2.3.2 Earthquake and Tsunami Disaster in Central Sulawesi

On September 28, 2018, several earthquakes occurred in Palu City and the surrounding areas in Central Sulawesi starting at 14:00. The maximum earthquake with Magnitude 7.4 was occurred at 17:02. The earthquakes and the consequent tsunami caused 2,081 fatalities, 1,309 missings, 4,438 seriously injured, 206,494 displaced and 68,451 damaged houses. Central Sulawesi Earthquake on September 28, 2018, had triggered three major disasters at the same time, namely: earthquake, Tsunami, and liquefactions-landslide in several locations that caused thousands of fatalities.

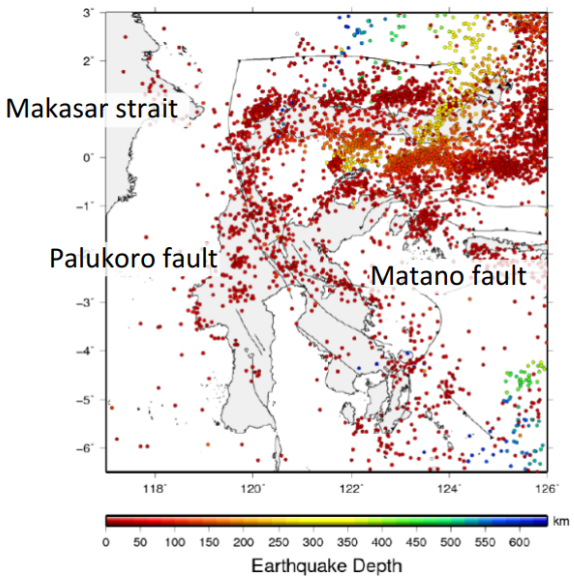


Figure 2-16 Indonesia Earthquake Source and Hazard Map (Peta Gempa Bumi 2017)

Palu City is located in a high seismicity area due to Palu Koro fault, Matano fault, and Makasar Strait. According to the Indonesia Earthquake Source and Hazard Map 2017 (Pusgen), Palu Koro fault consist of 3 segments (total length of 141 km) which ruptured continuously during the earthquake. In history, this area had been hit by several major earthquakes and most probably again in the near future.

Same as other locations in Indonesia, poor construction methods with lacking construction supervision had multiplied the risk whenever a disaster strike. Although some building regulations had been promoted, in reality, lack of awareness has made most citizens choose to save budget and ignore the seismic resilient design.

Another issue is the city planning that promotes economic growth but ignores the DRR aspect. Palu bay, especially Talise Beach in the southern part, was promoted as a tourist destination area with many attraction and facilities, such as hotels, food stalls, etc. In the afternoon of September 28, 2018, the city government was arranging the annual Palu Nomoni Festival and people were gathering waiting for the opening session when the Tsunami suddenly struck. The first wave arrives within 3-4 minutes. Without adequate countermeasure facilities, the Tsunami with a height of 6-7 meters entered freely to destroy all barriers up to 350 meters from the shoreline, including existing houses and public buildings.

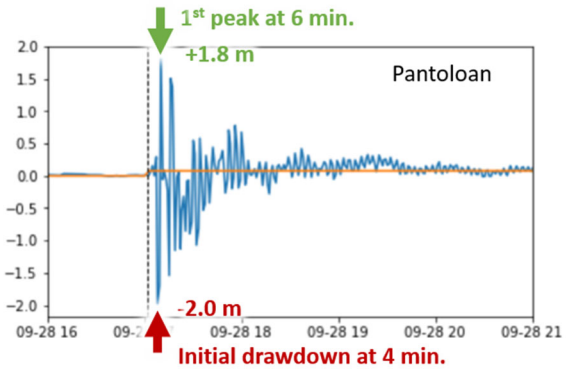


Figure 2-17 Pantoloan Tidal Station (JICA Study Team - 2018)

Eyewitnesses said that before the Tsunami, this area was filled with visitors. When the Tsunami struck, panic and lack of understanding on the evacuation direction have made them fail to run to the safer area quickly. Although the tsunami warning from BMKG was issued, the warning was not delivered because of the communication shut down due to the power failure.

This local tsunami is caused by a large-scale landslide at the entrance of Pal Bay, thus the Tsunami arrival time (3-4 minutes) is very quick compared with common existing Tsunami modeling by BMKG's InaTEWS for this area, where Tsunami generator is a fault displacement in Makasar Strait with estimated arrival time around 20-30 minutes, a crucial time for evacuation.

Beside Tsunami, the ground shaking also triggered major liquefaction-landslide in Balaro & Petobo (Palu City) and Jono Oge & Sibalaya (Sigi District). The massive sediment flow had buried thousands

of houses in these areas up to 5 meters. Some buildings were moved several hundred meters from their original locations.

Source: JICA Study Team 2018

Figure 2-18 Sediment Flow in Petobo

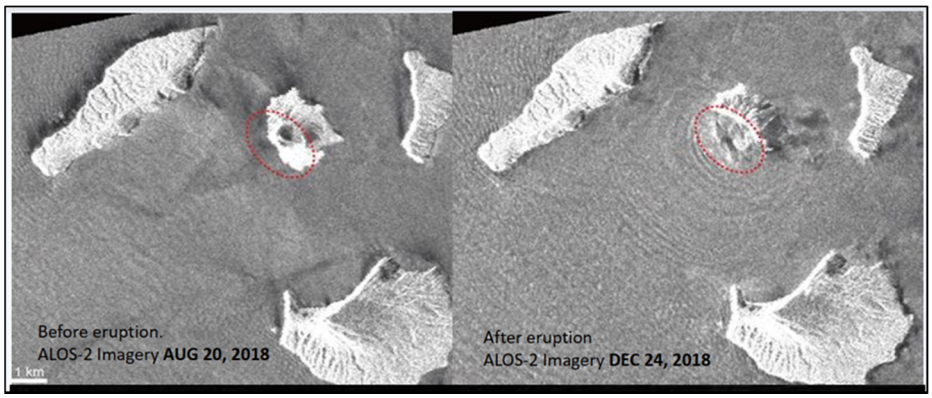
Source: JICA Study Team 2018

Figure 2-19 Local people confirmed the mosque is originally located around 400 meters from this site

2.3.3 Volcanic Disaster in Banten Province

On December 22nd, 2018 at 9.27 PM, sudden Tsunami hit the famous beaches along the west coast of Banten Province (Pandenglang District), including Carita, Tanjung Lesung, etc., where lots of tourists were gathering & celebrating the long weekend toward the new year holiday of 2018. This very rare Tsunami case, where no initial earthquake was felt by the people, gave no sign for alerting people to evacuate and finally caused several hundreds of fatalities, including personnel from a famous local rock band who was performing on stage in the beach area. Total fatalities were 430 people, 31,943 injured and hundreds of houses and hotels were damaged. According to BNPB, the total estimated damage & loss are IDR 453 Billion, mostly originating from tourism-related property and assets. Affected area is spread in two provinces (Lampung and Banten, covering 5 districts) with a coastal line along the Sunda Strait.

