Building the Resilience of Indonesia and its Communities to Disasters for the Next Generation

July 2006

The Joint Committee of Indonesia and Japan
on Disaster Reduction

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Index

Introduction

In December 2004, Indonesia experienced unprecedented disasters with approx. 130,000 victims, mainly around Aceh, due to the Sumatra Earthquake and the subsequent Great Indian Ocean Tsunami. In March 2005, another earthquake off the Nias Island caused damage to the island as well as surrounding areas. Along with promoting recovery and restoration of the affected areas, the current pressing necessity is to learn from these disasters and drastically improve and fortify Indonesia's disaster reduction system.

To this end, the President of Indonesia H.E. Susilo Bambang Yudhoyono visited Japan in June 2005 to receive a briefing on Japan's disaster reduction system, and agreed with Prime Minister of Japan H.E. Junichiro Koizumi to produce a "Joint Announcement on the Cooperation between the Two Countries on Natural Disaster Reduction". Based on this Joint Announcement by the two heads of state, the "Committee on Disaster Reduction" was established, co-chaired by Japan's Minister of State for Disaster Management and Indonesia's Coordinating Minister for People's Welfare.

The Joint Committee, while sharing vigorous efforts based on bitter experiences of natural disasters in Japan, reviewed the current state of disaster preparedness in Indonesia; gave guidance toward elaborating a comprehensive and effective system for disaster mitigation and preparedness; and finally submitted a report.

In January 2006, the first Committee meeting was held in Tokyo, co-chaired by the Minister of State for Disaster Management H.E. Tetsuo Kutsukake and the Coordinating Minister for People's Welfare H.E. Aburizal Bakrie.

At this Committee meeting, State Minister for Research and Technology H.E. Kusmayanto Kadiman was appointed by the Coordinating Minister for People's Welfare H.E. Aburizal Bakrie as the focal point for Indonesia.

At this first Committee meeting, Indonesia presented its specific topics of concern, including building standards and early warning system for tsunamis.

After the first Committee meeting, experts from relevant Japanese ministries and organizations held monthly meetings in Tokyo, and continued investigation and deliberation.

Further, missions were dispatched to Indonesia in April and July 2006, and discussions were held with experts from both countries present.

During this period, an earthquake occurred in Central Java Island that caused massive damage, over 5,700 deaths and over 38,000 injured, mainly in the Special Region of Yogyakarta. Although the Indonesian government handled the disaster swiftly and smoothly, and international relief assistance by Japan and other countries was also conducted, this disaster once again drew the attention towards the building of increasing disaster resilient society in Indonesia.

Throughout the duration of the joint investigation and deliberation by experts from both countries, the strong leadership of the Coordinating Minister for People's Welfare H.E. Aburizal Bakrie and the State Minister H.E. Kusmayanto Kadiman made available valuable inputs by Indonesian experts, which lead to meaningful findings.

Upon investigation and deliberation, maximum care was taken to achieve results that would contribute to the establishment of a comprehensive disaster reduction system in Indonesia.

In July 2006, the second Committee meeting was held in Jakarta, co-chaired by the Minister of State for Disaster Management H.E. Tetsuo Kutsukake and the Coordinating Minister for People's Welfare H.E. Aburizal Bakrie; this report was created under the leadership of the two ministers.

This report, based on investigations and deliberations by experts, discusses the lessons learned from recent disasters and the current status of disaster reduction efforts in Indonesia, as well as knowledge available in Japan acquired through similar disasters and disaster reduction administrations based on lessons learnt, and goes on to clarify the issues and possible solutions in the mid- and long-term plan to increase disaster reduction abilities in Indonesia. Among these, the importance of adopting the Total Disaster Risk Management (TDRM) approach in establishing core elements of the disaster reduction administration and inter-linked organic coordination of these elements is emphasized.

I. The Importance of Disaster Reduction in Indonesia

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Indonesia is a prominent country with land area of approximately 1.9 million square kilometers, and population of approximately 217 million. Although it went through major economic structural reform in the late 1990s, its economy has regained stable growth in the recent years, as the result of skillful economic and fiscal management by the present administration. Indonesia is one of the nations with immense potential, endowed with an abundance of human and natural resources.

On the other hand, like Japan, Indonesia is frequented by various natural disasters such as earthquakes, local tsunamis, volcanic eruptions, floods/debris flows, landslides, slope failure and wildfires. Disasters inhibit the steady development of the economy and the society, and in order to expose the massive hidden potential of Indonesia and realize sustainable development, disaster reduction efforts are indispensable.

There are many natural phenomena common to both Japan and Indonesia; of these, the most well-known are seismic and volcanic activities. As with Japan, Indonesia is one of the most volcanic countries in the world. Indonesia is positioned on the joining point of three major tectonic plates of Eurasia, Indo-Australia and Pacific. This causes the country to experience numerous earthquakes. Due to its topography with steep hills, it is also vulnerable to debris flows, landslides, and slope failure.

Located in Indonesia are approximately 130 active volcanoes, out of 1548 volcanoes on the globe. Since Indonesian volcanoes are positioned in densely populated areas such as the islands of Java and Bali, the effects of volcanic activities including pyroclastic flows and mud flows, upon residents in the surrounding area are sometimes quite grave.

Indonesia has repeatedly been experiencing the same types of disasters. Disasters such as earthquakes, volcanic eruptions, tsunamis, floods/debris flows, landslides, slope failure and wildfires are especially frequent, and measures to control and reduce these disasters are urgently needed.

The Indonesian government has taken “disaster reduction” as one of its important policies. Since the 1970s, Indonesia, with technical transfer and development assistance from Japan, has commenced efforts towards disaster reduction. The Great Indian Ocean Tsunami that brought major devastation in December 2004 has renewed their awareness towards the increasing importance of disaster reduction policy. With the establishment of this “Joint Committee on Disaster Reduction” on January 11, 2006 co-chaired by the Minister of State for Disaster Management H.E. Tetsuo Kutsukake and the Coordinating Minister for People's Welfare H.E. Aburizal Bakrie, now is a superb opportunity to drastically advance the disaster reduction capabilities of Indonesia.

II. Similarities between Disasters in Indonesia and Japan

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Both Indonesia and Japan are crescent-shaped archipelagos at the joining point of tectonic plates, and have many common geological, geographical and climatic characteristics. Hazards common to both are listed below.

(1) Trench-type earthquake occurring along Japan Trench/Sunda Trench.

(2) Tsunamis, both local and distant. Majority of deaths by tsunamis are caused by local tsunamis in both Indonesia and Japan.

(3) Numerous active volcanoes exist, inducing volcanic disasters.

(4) Numerous inland active faults exist, inducing frequent earthquakes.

(5) Floods and sediment-related disasters due to torrential rain.

(6) Fragile grounds composed of volcanic ash soils.

(1) Trench-type earthquake occurring along Japan Trench/Sunda Trench.

Indonesia is situated on the boundary of the three tectonic plates, Eurasia, India-Australian and Pacific. Japan is situated on the boundary of four tectonic plates, Pacific, Eurasia, North American and Philippine. Therefore, both countries are vulnerable and prone to damage by local tsunami and seismic motion occurring around coastal areas due to large earthquakes caused by fault movement of ocean-plates.

(2) Tsunamis, both local and distant. Majority of deaths by tsunamis are caused by local tsunamis in both Indonesia and Japan.

Tsunamis can be categorized into local and distant tsunamis, depending on the distance between the hypocenter (tsunami source) and the coastal area, and both Indonesia and Japan face the risk of both local and distant tsunamis. In the case of local tsunamis, since the seismic source of the earthquake is closer to the coastal area and the tsunami reaches the coastal area within a short time, it is necessary to identify the hypocenter and calculate the magnitude of the earthquake immediately after the occurrence of the earthquake; in addition, it is essential to have a tsunami warning system that can estimate the height of the tsunami and its arrival time on the basis of the information regarding the hypocenter and the magnitude.

