disasters, including through reduced exposures to hazards, lessened vulnerability of people and property, wise management of land and the environment, and improved preparedness for adverse events. Meanwhile, Disaster Risk Reduction and Management (DRRM) is the systematic process of using administrative directives, organizations, and operational skills and capacities to implement strategies, policies and improved coping capacities in order to lessen the adverse impacts of hazards and the possibility of disaster. Prospective disaster risk reduction and management refers to risk reduction and management activities that address and seek to avoid the development of new or increased disaster risks, especially if risk reduction policies are not put in place.

Section 4 of RA 10121 provides for the development of policies and plans and the implementation of actions and measures pertaining to all aspects of disaster risk reduction and management, including good governance, risk assessment and early warning, knowledge building and awareness raising, reducing underlying risk factors, and preparedness for effective response and early recovery.

The NDRRMC or the National Council plays a very critical role in shaping the country's disaster risk reduction and management system as a strategy for sustainable development and poverty reduction in the Philippines. The National Council is empowered with policy-making, coordination, integration, supervision, monitoring and evaluation functions which will be carried out through the seventeen (17) main

responsibilities stipulated in the law. The NDRRMC Chairperson is authorized, as provided for in Section 7 of the law, to call upon other instrumentalities or entities of the government, including the reserve forces, and non government organizations for assistance in terms of the use of their facilities and resources for the protection and preservation of life and properties in the whole range of disaster risk reduction and management.

The Office of Civil Defense, on the other hand, plays a strategic role, in the implementation of disaster risk reduction and management programs, projects and activities in the Philippines. The OCD is mandated to have the primary mission of administering a comprehensive national civil defense and disaster risk reduction and management program by providing leadership in the continuous development of strategic and systematic approaches as well as measures to reduce the vulnerabilities and risks to hazards and manage the consequences of disasters. The Administrator of the OCD serves as the Executive Director of the National Council. The National Council utilizes the services and facilities of OCD as secretariat of the National Council.

Related Studies

On the published article, “Knowledge Notes from the Learning from Mega-disasters Project”, a knowledge-sharing project sponsored by the Government of Japan and the World Bank, Japan’s DRM system, built up during nearly 2000 years of coping with natural risks and hazards, proved its worth. The loss of life and property could have been far greater if the country’s policies and practices had been less effective. The main elements of that DRM system are:

i. Investments in structural measures (such as reinforced buildings and seawalls) cutting-edge risk assessments, early-warning systems, and hazard mapping—all supported by sophisticated technology for data collection, simulation, information, and communication, and by scenario building to assess risks and to plan responses (such as evacuations) to hazards;

ii. A culture of preparedness, where training and evacuation drills are systematically practiced at the local and community levels and in schools and workplaces;

iii. Stakeholder involvement, where the national and local government, communities, NGOs, and the private sector all know their role;

iv. Effective legislation, regulation, and enforcement—for example, of building codes that have been kept current;

v. The use of sophisticated instrumentation to underpin planning and assessment operations.

According to Kenzo Hiroki on his article, *"Strategies for Managing Low-probability, High-impact Events",* every country should develop strategies for managing low-probability, high-impact extreme events—strategies that reflect their own as well as global experiences with mega-disasters. These strategies should integrate structural and nonstructural measures tailored to local conditions. Forecasting and early warnings, land-use planning and regulation, hazard maps, education, and evacuation drills are all vital. Lessons from the Great East Japan Earthquake (GEJE) can help improve these nonstructural practices, which in Japan have been shaped by trial and error after experiences with many natural disasters. The international community should develop knowledge-sharing mechanisms to help countries prepare for low-probability, high-impact extreme events.

The Knowledge Notes briefly discussed important detailed Japan's best practices and strategies on the structural and non-structural measures based on the findings and recommendations from the GEJE. For structural measures, Although 190 kilometers of the 300 kilometers of dikes in the area collapsed, they decreased the force of the tsunami and, in some areas, delayed its arrival inland, buying extra minutes for people to evacuate. All bullet trains stopped safely without casualty, thanks to a cutting-edge system of detecting the earliest sign of ground movement. The GEJE, however, exceeded all expectations and predictions in the extent of its ensuing

tsunami, demonstrating that exclusive reliance on structural measures will ultimately prove ineffective and must be supplemented with nonstructural measures and a basic understanding of the uncertainties surrounding the estimation of events such as earthquakes and tsunamis.

Because it is not practical—from a financial, environmental, or social perspective—to build tsunami dikes 20 to 30 meters high, Japan's government intends to accelerate the current paradigm shift in its thinking about disaster management, complementing its structure focused approach to prevention with soft solutions to achieve an integrated approach to disaster risk reduction. Understanding that the risks from natural hazards can never be completely eliminated, the new, balanced approach incorporates community-based prevention and evacuation and other nonstructural measures such as education, risk-related finance and insurance, and land-use regulation.

Thanks to Japan's strict and rigorously enforced building codes, earthquake-related losses from March 2011 disasters were limited. Since Japan's first building code was adopted after the Great Kanto Earthquake of 1923, the government has made regular revisions in light of experiences with a range of natural disasters.

A multilayered approach to DRM is needed, employing both structural and nonstructural measures. Defensive infrastructure alone is not enough to cope with infrequent disasters of high impact. Nonstructural measures also need to be established, including early-warning systems, rigorous planning and regulation, prompt evacuation of residents, and a variety of institutional and financial measures, such as insurance, rehabilitation funds, and emergency teams. New measures to facilitate evacuation by vehicle – for example, rules to mitigate traffic jams and training for drivers on evacuation during disasters, should also be considered.

The early earthquake detection system saved thousands of passengers in the Shinkansen. Nineteen bullet trains (Shinkansen) were running when the GEJE occurred, including two at 270 kilometers per hour, almost top speed. All were able to stop safely because of the early earthquake detection systems. The Japan

Meteorological Agency issued earthquake information based on nationwide seismography and observations of seismic intensity. The agency operates an earthquake early warning system that quickly estimates an earthquake's focus and magnitude and forecasts seismic intensities and the arrival time of ground shaking.

The Knowledge Notes Executive Summary also furthers stresses the important roles of the community in multihazard DRM (figure 7). Successful evacuations depend on prior measures such as hazard mapping, warning systems, and ongoing education, all of which proved essential in the evacuation that followed the GEFE.

Figure 7. Roles of the Community in Multihazard DRM

Community-based organization saved lives and needs to be nurtured. When the tsunami overwhelmed coastal defenses, local communities were forced to use their own knowledge and resourcefulness to survive on March 11. Fortunately, throughout the Tohoku region, communities had been intently engaged in tsunami preparedness. Given the unreliability of predictions and the limitations of defensive structures, community engagement should be put at the center of the disaster-response system.

Evacuation drills and DRM education, staples of the country's schools, kept children safe in Kamaishi City. The famous "Kamaishi Miracle" was not really a miracle at all, but rather the result of a sustained effort to instill a culture of resilience and prevention based on continuous learning.

According to Mr. Toshitaka Katada, a professor of civil engineering at Gunma University, he said that “the top priority of disaster prevention is to save lives. To accomplish that, we need to educate children who can save their own lives”. A prime example was the children in Unosumai, the hardest-hit district in the city. Immediately after the magnitude 9.0 earthquake struck that afternoon, the students of Kamaishi East Junior High School ran out of the school to higher ground. Their quick response prompted the children and teachers of the neighboring Unosumai Elementary School to follow, and consequently drew in many local residents.

As they continued to run, older students supported the younger school children, and together they reached a safe location while behind them the mega-tsunami swallowed their schools and the town. The city lost more than 1,000 lives to the disasters, but only five of them were school-age children, and they weren't at school when the quake hit. This successful evacuation is known as the "Kamaishi Miracle". It is the result of a tsunami disaster prevention education program which was implemented in Kamaishi schools under his leadership.

Under Cluster 5 on Hazard and Risk Information and Decision making still on the article, “Learning from the Mega-disasters”, effective risk communication does not necessarily require a sophisticated communication system. Although science-based early-warning systems are important during a disaster, regular sharing of predisaster information at the local level is equally important. The sharing should be accompanied—over time and with the community’s involvement—by disaster drills, community mapping, and other measures. In recent years, remote-sensing data has been used around the world to rapidly map the damage resulting from natural disasters. Japan has a well-established track record in disaster mapping: As early as 1995, remotely sensed data were used to map the damage from the Kobe earthquake.

The volunteer fire corps traces its history to the 18th century. Corps members have regular jobs but, when disaster strikes, they take part in disaster management activities in their own communities, such as firefighting, issuing warnings, assisting evacuations, conducting search and rescue operations, and operating facilities. There

are currently some 890,000 active volunteers across Japan, which is almost six times the number of career firefighters. The Fire Defense Organization Act and its bylaws stipulate the corps' roles, organizational structures, members' status as part-time government staff, and compensation and allowances. The local government has principal responsibility for the corps, while the central government subsidizes their facilities.

According to the head of the Jichikai, the participation rate in Kojirahama is low, while in Kerobe most people participate in the drill. In Kerobe and Oishi, community members have a strong sense of solidarity, as the population is much smaller than in Kojirahama and they have lived there for years. Toni residents have written books about the effects of past tsunamis, which are used by the communities as an awareness-raising tool. In addition, there are two tsunami maps: one issued by the Kamaishi City government and the other developed by the community members themselves. The former includes the expected flood area, expected height of the tsunami, and expected arrival time. The latter includes local information about which areas were flooded in the Meiji-Sanriku and Syowa-Sanriku-tsunamis, evacuation sites, evacuation routes, and dangerous areas. These maps are distributed to all families in the town of Toni (KN 5-3). Finally, a number of community festivals are used as opportunities to engage local schools in disaster awareness and preparedness activities (figure 3).

The volunteer fire corps plays a critical role in DRM for several reasons: – Since the volunteers come from the community, they have local knowledge of the context and are familiar with those residents who may need special assistance to evacuate, such as the disabled or bedridden. – The total number of volunteers is some six times that of the professional firefighting staff, providing a cost-effective way of mobilizing large-scale emergency response capacity. – The members receive regular training and can respond immediately because they are locally based.

Community-based DRM activities are well integrated in the daily lives of the residents, ensuring that awareness of natural hazards is maintained, for example, by marking the anniversary of a large catastrophe with disaster drills, and linking

awareness-raising activities with local festivals. • The role of communities in DRM is formally recognized and supported by local and national authorities through linkages with local institutions. (Knowledge Note 2-1, Learning from Past Disasters, 2012)

Statistics show that in the 1995 Kobe earthquake, 80 percent of those rescued were saved by their neighbors. So, while local and national authorities have key responsibilities for civil protection in hazard events, communities are always the first responders and should be empowered in that role.

The role of the Semi-Public Private Sector in Disaster Risk Reduction Electricity, Gas and Telecommunication companies as well as major transportation companies are private companies in Japan. Due to the nature of services and products they provide, they are regarded to be a vital player in disaster risk reduction. They are called “designated public organs” in the Disaster Countermeasures Basic Act and are given duties to prioritize emergency response and be resistant against possible disasters. They are also called “Life Line” companies in Japan and there are public expectations for them to be resistant against various natural disasters. Therefore they have developed advanced engineering systems for disaster mitigation, emergency response and quick recovery. For example the major Gas companies in Japan are the ones who have first fully utilized 3D GIS systems for gas pipeline management. Telecommunications companies have developed specialized emergency voice message systems to avoid over congestion of telephone lines.

The important role of Private Companies in Disaster Risk Reduction It is not only the “Life Line” companies who are expected to contribute to disaster risk reduction. In Japan, the Annual Official Report on Disaster Management 1991 defined the three reasons for private companies to be active in disaster risk reduction.

(1) Companies own and/or occupy space. The safety of employees, customers and visitors who are inside this space must be assured by the company who occupies this space. Buildings and Shops must be safe against disasters. They must be designed in accordance with seismic building codes, be equipped with safety apparatus, and be fire proof. Security and safety is the basics for all private enterprise

operations. Furthermore they can contribute to disaster risk reduction by developing technologies and methodologies for securing safety of space.

(2) Companies are members of the communities they are surrounded. Companies must be good neighbors and are expected to perform corporate citizenship. They can contribute to disaster 3 risk reduction activities of their communities. They can initiate goodwill for disaster risk reduction.

(3) The goods and services provided by companies should not be interrupted. It is not only the “LifeLine” companies who are expected to continue operations. Let us imagine what would happen if a major pharmaceutical company stops its operations. The same applies to others as well. Business continuity is expected for various kinds of industries and commerce. To minimize economic damage, business continuity planning (BCP) is essential for all industries. These three reasons came to be widely acknowledged over the years in Japan, especially after the Hanshin-Awaji (Kobe) Earthquake in 1995 and the Tokai Flooding in 2000.

Definition of Terms

For clarity, the following terms are defined operationally:

1) **Community empowerment** refers to the process of enabling communities to increase control over their lives.

2) **Disaster Mitigation** is the lessening or limitation of the adverse impacts of hazards and related disasters. Mitigation measures encompass engineering techniques and hazard-resistant construction as well as improved environmental policies and public awareness.

3) **Disaster Prevention** is the outright avoidance of adverse impacts of hazards and related disasters. It expresses the concept and intention to completely avoid potential adverse impacts through action taken in advance such as construction of dams or embankments that eliminate flood risks, land-use regulations that do not permit any settlement in high-risk zones, and seismic engineering designs that ensure the survival and function of a critical building in any likely earthquake.

4) **Disaster Risk Areas** refer to areas are designated by local government regulations as being highly vulnerable in a disaster situation. Building new residential structures is prohibited in the area.

1) **Mutual help** refers to helping each other and protecting their community, examples of which are rescue activities to ave people buried alive, supervising the vacation of children and people with special needs or other kinds of mutual assistance within a regional community.

2) **Non-structural measures** are measures not involving physical construction which use knowledge, practice or agreement to reduce disaster risks and

impacts, in particular through policies and laws, public awareness raising, training and education.

3) **Public help** refers to public support at the hands of administrative bodies, as seen in education, preparation and maintenance in anticipation of a disaster occurring, as well as disaster response measures such as information provision and operating evacuation centers.

4) **Self-help** refers to safeguarding one's own life, examples of which include stocking up supplies in anticipation of disasters, and being able to judge one's circumstances by oneself and taking the appropriate action for evacuation.

5) **Structural measures** are any physical construction to reduce or avoid possible impacts of hazards, or the application of engineering techniques or technology to achieve hazard resistance and resilience in structures or systems.

6) **Whole of society approach** is "Acknowledging the contribution of and important role played by all relevant stakeholders, including individuals, families and communities, intergovernmental organizations and religious institutions, civil society, academia, the media, voluntary associations and, where and as appropriate, the private sector and industry, in support of national efforts for non-communicable disease prevention and control, and recognize the need to further support the strengthening of coordination among these stakeholders in order to improve the effectiveness of these efforts;". (Source: 2011 Political Declaration, (37))

CHAPTER 3
RESEARCH METHODOLOGY

This chapter discusses the research design used in this study, the research locale and data gathering procedure.

Research Design

Descriptive-exploratory method was found by the researcher to be the most appropriate research design for this study. This research design is focused on collecting either secondary or primary data and using an unstructured format or informal procedures to interpret them. Interviews were conducted to validate and further expound the data gathered. This method is preferred for this kind of research because the expected responses and results are best presented by descriptions.

Research Locale

The researcher conducted her study in different strategic places at the Kansai Region through the use of the Asian Disaster Reduction Center (ADRC) office. The ADRC was established in Kobe, Hyogo Prefecture, in 1998 with the mission of enhancing the disaster resilience of its 31 member countries, building safe communities and creating a society where sustainable development is attainable.

The interviews were conducted at the Hyogo Prefecture Education and Training Institute, Hyogo Prefectural Government Office, Cabinet Office of Japan, CERD Osaka City University, Sendai City government, Universities of Kobe, Tokyo and Tohoku, Sojiji Temple from a monk leader and Tsurukabuto Community Welfare Council Office.

In the case of ocular visits and survey of community DRR knowledge, the researcher visited the Kobe City, Osaka City, tsunami affected areas in Sendai City, Ishinomaki City, Onagawa town and Natori City and Miki City with the assistance of the staff and supervisors of ADRC. The conduct of town mapping with JICA

participants was done at the Otani area in Kobe City. The group also conducted a tsunami hazard map at a small community in Kamakura City in Kanagawa Prefecture.

CHAPTER III

RESULTS AND DISCUSSION

This chapter presents the analysis and interpretation of data on the study to provide information on the various specific strategies, mechanisms and disaster countermeasures on Japan's adaptive capacities on the strengthening of disaster risk reduction and management.

For a clear and broad presentation of the findings, this chapter is organized into six (6) parts corresponding to the specific statement of the problem in Chapter I of this study.

Problem 1. What are the scenarios on the future disasters being undertaken by Japan and Philippines?

Japan's 4 main islands - Honshu, Hokkaido, Shikoku, and Kyushu - and more than 3,000 small islands cover a combined area of 377,727km2. These islands extend over 2,000km in total length but spread only about 300km in width.

Located in the Circum-Pacific Mobile Belt or the Ring of Fire, Japan is predominantly mountainous - about three-fourths of the national land is mountains - and long mountain ranges form the backbone of the archipelago. The dramatic Japan Alps, studded with 3,000-meter peaks, bisect the central portion of Honshu, the main island. Japan has around 200 volcanoes, about 60 of which are active. Consequently, earthquakes and volcanic eruptions are common.

This mountainous setting creates rivers that generally are short and have steep channel slopes. The rivers carry their sediment to the flatlands where they deposit it to form moderately sized alluvial plains.

In fact, there is also a high probability of the occurrence of large-scale earthquakes in the near future including impending possibilities of **Japan's Nankai**

Trough Earthquake and Tokyo Inland Earthquake. As such, natural disasters remain a menacing threat to the safety and security of the country.

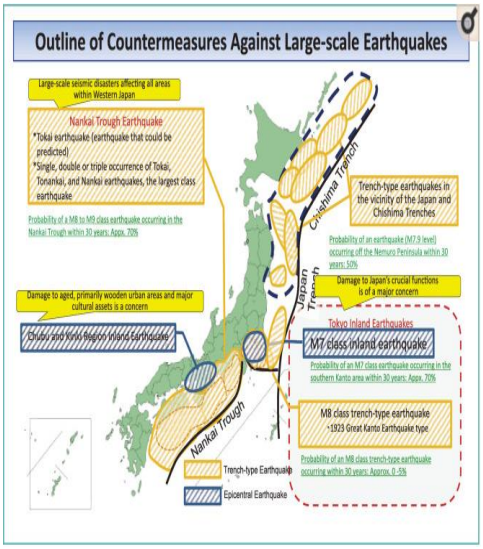


Figure 8: Diagram on Outline of Countermeasures against large-scale EQ

Photo Credit: Japan Medical Association Journal 2016 July 1

In the area along the Nankai Trough, trench type mega earthquakes have occurred on a 100 to 150 year cycle, causing great damage to the area. The study of large-scale earthquake countermeasures in this has been conducted. Based on the lessons learned from the GEJE in March 2011, the Central Disaster Management Council decided to assume the "maximum possible earthquake and tsunami" to occur.

Likewise, it is estimated in Tokyo, massive trench-type earthquakes with a magnitude of 8 or greater like the Great Kanto Earthquake (1923), will occur at intervals of 200-400 years. Additionally, it is presumed that several **Tokyo Inland Earthquakes** of M7 scale will occur before a M8 scale earthquake.

Moreover, according to the 2018 World Risk Report, the Philippines rank third on the index, behind Vanuatu and Tonga. This is the country's third year in third place, after moving down from second place in 2015. The Philippines also ranks third on the WRI's list of countries with the greatest exposure to natural disasters, with a score of 49.94%, just ahead of Japan (46.55%).

With that said, the Philippines is certainly at risk to earthquakes generally caused by the movement of active faults and trenches. Many earthquake generators are distributed all over the country including the Philippine Fault, Manila Trench, Philippine Trench, Negros Trench, Cotabato Trench and Sulu Trench. Specifically, Metro Manila is located in Luzon Island between Manila Bay which extends to the West Philippine Sea, and Laguna de Bay. As the National Capital Region, it is where the seat of government is, is central to businesses and economic activities, and is home to more than 12 million people.