On December 26th, BNPB stated that Tsunami might be caused by an undersea landslide of "Anak Krakatau" Volcano, located in Sunda Strait (between Sumatera and Java island), where the southwestern part of the volcano was collapsed into the sea. Currently, there is no Tsunami early warning related equipment or system installed in Indonesia to anticipate this type of Tsunami. Slightly different from this, Palu Bay Tsunami in Sept 2018 also caused by an undersea landslide but triggered by a massive 7.4 M Earthquake several minutes before the tsunami, swept the houses and buildings along the coastline.



Source: AHA Center Flash Update No. 04 – Dec 28th, 2018)

Figure 2-20 Missing part of "Anak Krakatau" Volcano based on satellite image analysis

Chapter 3. Present Situation and Problems on Disaster Management Fields in Indonesia and the International Regional Context

3.1 International and Regional Context

Having experienced several catastrophic disasters throughout the globe, frameworks such as the Sendai Framework for Disaster Risk Reduction (SFDRR) were agreed. Some targets to achieve their goals are being discussed through international dialogues. From these international dialogues, several well-known keywords such as "Mainstreaming DRR" and "Build Back Better: BBB" were used. These keywords have originally been used in Japan[4].

Figure 3-1 indicates the international context in a DRR field. Figure 3-2 shows disasters in the world, international conferences, and initiatives decided in those conferences. The 42nd UN General Assembly (GA) in 1987 decided to designate the 1990s as an International Decade for Natural Disaster Reduction (IDNDR) . The first UN World Conference on Disaster Risk Reduction (UNWCDRR) was held in Yokohama in 1994 and the mid-term review of IDNDR was conducted. The Yokohama Strategy for a Safer World, Guidelines for Natural Disaster Prevention, Preparedness and Mitigation, was formulated and adopted during the conference, based on the recognition that "sustainable economic growth and sustainable development cannot be achieved in many countries without adequate measures to reduce disaster losses"[5]. In the Yokohama Strategy and Action Plan, "Risk assessment is a necessary step to carry out adequate and effective disaster prevention policies and measures", was repeatedly stated as the first principle[6].The purpose of the "International Strategy for Disaster Reduction (ISDR)" adopted by the General Assembly of the United Nations is to inherit the achievements of IDNDR in 1999, and to address the remaining issues to appeal the necessity of disaster prevention with emphasis on consciousness included in disaster risk, evaluation and management capacity[7].

In the "Hyogo Framework for Action (HFA)" adopted in 2005, the first item of priority action stipulated that "disaster prevention is positioned as a priority in the national and local areas with the strong institutional basis for implementation". The conference emphasized the importance of the early warning system influenced by Indian Ocean tsunami[8].

"SFDRR" was adopted in 2015 based on the progress of each country's efforts regarding the HFA. In SFDRR, priority is placed on "investment in disaster prevention for strengthening (public and private investment for disaster prevention through hard/soft measures)". It is a framework mentioning the effect of not only non-suructural measures but also structural measure based on ideas which address the underlying disaster risk factors through disaster risk-informed public and private investments. These are more cost-effective than primary reliance on post-disaster response and recovery, and contribute to sustainable development[9].

3.1.1 Global Trends on DRR

3.1.1.1 International Decade for Natural Disaster Reduction: to shift into a pre-disaster mitigation and prevention measures approach

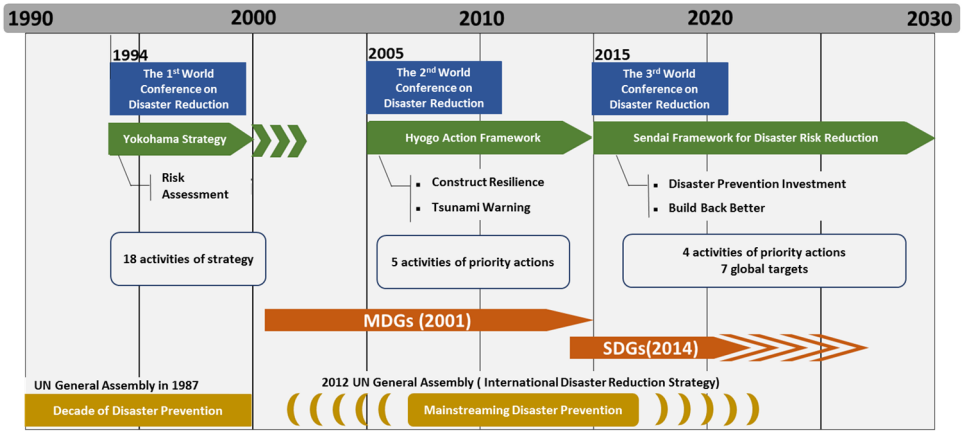
One year after the cyclone that caused more than 300 thousand casualties in Bangladesh, the United Nations Disaster Relief Office (UNDRO) was created to establish an international mechanism for the coordination of emergency humanitarian actions. During the 20 years after the creation of UNDRO, natural disasters caused

[4] JICA (2017), Data Collection Survey for Strategy Development of Disaster Risk Reduction and Management Sector in the Republic of the Philippines, Final Report, summary i
[5] JICA (2017), Data Collection Survey for Strategy Development of Disaster Risk Reduction and Management Sector in the Republic of the Philippines, Final Report, P.2
[6] GAR 2002 Chapter2.p.4
[7] GAR 2002 Chapter1.p.8
[8] Yuichi Ono(2016) Process to Goal Setting of SFDRR
[9] Third UN World Conference on Disaster Risk Reduction(2015), Sendai Framework for Disaster Risk Reduction 2015-2030, P.9

more than three million casualties, USD 23 billion of direct damage in the world and more than 20 million lives still were threatened by drought in Africa. Considering such circumstances, the UN GA decided to designate the 1990s as an International Decade for Natural Disaster Reduction (IDNDR) "in which the international community, under the auspices of the United Nations will pay attention to fostering international cooperation in the field of natural disaster reduction (Res. 42/169)" [10].

3.1.1.2 Yokohama Strategy：to build a strong society and reduce disaster damage with the implementation of pre-disaster measures to ensure sustainable socio-economic growth

The first UN World Conference on Disaster Risk Reduction (UNWCDRR) was held in Yokohama in 1994 and the mid-term review of IDNDR was conducted. The Yokohama Strategy for a Safer World: Guidelines for Natural Disaster Prevention, Preparedness and Mitigation was formulated and adopted during the conference. Based on the recognition that "sustainable economic growth and sustainable development cannot be achieved in many countries without adequate measures to reduce disaster losses", eighteen activities to be promoted during the second half of IDNDR at community and national levels were identified. The activities identified included disaster reduction education and information programs, capacity building of communities, establishment of a disaster prevention network, the constructive role of media, public involvement incentives and risk assessment improvement[11].