During the Flores Island Earthquake Tsunami in 1992, all of Flores Island was engulfed by the tsunami, killing 2,100, and many more were killed by the Sumatra Earthquake and the subsequent tsunami in December 2004. In Japan, the Meiji Sanriku Earthquake Tsunami in 1896 killed a total of approximately 22,000 mainly in the three prefectures of Iwate, Miyagi and Aomori, and the Showa Sanriku Earthquake Tsunami in 1933 killed 3,008.

(3) Numerous active volcanoes exist, inducing volcanic disasters.

Indonesia and Japan are two of the most volcanic countries in the world – Indonesia has 129 active volcanoes, while Japan has 108. Since volcanic ash soil is ideal for agriculture, areas surrounding volcanoes have been populated and farmed through the ages. However, volcanic ash soil regions are vulnerable to sediment-related disasters caused by rainfall. During the rainy season in Indonesia, high rainfall causes frequent volcanic mudflow and debris flows disasters; it is not an exaggeration to say that the lives and the livelihood of the people residing in these areas are constantly threatened by landslides. Japan, with its rain and typhoon seasons, experienced similar circumstances for a long period of time, from pre-war to post-war days.

Magma of Japan and Indonesia is highly viscous, which makes the volcanoes prone to extremely *explosive eruptions. The two countries both have many volcanoes that erupt explosively and settlements and cities tend to surround volcanoes, which increases the risks of volcano eruption disasters in both countries.*

(4) Numerous inland active faults exist, inducing frequent earthquakes.

Earthquakes are induced by the numerous inland active faults in Indonesia, such as Sumatra big fault in Sumatra Island, Palu-koro fault in Central Sulawesi Island, and Sorong fault in Irian Jaya. Japan has many large-scale active fault lines, such as the Median Tectonic Line, and the Itoigawa-Shizuoka Tectonic Line. The movement of active fault lines in all inland regions has caused many devastating earthquakes in the past, including the so-called M8 Nobi earthquake (on JMA scale) in 1891, caused by the Neotani Fault, and the most recent 1995 Great Hanshin earthquake.

(5) Floods and sediment-related disasters due to torrential rain.

Due to the limited amount of available land, many people of Japan and Indonesia have no choice but to live in areas where the probability of sediment-related disasters is high, and the two countries share many commonalities in the cause and mechanism of occurrence of disasters itself.
Indonesia has a maritime tropical climate, with a wet and dry season. For instance, annual rainfall in Java is between 1,500 to 4,000mm, with 70-80% of that rainfall occurring in the rainy season from November to March. Rainfall mostly occurs during thunderstorms lasting from 30 minutes to an hour, with rainfall concentrated locally within a few kilometers radius. There are almost no typhoons.
In Japan, rainfall is heavy during the spring rainy season, the typhoon season, and the autumnal rainy season (except in colder regions). In recent years, in particular, torrential rainfall of over 100mm in an hour has been recorded more and more frequently, inducing flash floods.

(6) Fragile ground composed of volcanic ash soils.

Although the number of disaster occurrences in Indonesia is almost the same as in Japan, the death and injury tolls are nearly eight times more; Indonesia's damage from disasters is severe. Many of the disaster victims are poor and have no choice but to live in these danger areas and natural disasters are dealing their worst blows on socially vulnerable people.

In particular, sediment-related disasters due to such geographic factors and characteristics of the rock occur frequently in the Bukit Barisan mountain range of Sumatra, including the volcanic ash plateau of West Sumatra, in the volcanic region of Java, in areas along the Palu-Kolo Fault in Sulawesi, and in all regions of the Nusa Tengarra islands.

There are several geologically vulnerable regions in Japan include the Shirasu Plateau, a volcanic ash plateau created by eruptions of the Aira volcano in Kagoshima Prefecture in South Kyushu, tectonic lines, such as the Median Tectonic Line and the Itoigawa-Shizuoka Tectonic Line, and tertiary deposit zones. These geological situations have long been the basic cause of slop failures and landslides.

III. Similarities with the Development of Disaster Reduction Administration in Japan

III. Similarities with the Development of Disaster Reduction Administration in Japan

Since its beginning as a modern state, Japan has spent over a century in establishing and enhancing its disaster reduction system, but it still continues to lose many lives and assets due to natural disasters every year. Especially until the 1950s, large typhoons and major earthquakes causing more than 1,000 deaths hit Japan frequently. However, based on lessons learned from major disasters, Japan has made efforts to upgrade and expand disaster reduction facilities, establish and improve accuracy of weather forecasts and warnings, improve disaster information communication methods, fortify disaster reduction systems and organization, and as a result, death and missing tolls following natural disasters have decreased.

Japan's disaster reduction administration experienced a major change of direction with the Ise-Wan Typhoon in 1959, which caused enormous damage. It was marked by the enactment of the Disaster Countermeasure Basic Act in 1961, when conventional ex-post disaster countermeasures were replaced with ex-ante measures to "prevent disasters from happening." Another change was that disaster countermeasures that had been individually devised for each separate disaster became more versatile so as to comprehensively tackle disaster reduction for all disasters in general. The Ise-Wan Typhoon was a major turning point in the history of Japan's disaster reduction administration.

Since then, it became the prevalent perspective to regard budget spending for "disaster reduction" not as "expenditures" but as "investments." The importance of disaster reduction is now sufficiently understood by the Japanese authorities, and in its economic and fiscal management, the stable allocation of disaster reduction related budget was hence secured.

Indonesia, after experiencing the Great Indian Ocean Tsunami in December 2004 and the earthquake in Central Java Island in May 2006, is now seeing a rapid rise in the importance of disaster reduction policy amidst its national political scene, as represented by its current efforts toward the enactment of a new Disaster Reduction Basic Act by the Presidential Decree issued in December 2005. Its situation is similar to that in Japan after the Ise-Wan Typhoon, when much reformation took place.

(1) The 1959 Ise-Wan Typhoon and the establishment of the Disaster Countermeasure Basic Act in Japan

(2) Miyagi-Oki Earthquake in 1978 and strengthening of construction standard regulations that followed

(3) Local tsunamis arose out of such earthquakes as the "Earthquake off the west coast of Tohoku-District (1983)" and reinforcement of tsunami early warning system thereafter

(4) Further efforts triggered by the Great Hanshin-Awaji Earthquake in 1995

(5) Establishment of Sediment-related Disaster Prevention law after Hiroshima

disaster in 1999

(1) The 1959 Ise-Wan Typhoon and the establishment of the Disaster Countermeasure Basic Act in Japan

The Ise-Wan Typhoon made its landfall on September 26, 1959 on the Kii Peninsula, causing enormous and extensive damage from the Kinki to the Tokai regions. The death and missing toll reached 5,098, the most severe damage since 1868. The formal nomenclature is Typhoon 195915, and its international name is VERA. It is one of the three major typhoons of Showa-era, along with the Muroto Typhoon and the Makurazaki Typhoon, which caused more than 3,000 deaths.

The severe damages brought by the Ise-Wan Typhoon compelled fundamental changes in Japan's disaster reduction. First, from lessons learned from this major disaster, the government made a cabinet decision on the ten-year sediment and flood control program, which became a historical turning point for commencement of full-fledged long-term sediment and flood control projects in Japan, and triggered the enactment of the Disaster Countermeasure Basic Act (enforced in July 1962). This Act promoted comprehensive and systematic advancement of disaster preparedness, and summarized the basics of creating of disaster reduction plans, disaster prevention, countermeasures and relief activities when disasters strike, recovery and restoration. Also, various specialized institutions, including the National Research Center for Disaster Prevention (currently NIED) of the Science and Technology Agency and the Typhoon Research Department of the Meteorological Research Institute of the Japan Meteorological Agency were established.

For the purpose of protecting the land, lives, health and properties of the people, maintaining social order, ensuring public welfare and conserving land, this Disaster Countermeasure Basic Act provided the following.