The Harmonized National Contingency Plan for Earthquake (National CP, for brevity) issued in 2018 and currently updated its version in early part of 2019, illustrated the 18 earthquake scenarios that may affect Metro Manila and the vicinity. The projected impacts of the West Valley Fault (WVF) earthquake were updated and enhanced in the Greater Metro Manila Area (GMMA) Risk Analysis Project (RAP) in 2013.

The identification of hazards on a magnitude 7.2 earthquake scenario resulting from the movement of the WVF was derived from the results of the Metro Manila Earthquake Impact Reduction Study (MMEIRS) conducted by PHIVOLCS, Metro Manila Development Authority (MMDA), and the Japan International Cooperation Agency (JICA) from August 2002 to March 2004.

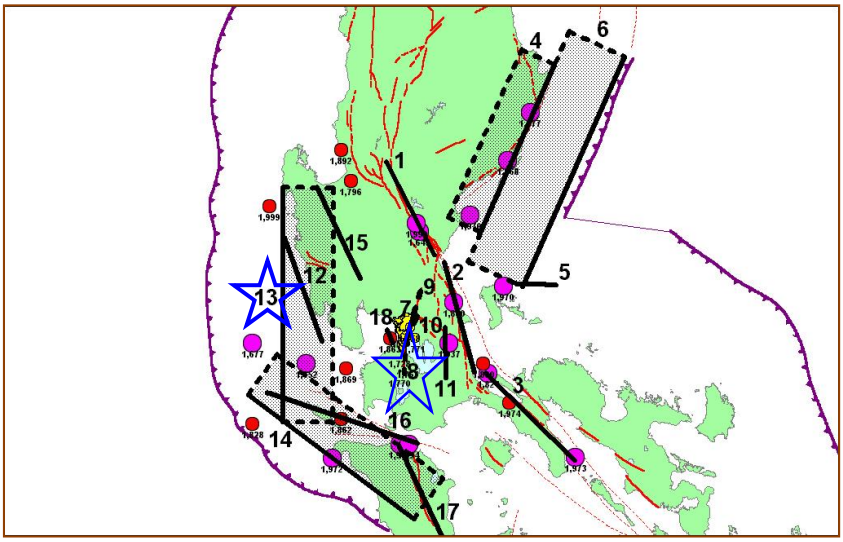


Figure 9: Diagram on the Map of the 18 Earthquake Scenarios based on MMEIRS

Specifically, the worst case scenarios identified in the MMEIRS are:

1. **SCENARIO 8**: Generated by the WVF, causing a 7.2 magnitude earthquake and leading to severe damage in Metro Manila

2. **SCENARIO 13**: Generated by the Manila Trench, causing a 7.9 magnitude earthquake and leading to the occurrence of tsunami

The WVF moved four (4) times and generated strong earthquakes within the last 1400 years. The approximate return period of these earthquakes is between 400 to 600 years and no large event along the West Valley Fault is known after 17th century.

The table below displays the analysis of earthquake as a natural hazard, based on consultations and discussions with technical experts from PHIVOLCS and various representatives from the member agencies of the National Disaster Risk Reduction and Management Council (NDRRMC):

ROOT CAUSE	EARLY WARNING SIGNS	EFFECTS	EXAMPLES OF EXISTING MITIGATING MEASURES
Movement of earthquake generators (faults and trenches)	NONE	Ground shaking Ground rupture Liquefaction Earthquake-induced landslide Tsunami Collapsed structure Fire Hazardous materials (hazmat) incidents Industry-related explosion	Implementation of building design standards Assessment of structural integrity of buildings and facilities Conduct of structural retrofitting Relocation of communities to areas safe from earthquake hazards

Table 1: Root Causes, Early Warning Signs, Effects and Existing Mitigating Measures for Earthquake

In this context, mitigating measures and strengthening the DRRM in the Philippines are being undertaken by the NDRRMC, local government and other stakeholders. Meanwhile, Japan, as being named the leader in disaster prevention, the government through the Cabinet Office continuously updated the strategies and mechanisms on disaster risk reduction to align and achieve the SFDRR global target until year 2030.

Problem 2. To what extent can these scenarios on the future disasters cause possible damages to properties, economic losses and losses of lives?

2.1 Nankai Trough Earthquake Scenario

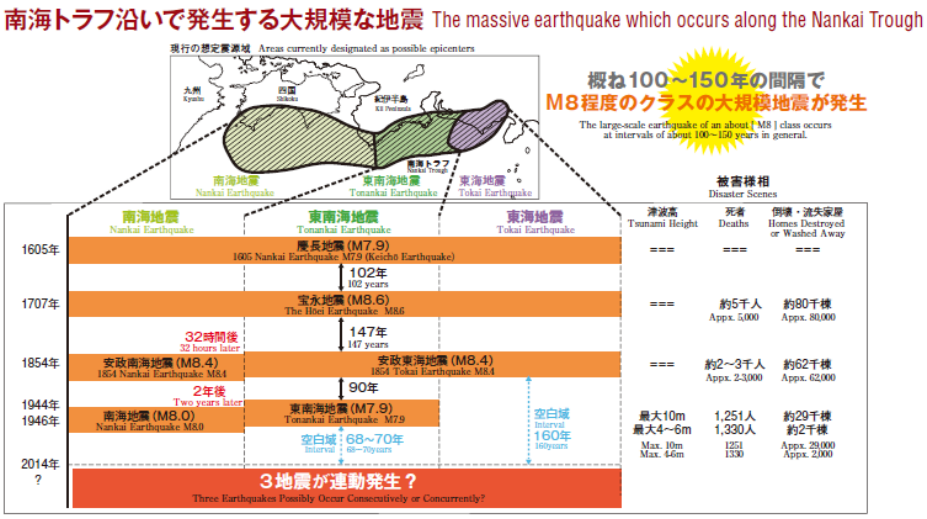


Figure 10: Records of Damages Past Earthquakes along Nankai Trough *(Source: Cabinet Office)*

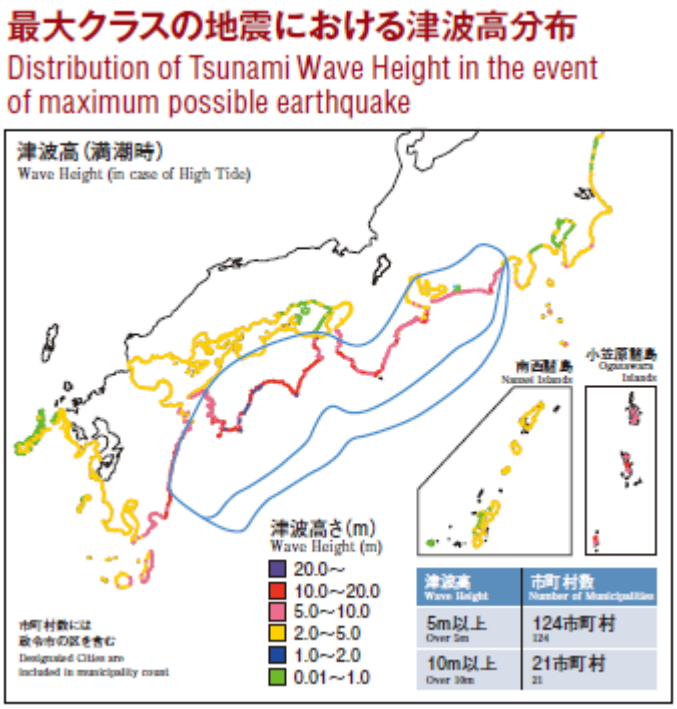


Figure 11: Distribution of Tsunami Wave Height during occurrence of Nankai Trough Earthquake *(Source: Cabinet Office)*

Shown on Figures 10 and 11, the massive earthquakes that occur along the Nankai Trough for over 100-150 year cycle caused several deaths and damages to houses and buildings. With the above assumption on the worst-case scenario on the movement of Nankai Trough and other trenches simultaneously, the possible maximum seismic movements and tsunami height were simulated. According to the

simulation, **maximum death toll is estimated at 323,000**, of which death by tsunami would amount to 230,000. Maximum possible economic loss could be **approximately 170 trillion yen for asset and 45 trillion yen for degradation of production and services.** It is estimated to about **2.5 million units of total collapsed buildings.** It is estimated, however that these damages could be reduced substantially by taking countermeasures in advance.

2.2 Tokyo Inland Earthquake

According to the final report, the earthquake with an epicentre in the southern part of Tokyo would cause extensive damage including a **death toll of as many as 23,000 people**, number of people in need of rescue of 72,000, **total collapse of 610,000 buildings** and a **maximum possible economic loss of 47 trillion yen for assets and 48 trillion yen for degradation of production and services**. Breakdown of figures are shown on Figure 12.

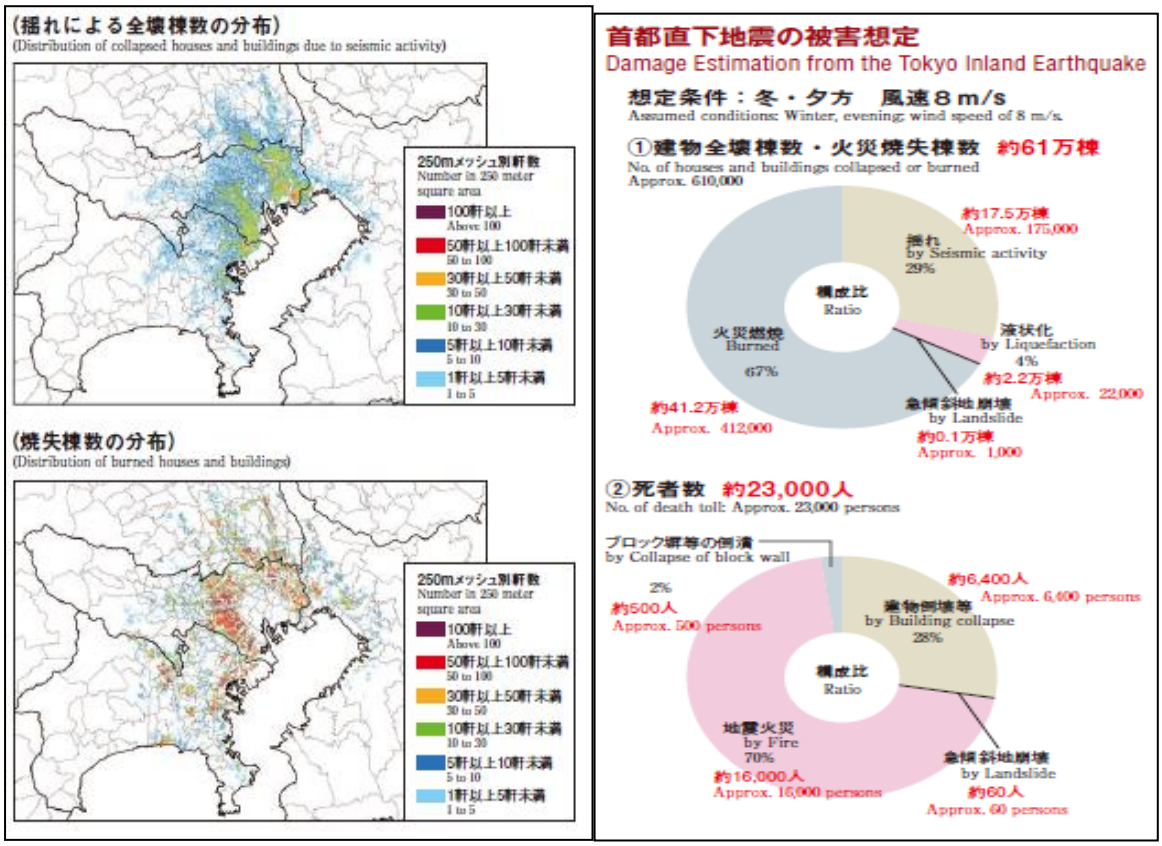


Figure 12: Damage Estimation from Tokyo Inland Earthquake (Source: Cabinet Office)

2.3 Magnitude 7.2 earthquake Scenario resulting from the movement of the West Valley Fault (WVF)

According to the study, the earthquake or being called as the “Big One” would cause extensive damage including a **death toll of as many as 52,000 people** and five million or more people being displaced and around **520,000 collapsed buildings** (totally or partly damaged).

Relatedly, data sourced from the National CP by the NDRRMC are the estimated breakdown of casualties and displaced persons for the three affected region: National Capital Region, Central Luzon and CALABARZON.

Below is the table of estimated number of dead, missing, injured, and displaced population across the LGUs in Metro Manila[2]:

REGION	LGUS	DEAD	MISSING	INJURED	DISPLACED
NCR East	Pasig	2,387	12,420	34,692	475,774
	Marikina	1,617	8,280	24,297	317,182
NCR North	Caloocan	3,114	6,560	54,105	198,478
	Malabon	874	3,300	13,774	99,240
	Navotas	740	3,280	12,431	99,000
	Valenzuela	1,169	6,600	20,522	198,000
	Quezon City	5,524	13,160	96,652	396,478
NCR West	Manila	5449	13,750	84,515	535,246
	San Juan	306	5,500	4,818	214,098
	Mandaluyong	817	8,250	3,664	321,147
NCR South	Las Pinas	1491	11,640	25,429	333,042
	Muntinlupa	1206	2,716	21,450	77,710
	Paranaque	1385	3,492	24,508	99,913
	Pasay	1117	3,104	17,183	88,811
	Taguig	2366	3,880	39,247	111,014
	Makati	1,427	11,640	20,737	333,042
	Pateros	239	2,328	3,698	66,608
TOTAL		**31,228**	**119,900**	**501,722**	**3,964,783**

Table 2: Estimates on Dead, Missing, Injured and Displaced in Metro Manila

[2] Reference for Dead and Injured (consolidated for slight, serious and very serious injuries): GMMA RAP 2013
Reference for Missing: INSARAG ERE, 2018
Reference for Displaced: INSARAG ERE, 2018

Below is the table of estimated number of dead, missing, injured, and displaced population for the affected LGUs in Central Luzon[3]:

LGUS	DEAD	MISSING	INJURED	DISPLACED
Bulacan	9,000	12,000	30,000	277,650
Pampanga	6,000	8,000	20,000	63,000
TOTAL	**15,000**	**20,000**	**50,000**	**340,650**

Table 3: Estimates on Dead, Missing, Injured and Displaced in Central Luzon

Further, below is the table of estimated number of dead, missing, injured, and displaced population for the affected LGUs in CALABARZON[4]:

LGUS	DEAD	MISSING	INJURED	DISPLACED
Rizal	500	2,000	12,000	331,360
Cavite	3,000	3,443	50,398	563,840
Laguna	3,145	100	65,600	119,680
TOTAL	**6,645**	**5,543**	**127,998**	**1,014,880**

Table 4: Estimates on Dead, Missing, Injured and Displaced in CALABARZON

Please take note that all of the estimates above are not to be taken as absolute projections. The figures may be subject for changes or revisions when another estimation of risks and vulnerabilities maybe carried out by DRR experts.

Below are the scenarios that can possibly occur should there be WVF movement:

SITUATIONS	BAD SCENARIO	WORSE SCENARIO	WORST SCENARIO
Description	The WVF moved with a magnitude of 5.0 – 5.9 and/or intensity VI	The WVF moved with a magnitude of 6.0 – 6.9 and/or intensity VII	The WVF moved with a magnitude of more than or equal to 7.0 and/or intensity VIII and higher
Impacts on Human Lives	Fatalities: Around 1,000 Injuries: Around 3,000	Fatalities: Around 5,000 Injuries: Around 10,000	Fatalities: Around 52,000 Injuries: Around 700,000
Impacts on Human Lives	Very old or poorly built houses and man-made structures are slightly damaged though well-built structures are not	Old or poorly-built structures suffer considerably damage. Some well-built structures are slightly damaged. Some cracks may appear on dikes,	Most buildings are totally damaged. Bridges and elevated concrete structures are toppled or destroyed. Water sewer

[3] Reference for Dead, Missing and Injured: RDRRMC III Contingency Plan for Earthquake 2018
Reference for Displaced: INSARAG ERE 2018

[4] Reference for Dead, Missing and Injured (consolidated for slight, serious and very serious injuries) in CALABARZON: CP for Earthquake for Rizal, Cavite and Laguna 2018
Reference for Displaced: INSARAG ERE 2018

	affected. Wall plaster may crack. Heavy objects or furniture move or may be shifted.	fish ponds, road surface, or concrete hollow block walls. Heavy objects and furniture overturn or topple.	pipes are bent, twisted or broken.
	Trees and utility posts are noticeably shaken	Trees and utility posts are shaken strongly.	Numerous trees are utility posts are tilted, toppled or broken.
	Limited rockfalls and rolling boulders occur in hilly to mountainous areas and escarpments.	Limited liquefaction, lateral spreading and landslides are observed.	Landslides and liquefaction with lateral spreadings and sandboils are widespread. The ground is distorted into undulations. Boulders are commonly thrown out. River water splashes violently on slops over dikes and banks.
	All roads and bridges remain passable	50% of roads and bridges are not passable	80% of roads and bridges are not passable Concrete dikes and foundation of bridges are destroyed by ground settling or toppling. Railway tracks are bent or broken.
	Power and communication facilities remain operational	50% of power, energy and communication facilities are no longer operational	80% of power, energy and communication facilities are no longer operational
	No outbreak of hazmat	Outbreaks of fire and hazmat incidents in some areas in Metro Manila.	Outbreaks of fire and hazmat incidents occurred in most areas in Metro Manila, Central Luzon and CALABARZON.
Response Capabilities	Local capacities are still functional in Metro Manila, Central Luzon, and CALABARZON	Around 70% of manpower and equipment of Metro Manila, Central Luzon and CALABARZON can still be mobilized for response.	Even the response groups in Metro Manila, Central Luzon, and CALABARZON are victims. They have limited capacity to respond within their respective areas for the early days of response operations.

Table 5: Indicators of Bad, Worse and Worst Scenarios for the Earthquake due to the WVF Movement

Problem no. 3. What are the innovations of disaster risk reduction strategies and countermeasures in terms of the following:

3.1 Non-structural measures

UNISDR has defined, non-structural measures as measures not involving physical construction which use knowledge, practice or agreement to reduce disaster risks and impacts, in particular through policies and laws, public awareness raising, training and education. Common non-structural measures include building codes, land-use planning laws and their enforcement, research and assessment, information resources and public awareness programmes. Note that in civil and structural engineering, the term “structural” is used in a more restricted sense to mean just the load-bearing structure, and other parts such as wall cladding and interior fittings are termed “non-structural”.

Below are the components grouped together by the researcher for clear illustration and categorization of the non-structural measures.

3.1.1 Current DRR laws, plans and policies

Japan’s disaster management system has been in place since Disaster Relief Act of 1947 and has long used the learning from past disasters to continuously improve this system. Recently, it addresses all phases of disaster preparedness, prevention and mitigation and emergency responses, as well as the recovery and rehabilitation.

Since the GEJE, the national and local DRM planning systems to prepare for and react to large-scale of disasters has been assessed, and revisions were proposed through new legislation.

Hence, after Hyogo Framework for Action for 2005-2015 has ended its term, a new DRR framework came into its being in 2015 and adopted globally. The Sendai Framework for Disaster Risk Reduction 2015-2030 was formulated. The framework outlines seven clear targets and four priorities for action to prevent new and reduce existing disaster risks: Understanding disaster risk; Strengthening disaster risk governance to manage disaster risk; Investing in disaster reduction for resilience, and; Enhancing disaster preparedness for effective response, and to "Build Back Better" in recovery, rehabilitation and reconstruction.

It aims to achieve the substantial reduction of disaster risk and losses in lives, livelihoods and health and in the economic, physical, social, cultural and environmental assets of persons, businesses, communities and countries over the next 15 years.

Japan's *Basic Disaster Management Plan*, as revised after the GEJE aims to rigorously enforce earthquake and tsunami countermeasures. Addressing a new set of scenarios that take into account the largest possible disaster and multiple simultaneous hazards, the plan calls for the development of disaster-resilient communities, the promotion of disaster awareness, increased research and scientific observation, and stronger systems to warn of tsunamis and deliver evacuation information.