Source: JCIA Study Team

Figure 3-1 International Trend of Disaster Prevention

3.1.1.3 Natonal Strategy for DRR

IDNDR takes time to succeed in the issue of disaster prevention. However, it is promoted with the recognition that it is indispensable socially and economically. In order to inherit the results of IDNDR, which ended in 1999, and tackle the remaining issues, the activities of the International Disaster Reduction Strategy (ISDR) started at the 2000 United Nations General Assembly. From around 2000, "mainstreaming disaster prevention" was advocated. The 2012 UN General Assembly resolution on ISDR also included the idea of "mainstreaming disaster prevention". Based on this concept, the following three points are being promoted to deal with disaster risk management as an important factor.1) Development strategies, policies, plans and processes2) Addressing issues of poverty reduction and climate change adaptation3) Normal activities of UN agencies

[10] JICA (2017), Data Collection Survey for Strategy Development of Disaster Risk Reduction and Management Sector in the Republic of the Philippines, Final Report, P.23
[11] JICA (2017), Data Collection Survey for Strategy Development of Disaster Risk Reduction and Management Sector in the Republic of the Philippines, Final Report, P.23

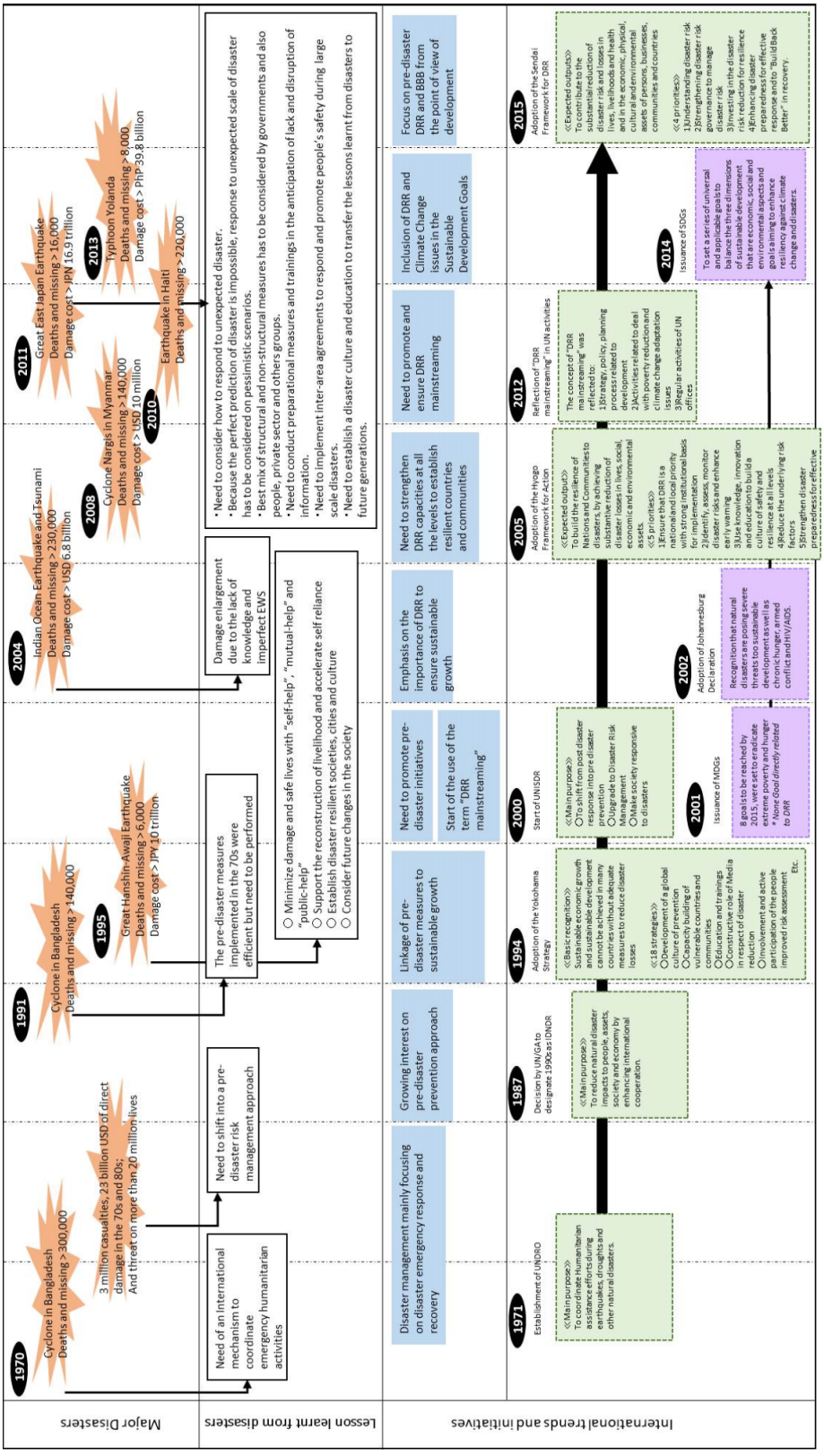


Figure 3-2 International Trend of DRR and MajorDisasters[12]

[12] JICA (2017), Data Collection Survey for Strategy Development of Disaster Risk Reduction and Management Sector in the Republic of the Philippines, Final Report, P.27

3.1.1.4 Hyogo Framework for Action（HFA）: to Build the Resilience of Nations and Communities against disasters

In September 2000, representatives from 189 countries met at the Millennium Summit and adopted the Millennium Declaration which set out the goals to be reached in the 21st Century by the international society. The Declaration recognized the gaps in human rights and good governance and emphasized the role of the UN in the 21st Century.

The Millennium Development Goals (MDGs), which were formulated in 2001, emanated from the international conferences and summits of the 1990s, and were endorsed in the Millennium Declaration. MDGs were constituted of eight goals such as eradicating extreme poverty and hunger to be achieved by 2015.

One year after the MDGs' formulation, the Johannesburg Declaration on Sustainable Development was adopted during the World Summit on Sustainable Development, in September 2002. In the commitment to sustainable development, natural disasters were recognized to pose severe threats to sustainable development as well as chronic hunger, armed conflict and HIV/AIDS.

The second UNWCDRR "to formulate a Disaster Risk Reduction (DRR) guidance for the 21st Century to reduce disaster damage" was held in Kobe, in 2005; and the Hyogo Framework for Action (HFA), indicating the actions to prioritize by 2015, was adopted. Since goals in DRR were not included in the MDGs and since no clear target value regarding DRR was specified in the Johannesburg Plan of Implementation, concrete activities aiming to realize sustainable growth were considered.

HFA aimed to build the resilience of Nations and Communities to disasters, by achieving a substantive reduction of disaster losses in lives, social, economic and environmental assets by 2015; and designated five Priorities for Action[13].

Priority 1: Ensure that DRR is a national and local priority with a strong institutional basis for implementation
Priority 2: Identify, assess, monitor disaster risks and enhance early warning
Priority 3: Use knowledge, innovation, and education to build a culture of safety and resilience at all levels
Priority 4: Reduce the underlying risk factors
Priority 5: Strengthen disaster preparedness for effective response at all levels

3.1.1.5 Sendai Framework for DRR (SFDRR): to accelerate and ensure the mainstreaming of DRR

The formulation of the post-2015 development agenda was agreed during the Rio+20 Conference on Sustainable Development, and seventeen Sustainable Development Goals (SDGs) including 169 targets were proposed in 2015. Building upon the experiences and lessons learned from the previous MDGs, SDGs set a series of universal and applicable goals to balance the three dimensions of sustainable development that are economic, social and environmental aspects and goals aiming to enhance resiliency against climate change and disasters.