- *Establish administrative structures for disaster reduction at national, prefectural and municipal government levels, and assign responsibilities.*

- *Set basic guidelines for formulation of plans for disaster reduction, disaster prevention, emergency response and disaster recovery, as well as fiscal and monetary measures to support disaster reduction and other necessary disaster countermeasures, to establish and promote comprehensive and systematic disaster reduction administration.*

Following the Disaster Countermeasure Basic Act, construction and renovation of tide walls and dikes in Tokyo and other locations in Japan referred to the Ise-Wan Typhoon as its construction criteria. Along the Ise-Wan coastal area, national and prefectural governments committed themselves to working together in completing the tide walls. The dike at the Nabeta Kantakuchi in Yatomi-cho, Aichi Prefecture, which received damages from tidal waves, was reconstructed higher and stronger so as to be able to withstand tidal waves of strength equal to those of the Ise-Wan Typhoon.

(2) Miyagi-Oki Earthquake in 1978 and strengthening of construction standard regulations that followed

The Miyagi-Oki Earthquake, which hit Miyagi Prefecture in 1978, brought a great number of injuries due to falling objects and collapsed houses and buildings. Also, there were many who died under concrete block walls that fell because of the earthquake. Deaths by falling block walls accounted for more than 60% of all deaths caused by this earthquake. (Total death toll of the Miyagi-Oki Earthquake in 1978: 28; death by falling brick walls: 18)

The Japanese seismic building code was amended in 1981 to increase the resiliency of earthquakes, based on the experience of the Miyagi-Oki Earthquake in 1978. Before amendment, the standard held the view that if a building was designed to withstand medium-scale ground-motion, the strength of the building should be enough to withstand ground-motion equivalent to the Great Kanto Earthquake, which devastated Tokyo in 1923. However, after this amendment, separate verification for large-scale earthquakes is to be made as well. To ensure compliance with this standard, it obliges builders to (1) confirm construction standard compliance with third-party agencies when building new buildings, and to (2) receive inspection by third-party agencies during construction and after completion regarding the adequacy of construction. Later, further improvements were made, such as promotion of seismic resilient building methods and replacement of brick walls to hedges.

Miyagi Prefecture has experienced strong earthquakes several times in recent years. On July 26, 2003, earthquakes sourced in the northern part of Miyagi with seismic intensity of 6 lower and above on JMA scale occurred three times in a row. Also, the earthquake that occurred off the coast of Miyagi on August 16, 2005 was very strong, with magnitude of 7.2 and maximum seismic intensity of 6 lower on JMA scale. This earthquake caused paralysis in mass public transportations such as railways, and reminded people of the nightmare of the Miyagi-Oki Earthquake in 1978. However, in contrast to the 1978 earthquake, there were no deaths.

This proves the effectiveness of the aforementioned earthquake disaster reduction efforts of the Japanese government.

(3) Local tsunamis arose out of such earthquakes as the "Earthquake off the west coast of Tohoku-District (1983)" and reinforcement of tsunami early warning system thereafter

While it is widely known that Japan currently possesses a tsunami early warning system, it took at least 10 minutes to issue a tsunami warning after the occurrence of earthquake in earlier days.

After Japan experienced such disasters as "Earthquake off the west coast of Tohoku-District, 1983" and "Earthquake off the south-west coast of Hokkaido, 1993", awareness toward a local tsunami early warning system had increased. Through much cooperation with public and private sectors, a local tsunami early warning system was improved, resulting in successfully issuing a tsunami warning in 3 to 5 minutes after the occurrence of the earthquake.

(4) Further efforts triggered by the Great Hanshin-Awaji Earthquake in 1995

The Great Hanshin-Awaji Earthquake that hit the city of Kobe and its vicinity in 1995 claimed more than 6,000 lives. One of the most significant lessons learned from this Great Hanshin-Awaji Earthquake was the necessity of strengthening houses to be earthquake-resistant. Such a large number of deaths in this earthquake were caused by collapsed houses. Based on this experience, efforts were made to further strengthen the seismic-resilience of buildings, such as via establishment of the Law on the Promotion of Seismic Retrofit of Buildings.

Another major lesson taught by this earthquake was the incredible threat of inland, near-field earthquakes. Major efforts were made to intensify the seismic observation system; prior to this earthquake, seismic intensity observation points numbered approximately 150, but now Japan is covered with approximately 4,000 seismic intensity observation points for accurate measurement of seismic intensity.

A new position, the Minister of State for Disaster Management, was newly assigned in the Cabinet Office, and in order to coordinate all governmental organs involved with disaster reduction administration, the Director-General for Disaster Management, Cabinet Office has been appointed under the command of this Minister of State to plan basic policies regarding disaster reduction and comprehensive coordination of ministries and agencies involved with handling of large-scale disasters.

Further, to enhance the crisis management function of the national government so as to deal with extreme disasters, major accidents and incidents, the position of Deputy Chief Cabinet Secretary for Crisis Management was newly created, and the Cabinet Information Collection Center was established. In case of the Niigata-Chuetsu Earthquake in 2004, these efforts proved effective, allowing the government to respond immediately and effectively.

(5) Establishment of Sediment-related Disaster Prevention law after Hiroshima disaster in 1999

Efforts have been made against sediment-related disasters such as debris-flows, landslides and slope failures due to downpours, earthquakes and volcanoes. For instance, Sabo Law (1897), Landslide Prevention Act (1958) and Act for Prevention of Disasters due to Collapse of Steep Slopes (1969) were enacted. Sabo facilities, including Sabo dams, were constructed across Japan, led by the national and local governments. In addition, the sediment-related disaster that struck a new residential area at Hiroshima city in 1999 led to the enactment of "The Law related to Promotion of Measures for Sediment-related Disaster Prevention in Restricted Area due to Sediment-related Disaster". At the same time, non-structural measures became legally binding and informing disaster-prone area to residents, establishing a warning and evacuation system and restraint of new residential development were promoted. Thus, structural and non-structural combined measures were promoted.

[NOTE: A Brief History of Japan's Efforts to Strengthen Buildings against Earthquakes]

Reviewing the history of Japan's efforts to strengthen buildings against earthquakes also may reveal numerous hints that could be useful in deliberating the direction of future efforts in the equivalent administration in Indonesia.

(1) Importance of seismic-resilience of buildings

In case of the Central Java earthquake in 27 May 2006, the ground motion was estimated not of extreme severity, but numerous houses collapsed.

The majority of deaths and injuries in this earthquake were from being crushed by parts of collapsed or heavily damaged. Buildings collapse because they do not possess adequate seismic-resilience. Provision of appropriate seismic-resilience of buildings is one of the most important elements to prevent deaths and injuries by earthquakes.

(2) Japan's past experiences (regulations and incentives)

When looking back at the past Japan's efforts of seismic-resilience improvement, preventing illegal buildings was one of the main issues.

Appropriate building codes with appropriate implementing organization and cooperation from relevant stakeholders are crucial for preventing illegal building. It could be possible to set higher safety requirement, however we can't expect stakeholders to follow requirements, which is higher above the social consensuses. In case of Japan, seismic resilient building laws and regulations were reviewed and improved after certain accidents and disaster, with careful consideration with social validity and accordance. Given this process, it can be said Japan's seismic resilient building laws and regulations has grown with step-by-step strategy and growth of society.

As for designing and operating Japan's building guidance system, reasonable method was adopted, aligned with characteristics of Japan society. The characteristics of Japan's construction and architectural industry are based on trust-oriented business strategy with high quality products sales and cost competition. On the other hand, local governments have had many officials with higher education (university, industrial college, and industrial high school) and maintained certain technical level. Therefore, basic idea of building guidance is that engineers in local governments confirm the building plan's conformity with building code and building codes has repeatedly revised according to the changes of building construction environment.

Local governments, which conduct building guidance, have hired and trained engineers, and this helped a lot when there were not sufficient engineers in private sectors.

It is critical to gain understanding and cooperation from stakeholders, especially influential clients, when preventing illegal buildings. In post-war days of Japan, a large number of houses were insufficient while loans from private sectors were strictly limited. Then, loans from the Government Housing Loan Corporation played a major role of constructing individual houses. Its loan system contributed to increased compliance to the building code and seismic-resilience of buildings. This was because compliance to the building codes was one of the conditions of financing.

It is likely that the cost of legal buildings is higher than that of illegal buildings, which may lead to more illegal construction. In this occasion, it is indeed necessary to create a stakeholder-friendly system to comply seismic resilient building laws and regulations.