In its recent revision in April 2017 as shown on Figure 9, descriptions were added as responses to the issues that emerged at the Kumamoto Earthquake and Typhoon 10 in 2016. Specifically, an increasing support for local governments was emphasized, including training courses for heads and senior officials of prefectural governments, and the utilization of ICT based on lessons learned from the Kumamoto Earthquake. The revised plan also clearly describes the clarification of people subject to evacuation recommendations, etc., changes in the evacuation information titles and the development of specific plans for emergency disasters concerning the facilities used by persons requiring special care based on lessons from 2016 Typhoon 10 disaster.

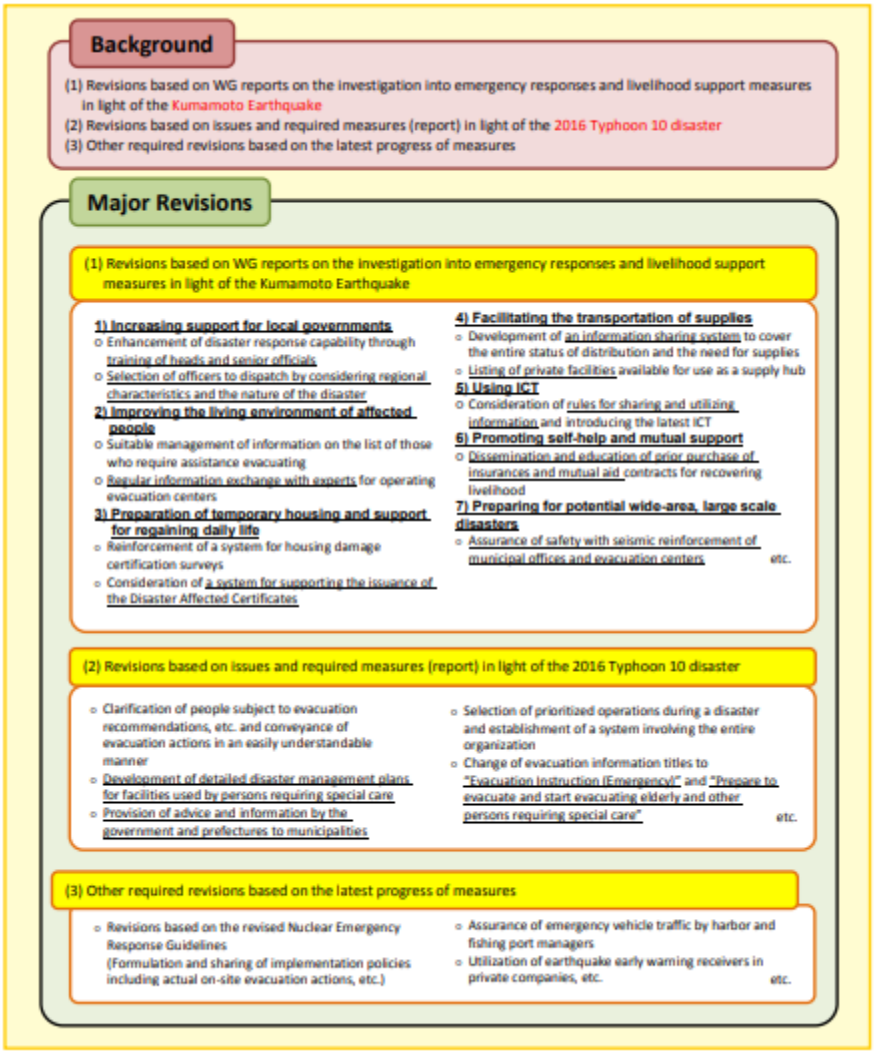


Figure 13: Overview of Revisions to the Basic Plan for Disaster Risk Reduction (April 2017) *(Source: Cabinet Office)*

The Central Disaster Management Council has developed the *"Policy Framework for Large-Scale Earthquake Disaster Prevention and Reduction",* a master plan of the countermeasures for the large-scale earthquake, that includes a range of activities from preventive measures post-disaster response and recovery: the "Earthquake Disaster Reduction Strategy", to determine an overarching goal of damage mitigation and strategic targets based on the damage estimation.

Based on GEJE experience, the *"Act on Promotion of Tsunami Countermeasures"* which includes enhancement of the tsunami observation systems, education and training about tsunami and construction of necessary facilities, and the "*Act on Development of Areas Resilient to Tsunami Disasters"* prescribing formulation

of comprehensive plan and restriction of development in areas estimated to be inundated by tsunami have been enacted.

Further, *Disaster Countermeasures Basic Act* was revised in 2011 to enable local entities to designate emergency shelter areas. Based on these laws, more comprehensive tsunami countermeasures were being undertaken.

Based on the Great Hanshin-Awaji Earthquake experience, the Central Disaster Management Council drafted the "*Urgent Countermeasures Guidelines for Promoting the Earthquake-resistant Construction of Houses and Building"* in 2005, which stipulates the earthquake-resistant construction throughout the country should be urgently and strongly enforced in close cooperation with related ministries as a national priority. In November 2013, the said act was revised, making obligatory to conduct a seismic qualification test and make reports on large-scale buildings, including hospitals and shops, which are available to the general public, as well as schools and nursing homes, which are used by those who need special attention in the event of evacuation.

Further, *Article 17 of the Law concerning Promotion of Seismic Rehabilitation of Buildings* (Ministry of Land, Infrastructure and Transport Notification No. 217 in Heisei 21) specified details concerning criteria for designation of seismic retrofit support center.

In March 2014, on the basis of "*Act on Special Measures for Promotion of Nankai Trough Earthquake Disaster Management"* areas were designated to make progress in the measures against the earthquake (29 prefectures including Tokyo, Osaka and Kyoto, and 707 municipalities as of April 2014), and further, areas encompassing 14 prefectures including Tokyo and 139 municipalities were designated to reinforce the evacuation plan against tsunami triggered by the earthquake.

In November 2013, the *"Act on Special Measures for the Tokyo Inland Earthquake"* was enacted, and in March 2014, areas were designated as in need of urgent measures to be taken (Tokyo and 9 prefectures and 309 municipalities as of

March 2015). At the same time, the Basic Plan for urgent implementation of measures and the *Business Continuity Plan* by Central Government were formulated.

The Basic Plan stipulates that the continuity of core functions of the metropolis be maintained and the damage would be significantly reduced by preparedness for the disaster and by emergency response plans. Thus, it is critically necessary that such measures be planned ahead and strategically implemented. As the basic policy, the Plan includes:

- Construction of the systems for continuation of the services of core institutions and the infrastructure supporting such systems;
- Construction of earthquake and fire resistant structures as the basis for all countermeasures taken, and measures against anticipated serious road traffic paralysis and measures for enormous number of evacuees and workers having difficulties getting home;
- Promotion of whole-society cooperation on a “self-help”, “mutual-help” and “public help” basis; and,
- Measures toward the 2020 Tokyo Olympic and Paralympic Games.

Furthermore, in compliance with a decision made at the Cabinet in March 2015, the Plan sets numerical targets for disaster reduction with a time limit, and includes concrete targets for measures to achieve those numerical targets.

The countermeasures against the earthquakes also include promotion of disaster management measures in the city areas with high concentration of wooden houses, damage reduction plan for the cultural heritages in the Kyoto and Nara areas, and security plan for the petrochemical plant complex concentrated in the Osaka and Ise bays.

Since the enactment of *“Flood Control Act”* in 1949, several revisions were made to improve flood countermeasures and reduce damage caused by severe weather disasters. Based on this Act, 417 rivers subject to flood warning and 1,555 rivers subject to water-level notifications are designated. Of these, inundation risk

areas are currently designated and published for 1,931 rivers (as of March 2014). As non-structural countermeasures, the warning and evacuation systems for the possible inundated areas and landslide prone areas have been developed in accordance with the *Flood Control Act and the Sediment Disaster Prevention Act.* Furthermore, in 2013, the Act was amended stipulating the participation of diverse entities including river management organizations in flood control activities, acquisition of appropriate maintenance and management need in river management facilities, etc.

To minimize the damage against large-scale floods, the Central Disaster Management Council has formulated the *Basic Policies for Metropolitan Area Large-Scale Water Hazard* and measures have been promoted so that prompt evacuation can be effected.

With the objective of improving the resilience of communities to disasters, related government ministries have set out and revised laws such as the following:

1) *Act No. 41 of Disaster Countermeasures Basic Act* (amended on June 27, 2012) specifies the obligation of residents to hand down to younger generations the lessons of disaster resilience. It also specifies that each disaster prevention organization including regional public bodies, private business etc must endeavour to implement disaster resilience education, and pursuant to this are permitted to seek the cooperation of educational bodies and public/private organizations.

2) *Guidelines for school disaster resilience education that nurtures "Zest for Life",* enacted on March 2013, was created as reference materials outlining the ideal state of school disaster resilience education and disaster prevention management, reflecting new item of concern emanating from schools in the wake of recent natural disasters.

A new frame of reference was added to the definition of safety in the existing government curriculum guideline: this included nurturing "the attitude of acting with an independent mind" and the "awareness of contributing to

creating a safe and secure society" in consideration of the report issued by the "council of advisors related to disaster resilience education and disaster prevention management post 3-11" (July 2012).

In particular, based on "*School Health and Safety Act"* and *"School Safety Promotion Plan"* (Cabinet Decision in April 2012), the guidelines make it clear to schools that they must set aside time for teacher disaster resilience and in order to bolster their instruction should organize structured and systemic contents.

3) *Act No. 110 on Law on Strengthening Regional Disaster Resilience with Volunteer Fire Fighting at the Core* (amended on December 13, 2013) specifies that national and local public bodies shall enact measures necessary to promote learning regarding disaster resilience in education at both the school and societal level. It also specifies that fire brigades shall assume a leadership role in the education and training for autonomous voluntary disaster management organization women fire safety clubs, junior fire resilience clubs and public entities within the boundaries of municipalities and any other organizations related to disaster reduction.

Notably, some basic principles from the Disaster Countermeasures Basic Act in the organization of community volunteers *(Jishu Bosai Soshiki)* are enumerated as follows:

a) Article 2-2 states that "disaster control measures shall be taken with the basic principles of the following matters:

(ii) while ensuring proper division of roles and mutual coordination and cooperation among the national and local governments and other public institutions, disaster prevention activities conducted voluntarily by each resident and those conducted voluntarily by voluntary disaster prevention organizations (which means voluntary disaster prevention organizations

based on a spirit of mutual cooperation among residents; the same applies hereinafter) and other various actors in the area shall be promoted as well.

b) Article 5 (1) is based on the Basic Principles and in the interest of protecting the area of a municipality, the lives, bodies, and properties of its residents from disaster, the municipality as a local government at the base shall have the responsibility to formulate, with the cooperation of related organs and other local governments, a disaster prevention plan concerning an area of said municipality, and implement the plan on the basis of laws and regulations.

(2) The mayor of municipality must, in order to fulfill responsibilities under the preceding paragraph, endeavor to employ to the highest degree all capacities of the municipality, by keeping the organization of fire-fighting organs, flood prevention units, etc., in good condition, by enhancing organizations related to disaster prevention, voluntary disaster prevention organizations, and other public groups within the area of the municipality, and by promoting voluntary disaster prevention activities among the residents.ereinafter) and other various actors in the area shall be promoted as well.

c) Article 8 (xiii) stipulates matters on the encouragement of the citizens to engage in voluntary disaster prevention activities such as fostering voluntary disaster prevention organizations, enhancing the environment for disaster prevention activities by volunteers, supporting activities to hand down lessons learned from past disasters, and others.

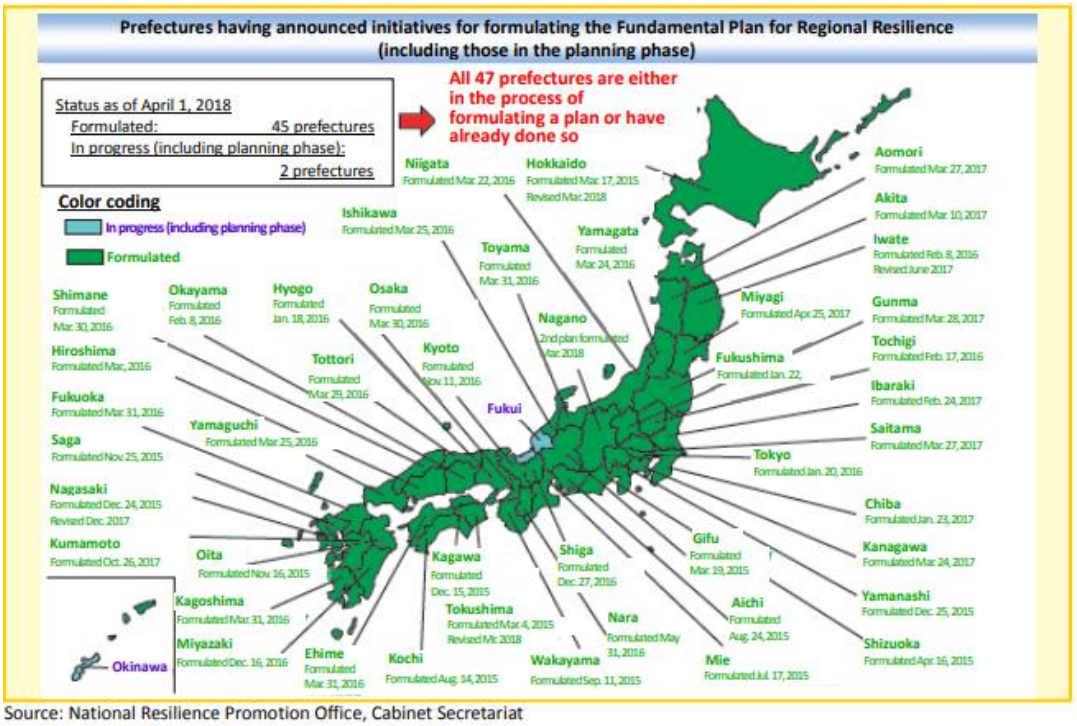
d) Article 15 (viii), on the organization of a prefectural disaster prevention council stating that *“persons appointed by said prefectural governor from among persons consisting of voluntary disaster prevention organizations or persons with relevant knowledge and experience”*.

e) Under Article 49-11 (2), the mayor of municipality shall give Information on the Name Lists to fire-fighting organs, prefectural police, welfare commissioners prescribed in the Welfare Commissioners Act (Act No. 198 of 1948), municipal social welfare councils prescribed in Article 109, paragraph (1) of the Social Welfare Act (Act No. 45 of 1951), voluntary disaster prevention organizations and any other persons engaged in implementation of Evacuation Support, etc. (referred to as "Evacuation Supporters" in the following paragraph) in order to prepare for the occurrence of a disaster, to the extent necessary for implementation of Evacuation Support, etc. and pursuant to the provisions of the area disaster prevention plan. If, however, except as otherwise provided by the ordinance of said municipality, said municipality is unable to obtain the approval of the person (which means a particular person identified by said Information on the Name Lists; the same applies to the following paragraph) regarding the provisions of Information on the Name Lists, this shall not apply.

As part of the initiatives to promote national resilience, the National Resilience Promotion Office approved the *Action Plan for National Resilience 2017* (“Action Plan 2017”, for brevity) on June 6, 2017. The Action Plan 2017 sought to make relevant measures more effective in response to the Kumamoto Earthquake in April 2016 and a series of typhoons in August and September and boost initiatives to broaden the base of national resilience by encouraging local governments and the private sector to implement initiatives and raising awareness; both within Japan and overseas. With regard to the Kumamoto Earthquake in 2016, existing measures were inspected against 45 “worst cases that should not occur,” and after reviewing approaches for a necessary response to the issues identified, the results of the inspection were reflected in the Action Plan 2017. Moreover, a PDCA cycle based on a newly emerging large-scale natural disaster in future will be added to the periodic review and evaluation of the program for the current PDCA cycle used to date to promote the action plan for further sophistication in a planned and steady manner.

Local governments are in the process of formulating their relevant *Fundamental Plan for Regional Resilience* (“Regional Plan, for brevity). As of April 1, 2018, 45

prefectures and 74 municipalities had already formulated the Regional Plan while two prefectures and 52 municipalities were in the process of doing so (Fig. 14). Government officials held briefings to support local governments in formulating the Regional Plan. In addition, 29 grants and subsidies under the jurisdiction of relevant ministries and agencies are made available to help fund initiatives undertaken by local governments based on their Regional Plan. Follow-up surveys are also conducted to ascertain the implementation status of support provided via these ministries and agencies, and the results are informed to local governments.



Source: National Resilience Promotion Office, Cabinet Secretariat

Figure 14: The Formulation Situation of the Fundamental Plan for Regional Resilience in Prefectures

Similar with Japan's recent developments on DRR, the Philippines has likewise undergone development and updates on certain DRR laws, plans and policies addressing the global call of the Sendai Framework for Action 2015-2030, Paris Agreement, APEC DRR Framework, and Sustainable Development Goals.

Section 27 of RA 10121 stipulates that a conduct of "Sunset Review' after the passage of RA 10121 in 2010. Therefore, as mandated by law, the OCD is delegated to undergo review of the Implementing Rules and Regulations of the RA 10121, as well as updating the National DRRM Plan (NDRRMP), which plan fulfil the requirement of the DRRM law.

Janice Padagdag – Philippines

Generally, the updating of the NDRRMP Plan for CY 2018 aims to review and evaluate the implementation of the NDRRM Plan and ensure the relevance of the plan towards the attainment of the long-term vision of a safer, adaptive and disaster resilient Filipino communities towards sustainable development.

Specifically, the NDRRM Plan review aims to:

1. Evaluate the accomplishment in the seven-year implementation of the NDRRM Plan;
2. Align the NDRRM Plan with the Sendai Framework for Disaster Risk Reduction (SFDRR), 2030 Sustainable Agenda, other related frameworks, and the national development plans;
3. Reinforce convergence of the national strategy on disaster risk reduction (DRR) and climate change adaptation (CCA);
4. Streamline and establish updated sets of outcomes, outputs, indicators and priority activities;
5. Reinforce the prevention and mitigation targets and indicators; and
6. Establish monitoring and evaluation tool on the accomplishments and impact of the plan implementation.

The National Disaster Preparedness Plan as adopted by the NDRRMC its first edition in 2015, has a primary goal of preparedness to avert the loss of lives and assets due to threats and emergencies. RA 10121 defines preparedness as the “knowledge and capacities developed by governments, professional response and recovery organizations, communities and individuals to effectively anticipate, respond to, and recover from, the impacts of likely, imminent or current hazard events or conditions.” While essentially implementation of preparedness is before any hazard or any disasters strikes, preparedness outcomes straddle between pre-disaster, disaster and post disaster phases based on existing definitions.

The objectives of the National Disaster Preparedness Plan (NDPP) emanates from the National Disaster Risk Reduction and Management Plan (NDRRMP). The

NDPP helps the national and local governments and other stakeholders contribute to the following objectives:

1. To increase level of awareness and enhanced capacity of communities to anticipate, avoid, reduce and survive the threats and impacts of all hazards;
2. To fully-equip communities with the necessary skills and capability to face and survive hazards and cope with the impacts of disasters;
3. To increase Disaster Risk Reduction and Management (DRRM) and Climate Change Adaptation (CCA) capacity of Local DRRM Councils, Offices and Operation Centers at all levels;
4. To develop and implement comprehensive national and local preparedness and response policies, plans and systems; and
5. To strengthen partnership and coordination among all key players and stakeholders.

Consistent with the NDRRMP and other mandates, the NDPP aims to contribute to the broader vision of reducing loss of lives and assets due to hazards and its potential impacts, by aiming at safe and resilient communities. National and local public and private stakeholders need to work together to contribute to attain this objective, with the government taking the lead in facilitating synergy of interventions and ensure that communities are able better to anticipate, cope with, and recover from hazards.

The Harmonized National Contingency Plan is the NDRRMC's contingency plan intended to address the response requirements resulting from the anticipated occurrence of the magnitude 7.2 earthquake scenario due to the movement of the West Valley Fault that will greatly affect Metro Manila Central Luzon and CALABARZON. The goal of the National CP is to provide effective, efficient, timely and well-coordinated response arrangements for all DRRMCs from the national, regional and local DRRMCs in the unlikely occurrence of the magnitude 7.2 earthquake. It was approved on 12 January 2018 as a "working document" and subjected to continuous review and enhancement by the NDRRMC Technical Working

Group based on latest scientific studies about geological hazards, risk assessment findings and innovations in DRRM policies and standards.