One year after the announcement of the SDGs, the third UNWCDRR was held in Sendai, in 2015. During the conference, initiatives to build resilience against disasters and reduce disaster risk were considered under a sense of urgency, and commitments to establish a framework to integrate DRR in policies, plans, and budget at all levels of governance were made by world leaders.

According to the HFA National Progress Reports of each country, DRR organizations and policies were established and enforced (HFA priority 1: Ensure that DRR is a national and local priority with a strong institutional basis for implementation, disaster response systems including early warning were performed (HFA priority 5: Strengthen disaster preparedness for effective response at all levels) in many countries

[13] JICA (2017), Data Collection Survey for Strategy Development of Disaster Risk Reduction and Management Sector in the Republic of the Philippines, Final Report, P.24

including developing countries. However, activities related to the HFA priority 4: Reduce the underlying risk factors were estimated to be behind schedule. During the second UNWCDRR, due to the influence of the 2004 Indian Ocean Earthquake and Tsunami, a Common Statement to establish an early warning system in the Indian Ocean was issued and priorities were still set on disaster response and early warnings even after the HFA adoption; and damage (especially economic losses) caused by recent large-scale disasters were not radically reduced.

Under such circumstances, the fact that DRR is not limited to humanitarian assistance and must be considered as an issue for development was emphasized during the third UNWCDRR and weight was put on pre-disaster DRRM and Build Back Better (BBB).

SFDRR 2015-2030 aims for "the substantial reduction of disaster risk and losses of lives, livelihoods, and health and in the economic, physical, cultural and environmental assets of persons, businesses, communities and countries". The following four Priorities for Actions were agreed.

Priority 1: Understanding disaster risk
Priority 2: Strengthening disaster risk governance to manage disaster risk
Priority 3: Investing in disaster risk reduction for resilience
Priority 4: Enhancing disaster preparedness for effective response and to "Build Back Better" in recovery, rehabilitation, and reconstruction

Seven global targets and indicators were set to evaluate the progress that should be monitored by each country[14].

1. Reduction of disaster mortality: Substantially reduce global disaster mortality by 2030, aiming to lower the average per 100,000 global mortality rate in the decade 2020–2030 compared to the period 2005–2015
2. Reduction of the number of affected people: Substantially reduce the number of affected people globally by 2030, aiming to lower the average global figure per 100,000 in the decade 2020–2030 compared to the period 2005–2015; substantially reduce the number of affected people globally by 2030
3. Reduction of direct disaster economic loss: reduce direct disaster economic loss in relation to global Gross Domestic Product (GDP) by 2030
4. Reduction of damage to critical infrastructure and disruption of basic services: Substantially reduce disaster damage to critical infrastructure and disruption of basic services, among them health and educational facilities, including through developing their resilience by 2030
5. Increase of the number of countries with national and local disaster risk reduction strategies: Substantially increase the number of countries with national and local disaster risk reduction strategies by 2020
6. Enhancement of international cooperation with developing countries: Substantially enhance international cooperation with developing countries through adequate and sustainable support to complement their national actions for implementation of the present Framework by 2030
7. Improvement of early warning systems and access to disaster risk information and assessments: Substantially increase the availability of and access to multi-hazard early warning systems and disaster risk information and assessments to people by 2030. During the UN/GA held in autumn 2015, the integration of "DRR mainstreaming" into the post-2015 agenda was recognized to be a must.

Looking at the past development targets, the MDGs had no description of goals regarding DRR. As a result, disaster risk-related projects are not a priority in disaster-prone developing countries and disaster risk did not reduce. The negative-spiral of many human and economic losses caused by each disaster could not be stopped with huge humanitarian aid only after the disaster.

However, as the center of the Sendai disaster reduction framework, we will promote pre-disaster investment to reduce disaster risks on a global scale in the 15 years until 2030, enhance disaster prevention capability, significantly reduce human and economic damage; it is significant that countries agree to show by a numerical value[15].

[14] JICA (2017), Data Collection Survey for Strategy Development of Disaster Risk Reduction and Management Sector in the Republic of the Philippines, Final Report, P.24-26
[15] Yuichi Ono（2016）, The road to setting goals in the Sendai Framework for Disaster Risk Reduction, the current status of terms and indicators, and the Global Center for Disaster Statistics, P.95

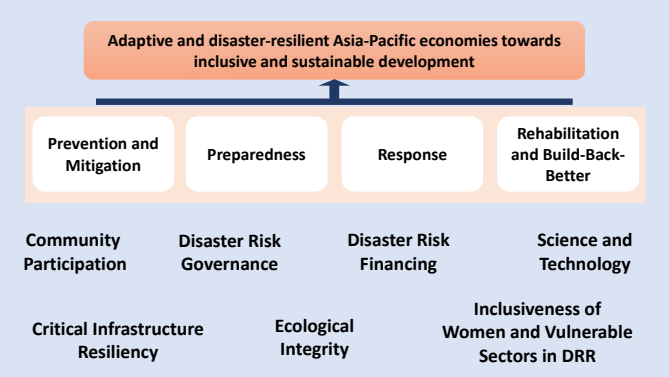
3.1.2 Cooperation at the Regional Level

3.1.2.1 APEC

The Asia-Pacific Economic Cooperation (APEC) is a regional economic forum and it is located in one of the disaster-prone areas in the world.

The first APEC Senior Disaster Management Official Forum (SDMOF) was held in 2008. SDMOF is held every year to share information and discuss disaster experiences and DRR initiatives. The APEC DRR Framework was adopted during the 9th SDMOF held in the Philippines, in 2015. The APEC DRR Framework aims to contribute to adaptive and disaster-resilient Asia-Pacific economies that can support inclusive and sustainable development. The framework was adopted in the face of disasters and the "new normal" and cuts across all areas of the APEC AGENDA including agriculture, forestry, fisheries, trade and investment, energy, infrastructure development, critical infrastructure resiliency, food security, science and technology, and ecological integrity[16].

APEC DRR Framework aims to contribute to adaptive and disaster-resilient Asia-Pacific economies towards inclusive and sustainable development[17].



Source: APEC DRR Framework

Figure 3-3 Outline of APEC DRR framework

3.1.2.2 ASEAN

Asia is the most disaster-prone region in the world and 90 percent of the world's natural disasters damage which occurred in the past 30 years were reported in Asian countries. Consequently, natural disasters are critical, proposing challenges for the members of the Association of South-East Asian Nations (ASEAN) both from the point of view of humanitarian issues and economic growth.

In 2003, the ASEAN Committee on Disaster Management (ACDM), consisting of the heads of national agencies responsible for disaster management of ASEAN Countries and ASEAN secretariat, was formed to intensify the regional cooperation in disaster management and response[18].

The AADMER Work Program 2016-2020 contributes to the aims of the AADMER, which are to reduce disaster losses and enhance regional cooperation to respond jointly to disasters. In the next five years, the goal of the new work program is to build resilient ASEAN Community. This shall be undertaken through the implementation of eight (8) Priority Programs that cover the entire range of thematic areas in disaster management.