(3) Current efforts by Japan (promotion of further seismic-resilience)

Approximately 60 years have passed since Japan began its efforts to increase seismic-resilience of buildings, and such efforts are still continued today. In these years, with major earthquakes adding momentum, the building codes have gradually become stringent, and it has been about 20 years since the current anti-seismic code was enforced. However, there are considerable numbers of buildings that do not meet the current code.

In the peripheral areas of the ocean trenches, ocean tectonic earthquakes of high magnitude occur periodically. The most effective countermeasure against such earthquakes would also be to promote improvement in seismic-resilience of buildings. However, regarding residential buildings, there are a total of approximately 11.5 million houses that were built before 1981, the year the current Building Standard Law was enforced, that are estimated to have insufficient seismic resiliency. This accounts for 25% of all existing houses. It has also been pointed out that the seismic-resilience of nearly half of the schools and hospitals that need to function as bases for relief activities during disasters as well as public facilities that must work as emergency response centers in disaster is questionable.

Therefore, in order to accelerate seismic-resilience improvement, various public incentives are offered in Japan. Specifically, Japan is promoting seismic-resilience diagnosis and seismic-resilience retrofitting, and enhancing systematized construction confirmation and building inspection. Also, Japan established the Earthquake Insurance Premium Deduction Program in the FY 2006 tax reform in order to encourage private efforts to prepare for economic losses due to disasters such as buying earthquake insurance policies, joining mutual aids for building reconstruction. Since seismic-resilience diagnosis, seismic-resilience retrofitting and rebuilding incur cost burdens, the government is promoting such measures through subsidies, loan systems.

In addition, the government is making various efforts such as distributing hazard maps to raise the public awareness towards risks of earthquakes, developing methods to realize seismic-resilience retrofitting without moving out of homes as well as low-cost retrofitting methods; establishing mechanisms to increase asset value of safe buildings such as having sellers explain the building's seismic-resilience upon selling; and promoting introduction of technologies that enable high seismic-resilience such as seismic base isolation engineering.

(4) Making school facilities that would play central roles in disaster reduction seismic-resilient

As for school facilities, its seismic-resilience is especially important, since it is essential for securing the safety of school children when earthquake strike, and since such facilities would be used as emergency evacuation centers for local residents. Therefore, the amendment of the Law on the Promotion of Seismic-Resilience Retrofitting of Buildings in November 2005 added schools and other facilities to targets of seismic-resilience diagnosis and seismic-resilience retrofitting supervision, and also added stipulations such as naming buildings that do not abide by instructions issued. At the same time, subsidies for seismic-resilience diagnosis and seismic-resilience retrofitting were greatly increased.

(5) What the efforts of Japan suggest

From the Central Java Island earthquake that occurred in May 2006, it is highly expected that the basis for shared understanding of the importance of improving seismic-resilience of buildings is spreading among people at all levels in Indonesia.

The first step to increasing seismic-resilience of buildings is to organize socially appropriate building-related laws and regulations with building codes and standards. The next step is to guide and control to increase legal buildings. Appropriate system, implementation and incentives are necessary.

In Indonesia, although building-related laws and regulations are already provided, it is required to review its social appropriateness. As for a building code, it is expected that Indonesia create a system of reviewing and amending the building code to match the changing status. When the building-related laws and regulations are adequately implemented and appropriate incentives are provided, Indonesia will be highly expected to progress in increasing the number of seismic-resilient buildings that meet the building codes.

IV. The Status of Indonesia's Efforts toward Disaster Reduction

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Indonesia is a prominent country with extensive land and a population exceeding 200 million, and each of its many regions is unique in its characteristics. However, due to occurrence of major disasters such as the Great Indian Ocean Tsunami in December 2004 and the Central Java Island earthquake in May 2006, and due to active efforts regarding disaster reduction by the Indonesian government, there is a growing concern of the importance of disaster reduction in Indonesia at all levels. Under such circumstances, the Basic Law on Disaster Management was proposed as an assembly bill, and the Presidential Decree No. 83 in 2005 was announced, and the law is on the verge of completing its deliberation process. This goes to prove that these disaster reduction efforts by the Indonesian government are beginning to show positive outcomes.

○ Emerging good efforts for disaster reduction

Some examples of emerging efforts are; launching of the development of an information communication system in the Indonesian disaster management administration centered on the BAKORNAS PB; establishing the BRR for Aceh and Nias, and handling of rehabilitation and reconstruction processes on a community basis; and enhancing the system for immediate emergency response to landslide disasters in West Java province and West Sumatra province.

○ Enhancement of BAKORNAS PB

The Presidential Decree in December 2005 demonstrated the government's firm position to enhance disaster reduction efforts, and to enhance the organization and authority of BAKORNAS PB. This is similar to how the Disaster Countermeasure Basic Act of 1961 became the major turning point in disaster reduction administration in Japan. It is expected to see further advancement of disaster reduction administration in Indonesia.

However, it is still at the stage where the new framework has just been created, and it will be important to fully implement the Presidential Decree in order for BAKORNAS PB to function so as to meet expectations.

○ The Basic Law on Disaster Management proposed by assembly bill

With the Sumatra Earthquake and the Great Indian Ocean Tsunami, awareness towards the importance of disaster prevention increased among the various groups of people in Indonesia, and as a result, the bill for the Disaster the Basic Law on Disaster Management was proposed by the Assembly in 2006. It is worthy of special mention that this law includes the positive role to be played the Red Cross, the military and the residents.

○The National Action Plan for Disaster Reduction

Indonesia through joint cooperation between BAKORNAS PB and BAPPENAS (The National Development Planning Board) has initiated to formulate "the National Action Plan for Disaster Reduction" as a follow up of the HFA. The establishment was supported by almost all relevant disaster management actors in Indonesia who come from government; national and international NGO, as well as UN agencies and organizations. The draft is considered to be the first comprehensive plan for disaster reduction ever in Indonesia.

○ Establishment of Tsunami Early Warning System for Indonesia

Immediately after the Great Indian Ocean Tsunami in December 2004, Indonesia swiftly initiated its effort towards establishment of Indonesian Tsunami Early Warning System, as described in 6-1.

○ The Indonesian government's emergency response of the Central Java Island earthquake

When the Central Java Island earthquake occurred in May 2006, disaster response was surprisingly swifter than in 2004; the news of the earthquake reached BAKORNAS PB within four minutes after the event, and the President H.E. Yudhoyono and the Coordinating Minister for People's Welfare H.E. Aburizal Bakrie reached the affected area on the same day to take leadership at the very frontline of relief activities. BAKORNAS PB assumed its important role along with the provincial and regional governments in coordinating the on-site emergency procedure mechanism, and, on the day following the earthquake, held a policy meeting in Jakarta that included members of relevant ministries and agencies across the board, to deliberate on countermeasures.

Here, observed data were utilized in disaster handling. Compared to the handling of the Sumatra Earthquake and the Great Indian Ocean Tsunami in December 2004, when difficulties were experienced in certain aspects, disaster reduction procedures have made great strides.

○ Evacuation drill and simulation exercise for tsunami in West Sumatra

BAKORNAS PB has successfully conducted emergency and contingency training program in East Nusa Tenggara as well as in West Sumatra. Especially in West Sumatra, the program has also been implemented at the district level; Pariaman, Padang City, Pasaman, Pesisir Selatan and Mentawai. Due to geological condition and large population, those regions are regarded as among the highest risk for earthquake and tsunami disaster. Therefore, evacuation drills and simulation exercises were also been carried out, with the relevant organizations. Indonesia is also willingly to conduct similar exercises in other locations.

V. Disaster Reduction for Sustainable Development and Social Stability

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The necessity of disaster reduction for sustainable development and social stability was recognized at the World Conference on Disaster Reduction (WCDR), held in January 2005 in Kobe, along with the importance of establishing a durable disaster reduction framework and structure based on national ownership.

At the World Conference on Disaster Reduction, the “Hyogo Framework for Action (HFA)” was adopted, and recognition of the importance of implementation oriented and strategic enhancement of disaster reduction capabilities in line with this HFA is a common global agenda.