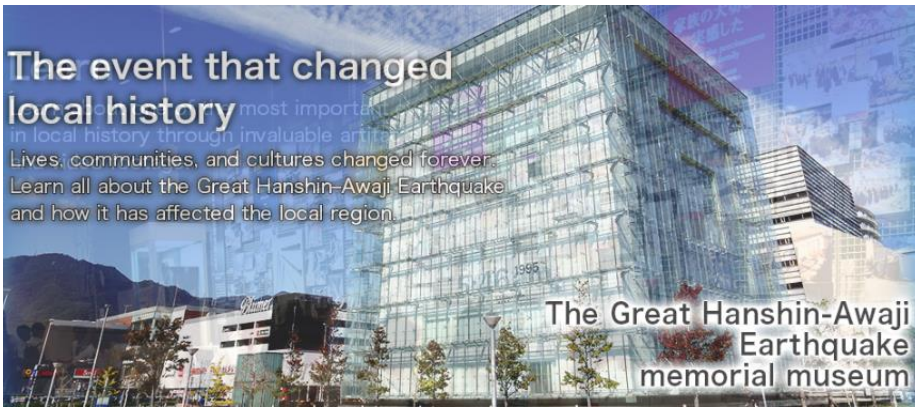
To lay down the foundation for more inclusive growth, a high-trust and resilient society and a globally competitive knowledge economy, the Philippine Development Plan for 2017-2022 (PDP, for brevity) was approved on February 2017. By the end of the planning period, Filipinos will have greater socioeconomic resiliency. A universal and transformative social protection will be provided to all, to empower the people and make them capable of preventing, responding to, and recovering from various risks (i.e., economic, governance, and political risks, risks from natural hazards and individuals' inherent vulnerabilities). Strategies to deal with natural hazards on prevention and mitigation measures include the rolling out of climate and disaster vulnerability and risk assessment nationwide and developing facilities for adaptation in local communities including risk transfer mechanisms. Hence, Executive Order No. 27 directs all government agencies and instrumentalities, including local government units to implement the PDP.

In the pursuit of national resilience, Executive Order No. 29 dated 28 June 2017, renamed the National Disaster Consciousness Month to National Disaster Resilience Month (NDRM), shifting its focus from disaster awareness building to disaster resilience. NDRM is observed throughout the country for the whole month of July of every year, through the conduct of activities relative to building resilience.

3.1.2 Public Awareness Raising

One of the best practices that we can replicate from Japan is institutionalizing a culture of safety and public awareness among the citizens. Below are some of the many institutions and programs established for disaster risk reduction knowledge and learning from the past disasters.

- Disaster Reduction and Human Renovation Institution



Disaster Reduction and Human Renovation Institution (DRI) also known as the Great Hanshin-Awaji Earthquake Memorial was founded by Hyogo Prefecture in April 2002 with the support of the Japanese government. It is located in Kobe City and being supervised by the Hyogo Earthquake Memorial 21st Century Research Institute. Hyogo co-manages the DRI in cooperation with the national government as a base for sharing the experiences and lessons learned from the earthquake.

The DRI aims at cultivating disaster prevention culture, mitigating social vulnerability, and developing policies for disaster reduction by transferring experiences of the Great Hanshin-Awaji Earthquake and applying lessons learned from the earthquake for a better future, thereby contributing to realizing a safer and more secure civil society along with education regarding the value of life and the preciousness of co-existing. Likewise, the DRI also aims to be an international research and study hub, which contributes to disseminating information on effective measures for all types of disasters. It receives many visitors, both domestic and international. Along with its role of an earthquake museum by collecting, preserving, and exhibiting earthquake-related resources, DRI conducts practical research on DRR using its unique research and survey functions. The institution trains DRR practitioners and deploys specialists to disaster-affected areas both at home and abroad to provide advice on disaster response activities. DRI takes advantage of the experiences and lessons learned from the earthquake in on-site disaster management and acts as an international hub for DRR activities.

Janice Padagdag – Philippines

The DRI established the *Museum Exhibits* which features actual experiences and lessons learned from the Great Hanshin Awaji Earthquake. This is in collaboration with disaster victims themselves, local citizens and volunteers. The museum is open for the rest of the world to learn from, especially for the children who are to create a safer future. The knowledge gained from this is for the children to consider in every decision they make so as to contribute in making a resilient society. Through this institution, DRI motivates citizens and visitors to take a sincere interest in, deliberate upon, and understand the importance of disaster reduction, precious human life, and the value of mutual dependence of people.

Tsunami Simulation Experience

- Honjo Life Safety Learning Center

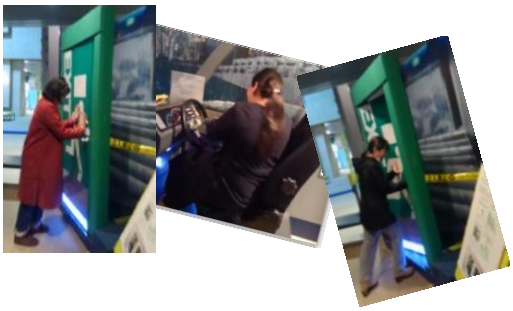
The Tokyo Fire Department (TFD) was formed as a municipal fire service body on March 7, 1948. In 1949, the TFD then saw the foundation of a command and control center, the Music Band and others as part of its organization. In 1960, the TFD extended its mission over to the Tama area, shouldering the fire service duties in this county region. This was followed by the establishment of the Fire Science Laboratory (Fire Technology and Safety Laboratory at present) in 1961, the Aviation Unit in 1966, and the Special Rescue Team in 1969. It was in 1976 that the TFD relocated itself to the present location (Otemachi, Chiyoda Ward). The TFD has Tokyo “divided” into ten districts for its mission; about 18,000 personnel protect Japan’s capital, working at firefighting, EMS, rescue and fire prevention. In case of a catastrophe beyond Japan, the TFD also sends its members over to the disaster scene on request as part of the International Rescue Team. The TFD has so far played a prior role in many locations out of Japan.

The TFD's Life Safety Learning Centers ("BOUSAI-KAN") are the places for everyone to have experience mock disasters and learn how to protect themselves in the event of a fire, earthquake, typhoons or other hazards.

One of the facilities is the Honjo Life Safety Learning Center is located at 130-0003 4-6-6 Yokokawa Sumida-ku, Tokyo, Japan. This four-storey building includes the following activities to enhance public awareness on the multi-hazards and risks and effects on these disasters.

- Earthquake experience corner
  Earthquake Simulation Section
  Please experience the genuine exact earthquake, know its horror and acquire the behavior in case of emergency.
  In addition, we explain the importance of preparing for earthquakes in an easy-to-understand manner.

- Urban resilience Experience Corner
  Urban Flooding Experiential Section
  Images relating to local concentrated torrential rain and tsunamis, opening underground doors and doors where water pressure is flooded by cars can be opened.



- Smoke experience section Corner
  Smoke Maze Section
  After knowing the characteristics and dangers of smoke, we evacuate the neutral zone which is the boundary between smoke and air. Learn the proper way to evacuate, please provide calm judgment and reliable action power.

- Firefighting experience corner
  Fire Fighting Training Section

Learn how to use a fire extinguisher or an indoor fire hydrant against a large screen simulating the actual fire.

- First Aid Experience Corner

  First Aid Training Room

  Here, you can experience first aid such as cardiopulmonary resuscitation by actually using the doll for training. Also, you can actually use and train AED (automatic external defibrillator).

- Storm experience corner

  Rainstorm Simulation Section

  Experience the strong wind and heavy rain that will cause wind and flood damage, know the widespreadness, and enhance your knowledge about strong wind and heavy rain.

- Disaster Theater

  Disaster Prevention Theater

  We will show powerful images with the theme of earthquake using sound effect, vibration of seat, etc. with impact.

  (Source: http://www.tfd.metro.tokyo.jp/hp-hjbskan/honjo-sisetu.htm)

➢ Meteorological Science Museum

The Meteorological Science Museum located on the first floor of the Japan Meteorological Agency (JMA) in Chiyoda-ku, Tokyo, Japan is an observation space displaying panels and devices related to weather and earthquake observation instruments, weather forecast mechanism, emergency earthquake bulletin, tsunami, volcano, global warming problem, disaster prevention knowledge against natural disasters. The JMA has provided services to protect people and their property against disasters by monitoring and predicting natural events for over a century since it was inaugurated as the Tokyo Meteorological Observatory in June 1875. JMA has set up this facility for the public to freely understand the hazards and risks brought about by

the geological situation of Japan and can apply the learning experiences on preparedness back at home. Figure 15 provides the different features when roaming inside the hall.

Figure 15: Feature Map of the Museum (Source: JMA Pamphlet)

- Tsunami and Storm Surge Disaster Prevention Station

Osaka has been a hub for the world's leading corporations and one of the internationalized and globally competitive prefectures in Japan. It also possesses a vibrant and lively culture that has attracted many people from all over the world. However, little has it known that Osaka also is at high risks to many hazards. In Osaka Prefecture, there are approximately 40km2 of areas below sea level, home to approximately 1.08 million people. Aside from the fact that the city is below sea level, Osaka experienced several typhoons and tidal surges, earthquakes and tsunamis in the past decades. Because of this, the facility named Tsunami and Storm Surge Disaster Prevention Station was built for knowledge and public awareness for Osaka residents to protect their lives from disasters.

The facility comprises the Disaster Prevention Building and Display Building. The former building provides collective control for tsunami and tidal surge protection

facilities, such as seawalls and gates, administered by the Nishi Osaka Flood Control Office. The latter building seeks to enhance awareness of disaster prevention among Osaka residents. The Display Building, open to the public, helps visitors gain correct knowledge of tidal surges that have struck Osaka in the past, as well as of the Tonankai/Nankai Earthquakes and tsunamis believed to surely hit Osaka in the near future. The building also enables the people to learn about how to react when an earthquake or tsunami occurs. By “looking, listening and touching,” you can enjoy learning, and realize the importance of preparing for disasters.

The recent developments of the facility include Remembering Tidal Surge Disasters, Functions of Tidal Surge Protection Facilities and Flood Prevention Teams of the Community.

Model Exhibition Section

It also showcases the Model Exhibition Section, with the floor regarded as sea level, enables you to keenly realize that Osaka is a city below sea level with potential risks. Integrated use of film, sound and illumination stirs your imagination on what would happen when a typhoon hits the city.

The Tidal Surge Disaster Tunnel provides information on Osaka’s three largest typhoons to date. Displayed on the tunnel are typhoon pictures and news films, as well as diorama of a submerged city. The tunnel is a symbolic space allowing you to feel as if you were lost in a disaster area, stirring up anxieties.

Tidal Surge Disaster Tunnel

As a symbol of facilities to protect people in Osaka from tidal surge disasters, a real iron gate is set up inside the building, helping you learn about reliable countermeasures against tidal surges, with an explanation of the functions and mechanisms of various disaster protection facilities. Using a movable model, explanation is also offered on an arched flood gate, which is rare in the world. Then, Osaka City is very proud of the flood prevention teams in their community. Their role

is to shut these tide protection gates when a threat of floods due to typhoons or other disasters happen. They work very hard to protect the general public.

Experiencing Dynacube, a Tsunami Disaster Experience Theater is a must to see and feel the fear of tsunamis in an overwhelming dynamic atmosphere. Also, a 3-D Hazard Map was created based on aerial photographs. By touching the map monitor panel and choosing an area, you can view a focused and enlarged image of the area with disaster prevention information for the area (such as evacuation sites and expected submersion depths).

Another best practice from Japanese culture is to learn the lessons of history and using these to work and plan in the future. Inside the facility is the display of the descriptions of O-Jishin Ryokawaguchi Tsunami-Ki and Yogo-Ji Stone Monuments. This monument seeks to let future generations know of the tragedy, with the hope that the monument's inscription continues to be well-marked to ensure it can always be clearly read. As the experience dictates, let us learn from our forerunners who witnessed large scale tsunami disasters and use their lessons into the future.

- E-DEFENSE

The three-dimensional full-scale earthquake testing facility is nicknamed "E-defense". The symbol E indicates Earth, suggesting the critical need for the promotion of research and development on the mitigation of earthquake disasters and protection of our lives and properties in a global scale. The log represents earth rupture and earthquake, with colors suggesting the three-dimensional motion that can be produced by E-Defense.

The earthquake test performed enables the verification of the collapse process and new quake-resistant techniques for the various structures. The wooden house experiment is useful for the comprehensive safety examination and development for new quake-resistant enforcement technology. The long period earthquake motion

against the high-rise buildings is reproduced to grasp the possible phenomena such as the damages it might cause. Dissemination is expected as the grassroots disaster prevention measures carried out through the activities such as public institutions, schools and neighborhood communities. Hence, the testing facility starts to conduct seismic analysis and recommend retrofitting or other prevention measures depending on the results of the test. Important buildings that may sound risky can do retrofitting. Common way to do seismic retrofitting is putting braces on the building. Seismic resistant design of building in Japan is very much important.

- Sendai 3/11 Memorial Community Center

Thinking about the future, talking to each other, and expressing oneself freely, while facing the past again, looking back at things so far, with that day as the origin – the day that, with a great pain, awakened many important things within us. In addition to being a place to study and learn about the GEJE, the Sendai 3/11 Memorial Community Center is also a gateway to the Eastern Sendai coastal areas, which were severely damaged by the tsunami. It constitutes a base for weaving wisdom and lessons through communication, with memories and experiences as vehicles, connecting them to the future and to the world.

- Iza! Kaeru Caravan

“Iza! Kaeru Caravan” is a disaster prevention art program launched as part of the ten-year commemorative project for the Great Hanshin-Awaji Earthquake. This educational combines a local disaster drill program and “Kaekko Bazaar”, a toy exchange program designed by artist Hiroshi Fuji. In this event, children learn about disaster prevention as a continuation of playing games. These disaster drill programs, developed and improved by listening to the victims of the Great Hanshin-Awaji Earthquake in 1995 and those of the Great East Japan Earthquake in 2011, provide not only fun activities but also practical activities that are

helpful at times of earthquake disasters. Workshops that influence disaster prevention measures include the use of miniature furniture and furniture overturning prevention devices so participants can learn how to use and understand the importance of their installation. Learning how to make simplified plates, slippers and emergency toilet out of old newspapers and flyers are initiatives from the community volunteers to share their small invention to the children. There is also a disaster prevention picture-story show told by volunteer members mostly belonging to senior citizen sector about the first tsunami happened in Japan and how the village people were saved by running up to the nearest hill and used fires to inform other people of the evacuation area.

As a result of this program, young families who rarely participated in disaster drills before began to actively participate in the program. The participants especially the children can learn about disaster prevention and acquire related skills through playing with families and friends.

Influence of Disaster Imagination Games

There are a variety of disaster imagination games, which seek to increase people's ability to deal with disasters. Participating in these games provides an enjoyable way to think about disaster and learn about many other people's views. The following are some of the examples of frequently used disaster imagination games where it can be part of Kaeru Caravan's activities.

a) *Crossroads*. This is a card game marked "Yes" and "No". Each participant, who has both cards are asked a yes-no question at random. (for example, "not enough food has been distributed to the evacuation center, but everyone is hungry. Do you decide on an order of priority and distribute the food accordingly, do you refrain from distributing the food until more supplies arrive? Each person decides on what they would

do and they all show the card corresponding to their choice at the same time. This enables people to see the majority view, but it is not the case that the majority view is the best course of action. The important thing is to share with other members of the group one's thoughts about why that course of action should be taken. It is therefore better to split up into small groups of five or six people, rather than playing as a large group, so that participants can spend time discussing each other's opinions.

b) *DIG: Disaster Imagination Game*. This is a tabletop exercise game in which participants add information about their local community — such as the location of evacuation centers, public telephones, hazardous areas, and residents requiring assistance during a disaster — to a map (ground plan) of the area in which they live. In addition, participants consider evacuation routes that would need to be taken to reach evacuation sites or centers in a disaster scenario and think about preparedness measures.

c) *EVAG: Evacuation Activity Game*. This is a role-playing game that tests evacuation behavior. First, each person takes an "attribute card" and considers the timing at which the person on that card would leave for an evacuation center if a torrential rain disaster struck their neighborhood. There are dozens of different types of card, covering different genders, ages, and nationalities; conditions on the card impose constraints on the means of transport that the person on the card can use. Young people can take on the role of an elderly person and imagine their thought processes, while able-bodied people can think about the situation from the perspective of a person requiring special care.

d) *HUG: Hinanjyo Unei Game.* The Hinanjyo Unei Game (evacuation center management game) was devised by Shizuoka Prefecture to prepare for a Tokai earthquake. It uses site plans (ground plans) of evacuation centers and gymnasiums. The "evacuee card" detailing the evacuee's age, gender, nationality, and personal circumstances is used to represent the space

actually required by the evacuee (three square meters per person). Participants then lay the cards on the ground plan to see how appropriately they can arrange them, and think about how to deal with problems that could actually arise in an actual evacuation center. To prepare for a major disaster, the Ministry of Education, Culture, Sports, Science and Technology issued a notice in January 2017, regarding key points concerning cooperation in the running of evacuation centers in schools. In response, elementary schools in Tokyo's Taito-ku used HUG for a drill involving teachers and other school staff.

e) *LODE.* Acronym of Little children, Old people, Disabled people and Evacuation. Designed to explore responses to issues involving people who would be vulnerable in the event of disaster and people living in medium- and high-rise residential buildings, this game uses simplified elevation views of condominiums and colored stickers providing information about the residents in each apartment. More than other tabletop exercises, this game focuses on providing evacuation guidance to people requiring assistance to evacuate in the event of disaster.

- Ruins of the Great East Japan Earthquake Sendai Arahama Elementary School

Directly after the earthquake struck, the four storey reinforced concrete school building became the evacuation area for 320 residents, students and school personnel. The tsunami surged up to the 2nd floor, and everyone who had evacuated to the school building managed to escape safely to the rooftop.

It is Sendai City's goal to never again fall victim to a tsunami, to pass on the lessons we learned also and to show the real threat of tsunami to future generations. For these reasons, the ruins of the Arahama Elementary School Building will be preserved, along with other records and opened to the public.

The Arahama area is located on the Pacific coastline approximately 10km away from the center of Sendai City. Approximately 800 households and about 2,200 people

have settled in the area around the historical Teizan Canal which runs along the coastline. Arahama Elementary School was established in 1873, located about 700m inland from the shoreline. The school had 91 students in total.

The school reviewed their disaster prevention measures before the earthquake based on the experience of the earthquake and tsunami which occurred in Chile in 2010. Based on the events which took place in Chile, as a strong measure against a possible tsunami, the evacuation site was changed from the gymnasium to the rooftop, and the blankets which were kept in the gymnasium were transferred to the 3rd floor of the school building. This action alone helped to save the lives of many children and evacuees.

Based on the real life accounts of those affected and of records from the time and by looking at photos and debris show after-effects from the tsunami and extend of the damage to the school. Understanding the threat of the tsunami that hit Arahama Elementary School, visitors will be able to learn about the importance of preparing for disasters. We look back at the life-endangering events that took place in the 27 hours from the time the earthquake happened, the following evacuation, the extent of the tsunami itself, and up until the evacuees were rescued from the school.

- Ishinomaki Okawa Elementary School Memorial Monument

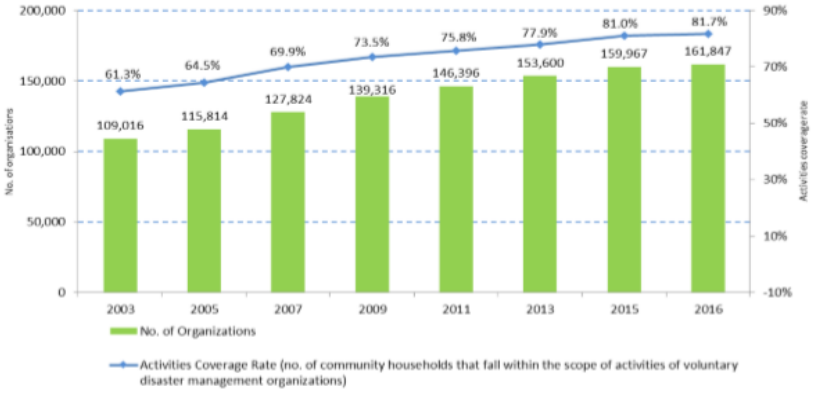
Ishinomaki was among the municipalities most seriously affected by the 2011 Tōhoku earthquake and tsunami. Several tsunamis, up to about 10 metres (33 ft) high, traveled inland up to 5 kilometres (3.1 mi) from the coast. Many public schools were completely destroyed. One could not forget the ruins of the Okawa Elementary School and the lessons learned from this tragedy. According to the local folk and a guide touring the historical landmark of the tsunami debris, the tsunami came at about 51 minutes after the tsunami warning was released. However, for some time, the children and teachers who tried to move to a higher ground were caught up with the big waves from the sea.