[16] JICA (2017), Data Collection Survey for Strategy Development of Disaster Risk Reduction and Management Sector in the Republic of the Philippines, Final Report, P.28
[17] Philippines (2015), APEC DRR Framework
[18] JICA (2017), Data Collection Survey for Strategy Development of Disaster Risk Reduction and Management Sector in the Republic of the Philippines, Final Report, P.29

The 8 Priority Programs were developed based on: i) an assessment of the implementation of the AADMER Work Program 2010-2015; ii) the visioning exercise of each ACDM Working Group together with the partners; and iii) existing and ongoing projects under Strategy and Priorities for AADMER Work Program Phase 2 (2013-2015) (the 21 Concept Notes) that would be carried over in the next work program. The 8 Priority Programs with their specific objectives and outputs are as follows[19]:

1. Aware: risk-aware ASEAN community
2. Build safely: building safe ASEAN infrastructures and essential services
3. Advance: a disaster-resilient and climate adaptive ASEAN community
4. Protect: protecting economic and social gains of ASEAN community integration through risk transfer and social protection
5. Respond as one: transforming mechanisms for ASEAN's leadership in response
6. Equip: enhanced capacities for one ASEAN one response
7. Recovery: ASEAN resilient recovery
8. Lead: ASEAN leadership for excellence and innovation in disaster management

3.2 Historical Variation of DRR in Indonesia

Current disaster management system in Indonesia was developed based on the experience of the large tsunami caused by Indian Ocean Earthquake and Tsunami in December 2004 and the large-scale Central Java Earthquake in May 2006, where many international donors were involved in supporting the recovery activities. Before the formulation of the current system, disaster response was organized by a coordinating organization called National Disaster Management Coordinating Board (BAKORNAS PB), which main task is to coordinate government's responses during disasters from various ministries/agencies, and BAKORNAS PB was not performed as coordinator of preparedness. While at the local government level, a similar temporary organization called SATKORLAK PB[20] and SATLAK PB[21] was established whenever disaster strikes and active only during this period.

With the lesson learned from these experiences during huge disasters, the Government of Indonesia started to strengthen the disaster management system and shifted the paradigm from response to risk reduction. The Disaster Management Law[22] was developed in 2007, and Presidential Decree No. 8 the Year 2008 states establishment of BNPB as a permanent institution in charge of disaster management, not only focusing on disaster response but also on disaster prevention and post-disaster management. At the local government level, BPBD was established by each local government to manage disaster issues at their respective region under supervision and cooperation with BNPB.

3.3 Disaster-Related Regulations and Framework in Indonesia

3.3.1 DRR and Development Targets /DRR in National Plans

Indonesian Mid Term Development Plan (RPJMN 2015-2019) as the main reference for formulating the government annual working plan for the next 5 years (in accordance with current president term), was launch by Bappenas[23] in 2015. In the RPJMN, as a strategic target for Disaster Management and DRR is set as "to reduce the disaster risk index at economic growth centers with high risk" [24], or simply means to protect economic development from the disaster hazards to ensure sustainable development by reducing risk index of these prioritized areas. Further, in BNPB's Disaster Management Policy and Strategy 2015-2019[25], the target was set to reduce 30 % of the risk index from 2015 (as baseline) until 2019. To achieve this target, the following strategies are stated: 1) Internalization (Mainstreaming)[26] of DRR into development process at

[19] AADMER-work-programme 2016-2020、P13-14
[20] Coordinator of Implementer Unit for Disaster Management (Provincial Level)
[21] Implementer Unit for Disaster Management (District/City Level)
[22] Law No. 24 Year 2007 on Disaster Management
[23] National Development Planning Agency
[24] This sentence is stated in the Book 1 RPJMN 2015-2019, Chapter 6 – National Development Agenda, page 6-171
[25] Disaster Management Strategy and Policy 2015-2019, page iii
[26] In Indonesia, usually, the word of "internalization" is used to show the mean of "mainstreaming". This is coming from the word

both national and local level, 2) reducing the vulnerability level, and 3) increasing the disaster management capacity.

3.3.2 DRR Related Regulations

The Disaster Management Law provides the legal basis for disaster management in Indonesia. In this regulation, the responsibility of both central and local government, community's right and responsibility, roles of businesses and international organizations during disaster management phases and so on are described. This Law was equipped with one presidential regulation: No. 8/2008 on National Disaster Management Agency (BNPB) and three (3) government regulations, namely: 1) No. 21/2008 on the implementation of disaster management, 2) No.22/2008 on financing and management of disaster support/aid, and 3) No. 23/2008 on the role of international institutions and INGOs in disaster management. Additional regulations were later provided by Head of BNPB regulations, which provide technical guidelines for the implementation at the field, such as No. 3/2008 on a guideline for the establishment of BPBD, etc. For a complete list of these Head of BNPB's regulations, please refer to Appendix 1.

3.3.3 Other Regulations Related to Local DRR

Same as BNPB at the national level, BPBD was established by local governments to coordinate & implement disaster management activities at their respective regions (province, district/city level) with close cooperation with BNPB. Establishment of BPBD is mainly following 2 regulations: 1) Minister of Home Affairs Regulation No. 46/2008 on the Organization Guideline and Working Management of Local Disaster Management Agency, and 2) Head of BNPB Regulation No. 3 /2008 on the Guideline for the Establishment of Local Disaster Management Agency.

Although it is clearly stated in Law No. 24 year 2007 (Article 8) that local governments are responsible to implement DRR (point C) and to allocate sufficient budget for disaster management at their local annual budget (APBD) (point D), but in reality, the majority of BPBDs are suffering to get budget for DRR from local governments, except for selected area that has either high awareness leader or has been hit by major disaster in the past.

A recent development for local DRR financing shows that there are two (2) main Laws and their derivatives regulations that could possibly boost the implementation of DRR at the local level in the near future, namely: 1) Law No. 23 the Year 2014 on Local Government and 2) Law No 6 the Year 2014 on Village. In the reform of Local Government Law, disaster management becomes a basic service (*Standard Pelayanan Minum*: SPM) that must be provided by every local government to their citizen. While based on Village Law, since 2015, the government allocates approximately 0.8 billion Rupiah per village annually to boost the development at the village level. Current utilization is mainly for basic infrastructure development, but disaster-prone communities expect to utilize part of this fund to address DRR activities at the local level such as Resilient Village, community drills and so on.

3.4 DRR Governance in Indonesia

3.4.1 Development Plan, DRR Strategy and Guideline

Since the issuance of the formulation of Disaster Management Law in 2007, BNPB had formulated 2 (two) National Disaster Management Plan (NDMP), namely: NDMP (2010-2014) and NDMP (2015-2019) as the main reference for disaster management activities in Indonesia, which targeted to unify all disasters[27] related activities from all stakeholders (ministries, agencies, communities, private sectors, etc.) under coordination

of "internalisasi"

[27] Based on the NDMP, disasters can be categorized as follows. **Natural Disasters:** *Gempa Bumi* (Earthquake), Tsunami, *Letusan Gunung Api* (Volcanic Eruption), *Tanah Longsor* (Landslide), *Banjir* (Flood), *Banjir Bandang* (Flash Flood), *Kekeringan* (Drought), *Kebakaran Hutan dan Lahan* (Forest and Land Fire), *Angin Puting Beliung* (Extreme Weather), *Gelombang Pasang dan Abrasi* (Extreme Wave & Abrasion), **Man-made Disasters:** *Konflik Sosial* (Social Conflict), *Kegagalan Teknologi* (Technological Failure), *Epidemi dan Wabah Penyakit* (Epidemic and Disease Outbreak)

of BNPB. But in the practice, it is very challenging to make NDMP as the master plan for all disaster stakeholders in Indonesia[28], considering every institution have their own tasks, responsibility, and priority.