Indonesia is already actively and vigorously addressing all five priorities for action defined in the HFA, and this is extremely important for sustainable development and social stability of the country. Indonesia has stepped up to pay its efforts, including thorough action by BAKORNAS PB, in all five of the HFA priorities for action; attempting to vitalize the disaster reduction system at all levels of national, provincial and municipal (priority 1), aiming to establish an early warning system (priority 2), working to enhance disaster reduction abilities at the community level (priority 3), promoting people’s movement to reduce damages by hydrometeorological disasters (priority 4), and encouraging appropriation of emergency funding to local governments for disaster emergency relief activities (priority 5).

Also, the HFA has been translated into Bahasa Indonesia by the Indonesia Disaster Reduction Association, and is being distributed to relevant organizations within Indonesia. This demonstrates Indonesia’s firm commitment to the promotion of HFA.

Following the tragic Great Indian Ocean Earthquake Tsunami, efforts in line with the HFA are progressing with the strong political will of the government and the support of the people and the society. Further actions by various sectors in Indonesia will be required to accelerate these efforts. The HFA sets efforts to be made for ten years up to 2015, and if Indonesia’s active efforts prove successful, it will more than likely to be a model country for other disaster prone countries to follow.

Ⅵ. Towards the Promotion of Total Disaster Risk Management (TDRM)

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Disaster risk management requires a comprehensive and multi-dimensional approach addressing four phases of prevention/mitigation, preparedness, emergency response, and rehabilitation/reconstruction and multi-sectoral approach involving all stakeholders in public and private sectors. These phases are closely interrelated; emergency response, for example, must be executed in view of long-term post-disaster reconstruction.

The total disaster risk management (TDRM) approach is therefore important, and in order to realize TDRM. TDRM, in the true sense of the term, the individual components or building blocks for disaster risk management needs to be established, and organically interlinked with each other.

In other words, TDRM is like a product in its entirety. For the product to be functional, its critical building blocks must be well produced, and well assembled.

Likewise, for disaster reduction to be successful, it is important to address both structural and non-structural measures, and to combine investments in social infrastructures with sound risk management expertise.

The present chapter discusses requirements for the promotion of TDRM, in two parts, “6-1 Establishment of Major Components” and “6-2 Involvement of Stakeholders and Inter-linking the Components”

６－１． Establishment of Major Components

The existing relevant institutions and systems in Indonesia have been carefully examined through, among others, studies conducted by the Japanese governmental delegation dispatched in connection with the Joint Committee. As a result, critical building blocks, required for the advancement of Indonesia’s disaster reduction institutions and systems, have been identified, and their necessity has been confirmed.

In promoting TDRM, it is indispensable to establish, develop and reinforce the building blocks as listed below.

As Indonesia undertakes the task of establishing and/or reinforcing these critical buildings blocks, it can make use of lessons Japan has learned while overcoming similar disasters and instituting and reinforcing administrative measures for disaster reduction.

(1) Seismic-Resilient Houses and Buildings

Building standards can be effective in society only when appropriately observed.

It is expected that seismic-resilient building will be widely accepted after revision and of building codes, establishment of building guidance system, provision of incentives in accordance with present condition in Indonesia and implementation of building codes properly.

① Current Status of the Building Codes in Indonesia

In Indonesia, building standards are instituted as Laws, Regulations, Ministry

Decrees, Guidelines and Standards and Local Government Acts. Laws, Regulations and Guidelines are administered by the Ministry of Public Works, while Government Standards are administered by the BSN. Additional Local Government Regulations are issued by concerned local governments.

Specifically, with regard to structural codes, for example, Laws demand safety against load and external force, while Regulations and Ministry Decrees stipulate, among others, that usability must be maintained under a load, that design must be executed in accordance with regional seismic characteristics, and that actual loads and seismic forces must be calculated in compliance with relevant Guidelines and Standards. Guidelines and Standards, in turn, indicate methods for seismic designing, concrete construction planning.

② Improvements Required with Regard to the Building Codes in Indonesia

The first improvement required concerns the development of more appropriate building codes. The methods for seismic designing and concrete construction calculation as prescribed in the Guidelines and Standards are highly sophisticated. The verification methods stipulated therein are also sophisticated and premise a system well equipped with facilities. Nevertheless, these methods would be meaningless if they do not correspond to the actual level of facility development, social situation, and standards of technical personnel engaged in construction in the field. The methods seem too complex to be applied to detached housing units, in particular, which make up the majority of buildings in Indonesia. It is necessary, therefore, to institute standards that are simplified in accordance with building purposes and structures.

In addition, building codes being highly society-dependent in nature, it is necessary to review them regularly relative to changes in society. To do this, it is also necessary to establish an institution or system that enables Indonesia to independently review the building standards and other relevant criteria.

Moreover, building codes is questioned for its effectively, necessity and validity from abroad and domestic. Accountability and transparency of code and organizational structure are needed when building codes are used to guide and control.

The second improvement required concerns the system of instruction and execution of building codes. Building codes alone cannot guarantee building safety unless they are observed. It is essential, therefore, to ensure solid compliance with the codes and organize a system that can facilitate verification of compliance. It is necessary, at the same time, to upgrade the competence of building officials working in local authorities and engineers.

The third improvement required concerns the system of incentives for compliance with building codes. In addition to improvement in the above two areas, incentives should be put in place to encourage compliance with the building codes, so that housing units and building structures satisfying the legal requirements will increase in number. Incentives for compliance with the building codes that have proven effective in Japan include a housing loan system offering a lower interest rate for buildings that comply with the codes.

③ Direction for Future Improvement of Building Standards in Indonesia

For future improvement in the development of building standards, the following may be considered: review of the existing building standards and other criteria, the stipulation of technical specifications not requiring complex methods and the establishment of seismic standards in consideration of different building purposes and structures. These measures, already important at ordinary times, may also provide critical advantage in post-disaster reconstruction, as well as safety improvement when a large volume of housing must be repaired or newly constructed in a short period of time following a devastating earthquake or other disaster, since such construction will be facilitated by building standards already in force, according to the conditions of the affected area.

It is also necessary to establish a mechanism or system that enables Indonesia to institute and review building standards independently by utilizing its own existing resources.

With regard to the system of building standard instruction and execution, it is necessary to clarify the scope of duties of builders and other related parties, as well as the authorities of executive organizations, establish systems and institutions that support activities by the executive organizations, including the regulation of clerical procedures, and form appropriate systems and institutions in consideration of regional characteristics that ensure the observance of relevant laws and regulations. In addition, workshops and training programs for continued skill development may be introduced to upgrade the overall level of competence on both sides, of controller (official in administrative organization) and controlled (private-sector construction business).

Incentives for compliance with the building standards can be offered, for example, in the form of a housing loan system providing assistance for housing units satisfying a certain level of quality and the quality indication of housing and building quality levels, enticing builders and consumers to opt for higher-quality buildings. Also, it is effective to make model houses village to show the effect of seismic-resilient houses.

④ Importance of Seismic-Resilient Buildings

Regarding the earthquake resistance of buildings, the damage caused to buildings in the recent Central Java Island earthquake indicates the following:

For disaster reduction in urban areas, it is important to ensure sufficient earthquake resistance in engineered structures by applying advanced design methods and techniques.

For non-engineered structures, measures must also be taken to ensure their seismic safety, in consideration that the majority of buildings in Indonesia, mainly residential housing, are non-engineered.

In particular, post-earthquake reconstruction of buildings should be carried out while adding or reinforcing their earthquake resistance, drawing on lessons learned in the disaster, so as to make the communities resilient, which is one of the fundamental rules of post-disaster restoration. Therefore, adopting building standards in accordance with local conditions and imposing conformity with such standards as a condition for housing reconstruction assistance are considered highly effective both in terms of reconstruction acceleration and safety improvement.

・Damage to Engineered Structures

In Yogjakarta and other urban areas, there are engineered structures, that is, relatively recently-built, high-rise, large-scale buildings, which have been damaged by the Earthquake.