3.1.3 Community Empowerment

Community empowerment refers to the process of enabling communities to increase control over their lives. The recognition of the community involvement on DRR and empowering them as well is as important as getting them engaged in all of the DRR phases: prevention, mitigation, preparedness, response and recovery. Empowering the community by internalizing the tools and methods of disaster risk reduction is a good way to deal with the future potential risks. In order to build disaster-resilient communities, they first need to be empowered so that community members can cope with the adverse effects of natural hazards. This is the most effective approach to achieving sustainability in dealing with natural disaster risks. Further, community empowerment contributes to the global call that *"no one can leave behind*" in every disaster that may happen in the future by using the three initiatives thought by **self-help, mutual help and public help.**

Guided by the various laws in Japan, voluntary disaster management (DM) organization rose again as early as 1971, triggered by LA earthquake. It started in urban areas for earthquake countermeasures, gradually reaching to the rural areas.

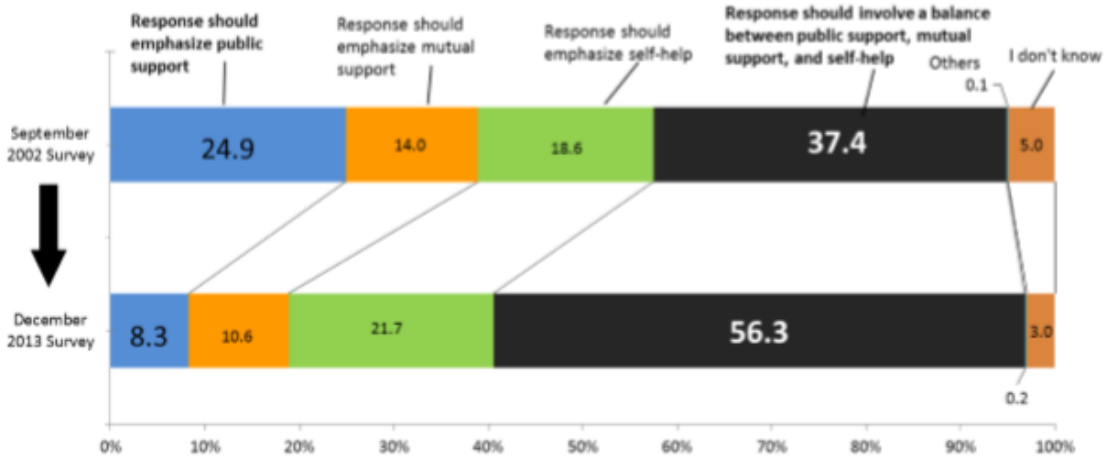
There are three kinds of volunteer DM organizations, most popularly known in Japan as, Jishu Bosai Soshiki, Shobo-dan and Suibo-dan. Kobe City calls community-based voluntary organization for DRR as "Disaster-Safe Welfare Community". The short name for a Disaster-Safe Welfare Community is "BOKOMI, short for Bosai Kobe Mirai". In Nada Ward, there are sixteen (16) disaster prevention welfare communities formed. Disaster prevention welfare community regularly carries out disaster prevention drills and others. Everyone can participate actively and raise the disaster prevention power. Learning from the past disasters during the Great Hanshin-Awaji earthquake, self-help came into publicity. In the recent years, a significant increase of volunteers DM organizations (Figure 16), probably because of the valuable support from the national and local governments in the creation of the organization and carrying out their activities through annual subsidies and protection from DRR laws and ordinances.



Source: Produced by the Cabinet Office based on the Survey on the Current Status of Fire and Earthquake Disaster Management Measures of the Fire and Disaster Management Agency. Figures as of April 1 each year.

Figure 16: Trends in Voluntary Disaster Management Organizations

Sustainability of the community volunteer DM organization is often a challenge. But, in Japan, it has recognized the collaborative efforts of the three initiatives: self-help, mutual help and public help, summarized on Figure 17.



Source: Produced by Cabinet Office on basis of "Public Opinion Poll regarding Disaster Risk Reduction" conducted by the Cabinet

Figure 17: Awareness of Self-Help, Mutual Support, and Public Support Measures

As previously mentioned, these volunteer DM organizations are given importance to the government. As a matter of fact, they are constantly empowered and strengthened on capacities on DRR (soft and hard measures) with the trust and close collaboration by the Fire and Disaster Management Agency (FMDA), whose roles are to provide "safe and secure regional development with the cooperation with residents" and "national response in times of need". Soft measures are other actions taken by government to change behavior. They usually involve the provision of factual

information or the linking of behavior with positive or negative outcomes. Soft programs include but not limited to as evacuation drills, training, and education. On the other hand, hard measures are those targets and accomplishments achieved by the soft measures such as the increase in numbers on population and these people trained or capacitated and the provision of DRR equipment.

The following data on the tables (Tables 6 to 12) are compilation of the consolidated submissions of these particular prefectures sourced from the Voluntary Disaster Management Organization Guidebook Information (rev 2017) issued by the FDMA annually that would be useful statistics in evaluation and possible enhancement of laws or policies in the improvement of the effectiveness of the community volunteer DM organizations*. (Complete list in Japanese text can be found on the annexes)*

Prefecture Name	Municipalities	No. of Households (A)	No. of Municipalities with VDMO[5]	No. of Households Covered by VDMO (B)	%age (B/A) %
Hokkaido	179	2,743,797	142	1,489,259	54.3%
Miyagi	35	968,076	35	797,294	82.4%
Hyogo	41	2,495,847	41	2,404,553	96.3%
Osaka	43	4,190,016	43	3,772,317	90.0%
Kyoto	26	1,192,774	24	1,068,504	89.6%
Nara	39	581,640	38	441,326	75.9%
Wakayama	30	437,909	30	381,816	87.2%
Shiga	19	560,689	19	451,145	80.5%
Mie	29	776,962	29	682,735	87.9%
Tokyo	62	6,914,473	54	5,272,641	76.3%

Table 6: List of Voluntary DM Organizations

Prefecture Name	No. of VDMO	Neighborhood Unit	Elementary School Zone	Others	No. of Persons Involved	No. of VDMO with regulations
Hokkaido	4,577	4,454	36	87	587,735	1,960
Miyagi	4,467	3,813	4	650	1,074,104	4,074
Hyogo	5,703	5,280	244	179	2,372,020	4,732
Osaka	2,763	2,355	326	82	1,112,345	1,918
Kyoto	2,120	1,846	255	19	1,878,807	1,715
Nara	1,790	1,709	49	32	472,074	1,487
Wakayama	1,598	1,584		14	585,962	1,255

[5] Voluntary Disaster Management Organization

Shiga	2,221	2,151	38	32	177,822	1,783
Mie	3,702	3,672	29	1	53,741	3,486
Tokyo	7,128	6,368	143	617	4,046,410	5,190

Table 7: List of Organizations with Regulations

Prefecture Name	Municipalities	Municipal Plan with VDMO Inclusion	Municipality with Ordinance	Municipality with Guidelines	Municipality with Joint VDMO
Hokkaido	179	124		23	13
Miyagi	35	34		8	16
Hyogo	41	38	2	18	7
Osaka	43	39	4	31	18
Kyoto	26	23	2	15	6
Nara	39	31		12	7
Wakayama	30	27	1	13	12
Shiga	19	19	3	5	1
Mie	29	27	1	6	10
Tokyo	62	55	6	35	21

Table 8: List of Municipalities with VDMO inclusions

Particulars	Hokkaido	Miyagi	Hyogo	Osaka	Kyoto	Nara	Wakayama	Shiga	Mie	Tokyo
Municipalities in relation with Fire Dept										
• Provision of training at ordinary times	43	32	38	34	19	26	18	16	25	46
• Provision of training during disaster times	24	13	7	2	9	9	6	9	11	3
• Training separate with fire dept.	71	23	32	27	18	17	20	14	16	42
• Training by fire dept	41	25	32	21	14	12	11	12	15	34
• Training by shubodan	11	13	21	6	11	10	11	11	14	19
• Training with Mun. DM Officers	65	28	35	31	18	24	20	18	27	48
• Training with Police	1	1		1	1		2	1		5
• Others	9	1	3	8	1	4	1	1	4	6
Methods of Training										
• Drill	65	34	38	29	18	21	19	15	25	47
• Guidebook/pamphlet	44	26	31	23	13	20	12	10	16	34
• Talk/lecture/movie	38	24	26	2	14	12	14	12	20	39
• Leader's Training	16	26	21	20	13	8	6	12	16	32
• Others	8	8	9	6	3	3	2	1	2	5

Table 9: No. of Municipalities provided with trainings and their methods of training

Particulars	Hokkaido	Miyagi	Hyogo	Osaka	Kyoto	Nara	Wakayama	Shiga	Mie	Tokyo

(During Normal Activities)										
• Disaster Drill	3,860	4,334	5,146	2,150	1,423	1,497	1,546	2,002	2,963	6,680
• Public Awareness Raising	3,861	4,362	5,033	2,104	1,480	1,320	1,556	1,722	2,530	6,458
• Patrolling during disaster	3,163	3,725	4,023	1,213	1,060	1,201	976	1,898	2,026	4,109
• Buying, distributing materials like fire extinguishers	415	738	1,882	351	1,025	930	683	1,102	838	2,078
• Others	2,558	821	1,105	818	720	128	51	795	203	1,626
(During Disaster)										
• Patrolling dangerous areas	2,947	3,523	3,533	1,433	1,213	1,066	818	1,277	1,321	4,688
• IECs	4,154	3,880	4,262	2,493	1,277	1,396	1,481	1,890	3,560	6,247
• Firefighting	3,682	3,908	5,206	2,304	1,527	1,445	1,475	1,976	2,846	6,059
• Rescuing /First Aid to Injured	3,721	3,645	5,139	2,216	1,234	1,334	1,465	1,848	2,820	6,133
• Evacuation Instruction	4,015	3.549	5,142	2,188	1,393	1,447	1,499	1,964	3,295	6,102
• Cooing/Food/Water	3,689	3,904	4,343	2,095	1,169	1,109	1,087	1,777	2,511	5,612
• Others	2,404	760	835	724	710	62	79	661	279	2,380

Table 10: No. of Organizations provided with training during pre and actual disaster

Particulars	**Hokkaido**	**Miyagi**	**Hyogo**	**Osaka**	**Kyoto**	**Nara**	**Wakayama**	**Shiga**	**Mie**	**Tokyo**
(During Normal Activities)										
• Disaster Drill	2,626	2,701	7,219	2,182	945	867	618	1,437	951	5,359
• Public Awareness Raising	2,540	1,898	3,980	1,206	523	693	452	953	412	2,806
• Patrolling during disaster	2,373	2,303	1,638	371	692	669	57	2,135	276	2,964
• Buying, distributing mat like fire ext.	92	108	235	141	288	254	35	191	5	652
• Others	2,111	171	1,534	408	503	42	36	826		1,424
(During Disaster)										
• Patrolling dangerous areas	1,891	376	114	173	43	97	27	257	162	594
• IECs	1,951	855	382	644	279	31	111	214	172	731
• Firefighting	1,921	634	174	473	94	57	89	323	168	960
• Rescuing /First Aid to Injured	1,919	472	123	467	77	23	82	190	88	759
• Evacuation Instruction	1,949	489	374	476	117	39	128	213	213	755
• Cooing/Food/Water	1,910	439	31	465	53	27	92	53	88	631
• Others	1,850	63	40	36	517		19	9	1	330

Table 11: No. of Frequencies/Occurrences in Conducting the Activities

Particulars	Hokkaido	Miyagi	Hyogo	Osaka	Kyoto	Nara	Wakaya ma	Shiga	Mie	Tokyo
Firefighting Equipment	2,194	1,166	4,103	1,071	832	1,065	603	1,104	2,190	4,789
Portable Radio	135	500	601	574	191	165	255	138	674	874
Megaphones	562	2,845	3,351	894	453	356	513	728	2,385	3,892
Jack for SAR	2,513	1,444	3,306	1,783	562	684	776	801	2,437	4,880
Evacuation items (tent, stretcher etc.)	2,400	2,087	2,545	1,341	498	522	626	750	2,530	4,126
Flood fighting materials(sandbags, ropes etc)	126	498	3,014	487	591	373	314	467	1,377	1,572
Medical/first aid kit	2,400	2,410	2,442	1,109	204	344	502	414	2,370	3,793
Individual PPEs (helmet, fireproof gear)	2,423	1,293	3,677	1,435	972	513	670	1213	1,930	4,326
Equipment for awareness (video)	17	13	164	57	15	24	88	191	680	98
,Portable pump	187	96	744	621	101	112	17	1,008	242	2,684

Table 12: No. of Organizations with Personal Protective Gears (PPGs)

To cap it off, Figure 18 is an illustration of the history of the community organizations of their different hazards with respect to the legal act and the time they were established.

FIGURE 2: **The Sanriku Expressway was built with tsunamis in mind**

Organization	*Hazard*	*Legal act*	*Supervising government organization*	*Date established*	*Number of staff or groups*
Suibo-dan	Flood	Flood Fighting Act	Ministry of Land, Infrastructure, and Transport	17th century	900,000 staff in two organizations
Syobo-dan	Fire	Fire Defense Organization Act	Fire and Disaster Management Authority (FDMA)	18th century	
Jisyubo	Earthquake	Basic Act on Disaster Reduction	Cabinet Office, FDMA	1970s	140,000 staff
NPO	All	Act to Promote Specified Nonprofit Activities	Cabinet Office	After the Kobe earthquake in 1995	> 2,000 groups

Figure 18: Creation of VDMOs according to hazards (Source: Cabinet Office)

3.1.4 Implementation of Disaster Resilience Education

The primary objective of disaster resilience education is to bolster the disaster resilience (the capability to proactively prevent disasters and in the event of weathering a disaster, the capabilities to prevent the damage from worsening and to enact restoration measures) of communities, by heightening the disaster resilience awareness of each individual belonging to a community and by forging strong links within the community.

In order to do this, it is vital to create an educational climate that fosters equilibrium of the three elements of **knowledge** of the disaster history of a particular community, the **attitude** required to work together in standing strongly against disasters, and the **skills** necessary for safe evacuation and precise lifesaving and emergency aid.

In the GEJE of March 11, 2011, disaster resilience education initiatives bore fruit, exemplified by the case of Kamaishi City Kamaishi Higashi Junior High School (Kamaishi High School, for brevity) in Iwate Prefecture, where lives of many school children and students who were at school were saved from the tsunami.

Kamaishi High School has implemented a disaster resilience education program on an ongoing basis with the following three aims, from the desire for each student to become project leader in the community's disaster prevention in their capacity as members of the regional community. The aims are:

a) Be responsible for protecting your own life.
b) From rescued to rescuer.
c) Passing on the culture of disaster resilience.

The disaster resilience education program was implemented with the aim of cultivating the ability of students to judge circumstances by themselves and to

proactively take the initiative in reacting. The program encompassed collaborative initiatives with the region including joint evacuation exercise with the neighbouring Unosumai Elementary School and a disaster resilience learning program involving all school members called “East Rescue”.

When the GEJE struck, the 570 students of Kamaishi High School and Unosumai Elementary School follow what they had been trained to do over and over again, and all begun to evacuate toward higher ground as soon as the earthquake began. Thanks to their ability to calmly judge their situation as it unfolded around them and to respond swiftly, they were able to protect their own lives from the surging tsunami.

In a similar case, like Kamaishi High School, the students and teachers of the Arahama Elementary school went up to the rooftop of the school building and were safe from the ravaging debris and tsunami waters. Using the three elements: knowledge, attitude and skills, the principal of the school decided to revise the evacuation planning from the gymnasium to the top of the building, not underestimating the tsunami to occur.

Below are the five basic principles to remain mindful of when implementing disaster resilience education:

1) Learn about the problems and peculiarities of a community, as well as its past experiences in suffering disasters. It is important to precisely gauge the envisaged disaster risk of a community by using materials and site visits to understand its vulnerabilities.

2) Act on your own initiative, witness everything firsthand. It is important by taking action yourself, setting an example to others.

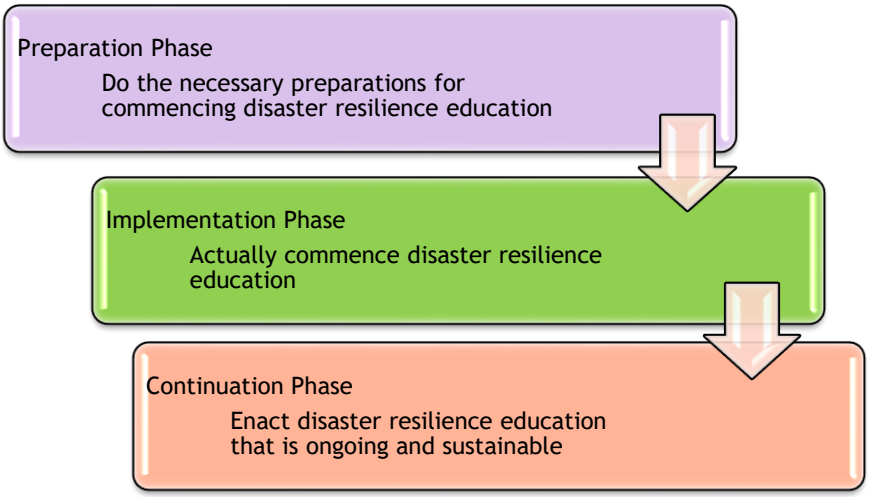
3) Set smart and realistic goals. While it is fine to set ideas and goals, it is important to confirm the resources necessary for your programs, and to go

about implementing them within realistic boundaries in a reasonable manner without being greedy in one's objectives.

4) Be proactive in mingling with key people in various fields and disciplines. It is important to take onboard new insights and know-how by networking and cooperating with key persons in the field, always looking to reinforce the framework of your initiatives.

5) Keep your approach positive, fun and lighthearted. Connect disaster resilience with having fun, and ensure that your initiatives and programs can be comfortably accommodated within daily life on an ongoing basis. Also, develop initiatives that provide people with knowledge of the beneficence of nature, rather than focusing exclusively on seismic and wind/water disasters and in doing so engender a sense of pride in living in that particular community.

Notably, disaster resilience education occurs through the following 3 phases:



Below are some of the case studies implemented by some schools and communities and how the following phases were carried out in the whole process.


Checking out goods in the local supermarket that you need when disaster strikes

1) Toba City Arashima Children's Club (Toba City, Mie Prefecture) on appointing a graduate of the children's club who is also a local mentor as project leader who won't be impacted by staff alternation.


Distributing "safe and sound" placards to residents *2

2) Kamaishi Higashi Junior High School (Kamaishi City, Iwate Prefecture) on consultation with PTA chairman and district head to introduce people who could help the local residents passing on the wisdom of "Tsunami Tendenko"[6] and distributing "safe and sound placards"[7] to residents.

3) Chiba Prefectural Togane Special Support School (Togane City, Chiba Prefecture) by setting up "Sanbu Resilience Universal Network" comprised of various organizations involved in disaster resilience/welfare/education within the Sanbu Community. This was conducive to a coordinated, aligned approach across the community and implementation of an integrated disaster resilience education program.


Map freely created by children

4) Toba City Arashima Children's Club (Toba City, Mie Prefecture) established a principle dictating that leaders would be active within their spare time and that they would not exhaust themselves trying to broaden networks with government agencies and schools. They were able to continue the program by avoiding labor and cost-heavy tasks such as printing and distribution of Arashima Resilience Maps.

[6] "Tsunami Tendenko" is a slogan coined during a panel discussion with tsunami disaster researcher Fumio Yamashita, at the first "All-Japan Tsunami Summit for Coastal Cities, Towns and Villages" held in November 1990 meaning "if a tsunami comes, save yourself and flee to higher ground, even if your family is in trouble".