Therefore, during the implementation of RPJMN 2015-2019, BNPB issued the Disaster Management Policy and Strategy 2015-2019, as their main reference for the next 5 years period with a clear achievement target, which is to reduce the risk index up to 30% during 2015-2019 by increasing the disaster management capacity at district/city level through the implementation of 71 Resilience Indicators[29]. The related stakeholders to achieve this target are including 23 ministries/agencies, military, police, and others.

For long term perspective, BNPB and Bappenas are currently arranging the formulation of Disaster Management Master Plan (RIPB 2015-2045), which is positioned to be the long-term reference for disaster management activities in Indonesia. Learning from the experience with NDMP, RIPB is expected to be legalized as a Presidential Regulation[30]. From a regulation perspective, this status will bind all disaster-related stakeholders (including another superior ministry like PUPR) to implement this master plan in accordance with their respective responsibilities.

3.4.2 Organizational Structure of Disaster-related Institutions

3.4.2.1 BNPB

As the main focal point for comprehensive disaster management in Indonesia, BNPB was established in 2008 to replace the previous disaster response-oriented coordinating agency, the BAKORNAS PB. According to the Disaster Management Law, the responsibilities of BNPB are as following:

a) Provide guidelines and directions on disaster management measures, which including disaster prevention, emergency response and rehabilitation/reconstruction in a fair & equal manner.
b) Provision of standardization and requirement for implementing disaster management based on the provisions of law
c) Publishing their activities to the public.
d) Report the implementation of disaster management to the President on a monthly or ongoing basis in the event of a disaster
e) Utilization and accounting of domestic and international donation/support
f) Accounting for the utilization of State Budget
g) Implementation of other tasks based on the provisions of law
h) Preparation of the guideline for establishing the local disaster management agency (BPBD).

BNPB is led by a minister-level Head/Chief (current is Mr. Willem Rampangilei, in office since Sep. 2015). BNPB has one principal secretary, in charge of administrative tasks, including planning, finance, cooperation & general issues, and one principal inspector, in charge of internal audit. For technical issues, BNPB equipped with three (3) deputies based on disaster phases (prevention & preparedness, emergency response, and rehabilitation & reconstruction) and one (1) deputy for Logistics & Equipment (Figure 3-4). BNPB also has two (2) centers, namely Training Center and Data & Information Center (including Public Relation). Since the establishment in 2008, BNPB had gradually expanded its human resources, with current 525 staffs (Sep. 2017) from originally around 100 in 2008 and 225 in 2011. The main office is in Pramuka Street Jakarta, with another office for Training and Logistic Center in Sentul, Bogor.

3.4.2.2 BPBD

At the local level, BPBD was established as part of a local government agency in charge of disaster management at their respective area, with close cooperation with BNPB. Until 2017, all 34 provinces and 471 district/city (around 90% from total districts/cities in Indonesia) have established their own BPBD.

[28] NDMP 2015-2019, Chapter III Issues, Challenge and Opportunity
[29] Jakstra (DM Policy & Strategy) 2015-2019, page iii
[30] Until the preparation of this report, the presidential regulation is not yet issued

The organizational structure of BPBD is following the Head of BNPB Regulation No. 3 the Year 2008 on Guidelines for the establishment of Local Disaster Management Agency and the structure is more or less unified at both provincial & district/city level. Examples of typical organizational structure at both provincial and city level are shown in Figure 3-5 and Figure 3-6

The typical structure consists of one Secretary (same as Prime Secretary in BNPB) and three (3) divisions (Prevention & Preparedness; Emergency Response and Rehabilitation & Reconstruction). While for logistics & equipment, in some provincial BPBD it was created as a UPT (special technical unit) or merged into Division 2 (Emergency Response) as one of the subdivision.

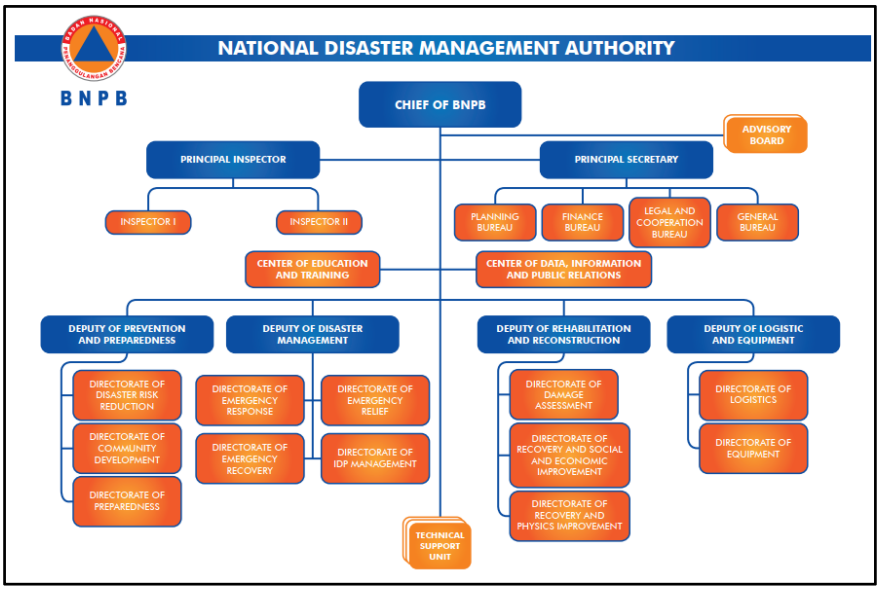


Figure 3-4 Organization Chart of BNPB[31]