The external force generated by the Earthquake was not great. Moreover, the Indonesian building-related laws and regulations and building codes were already in place at the time of the Earthquake.

Nevertheless, some buildings were damaged while others remained intact. This suggests that the damaged buildings might have been inappropriately constructed or might not have been in compliance with the codes.

This represents a serious problem in terms of disaster reduction in urban areas, since damage to engineered structures, generally high-rise and large-scale and therefore housing many lives and properties, tend to result in huge damage and loss of life.

Damage to engineered structures highlights the need for strict execution of regulatory measures to ensure that the building codes are observed.

・Damage to Non-engineered Structures

In farm villages in rural areas, on the other hand, a very large percentage of housing units were destroyed. They were usually non-engineered structures, built with mutual assistance by dwellers.

Such non-engineered structures, built without technical expertise and not systematically subjected to technical standards, require a different approach from engineered structures.

It is important, in making this type of building seismic-resilient, to adopt methods that require neither highly specialized knowledge nor advanced construction techniques and which are feasible at relatively low cost. Some excellent studies have already been presented on such approaches. To apply the findings of such studies to actual buildings, it is necessary to define precise specifications by verifying actual earthquake resistance and confirming the compatibility of techniques under consideration with the local mode of building production.

The destruction of a very large number of non-engineered structures suggests that simple and inexpensive methods for earthquake resistance reinforcement for buildings should be examined in consideration of the current situation in Indonesia, identify among them the most suitable and locally acceptable ones, work out details of these methods and take action to popularize them.

(2) Establishment of an Early Warning System for Tsunami and Other Disasters

① Current Issues and Future Direction of Indonesian Tsunami Early Warning System

Since the level of seismicity in the vicinity of Indonesia is high, Indonesia is prone to local tsunamis as is Japan. Tsunamis may arrive at coastal area within a very short time. In view of this, it is essential that Indonesia be equipped with a tsunami early warning system that estimates, immediately upon the occurrence of an earthquake, eventual tsunami height and its coastal arrival time, based on analysis of seismic waveform data from which tsunamigenic potential can be recognized most rapidly.

In order to realize such a system, firstly, it is necessary to improve the system that is capable of refining source parameters (hypocenter and magnitude) that were automatically obtained, by amending phase/amplitude readings of seismogram manually and recalculating hypocenter in an interactive manner.

Furthermore, to estimate tsunami height and arrival time from seismic source parameters, it is appropriate to introduce quantitative tsunami forecast system like that used in Japan, i.e., the system stores many cases of numerical tsunami simulation in a database in advance, and when a large earthquake occurs, retrieves the most appropriate case from the database.

On the other hand, considering the current situation of Indonesia, where tsunami warnings have never been issued operationally and where construction of the database will take a long time, it would be necessary to take a step-by-step approach, namely, Step 1: start estimating tsunami height and arrival time from the seismic source parameters such as maximum amplitude of seismic waves, by using an "inverse tsunami travel time chart" and an "empirical chart for estimation of tsunami height", and Step 2: introduce a quantitative tsunami forecast system.

In addition, sea level observation data play an important role in monitoring tsunami generation and updating/cancellation of tsunami warning. BAKOSURTANAL operates 60 tide gauges stations of which 25 are digital stations with 1 minute sampling rate telemetered to BAKOSURTANAL using dial up communication. It was 1 hour sampling rate before tsunami in Aceh. Furthermore, effort has been made to improve 4 stations from offline to real time using meteo-sat to be available in GTS. 20 more stations will be deployed by other donors. RISTEK commits to deploy 10 stations, of which 2 stations have been installed off line.

BPPT will be responsible for buoy operation along with German; two buoys were deployed last year, and more buoys are planed to be added. It is necessary to collect real-time tidal data both from tide gauge and buoy at BMG which is responsible for the operational body of the Tsunami Warning System appointed by vice president.

Sustainability is the vital element of tsunami early warning system. Although tsunamis rarely occur, but bring devastating disasters. Once occurred, sustainability should be well considered in constructing the system and establishing the operational structure.

From the viewpoint of disaster prevention, precise observation of natural phenomena and proper issuance of tsunami warning are important. But also important is to transmit such information without delay to all stakeholders, i.e., municipalities likely to be struck by the tsunami, relevant organizations and inhabitants, so that they can take necessary actions, e.g., rapid evacuation.

A hazard map is effective for inhabitants to recognize tsunami disaster risks. At the same time, disaster information literacy, well considered evacuation plans and repeated evacuation drills are necessary to ensure appropriate actions in an emergency.

② Current Status of the Indonesian Seismological Observation Network

The Badan Meteorologi dan Geofisika (BMG, Meteorological & Geophysical Agency), which corresponds to the Japan Meteorological Agency (JMA), is in charge of earthquake observation in Indonesia. Until 2004, the main seismological network had consisted of 29 short-period analog seismographs with drum recorders located at geophysical observatories, and 27 SP radio telemetered digital. In addition, the Japan's National Research Institute for Earth Science and Disaster Prevention (NIED) deployed 21 offline broadband seismographs in cooperation with BMG. Each regional center had determined hypocenter location and magnitude from the radio telemetry observation networks and phase readings data reported from observatories by telephone. Part of the radio telemetry data had been transmitted from each regional center to BMG headquarters via satellite telecommunication circuit, and BMG headquarters had calculated hypocenter and magnitude from these data and phase readings. At the time of off the coast of Sumatra earthquake and following tsunami in December 2004, BMG could not get precise hypocenter location since radio telemetry system in the northern Sumatra regional center had failed. Since available seismographs were of the short period type, the magnitude could not be properly obtained. Consequently, BMG could not issue tsunami forecast earthquake information.

Reflecting these experiences, the Government of Indonesia plans a large-scale deployment of seismographs as part of the establishment of a tsunami early warning system. According to this plan, 160 broadband seismographs with satellite telemetry link will be deployed. These 160 seismographs include seismographs to be installed under research cooperation with NIED.

As mentioned above, the Government of Indonesia proceeds to establish seismological observation networks taking the lessons learned from off the coast of Sumatra earthquake and following the Great Indian Ocean Tsunami. At the time of the Central Java Island earthquake in May 2006, earthquake information was issued promptly and transmitted to the staff members of disaster management organizations around four minutes after the occurrence of the earthquake.

The seismo volcanic monitoring are deployed and operated by the Center for Volcanology and Geological Hazard Mitigation. Several active volcanoes and submarine volcanoes which are potentially tsunami-genic for example Krakatau eruption in 1883 is an example of Indonesian experience due to volcano tsunami-genic occurrence.

③ Improvements Required of the Indonesian Seismological Observation Network

Currently, multiple seismic data analysis systems are in operation at the Headquarters of BMG in Jakarta, i.e. the framework to promptly provide accurate information on hypocenter is being established.

Although seismic information is provided to governmental organizations, local governments and general public via a number of communication tools, such as dedicated line, radio, television and short message service by mobile phone, information accuracy and swiftness remain unsatisfactory. It is desirable to increase the number of observation sites and to improve data quality, deploy a practical manual analysis system with sophisticated man-machine interaction, and enable information quality refinement/confirmation just before its issuance.

Since a seismic intensity observation (strong-motion seismograph) network has not yet been established in urban areas, it is impossible to quantitatively evaluate relation between seismic intensity or ground motion, and damage.

Strong-motion seismograph is also essential in properly determining the magnitude of large earthquakes, since it can provide unsaturated amplitude readings of seismic waves. In addition to establishment of tsunami forecasting system and a sea level observation network, establishment of a strong-motion observing network is the field which should be promoted in earthquake and tsunami early warning system in Indonesia.

④ The Significant Role of Media including Broadcasting and Communications

Broadcasting and communications play an extremely important role in receiving, exchanging, transmitting, announcing and relaying forecasts and warnings related to tsunami and other disasters.

Prompt and accurate forecasts and warnings must be transmitted without fail. Broadcasting and telecommunications networks are indispensable to this end. And, radio communications networks which exchange and transmit information among institutions related to disaster reduction are also very important. In emergency situations, securing communications among relevant offices is critical. Therefore, redundancies in communications need to be also sought. Since forecasts and warning must reach all residents, means of direct transmission, including the use of sirens and loudspeakers, are also important. In Japan, a digital terrestrial television broadcasting system that can transmit digital information, including images, to mobile phones is being considered as a means of emergency information transmission.