[7] Safe and Sound Placards: By hanging a placard on the front door, during a disaster, that tells emergency responders that you have already gone to an evacuation center save them confirming the safety of those in the house.

5) Aichi Prefectural Handa Commercial High School (Handa City, Aichi Prefecture) by using computer graphics to design the base pictures and creating picture story shows panels by painting acrylic onto the base pictures.


Creating picture story shows panels by painting acrylic onto the base pictures


Elementary school students enjoy participating, as the instructors teach naturally, with ease

Also, through outreach classes run by the students, they had to switch their frame of mind from “learner” to “high school teacher”. On each occasion, they divided into two groups, one in charge of “instructor role” and one in charge of “student role”. They alternated these roles each time and in doing so were able to experience both sides of the process.


A disaster resilience workshop convened in the local community center hall.

6) Kunitachi Local Foreigners’ Disaster Resilience Network (Tokyo Metropolitan) by designating a local public hall as a hub for disaster p revention information for foreigners in its disaster resilience plan.

7) Shiga Prefectural Hikone Technical High School (Hikone City, Shiga Prefecture) students were able to get inspiration about initiatives that they could carry out themselves from disaster resilience equipment exhibited at a disaster resilience exhibition.


Normally used as a bench

During disasters, doubles up as a cooking stove

8) Kobe Gakuin University Disaster Prevention-Social Contribution Unit (Kobe City, Hyogo Prefecture) especially the 5th graders created teaching materials that incorporated disaster resilience elements into general subjects (8 subjects). A teaching manual for each teaching material was formulated, even teachers with no experience whatsoever in disaster resilience education can use them with ease.


Using teaching materials to implement "outreach" classes

9) Itoigawa City Nechi Elementary School (Itoigawa City, Niigata Prefecture) received advice from the community coordinator of the “Regional Head Office Project for Supporting Schools” about how to utilize school support volunteers.

10) Tokushima City Tsuda Junior High School (Tokushima City, Tokushima Prefecture) created tsunami evacuation support maps collaboratively between neighbourhood community groups, universities and the city and put up at road crossings. Thanks to disaster resilience initiatives becoming a tangible entity that was returned to the community, the school was able to gain a high level of understanding from the community towards disaster resilience education.


Tsunami evacuation support maps put up at road crossings


Experiencing torrential rain with a rain experience simulation, at a disaster resilience event.

11) Yasashii Nihongo Volunteer Association (Kyoto City) created an open and accessible system for implementing disaster resilience education for foreigners, including claasess held by various communities that are familiar with the needs of foreign residents. They also created “Disaster Resilience Goods Cards”. These cards express disaster resilience goods with simple illustrations and easy to understand Japanese.

12) MIzu no Jiyujin Shinsui Sentai Akazatai (Hofu City, Yamaguchi Prefecture), an organization with limited funds, was able to organize with various related bodies to teaching materials and venues free of charge. For example, for the rainfall experience event, they utilized the outreach class to have the Ministry of Land, Infrastructure, Transport and Tourism provide a booth with a staff dispatched from a local observatory of the Japan Meteorological Agency.


Exhibited at resilience event in Hyogo Prefecture

13) NPO Himawari no Yume Project (Kobe City, Hyogo Prefecture) leased the "Disaster Resilience Fun Maze"[8], which was developed as a teaching material for disaster resilience education, as a disaster resilience training facility to exhibition facilities countrywide (such as the famous "DRI").

Implementation of disaster knowledge to community was an approach of the Disaster Prevention Research Project by Osaka City University Center of Education and Research for Disaster Management (CERD) lead by the CERD Director Dr. Sci. Muneki Mitamura. The project concept is illustrated in Figure 19. The project carries out several free educational programs together with young and elder people to local community in Osaka City University and Southern part in Osaka City.

Figure 19: Project Concept
(Photo Credit: Dr. Sci. Mitamura)

In fact, it conceptualized the "Inochi Lab". It simply means that in an area where a community with 10,000 people, a 10% or 1,000 people may be designated as supporters and 1% or 100 leaders will also be designated as one. The proponents of the project provide the community people the important of disaster response at the community through the self-help and mutual assistance approach by the local residents during disasters. Knowledge of stockpiling at every family and re-recognition of the disaster risk by local community. It educates also the importance of construction of disaster-prevention facility for the disaster response which facility has a diverse use in the community from a center for disaster prevention education (e.g. storage facility for disaster stockpile, sports) to a shelter operations base and a haven for vulnerable people.

(Photo Credit: Dr. Sci. Mitamura)

[8] "Disaster Resilience Fun Maze": using a 4-way 10 meter wooden maze, and based on the scenario that your house has collapsed during a disaster and has ended up like a maze, participants enjoy games including looking for hidden picture cards, and making disaster resilience maps through assembling the maze to look like a small town.

Risk learning, exercise on response to extraordinary and living environment improvement are participated by young children and elderly together with community leaders for disaster prevention. They were taught to establish a disaster classroom with three (3) subjects: Risk Learning and Making Hazard Map (hazard mapping and DRR subjects), Disaster Response Training and My Safety Portfolio and Living Environment Improvement / Planning on our Improvement. The seven (7) learning materials to be used are categorized such as the “Drill for our safety, Checkup kit on disaster risks, Self-care kit, Evacuation kit, Kit for evacuation area, Mutual assistance and Theater act company”.

3.1.5 Investment in Disaster Risk Reduction

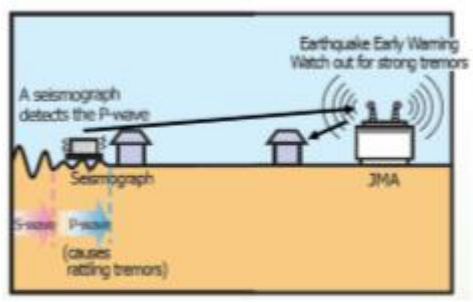
3.1.5.a Early Warning and Monitoring System

Japan invests heavily in disaster risk reduction and becomes the first and advanced in terms of the innovations on early warning and monitoring systems.

One is the Earthquake Early Warning (EEW) by Japan Meteorological Agency (JMA) which is in service since 2007. It is a system to detect earthquake and issue a warning in seconds so that people can prepare before being shaken by strong earthquake motion. The JMA quickly determines the hypocenter and magnitude of an earthquake based on real-time monitoring data. The agency estimates the distribution of strong ground tremors, and issues warnings to government officials and the mass media, such as radio, television, and communication companies before the tremors reach them. For example, gas and train companies use this warning to control their operations. Also, warnings are issued to the public through SMS alerts.

During the GEJE, the JMA issued the first EEW 8.6 seconds after detecting the first primary wave (P-wave) at the nearest seismic station. There were 15 to 20 seconds of lead time after the warning and before the main shock hit Sendai. At Seisho High School, Kanagawa Prefecture, students used this time to get under their desks or leave at-risk spots before the main ground tremors arrived. Also, at a primary school where teachers and students had conducted practice evacuation drills, they calmly

began evacuating as soon as they got the warning. (Source: Knowledge Note 2-5, p. 8)



EEW system by JMA

EEW is useful only in a certain distance range from the epicenter, from where the warning is given early enough before shaking, and to where the damage is significant and it is worth responding. The distant limit (the damage radius), depends on earthquake sizes and fragility of the buildings. It means EEW works more efficiently in developing countries to reduce loss of lives where buildings are weaker than in Japan where buildings are strong.

Another example of EWS is the advanced technology for satellite based Quasi Zenith Satellite System (QZSS) early warning message platform. QZSS is one of the Global Navigation Satellite System (GNSS) which is developed, operated and managed by Japan. The other GNSS includes GPA, by the United States of America, GLONASS by Russia, GALILEO by European Commission, BEIDOU by China and IRNSS by India.

Its main function is its capacity to send & receive early warning message/information. Figure 20 below is a clear illustration of how the system works. QZSS-EWM is available when and where Wi-Fi, radio, TV and telephone are not available.

Figure 20 : QZSS Application to Communities

By applying QZSS technology, you can receive early warning messages with a small QZSS signal receiver. The message can be translated into local languages and voice messages with local languages. With the receiver, you can check the message on smart phones and signboards or hear messages from loud speakers. This project is in collaboration with EC-GALILEO to cover the entire globe and to develop information format. QZSS-EWM Platform is public goods for DMOs in Asia and the Pacific. (Source: Abstract Paper from Mr. Koji Suzuki, 4th GSRIDRR)

Similarly, NDRRMC has issued a Joint Memorandum Circular No. 001 on July 21, 2015 pursuant to the Republic Act No. 10639 otherwise known as the "Free Mobile Disaster Alerts Act", RA 7925, E.O. 546 and in order to establish and operate a National Early Warning System that is capable of near real-time delivery of critical and informational messages like emergency announcements, storm warnings, tsunami alerts, evacuation directives and others related to disaster management to active mobile devices in targeted and specific locations.

All warning agencies shall be the source of Emergency Alert and Warning Messages (EAWM), which shall be submitted to NDRRMC for validation and confirmation for transmission by the Mobile Phone Service Providers. All processed EAWM shall emanate from the NDRRMC through the NDRRMOC. The system works in two (2) ways as illustrated on Diagrams 2 and 3. One is through direct coordination

/communication between NDRRMC and the TELCOs as shown in Diagram 1; and/or, a simple interface between NDRRMC and the TELCOs as shown in Diagram 2. All messages sent should be hazard specific, area focused and time bound. Second is through an automated Mobile Emergency Alert System (MEAS) that shall serve as an interface between the NDRRMOC and the TELCOs. This MEAS shall be established, owned and maintained by the NDRRMC.

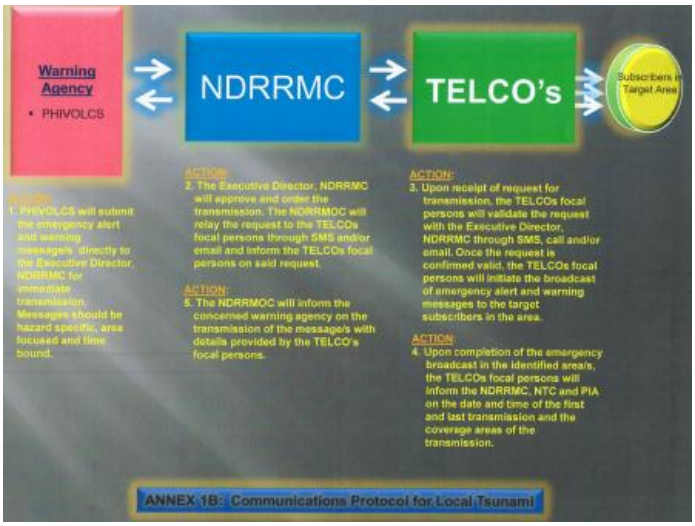


Figure 21: Working diagrams for the Operationalization of the IRR of RA 10639

The rivers flowing through the urban area of Kobe City have steep slopes with the Rokko mountain behind, and when heavy rainfall continues in the upstream mountain areas, the rivers will rapidly increase.

At the Kobe City Policy Research Council, a plan was put forth and discussed to install cameras, in addition to the existing water level observation systems, to monitor the rivers. However, the state-installed system was extremely expensive and installing the same equipment was problematic in terms of budget. While gathering information, an article about the "NetEye" camera service provided by ArkSystem, an Axis partner, attracted attention. The possibility of installing a network camera system was reviewed. In 2006, 4 Axis network cameras were evaluated and the results were as follows: Image quality was good (both day and night) and the cameras gave good value for the price. The next year 16 additional cameras were installed for a current total of 20 AXIS 221 Network Cameras operating in 20 locations. The monitoring screen displays not only images of the river, but the water level indicator as well. Monitoring can be done via the Internet at the Rivers Section or the Fire Department. In addition, monitoring footage is publicly available on a website so citizens can confirm the current situation using the image information and raise damage prevention awareness.

Figure 22: Tsukagawa downstream (Image credit: Kobe City Webpage)

Figure 23: Tsukugawa Water level indicator (Image Credit: Kobe City Webpage)

At Myohoji River[9], three river cameras (Figure 24) have been installed to collect data for flow velocity analysis, and two of them are available for viewing. Also, three water gauges were installed for data collection.

[9] Located at Yokoo, Suma Ward, Kobe City, Hyogo Prefecture

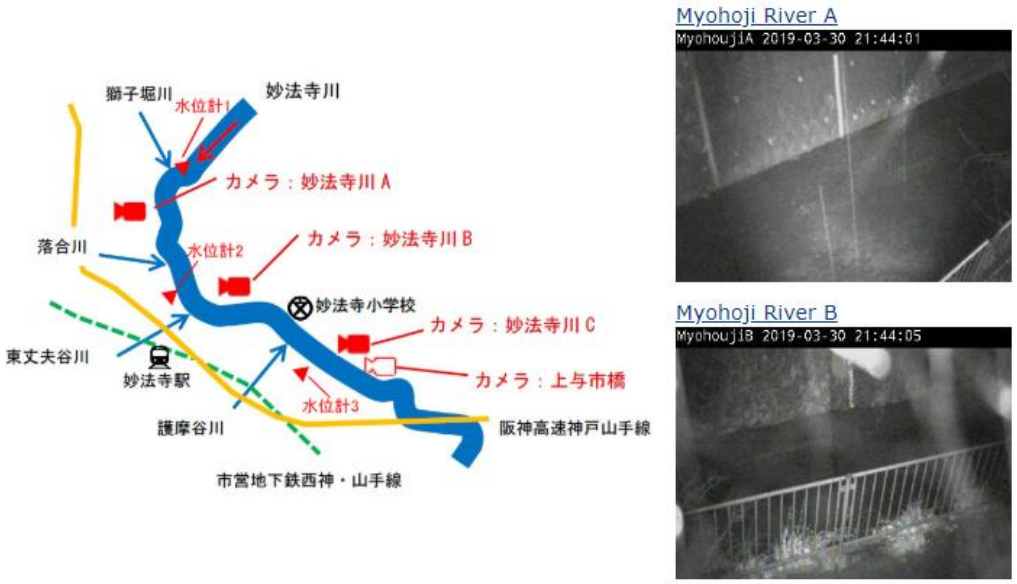
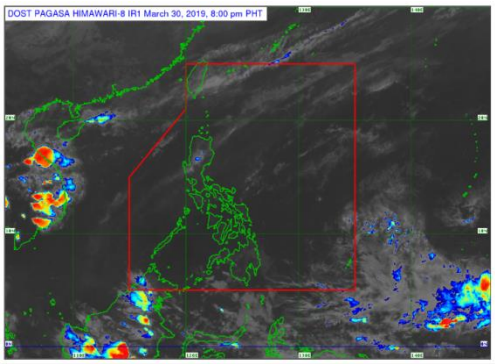


Figure24: Myohoji River Monitoring Camera

It is noteworthy to say that Philippines has also developed and updated the early warning and monitoring systems for disaster prevention and mitigation measures for the past decades. As for the early detection of possible flood and sediment disasters, Philippines acquire HIMAWARI-8, a geo-stationary weather satellite, successor to Japan Meteorological Agency's Multi-functional Transport Satellite (MTSAT) series. It was installed at PAGASA last December 2015. It is the most utilized satellite imagery in real time weather forecasting, tropical cyclone analysis and for research purposes as it generates images every 10 minutes.

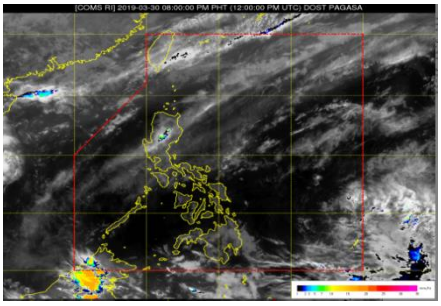


(Image Credit: PAGASA webpage)

Another one is the FY-2G Fengyun Cast Receiving System. The FY-2G receiver was installed in 2007 as a donation by the Chinese government to the Philippines. A geosynchronous meteorological satellite generating images twice per hour. It is used as a back up to the MTSAT in real time weather forecasting. Products are Composite, Infrared IR-1 and IR-2, Visible, Water Vapor.

COMS DATA ANALYSIS SYSTEM

The Communication, Ocean and Meteorological Satellite (COMS) is the first geostationary multi-purpose satellite of Korea which was launched in 2010. It was inaugurated at PAGASA in partnership with the Korea International Cooperation Agency (KOICA) in May 2017. Images generated every 15 minutes is used in weather forecasting and numerical weather prediction including cloud detection, estimation of radiation level in cloud-free region, land and sea surface temperature, fog detection, and rainfall intensity.



(Using COMS satellite image)
(Source: PAGASA)

Recently, the Korean government, through the Korea International Cooperation Agency (KOICA), and the Philippine Atmospheric, Geophysical and Astronomical Services Administration (PAGASA) inaugurated in December 2018 the Pasig-Marikina-Tullahan River Basin Flood Forecasting and Warning Center located in Quezon City. The center marks the completion of KOICA and PAGASA's Automation of Flood Early Warning System for Disaster Mitigation in Greater Metro Manila project. The said project aims to improve responsiveness to natural disasters and mitigate damages to residents in Tullahan and Pasig-Marikina river basins. The project will help minimize property damages and casualties since this will enable PAGASA to forecast way ahead of flooding incident.

According to Department of Science and Technology (DOST) Secretary Fortunato dela Peña, KOICA provided PAGASA with a USD5.2 million for the project. The grant will be used to establish a command center with state-of-the-art equipment, specifically, for the installation of automatic water level gauges, automatic rain gauges, warning posts, close-circuit camera television units (CCTVs); the development of 10 units of software; and setting up relay stations and wireless network for the CCTVs. As part of this project, Korean experts will share their technical know-how, and enhance the capabilities of PAGASA personnel to respond to natural disasters.

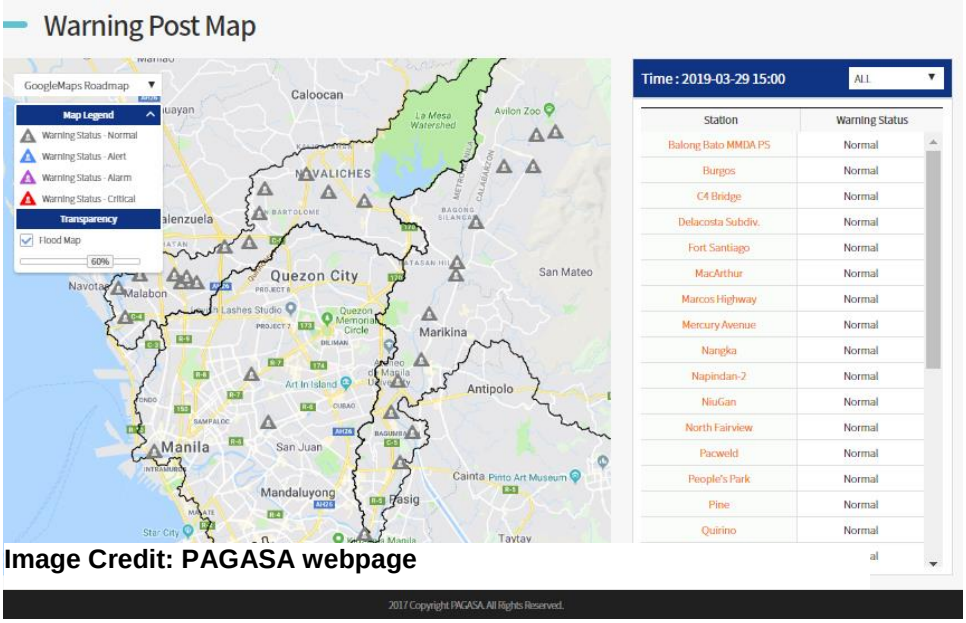


Image Credit: PAGASA webpage

Figure 25: Image from PAGASA website

As seen on Figure 25 are the designated stations in Greater Metro Manila area showing on each station at the right side the warning status which the public could be notified in real time.