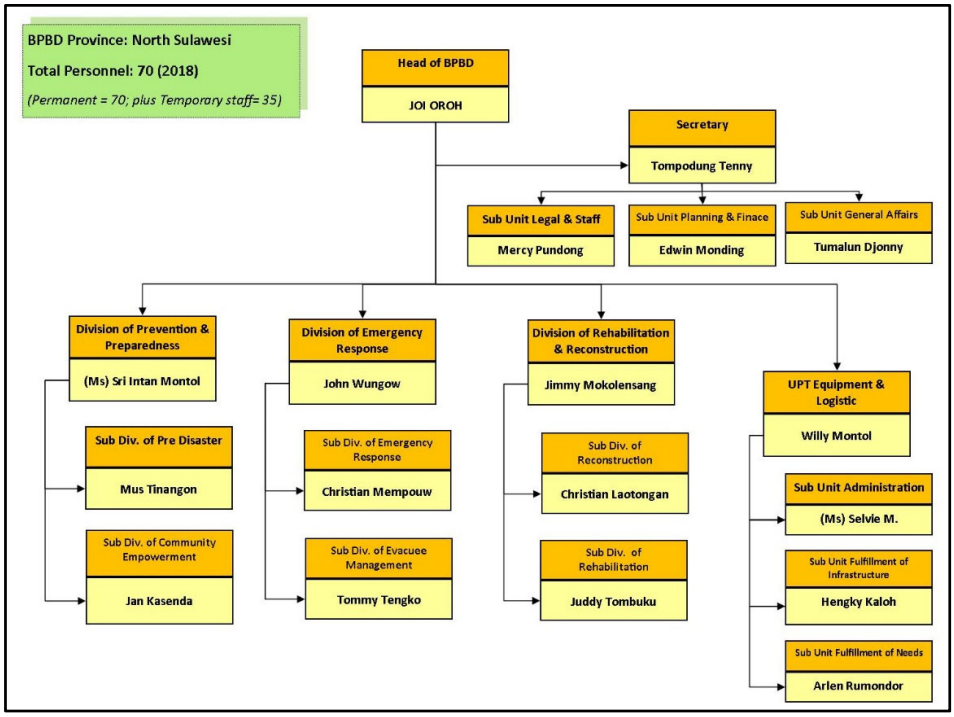


Figure 3-5 Organization Chart of BPBD North Sulawesi Province

[31] BNPB Profile, 2015

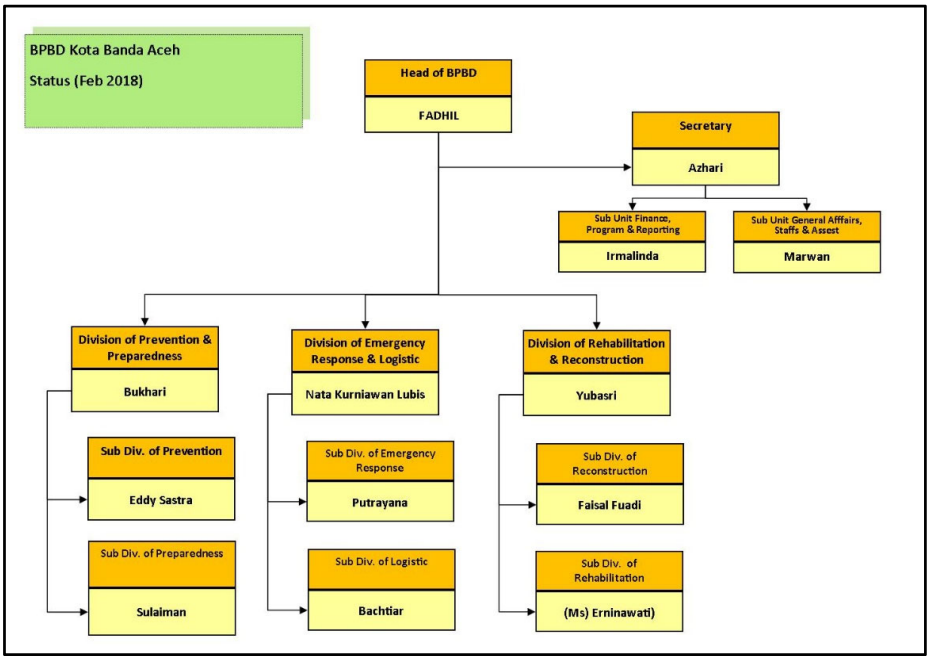


Figure 3-6 Organization Chart of BPBD Banda Aceh City

3.4.2.3 Other Disaster-Related Institutions

Beside BNPB and BPBD as the main focal points, there are many other government ministries/ agencies that are related to disaster management in Indonesia. According to BNPB, there are 23 institutions[32] that are involved in reducing the disaster risk index, and Table 2-1 is the list of these institutions with their respective general role in DRR[33]:

Table 3-1 DRR related Ministries & their Respective Roles

No	Original Name	English Translation	Role in Disaster Risk Reduction
1	Kementerian Dalam Negeri (Kemendagri)	Ministry of Home Affairs	controls development activities related to disaster management conducted by local governments
2	Kementerian Energi dan Sumber Daya Mineral (ESDM)	Ministry of Energy & Mineral Resources (Badan Geologi & PVMBG)	plans and controls disaster mitigation efforts in geological sectors and other geological hazards caused by human activities
3	Kementerian Pertanian (Kementan)	Ministry of Agriculture	plans and controls mitigation efforts related to drought and other hazards related to agriculture
4	Kementerian Lingkungan Hidup dan Kehutanan (Kemen LHK)	Ministry of Environment and Forestry	plans and controls preventive efforts, advocacy and early warning in preventing environment-related disasters as well as forest and land fires.
5	Kementerian Kelautan dan Perikanan (KKP)	Ministry of Marine and Fishery	plans and controls mitigation efforts in the field of the tsunami and coastal abrasion
6	Kementerian Pekerjaan Umum dan Perumahan Rakyat (PUPR)	Ministry of Public Works and Public Housing	plans risk-sensitive spatial planning, location & evacuation routes, recovery of public facilities & infrastructure and housing for disaster victims.

[32] Disaster Management Policy and Strategy 2015-2019, page 26 - BNPB
[33] There are no official regulations that describe the detail task & responsibility of each ministry/agency in disaster management. In Disaster Management Law, only BNPB and BPBD were described. Therefore, during the real implementation, each ministry/ agency usually will need to refer to their respective task & responsibility as stated in their original regulations, e.g.: PUPR will need to refer to Minister of PUPR Regulation No. 15/PRT/M/2015 on Organization and Working Procedure of Ministry of PUPR. The aforementioned description is as stated in NDMP 2010-2014, Chapter 4 – Disaster Management Policy.

No	Original Name	English Translation	Role in Disaster Risk Reduction
7	Kementerian Kesehatan (Kemenkes)	Ministry of Health	plans health and medical services including medicines, medic/paramedic staffs, and volunteers during emergency response and post-disaster recovery
8	Kementerian Pendidikan dan Kebudayaan (Kemendikbud)	Ministry of Culture and Elementary and Secondary Education	plans and controls emergency education for disaster-affected areas and the recovery of education facilities and infrastructure, and coordinates disaster awareness education
9	Kementerian Sosial (Kemensos)	Ministry of Social Affairs	plans food, clothing and other basic needs for people displaced by the disaster.
10	Kementerian Komunikasi dan Informatika (Kominfo)	Ministry of Communication and Informatics	plans and controls the provision of facilities and infrastructures for emergency communication to support disaster emergency response and post-disaster recovery.
11	Kementerian Riset dan Teknologi dan Pendidikan Tinggi (Ristek & Dikti)	Ministry of Research, Technology and Higher Education	conducts study and research as inputs for disaster management planning before and during a disaster and for rehabilitation and reconstruction stage
12	Kementerian Desa, Pembangunan Daerah Tertinggal dan Transmigrasi (Kemendes PDTT)	Ministry of Villages, Disadvantaged Regions, and Transmigration	plans and controls development programs in villages & disadvantaged areas based on disaster risk analysis.
13	Kementerian Perencanaan Pembangunan Nasional / Badan Perencanaan Pembangunan Nasional (Kemen PPN / BAPPENAS)	National Development Planning Minister / National Development Planning Agency	supports the planning of risk sensitive development programs
14	Tentara Nasional Indonesia (TNI)	National Army	supports the conduct of search and rescue (SAR) and supports the coordination of disaster emergency response.
15	Kepolisian Republik Indonesia (POLRI)	Police	supports SAR and provides security during an emergency situation, including guarding the left behind locations by evacuated citizens.
16	Badan Meteorologi, Klimatologi, dan Geofisika (BMKG)	Meteorological, Climatological and Geophysical Agency	coordinates the monitoring of hazards related to meteorology, climate, and geophysics
17	Badan Informasi Geospatial (BIG)	Geospatial Information Agency	plans and controls disaster risk mapping in coordination with technical ministries/agencies
18	Badan Pengkajian dan Penerapan Teknologi (BPPT)	Agency for the Assessment and Application of Technology	supports in the assessment and implementation of technology that related to disaster management
19	Kementerian Agraria dan Tata Ruang (Kemen ATR)	Ministry of Agrarian Affairs and Spatial Planning	supports organizations by providing spatial planning (land) related information
20	Lembaga Penerbanagan dan Antariksa Nasional (LAPAN)	National Institute of Aeronautics and Space	supports to organization provide satellite images
21	Kementerian Agama (Kemenag)	Ministry of Religion	for Islamic school, plans and controls emergency education for disaster-affected areas and the recovery of education facilities and infrastructure, and coordinates disaster awareness education.
22	Kementerian Keuangan (Kemenkeu)	Ministry of Finance	preparation of the budget for the conduct of disaster management activities (pre-, during and post-disaster)