Media, including broadcasting, should make efforts to raise the public awareness of tsunami risk, not only during actual emergencies, but also at normal times. In this way, the entire nation can become clearly conscious that a disaster is not a transitory event but can reoccur. This should, in turn, lead to reinforcement of disaster preparedness in all quarters of the nation. Continuously and accurately transmitting the message that natural disasters, regardless of their scale, are phenomena that can occur and reoccur at any moment is an effective way to raise people’s awareness, in which process media can play a major role.

(3) Measures to Cope with Floods, Debris Flows, Landslides, Slope Failure and Volcanic Eruptions

① Importance of Continuous Observation

The very first and most important step in devising disaster reduction measures is to accurately and continuously observe natural phenomena, such as seismic movements, volcanic activities, rainfall and river water levels, as well as precursors, such as changes in shape of slopes, each of which can trigger a disaster.

Moreover, informing the general public of such natural phenomena in a continuous manner is the only and best method to lead the public, policy makers and media to the correct risk recognition that Indonesia is constantly exposed to natural disaster risk. This would pave the ground for proper understanding of natural disasters and would form the basis for proper action, once there is a warning based on observations.

② Utilization of Earth Observation Satellite for Disaster Information Collection

Indonesia being a large country with numerous islands and steep topography in many locations, but not fully equipped with sufficient overland infrastructure, the necessary degree of accuracy may not be easily attained by ground-level observation of natural phenomena.

These geographical characteristics of Indonesia can actually make it difficult to draw up detailed topographical maps, which constitute the base data for hazard maps.

Furthermore, observation needs to be constantly updated, since hazards to be reflected on a hazard map may not be static but dynamic.

In consideration of these problematic conditions, an earth observation satellite can be highly effective for ground measurement. In general, ground measurement by an earth observation satellite is less advantageous in terms of cost and accuracy. Nevertheless, Indonesia's geographical traits offset these disadvantages, even in comparison with direct ground-level observation.

Satellite-aided observation makes it possible to observe general meteorological conditions, as well as areas considered highly inaccessible thus far, such as Banjir-Bandang and other phenomena occurring over an extensive area, such as wildfires. Advanced studies can be pursued regarding these extensive phenomena and areas, insufficiently elucidated to date. In addition, satellite-aided observation is expected to improve disaster reduction in other aspects as well by, for example, enabling real-time monitoring of ongoing disasters and prevention of secondary disasters.

③ Importance of Hazard (Risk) Maps

To prevent human causalities following volcanic eruptions, debris flows, landslides, slope failure, floods, tsunami, it is important that people are informed of high-risk locales. In doing this, the use of hazard (risk) maps, indicating high-risk locales and safe areas and routes for evacuation, updated as deemed necessary, can be highly effective.

In addition to informing of high risk locales, it is important to actively organize local systems for emergency evacuation, for which hazard (risk) maps are indispensable.

④ To Ensure the Effectiveness of Hazard (Risk) Map

In preparing a hazard (risk) map, it is important to secure the participation of residents of the concerned locale, to reflect local information on the hazard (risk) map. By taking part in hazard (risk) map preparation, setting evacuation routes while taking local conditions into consideration and anticipating specific situations, residents will be able to respond appropriately in emergencies.

Once a hazard (risk) map is completed, it is important to actually use it to formulate an evacuation plan and organize an evacuation drill at community levels, since actual use is essential for adding effectiveness to a hazard (risk) map.

Through resident involvement in hazard (risk) map preparation followed by actual use, the effectiveness of a hazard map can be assured, and people's risk recognition can be raised on an individual basis. That is to say, disaster reduction can be truly effective only through an active, and not passive, involvement of the local residents.

⑤ Hazard Map-aided Land Use Planning and Investment

The primary objective of a hazard map is to visualize, on a map, degrees of existing risk in a given locale at a given time so as to help develop accurate risk perception and enable appropriate emergency responses.

Another usage of a hazard map is to assist safe land use. The optimal distribution of resources for positive disaster risk mitigation can be realized by preparing, improving and utilizing hazard maps.

Moreover, hazard maps can also be used to accurately assess the disaster risk of a given project site in preparation for infrastructure development by public authorities and private-sector investment. In this manner, risk management can be optimized; minimizing possible risk involved in such investment projects.

(4) Measures to Cope with Wildfires

① Ongoing Activities/ Achievements

Preventing wildfires is one of the main disaster risk management agendas in Indonesia, as well as being a global environmental issue for conservation of the world's prominent tropical forests. In this connection, the government of Indonesia has been developing forest fire prevention measures in collaboration with the government of Japan.

Indonesia has improved its forest fire management system through the development of an early warning and detection system utilizing satellite information at the national level, and development of forest fire management models and systems through conducting training and extension programs for forest fire prevention at local levels.

Indonesia has also been strengthening forest fire management measures in national parks through application of an early warning and detection system using a satellite image processing system, improvement of initial suppression techniques against forest fire by organizing national parks' fire brigades and developing patrolling system, implementation of awareness-raising programs such as forest fire prevention campaigns and issuing public relation leaflets.

② Expected Actions in the Future

Indonesia has initiated additional forest fire management measures such as conducting prevention and suppression against forest fire with by villager participation, conducting the activities in and around forests, development of Manggala Agni institutions, and cooperation among ministries, local governments, and local villagers. The forest fire prevention measures in collaborating with local villagers and Manggala Agni need to be further strengthened.

> * Manggala Agni：Forest fire brigade system with a clear chain of command from central to field levels. This system has been developed based upon the Japanese fire brigade system. Its activities cover not only prevention and suppression activities against forest fire but also other disaster related relief activities.

6－2. Involvement of Stakeholders and Inter-linking the Components

To interlink the major components and to involve all relevant stakeholders to join efforts for TDRM, it is important to address the following:

Establishment of Organizational Structures

(1) Establishment of Disaster Risk Management Organizations and Strengthening of Inter-organizational Collaboration

It is of primary importance to establish laws and regulations and devise plans and strategies for disaster reduction at all layers of administration, including national, provincial and municipal governments. Moreover, to promote disaster reduction, organizations must be established that coordinate among all disaster reduction stakeholders at different governmental levels, involving, for example, BAKORNAS PB at the national level and SATLAK at the municipal level. This process should be pursued while aiming for the following:

- Strengthening of BAKORNAS PB, SATKORLAK and SATLAK
- Reinforcing collaboration between these organizations through constant information exchange, human networking and periodic meetings
- Qualitative capacity building of personnel administering these

organizations, and taking charge of disaster reduction and risk management

To ensure that the coordinating organizations function and fully meet the demands, it is essential that institutional arrangements be formed that enable first-rate experts representing various relevant stakeholders (governmental ministries and agencies, the armed forces, police, the Red Cross/Crescent) to meet regularly to discuss various issue of concern. Professionals with rich experience in coordinating of disaster risk management over an extended period will be good assets for the government in advancing its efforts to realize TDRM and enhance its disaster reduction capabilities.

The coordinating organization should also assume the function of disaster prevention strategy planning at the national, provincial and municipal levels, in addition to coordinating emergency responses in time of disaster.

The disaster risk management system in Japan also has a three-layer structure of national, prefectural and municipal levels, and risk management organizations and plans are formed at each of these levels. Japan's experience and expertise would be useful for Indonesia's endeavors in this regard.

Collaboration between administrative organizations at different levels is also important in the process of establishing major TDRM components, such as the reinforcement of building seismic resistance. Collaboration should be pursued through appropriate role-sharing and in view of common objectives.

(2) Enabling Environment for Solid Disaster Risk Management Administration

In general, governmental budget planning tends to be assessed on the basis of the previous year's figures. It is inadequate, however, to apply the same principle to budget planning for disaster risk management, since natural disasters may, in reality, happen at any time. In view of this, it is necessary to secure a stable and sufficient budget at all times, and to have a reserve fund that can be immediately mobilized in case of need. In fact, creating a good financial environment enabling such budget planning contributes to promoting solid disaster risk management administration.