3.1.5.b Promotion of Public and Private Sectors Partnerships

- Through public-private partnerships (PPPs), governments can attract private sector partners who can provide financing for infrastructure investment, management skills, and expertise to address the challenges of natural disasters. Leveraging private finance is important especially for developing countries prone to natural disasters and suffering from insufficient access to basic infrastructure—an approach fully in line with the World Bank Group's Maximizing Financing for Development approach. Governments overseeing DRM efforts and infrastructure development will have to coordinate and find ways to provide incentives for the private sector to invest in resilience that are technically and commercially viable. The national government communicates with the Private Sectors to encourage in their engagement in DRR. Private Sectors in contributing to the DRR initiatives and innovation can

also protect their own business thru BCP. It also strengthens strong relationships between the national and local level partnerships

1. *Oyo International Corporation (OIC)* is a geological, geotechnical and geophysical consulting company and manufacturer of instruments as well. The corporation is established since 1957. It specializes on the geological hazard and risk assessment, disaster risk reduction planning, hydrogeology, environment management. The OYO Group endeavors to support and provide safety and security, which are unchanged values of mankind, through its proprietary technologies in an effort to contribute to building a sustainable society.

(Photo credit: http://www.oyointer.com/english/)

One of the most important issues in risk management is to estimate the seismic intensity of earthquakes, landslides ad slope failure hazards; caused by typhoons or torrential rain, and damage by floods in advance. In the field of earthquake disaster management, the building damages and casualties for scenario earthquakes are calculated considering: ground conditions, building vulnerabilities, and scenario earthquakes. OIC is contributing to improve the risk management capacity of recipient government by collaborating with risk assessments and risk management planning. The disaster evacuation drills and disaster imagination games aimed at students and local residents are also planned and implemented by OIC, to utilize the potential abilities of the local communities in risk management. For the disasters caused by landslides and slope failures, OIC supports local authorities in establishing effective monitoring systems of hazardous slopes and advise them about safer, reliable, and cost effective countermeasures. They also provide technical support to improve the accuracy of soil analysis, slope stability surveys, and risk assessments to their counterparts.

2. *Furuno Electric Co. Ltd.* is a Japanese electronics company whose main products are marine electronics, including radar systems, fish finders and navigational instruments. The company also manufactures global positioning systems, medical equipment and meteorological monitoring and analysis systems. Furuno was founded in Nagasaki, Japan in 1938 and has subsidiaries in the USA, Panama, Europe and China. Recently the company's GNSS Receiver Modules were used in radio controlled flying quadcopters. Its current contribution to DRR is the Furuno Compact Weather Radar. The purpose for radars is demonstration of effects of reducing damage from flood accidents by water level prediction of sewage networks. Furuno provided radar sensors. The systems were demonstrated in two cities, Toyama and Fukui. Three radars were deployed in each city. A distance between two radars is set to 15 km to ensure observation of precipitations up to 50mm/h without data dropouts.

(Photo credit: https://www.furuno.com/en/

3. *Takuwa* is a leading company in flood control and disaster prevention in Japan. For more than 50 years, they have continued to provide technologies and solutions specialized in Japan's flood control and disaster countermeasures, "Water Measurement Techniques for Measuring Water" including water level gauges. Thanks to its high technology and quality, it has realized a country-resistant country with water disasters, and has supported the recovery and high growth of Japan after the war. It has been nurturing Japan quality technology to the world. In fact, their major clients in Asian countries include the Philippines. Its specializes water management and sediment disaster monitoring system as seen on Figure 26. *(Source: Public-Private Seminar for DRR with Cabinet Office, 06 February 2019)*

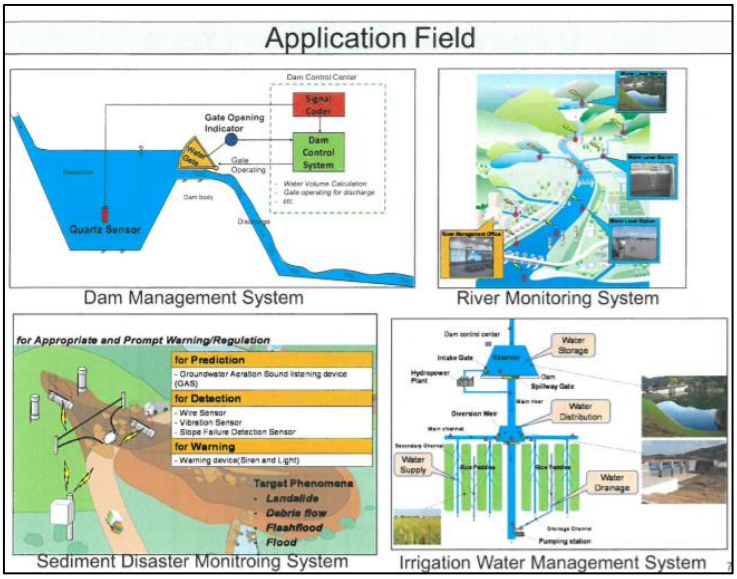


Figure 26: Takuwa Corporation Application Field

4. *Challenge Co Ltd.* introduces its Earthquake Sensor Alarm System (ESAS). The system based on network of EQ guard can work as a standalone, and also can work as a local network with several installations. It is possible to construct a regional earthquake alarm system by making network of EQ guard. This system works without nationwide dense seismometer network. Its contribution to global targets is, “Reduce fatalities and injured people by ESAS”. Meanwhile, it contributes to Sustainable Development Goals by rectifying inequality and ensure the safety of all people by introduction of ESAS and Establish a resilient infrastructure through ESAS. The benefit of EW guard is to that 5 seconds extra warning can make a difference between life and death by preventing 80% of deaths using the early and accurate alarms.

5. *Takeda Cardboard Co., Ltd.* is engaged in the manufacture and sale of corrugated cardboard boxes and sales of sub-materials for gardening with the motto "Creating products friendly to people and the earth". In addition to manufacturing cartons for disaster prevention goods and drinks, they are also handmade to order from small lot to meet the needs of various customers.

The company Takehi Naka Corporation effectively utilizes natural materials and aims to be a company with high reliability in order to deliver gentle items to people and the earth with the theme of environment, safety and security. One of the products that they can offer to the public is the “warm dan room”) wherein it has lots of cardboard designs and parts and can transform into the different items according to your purpose. It can be converted as a bench, bed with partition, tables, cabinets and cubicle which are very useful in achieving a safe place and private space in the evacuation areas during disasters.

6. At *Mitsubishi Corporation Insurance Co., Ltd. (MCIC),* they coordinate property and casualty insurance and life insurance plans while providing integrated risk management services. In doing so, they meet the needs of numerous partner firms and organizations across Japan and around the world including the more than 600 companies of the Mitsubishi Corporation Group. Drawing on the vision of true risk professionals and the expertise they have gained through long experience, they propose optimal solutions for all lines of insurance. In this way, they strive to satisfy the needs of the customers while providing them with safety and security.

   The MCIC provide risk management support and advice by listening closely to their clients. They retain a group of highly experienced risk consultants capable of providing integrated risk management services, an unrivalled strength of Mitsubishi Corporation Insurance. These management services encompass risk assessment, risk treatment (i.e. implementing measures to remove, mitigate, and prevent risks), and the evaluation of risk treatment measures. Appropriate risk management is an indispensable factor in order to maintain the soundness of corporate management and continue to develop. (Source: MCIC brochure and link: http://www.mcic.co.jp/corporations/risk/)

3.2 Structural Measures

3.2.1 Countermeasures for Tsunami and Storm Surge Defense

Sendai City has multiple lines of protection against tsunamis, such as a coastal levee, coastal disaster prevention forests and evacuation hills and an elevated road as illustrated on Figure 27.

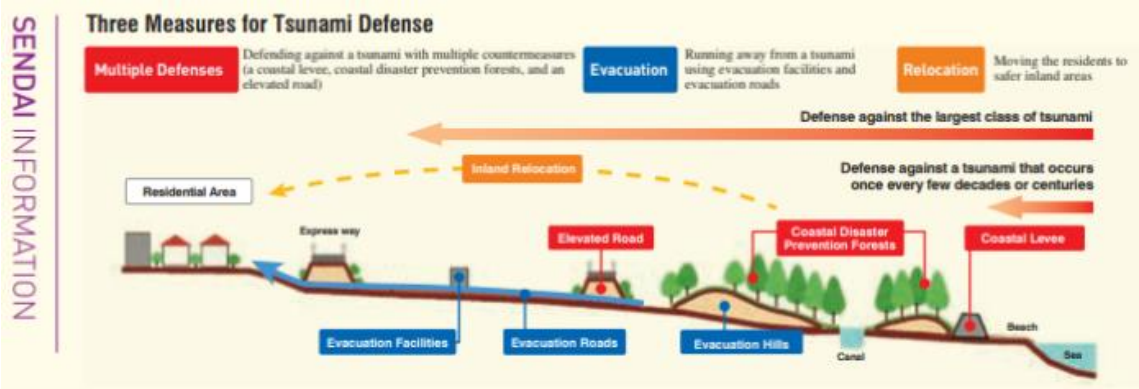


Figure 27: Three measures for tsunami defense
(Source: City of Sendai)

Coastal levee of about 9km in length and a height of T.P. plus 7.2km was constructed jointly with the national and Miyagi Prefectural government. The levee was completed in March 2017. The coastal levee will protect against large tsunamis and high tides which occur only once every few decades or centuries. Construction to elevate a prefectural road running approximately 10km north-south through the coastal areas is expected to complete by the end of FY 2018. The road will be elevated by 6 meters using, in part, tsunami sand and mud deposits, and debris from the earthquake and tsunami disaster. In this way, if a tsunami as devastating as that which occurred during the GEJE were to occur, the elevated road would act as a coastal levee together with the coastal disaster prevention forests to considerably mitigate flood damage. The areas that are designated disaster risk areas have been replaced by the city's coastal disaster-prevention forests since construction of homes is prohibited and former residents have moved to safer inland areas. It is also a measure to slow down the momentum of tsunamis. At the same time, the development of Kaigan Park restores the natural environment and landscape around the coastal areas. A hill 10-15m in

height designed for temporary evacuation has been built in each of these zones, allowing for the evacuation of nearby residents and visitors up to the hills when a tsunami strikes.

Furthermore, the city is equipped with facilities that place importance on evacuation. In fact there are thirteen (13) evacuation facilities, including six towers, five buildings and fire corps' stations, and two sets of outdoor tsunami evacuation stairs for existing elementary and junior high schools. The evacuation tower in Nakano 5-chome is a two-story steel-framed structure that stands over 6m above the ground, allowing 300 people to evacuate at any given time. Even so, in areas where safety cannot be secured, the city promotes measures including home relocation that places importance on "disaster mitigation" and minimizing damage.

Ajigawa River Flood Gate in Osaka City

Osaka City is surrounded by the Yodo-gawa, Kanzaki-gawa, Yamato-gawa, and Neya-gawa Rivers, as well as the sea. With up to 90% of its urban area on flat lowlands, natural water drainage is a challenge and the city is extremely vulnerable to flooding due to heavy rains and tsunamis. The City of Osaka is presently upgrading its sewage system to handle up to 60 mm/h of rainwater.

There was great damage from high flood tides during Typhoon Jane and the Muroto No.2 Typhoon. Because of this, Ajigawa River flood gate and Shirinashigawa River flood gate were build in 1970, modeled on the flood gates on Holland's River Lek, to prevent flood tides from breaking through during typhoons. It is an arched gate against storm surges in the mouth of Ajigawa River. In September 2018, Typhoon Jebi, the most powerful storm in twenty five (25) years hit Japan greatly, to include Osaka

Prefecture. As a preventive measure, the Osaka Government closed the Ajigawa flood gates prior to the threatening storm surges and water overflow due to the typhoon.

Problem no. 4. What are the best practices of Japan's learning experience from past disasters that can best replicate from a developing country?

4.1 Strict implementation of the Building Code and its importance of regular seismic diagnosis of structures

One of the main concerns in building control has been to construct buildings that can withstand earthquakes. The Japanese Building Code has required structural calculation in considering seismic force since 1924 (The next year of the Great Kanto Earthquake). This was the first such requirement in the world. The current earthquake resistance standard based on Building Standard Act was introduced on June 1, 1959. Learning from the past disasters like the Great Hanshin-Awaji Earthquake and GEJE, the national government has constantly updated relevant laws or policies on earthquake-resistant buildings. At present, Japan's earthquake-resistance technology is at a high level and has been recognized all over the world.

The statistics below serves as proof of how Japan has championed in promoting the seismic resistance buildings with the significant increase in the number of houses and buildings with or without earthquake resistance surveyed once in every five years.

Particulars	**平成１５年 (CY2003)**	**平成２０年 (CY2008)**	**平成２５年 (CY 2013)**	**平成３２年 （目標） (CY 2020)**	**平成３７年 (目標) (CY2025)**
Total	47M	49.50M	52M	52.50M	耐震性を有しない住宅ストックの比率 → おおむね解消 **Houses without resistance ratio is almost eliminated**
With EQ resistance	35.50M	39M	43M	50M	
w/o EQ resistance	11.50M	10.50M	9M	2.5M	
Shockproof Rate	**75%**	**79%**	**82%**	**95%**	

Table13: Earthquake Resistance Rate of Houses (Source: FDMA)

Particulars	平成１５年 (CY2003)	平成２０年 (CY2008)	平成２５年 (CY 2013)	平成３２年 （目標） (CY 2020)
Total	0.36M	0.41M	0.42M	0.44M
With EQ resistance	0.27M	0.33M	0.36M	0.42M
w/o EQ resistance	0.09M	0.08M	0.06M	0.02M
Shockproof Rate	**75%**	**80%**	**85%**	**95%**

Table 14: Earthquake Resistance Rate of Buildings (Source: FDMA)

As a means of promoting the seismic resistance of the buildings, the Tokyo Metropolitan Government provides technical assistance to owners so that they will take the initiative in enhancing their building's resistance to earthquakes. This includes the establishment of a consultation system; provision of information on seismic retrofitting methods and selection; registration and introduction of offices fulfilling conditions necessary to conduct seismic evaluations; and opening a portal site for central provision of information on earthquake resistance. Due to their highly public nature, the TMG is also working to advance seismic resistance of wooden framed houses in closely-packed housing districts, condominiums and buildings along emergency transportation roads by subsidizing seismic inspection an retrofitting costs. TMG is also expanding the subsidy system for seismic inspections and the seismic retrofitting of buildings, and is advancing seismic resistance in cooperation with the municipalities. Furthermore, the TMG's own Seismic Certification System has been established so that the people can be reassured about the safety of buildings through the wide availability of information on the seismic resistance of buildings. Through this system the TMG will heighten the awareness and sentiment of residents with respect to seismic retrofitting in order to promote efforts to make the city more resistant to earthquakes,

Moreover, using the E-Defense facility on testing the seismic analysis would also help the construction companies to test the strength of their model houses before selling out to the market. That is why, it is a must to indicate the year the building was constructed as an indication that the structure has actually followed the building code and has passed the seismic test through the E-Defense facility.

As a practice, Arahama Elementary School, which building constructed in 1985, also conducted regular seismic retrofitting prior to the tsunamis and after tsunami for preservation of the "ruins' for future generations to see. The school structure withstood the ravaging flow of water and debris coming into the building because of the support of the braces on the walls as a countermeasure for any earthquake hazard to occur.

Undeniably true is that Japan has achieved its 100% target goals for achieving earthquake-resistant buildings for public schools (elementary and junior high).

4.2 Promoting Widespread Adoption and Awareness of Community Disaster Management Plans (CDMP)

Citizens must gain an understanding of the regional attributes and risks of the area where they live and build relationships of trust with their neighbors before disaster strikes, to ensure that self-help and mutual support functions effectively in coordination with public support in the event of a disaster. An effective way of achieving this is for citizens to independently formulate action plans and share them with their neighbors before disaster strikes. As such, the Cabinet Office revised the Basic Act on Disaster Management, positioning CDMPs under the Local Disaster Management Plans (LDMPs) of municipalities from April 2014. It implemented model projects in 44 districts over the three fiscal years through to FY2016, promoting initiative in which local citizens put together plans for their community.

In this three-year model project, 27 of the 44 districts drafted CDMPs and six districts' successfully revised the municipal disaster management plans and reflect their plans in the CDMPs. This report pointed out the effects of CDMPs, noting the fact that participation in the model project awakened an awareness of disaster preparedness and a spirit of mutual support among local residents who did not actually talk about disasters, and also triggered regional revitalization.

In line with the CDMPs, the Cabinet Office issued (2010, 2011) Information and Tips for organizing groups for community resilience: Introducing good examples from Voluntary DRR Groups, business communities, etc.

The local governments also work hand in hand with the communities in carrying out DRR activities and the development of several voluntary DM organization guidebooks. Samples of the guidebook can be seen on the Annex.

Source: From left, Kyoto Pref, Ishikawa Pref, Setouchi City

As a matter of fact, Kobe City has made a template for the CDMP (see Appendix). As a verification of the CDMP, they conducted regular community drills. For example, as an initiative, Volunteer Fire Corps and Motomachi shopping mall had a tsunami evacuation drill held on 01 March 2019. The drill was actively participated by 30 shopping mall owners, Kobe city Central Volunteer fore corps, government officers from National Research Institute of Fire and Disaster, Fire and Disaster Management Agency, Kobe city Crisis Management Officers and Kobe Central Fire Station officers. The objective of the said drill is a reverification of the 4 items described in CDMP, namely: 1) confirmation of the linkage between the broadcast equipment of the shopping mall owners and an emergency administrative radio system; 2) evacuation preparations; 3) evacuation with vulnerable people using trolleys and wheelchairs as a measure of transportation; and, 4) establishment of a disaster operations headquarters in Hanakuma Park using only a table, tsunami map and a copy of CDMP.

4.3 Manifestation of Self-Help and Mutual Support Initiatives

Before March 11, 2011, Japan had already developed sophisticated high-technology tsunami-warning systems that included satellite communications and hundreds of real-time monitoring stations. But on March 11, the community-level response (and community-based warnings) was the key that saved countless human

lives. The **volunteer fire corps—which are community-based organizations (CBOs)** trained in disaster management - used various tools such as handheld loud speakers, fire bells, sirens, and fire engine loud speakers to warn communities throughout the affected areas. In Katsurashima, Shiogama City, all community members including 30 disabled people were safely evacuated because the fire corps went door to door to every house, helping community members move to higher ground. In Otsuchi and Natori cities some members of the corps kept ringing fire bells or giving directions on their loud speakers right up until the tsunami hit—some at the expense of their own lives.

On April 17, 2016, the Cabinet Office published and circulated the Evacuation Center Management Guidelines, the Guidelines for Securing and Managing Toilets at Evacuation Centers and the Guidelines for Managing and Operating Welfare Evacuation Centers, to facilitate appropriate operation of evacuation centers by affected local governments.

Right after the issuances, at the evacuation centers, community association members do initiatives by:

- Involvement of community association committee members to performs functions before, during and post evacuation activities. (as illustrated)
- Improvised simple emergency toilet using plastic and container box inside a closed tent.
- Disaster well installed in the parks
- Installation of manhole toilet (need intervention of govt efforts and funds) about million yens used to build this)
- Ensuring privacy through partition using cardboard /thick paper materials, curtains, providing changing rooms for women and suckling room
- Consideration for elderly people – more space for them, improvised cardboard box bed, roll away bed, relaxation space.
- Simple Evacuation plan and procedures for community members
- Early warning signs for evacuation.

Disaster Resilience Education (DRE) should start from the family and citizens. People saw the importance of “self-help” and “mutual help” especially when “public help” showed its limitations against such a large-scale wide area disaster. It made “disaster resilience education” receive a great deal of public attention, as an initiative to strengthen both self-help and mutual help.

Japanese community has long been institutionalized DRE since after learning from the past disasters (Great Hanshin Awaji Earthquake and GEJE). With the help of several guidebooks issued and government subsidies, the voluntary DM organizations have been increasing in numbers and were able to sustain “Bosai” community initiatives in their own backyard. For example, conduct of community drills, participation to disaster management trainings from different DRR learning centers and FDMA for capacity building activities and widespread distribution of hazard maps and public awareness information materials to every household. “Build Back Better Town Planning” by community-initiative is also very evident. A community (六甲道南公園) in Sakuraguchicho, Nada Ward in Kobe City, once hardly hit by an earthquake, were re-built with the help of the community planning through set up of a well for emergency use and fire hydrants strategically located in their area.