Furthermore, since TDRM involves all relevant governmental institutions and systems as one unity, the risk management coordinating organization should thoroughly understand relevant policy measures within the government, and establish a statutory system for informing the public, via the media, regarding governmental efforts towards disaster reduction and the related developments.

Finally, it is extremely important and necessary for all organizations involved in disaster risk management to record and systematically archive "institutional memories and records," i.e. how they have made decisions, responded and taken action on all critical occasions following the outbreak of each disaster. Such records should not be temporary in nature but chronologically continuous; they can add promptness and efficiency to future disaster responses.

(3) Involvement of All Stakeholders

Promotion of TDRM approach requires stakeholders other than the governmental sector to play active roles. It is essential to promote collaboration between public and private sectors, the latter including the media, such as television and radio providing news on disasters and early warnings, construction companies providing earthquake-resistant buildings conforming with building standards, and the Red Cross providing relief assistance. For example, considering that the prompt communication of warnings to people living in locales at risk and their safe evacuation are essential for minimizing the damage from tsunami and other disasters, relevant information must not stop where it is collected (i.e. at national disaster reduction centers), but should be transmitted to all local governments and organizations involved in disaster response. For this, it is important to develop a network for secured information transmission. Broadcasting and telecommunications systems can play an extremely important role in ensuring the transmission of evacuation orders, and other important information, from the authorities to the general public. Therefore improvement should be sought in both structural and non-structural measure for facilitating information sharing among governmental offices and between the authorities and the public.

(4) Enhancement of Community-level Disaster Risk Management Capacity

Community-level disaster risk management capacity is the indispensable supporting element of TDRM. Enhancing community-level disaster risk management capacity must include preventive and preparedness activities at normal times. Activities organized at local public facilities such as schools, community centers and village clinics, workshops and training programs for community leaders and the provision of public awareness-raising materials, such as the booklet "*Inamura-no-hi*" used in Japan, are effective. Local knowledge inherited in communities such as "smong" in the Simeuleu communities is also highly important.

("Inamura-no-hi," a story that informs the readers of the danger of tsunami, the importance of quick and appropriate judgment and evacuation and the value of handing down the memories of past disasters to future generations, is considered useful for raising the public awareness for disaster reduction. "Smong", in forms of verbal tales, has been inherited in the Simeuleu communities for decades, which is considered able to save the Simeuleu communities from the Great Indian Ocean Tsunami in December 2004.)

Ⅶ. Promotion of a Culture of Disaster Prevention

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The expression “promotion of a culture of disaster prevention” is stated in the Hyogo Declaration of the United Nations World Conference on Disaster Reduction (WCDR), held in Kobe in January 2005.

In the Hyogo Framework for Action (HFA) which was adopted at WCDR is expected to serve as the international guideline for disaster reduction strategies in the following 10 years, toward 2015 “Use knowledge, innovation and education to build a culture of safety and resilience at all levels” is defined as one of the five priority actions.

(1) Culture of Disaster Prevention Rooted in Daily Life for Disaster Information

The Japanese have an interesting custom related to earthquake and tsunami awareness which is not found in other countries. Immediately following an earthquake, people turn TV on public broadcasting channel and wait impatiently to find out more about the earthquake and obtain eventual tsunami warning information from Japan Meteorological Agency, which will appear as a specialized screen image.

This is because it is widely known in Japan, that accurate information on a disaster, including seismic observation results, is promptly transmitted on TV and radio networks immediately following the event. This is one example of the culture of disaster prevention deeply rooted in Japanese life, in which organizations and individuals respond appropriately (for example, evacuate), according to the information thus obtained.

Media can play a major role in developing such a culture of disaster prevention and awareness. Media should disseminate relevant information not only at the time of a disaster but in normal times as well. Media should regularly offer information relating to disasters, which are also useful in everyday life, meteorological forecast and rainfall data. In promoting a culture of disaster prevention, it is important to incorporate disaster-responsive activities into daily activities, anticipating disaster even at normal times.

(2) Culture of Disaster Prevention Rooted in Daily Life for Seismic-Resilience of Housing in Japan

In Japan, some advertisements for residential housing carry details about the seismic-resilient performance. This indicates that for the Japanese, earthquake resistance is an object of great interest and concern. This also indicates the culture of disaster prevention is deeply rooted in Japan.

It may be surprising that earthquake resistance can be part of a sales talk in Japan, while in many other countries its importance and necessity are not fully understood, and do not attract the general public

Building codes and criteria for earthquake resistance are observed where there is a good understanding of the importance and necessity of earthquake resistance in the general public. The latter is essential for making the former effectively function.

(3) Interdisciplinary Approach to Disaster Risk Reduction

Disaster reduction is impossible without a correct understanding of natural phenomena that can trigger disasters. In other words, disaster reduction must be firmly based on natural sciences. At the same time, the objective of disaster reduction being the protection of people's lives and properties, it must be also based on human and social sciences.

Disaster reduction represents an interdisciplinary area where all branches of natural, human and social sciences are combined as new frontiers of sciences. Therefore, it is most appropriate to take an interdisciplinary approach to disaster reduction, mobilizing the latest scientific findings while taking into consideration their social applicability. Such an approach will also contribute to the establishment of a culture of disaster prevention.

(4) Reconstruction from Disasters, Lessons Learned, and Education for Disaster Prevention

The occurrence of a disaster and any loss of life are indeed lamentable. Yet, once damage has been done, the best one can do is to draw maximum lessons from it, as well as from the recovery and reconstruction experience, and be better prepared for future events so that the country and the communities can be more resilient. To do so, it is extremely important to record the disaster itself and the process of subsequent reconstruction.

Reconstruction in a locale affected by a disaster is a difficult task, for any country. Nevertheless, during this process, keeping a thorough, detailed record of all the actions taken and efforts made in different areas and sub-areas, ranging from emergency response and recovery to later rehabilitation and reconstruction, are of immeasurable value not only for the affected locale but for other localities, since such a record can provide highly valuable lessons and findings.

A good way to never forget a disaster and remember useful lessons learned, for enhancing the country's disaster preparedness is to designate a special day in commemoration of the event. In Japan, for example, September 1st is designated the Day of Disaster Prevention, and days before and after this date are named the Week of Disaster Prevention, during which a variety of disaster risk public awareness activities are organized.

Since Indonesia is a vast country with natural conditions varying in one region from another, different disasters can occur in different regions. In view of this, Indonesia may consider setting different commemorative days in different regions.

Such commemorative days are ideal occasions for enticing people to take part in emergency drills, which should be regularly held for different types of disasters. It is necessary, during such drills, to confirm the adequacy of information communication routes. Organizing such drills for enhancing disaster preparedness is also effective in nurturing a culture of disaster prevention.

In order to deeply root the culture of disaster prevention in society, it is important that the general public be constantly reminded of the fact that disaster risk is always present. Education for disaster prevention both through the school system and through other opportunities is an important issue to be addressed in this regard.

(5) Turning the Disaster Experience to Developing Disaster Resilient Indonesia

In Japan, there is a proverb that says “turn a misfortune into a blessing.” Behind this is the idea that a misfortune (such as a natural disaster) should not be viewed only from its negative side since it may later lead to a positive outcome (such as future improvement in disaster risk reduction). Indonesia has had a series of serious disasters, from the Great Indian Ocean Tsunami in December 2004 and the landslide in January 2006 to the more recent Central Java Island earthquake and landslide on Sulawesi Island. It is vitally important for Indonesia to move forward so that it can look back at these events as opportunities for the country’s improvement in safety for future generations.

In Japan, there is another proverb “a disaster strikes when one has forgotten about it”. Indonesia, remembering the valuable lessons of the past disasters, understanding the importance of disaster risk management, and succeeding in cultivating a deep-rooted culture of disaster prevention, making the country fully prepared even for dormant disaster, will indeed mark a historic achievement. Such an achievement will be the greatest gift for Indonesia’s next generations.