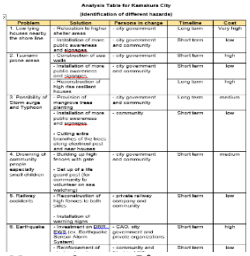

Picture from (Left) A view of the community park in Nada Ward; (Right) a well is setup by community people for immediate water supply on disaster

Town-Watching for Disaster Reduction is a simple and practical tool for efficiently implementing community based hazard mapping in various local communities around the world. The major merits of town-watching are that, after experiencing physical involvement in such activities as walking, observing, mapping by hand and discussing findings, people are better able to:

1) Develop a concrete image of disaster reduction activities;
2) Autonomously identify problems in their own communities;
3) Share opinions arrived at various viewpoints;

4) Build confidence within the local community through face-to-face discussions; and,
5) Reach a reasonable social consensus.

Objectives of town watching are: to involve local residents in developing hazard maps for their community; to reflect the opinions of local residents in local policy making; and, to promote common understanding of risks among local residents, government and experts.



Output of Town Mapping at Kamakura City

The understanding on risks and useful facilities in our community leads you to think about the effective countermeasures and disaster preparedness. This serves as an initial risk assessment tool in developing the other hazard maps in the locality. Saving lives is the most vital thing when a mega-disaster might happen. First thing that must be learned from this initiative it the information about the evacuation areas and nearest lifelines where to seek for help or survival (convenience stores, supermarkets, gas stations, pharmacy etc.)

As a disaster prevention tool and mainly practiced all over Japan, several communities were able to develop community hazards maps whose information were useful in the formulation of the cities and municipality hazard maps. In fact, places that the researcher visited like Kobe City, Kamakura City and Chiyoda city showcased several hazard maps which were collaborated with the their respective communities.

Problem no. 5: What are the challenges faced by the government and the community in carrying out future disaster risk management?

5.1 The early warning message is very important in contributing to managing the risks and reducing impact due to disasters. People can promptly prepare before the impact and any impending danger to come. There are a lot of researches about

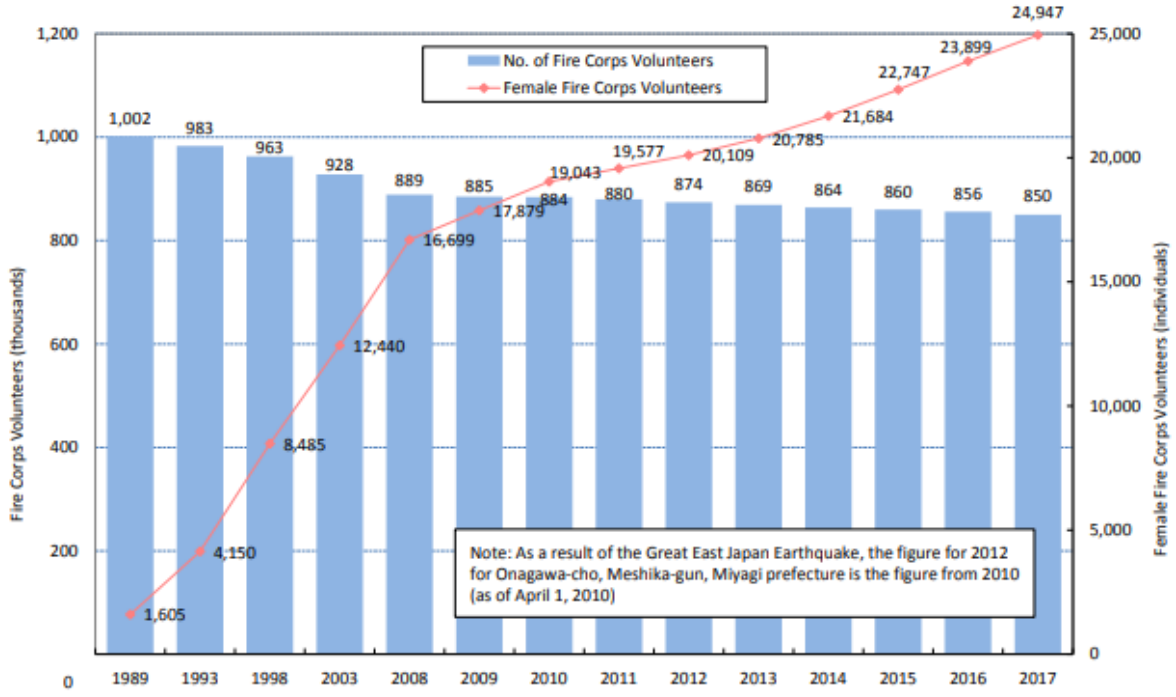
how to achieve advanced early warning systems for multi-hazards. There are science-based and information technology application through the use of SMS, Wi-fi, Radio Television, radars, satellites and other paraphernalia to transmit early warning signals and messages to everyone. But when and where those communication infrastructures are out of service or unavailable, they sometimes fail.

For example, the application of QZSS in Japan, its capacity of sending message is not large for now. The message needs to be coded to make the volume short. In the case of the EAWM in the Philippines, it has to address on how to send the message to all networks and receive by the receiver on a real time basis. Sending and receiving messages due to the volume of messages sent to network subscribers is very crucial especially in the decisions and careful planning for contingencies if there is an impending danger to come.

5.2 Another issue pointed out from the study was the difficulty of maintaining the continuity of initiatives through public awareness raising campaigns and measures which may connect “awareness” to “preparedness” to “prevention” between government officials, local citizens and tourists while building trust between them. There are still indifferences of some cultural diversity in areas which preservation of the culture is high. The laws and ordinances on the protection of the privacy of household is also another challenge between the government and the “BOSAI” leaders. It also pointed out the need to familiarize the citizens of surrounding districts with the content of the plans and to make sure of the active participation of all community people from all walks of life. This challenge was expressed from a BOKOMI member, Mr. Hatori, in Tsurukabuto, Nada in Kobe City. It has always been very difficult to carry out DRR activities in the community since not everyone spontaneously cooperates in such activities especially from the young population. However, the good thing is that BOKOMI receives assurance of everyone’s help as necessary.

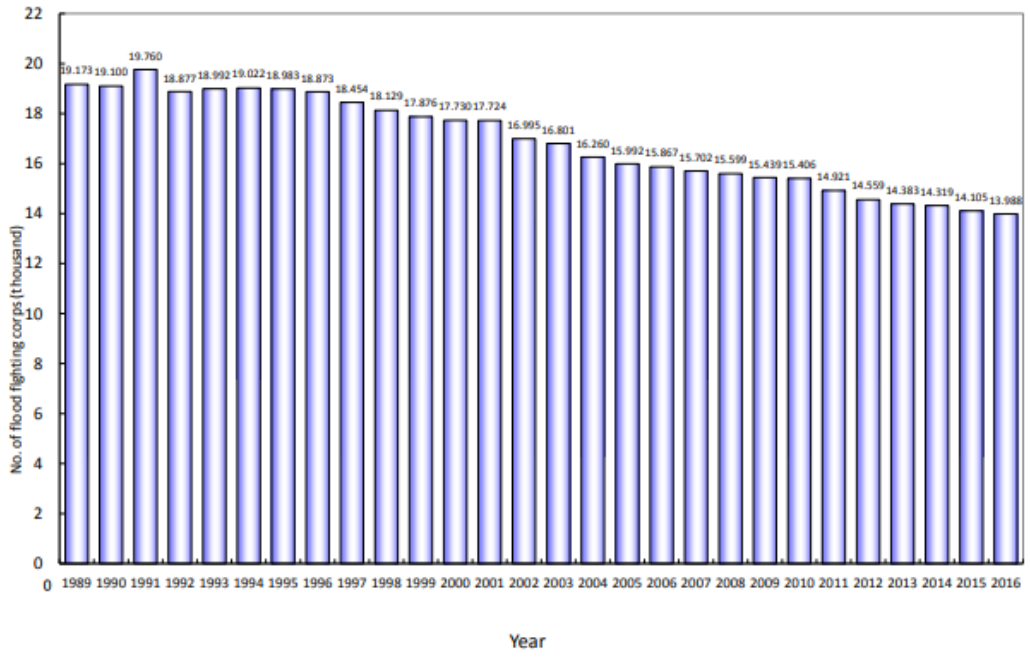
5.3 Emerging shortage of disaster management leaders has been a challenge in an ageing society like Japan. The number of fire and flood fighting corps volunteers, who directly support local disaster resilience, is on a long-term downtrend, and at the same time, aging is proceeding among such volunteers (Fig. 28 and 29).

The decrease in and aging of fire corps volunteers not only means the shrinkage of the pool of personnel who directly support disaster resilience but also raises concerns that disaster resilience may not necessarily be effectively exercised.



Source: Formulated by the Cabinet Office based on the Survey on the Current Status of Fire and Earthquake Disaster Management Measures of the Fire and Disaster Management Agency

Figure 28: Trends in Numbers of Fire Corps Volunteers



Note) Number of full-time flood fighting corps personnel
Source: Ministry of Land, Infrastructure, Transport and Tourism (MLIT)

Figure 29: Trends in Numbers of Flood Fighting Corps Personnel

5.4 Another challenge is the reluctance of affected households for pre-emptive evacuation and leaving their homes for fear of losing their valuables and livelihood or they may feel uncomfortable to the alternate location. The safety of these numerous number of affected families is the primary consideration but the readiness and available resources for this purpose is constantly an issue of every local government depending on the magnitude of the disaster. Evacuation planning management is regarded as the most difficult tasks to undertake and manage when done only during emergencies.

Problem no. 6. What are the goals and approaches on disaster risk reduction for these hazards?

Goals for promoting earthquake-resistant buildings and their progress are set. (Fig 29). Based on the figure, it shows a progressive trend of achieving a “Disaster-Resilient Country” in terms of structural capacity. By 2020, it is targeted to attain 95% of houses but it has believed to achieve a 100% compliance of critical facilities to include public schools and hospitals).

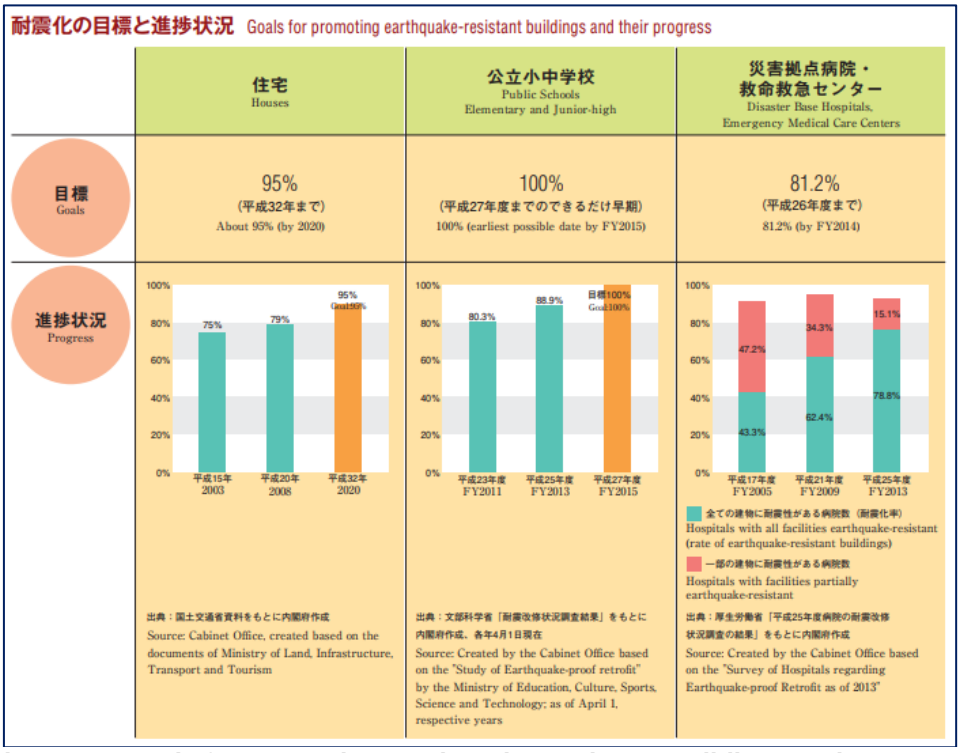


Figure 29: Goals for Promoting Earthquake Resistant Buildings and Progress

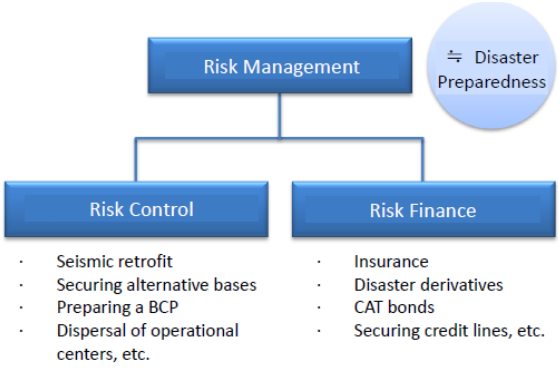
(Source: Cabinet Office, March 2015)

Based on the policy for the Nankai Trough Earthquake Disaster Management, the Plan set clear goals to be achieved within ten (10) years:

"More than 80% in the number of deaths and more than 50% in the economic value of damage to houses and buildings".

The policy also defines concrete measures and target dates to accomplish the goals, such as promoting earthquake-proof or fireproof buildings, developing tsunami hazard maps, and improving the capacity for disaster management for local communities. Various support systems have been established at national and local governments in order to alleviate individual burden on seismic diagnosis and seismic retrofitting and to promote earthquake resistance of houses and buildings. They make use of the quad media pronouncements featuring a system to support seismic diagnosis / earthquake repair. "(Cabinet Office website)

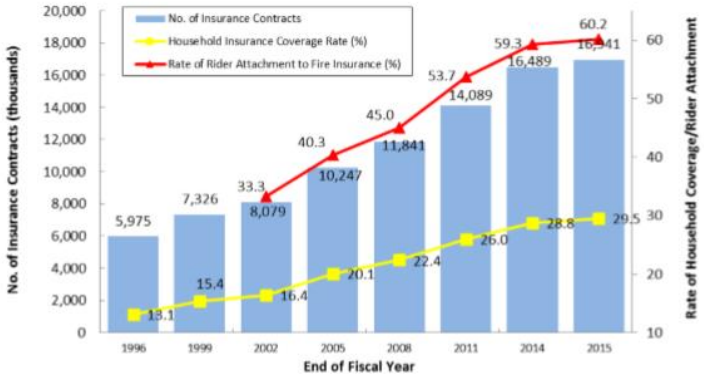
More so, disaster risk management by business operators to prepare for disaster can be divided into two categories: disaster risk control initiatives, which aim to reduce the level of risk itself through such measures as preparing a business continuity plan and seismic retrofit of facilities; and disaster risk finance initiatives, which seek to alleviate any impacts on business management by sharing (relocating) risk through such measures as taking out insurance or securing credit lines. (Fig. 30).



(Source: Cabinet Office)

Fig 30: Concept of Risk Management concerning natural disasters

A key concept in risk finance is that desire to utilize these insurance mechanisms and encourage individuals to enroll in the method. With the collaborative efforts of relevant ministries, agencies and organizations, the Cabinet Office provided approaches in informing the public and encouraged them in the enrollment of insurance. It made use of pamphlets for the general public. Figure 31 illustrates the trend in the increasing number of earthquake insurance contacts for a span of ten years.



Source: Produced by the Cabinet Office based on materials from the General Insurance Rating Organization of Japan

Figure 31: Trends in the Number of Earthquake Insurance Contracts

CHAPTER VI

SUMMARY, CONCLUSION, AND RECOMMENDATION

This chapter summarizes the findings of the study, draws conclusions from the findings and advances relevant recommendations.

The findings of this study are as follows:

1) Japan has been continuously improving and updating the disaster risk reduction laws, policies, regulations, even up to their DM plans right after a disaster. Learning from the past disasters is a key point to improving and coming up with possible solutions to the issues and problems. The trend on the formulation and revision of these rules and regulation is traced back to what hazard or disaster that triggered it. Similarly, the Philippines is currently updating the Implementing Rules and Regulations of RA10121, the National DRRM Plan and the National Prevention and Mitigation Plan to adopt with the recent improvements on the global context.

2) Effective legislation, regulation and enforcement of the basis disaster management laws and systems manifest Japanese cultural mindset and discipline which is inherent in every people's lives. Japan's strict and rigorously enforced building codes generate almost all earthquake-resistant buildings. Seismic retrofitting of houses was supported partially through government subsidy in order to encourage homeowners. The national government has urged the local government to do their own initiative in promoting and becoming a disaster resilient environment for the future generations to enjoy.

3) Importance of public awareness raising measures can save lives. It is every government's goal to never again fall victim to any disaster, to pass on the lessons learned and to show the real threat of these disasters to future generations. For these reasons, Japan had kept this advocacy as part of their culture and discipline. The monuments serve as memories of the past disasters. The preservation of the debris and ruins are kept as if the disaster was still fresh in their memory. Lastly, the

existence of disaster risk reduction facilities and institutions for public viewing is one of the best strategy for increasing public awareness, a venue for research and a haven for DRR knowledge.

4) There were several events in the past that tested the capacity of these structural and non-structural measures. First, the EEW were able to reduce economic damages and loss of life by shutting down bullet trains during the GEJE and providing lead time for people to take protective measures. Japan has developed new technologies to improve these systems. Second, the Osaka flood gates installed in the Ajigawa river saved many Osaka residents of storm surges in September 2018. Third, the Tsunami gate in Fudai caused zero casualties. Lastly, learning from Date Masamune's intelligence on countermeasures of tsunami defense, the navigation (Teizan canal) reduced the flow velocity of tsunami water to flow inland.

5) "BOSAI" (Disaster prevention) is a Japanese culture. One realization from the study is that hazards and risks has been part of Japanese historical, cultural and emotional aspects of their lives. It has long been part of history and since then they have been accustomed to these hazards and risks. The increasing awareness of disaster prevention is very much evident in Japan. For one, Japan has preserved cultural heritages and sites by using indigenous materials as part of disaster prevention measures. Methods to improve such have been under its way. Because of the cultural mindset and discipline, they are the perfect example of showcasing self-help and mutual help initiatives amidst disasters. They put DRR into their body system through the formation and development of citizens groups, by sustainability on community DRR programs, environmental protection, and evacuation planning management. "Bosai" is not exclusive to Japan. The awareness is growing overseas as well after the experiences of various disasters such as the large-scale eruption of Mount Merapi in Indonesia, the heavy flood in Thailand, and the damage caused by Typhoon Haiyan on the island of Leyte in the Philippines.

Conclusions and Recommendations

Based on the findings of the study, the research draws the following conclusions and recommendations:

1) The importance of **investment for disaster risk reduction** has already been recognized in the Sendai Framework for Disaster Risk Reduction 2015-2030. One of the guiding principles says *"Addressing underlying disaster risk factors through disaster risk-informed public and private investments is more cost-effective than primary reliance on post-disaster response and recovery and contributes to sustainable development"*, while one of the four priorities for action indicates *"investment in disaster risk reduction.* Emphasis that national government should take part in fulfilling DRR advocacy by investing on DRR technology and shifting the mindset from "costs" to "investments" for future generations to benefit.

2) The need for voluntary disaster management organizations (VDMOs) is an important **investment for human capabilities**. Community empowerment is the first line of defense for immediate survival and safety. So, while local and national authorities have the key responsibilities for civil protection in hazard events, communities are always the first responders and should be empowered in that role. They can be empowered if they have the skills through DRR training and knowledge, active involvement from the planning, implementation and execution of the DRRM initiatives and most especially resources that they can get from the government's support for sustainability of their own initiatives.

The promotion of the development of community disaster management plans is also a tool for community empowerment which serves as a good strategy in minimizing death tolls in a catastrophe. Local and national governments should develop legislation on and institutionalize the role of the community people through the implementation of such plan. The national effort on promoting of widespread adoption and awareness of community disaster management planning system is an inclusive effort of the government and the community. The government recommended

that drills be conducted on the basis of the plans to check the plan's effectiveness and identify any areas for improvement

3) One of the best practices that Japan could share to the world is that Japan uses the lessons learned from the past disasters and recognizes the structural and non-structural limitations of the risks from natural hazards in order to improve its policies, laws, plans and regulations. Resolving the issues of the problems encountered from the disaster helps in the decision making process and investment patterns thus, continues to develop a more effective disaster risk management system.

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