3.4.2.4 Non Formal Organization

Beside government institutions, various independent DRR related forums are also established at both national and local levels, especially during the implementation of HFA[34]. At the national level, such forums are called Planas PRB (DRR National Platform), while at the local level, DRR Forums were established at both provincial and district/city levels. These forums consist of various elements such as NGOs, business communities, universities, and media. After HFA, most of these forums especially at the local level were

[34] Hyogo Framework for Action (2005-2015)

having limited regular activities and only were active during selected events, such as formulation/reviewing specific DRR related documents/policy, DRR events, etc.

3.4.3 DRR Implementation in Indonesia

According to Government Regulation No. 21 the Year 2008, the implementation of disaster management in Indonesia[35] covers three phases, namely pre-, during and post-disaster. Pre-disaster itself will be divided into two categories; 1) no disaster situation (prevention and mitigation) and 2) when disaster potential is visible (preparedness) (Figure 3-7). In pre-disaster phase, disaster management actions are aiming to strengthen the capacities and resilience of government and communities to protect their lives and livelihoods through measures to avoid (prevention) or limit (mitigation) the negative impact of hazards and to provide timely and reliable hazard forecast. During the disaster phase, responses are focusing to save lives and property. In the post-disaster phase, the focus is on recovery and later rehabilitation & reconstruction. In the reality, the shift between these phases is fluid, in particular, between the stages in which communities move from rehabilitation to development, integrating aspects of hazard mitigation (DRR) into their developmental activities.
In RPJMN 2015-2019 and BNPB's NDMP, the objective of disaster management and DRR is to reduce the Disaster Risk Index (RI) at the centers of economic growth with high disaster risk. BNPB had set the goal to reduce DRI by 30% during this 5 years period. Figure 3-8 indicates a multi-hazard risk map made by BNPB.

Figure 3-7 Disaster Management Cycle[36]

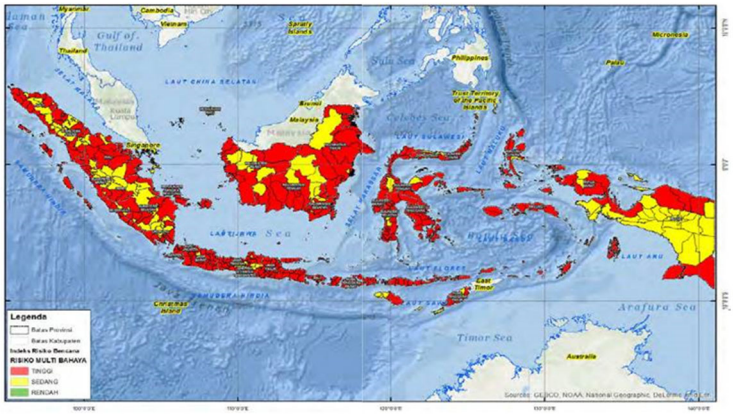


Figure 3-8 Multi-Hazard Risk Map (IRBI 2013, BNPB)

[35] Government Regulation No. 21 Year 2008 on the implementation of disaster management, article 3.
[36] Guideline for Contingency Planning, second Edition – BNPB 2011

To achieve this target, BNPB chooses the strategy to increase the disaster management capacity at the local government level by implementing 71 resilient indicators with 136 district/cities set as priority locations.

A baseline value is prepared based on previous BNPB's risk assessment activities during the preparation of the local disaster management plan and updated on a yearly basis. To support the assessment process, BNPB created a document called "Questionnaire – Local Capacity Assessment on 71 Indicators", which contain 284 questions from all 71 Indicators that can be used by local governments to assess their current condition by themselves (self-assessment). This is a "Yes-No" type of question. If "yes" is selected, then a supporting document needs to be attached as a proof to validate the answer. More detailed description of this issue will be explained later in Chapter 6.

3.4.3.1 Prevention/ Mitigation

(1) Risk Assessment

Until 2011, hazard map was not commonly available in Indonesia except for volcanoes or at a selected area that had been hit by large scale disaster such as Aceh & Yogyakarta. Whenever available, the scale is very big such as Earthquake hazard map prepared by PUPR (national scale). Through various international donors' activities, included JICA Study on Natural Disaster Management in Indonesia (2007-2009), districts scale (1:50,000) hazard map for various disaster type was introduce and started development by BNPB in cooperation with respective authorized ministries, such as PUPR for Flood & Earthquake, BMKG and various disaster experts from universities for Tsunami, etc.

In 2012, BNPB introduces the Guideline for Risk Assessment[37] to support their activities in conducting the risk assessment during the preparation of the Local Disaster Management Plan (district/city level) for 33 districts in Indonesia. During the progress, commonly 3 maps will be developed and assessed, namely: hazard, vulnerability, and capacity. Every year, BNPB support around 20-40 district/city level BPBDs to conduct Risk Assessment in their area with the main target to finish all 136 priority district/city by 2019.

(2) Structural Measures

For structural countermeasures, activities are conducted mostly by PUPR as the ministry in charge of physical development. For Flood-prone area, JICA and ADB actively supported PUPR in preparing master plans until actual implementation such as in Bandung, Manado, etc.. For volcanos, sabo dam introduced by JICA in the late 80s was very successful and remains as one of the main facility for disaster mitigation throughout Indonesia. For earthquake disasters, although building code has been introduced for some time, most utilization is limited to commercial & high-rise buildings, while for common citizen houses especially in a rural area, earthquake-resistant houses were optional considering the extra cost for the construction and lack of awareness of the local people. For an area with previous experience of earthquake in the past, people are much aware of the importance of earthquake resistant houses but unfortunately, this is not the case for all over Indonesia in general.

(3) Non-Structural Measures

For Non-Structural measures, BNPB was actively promoting to increase the capacity of the local entities, including government and communities. Every year, BNPB provides various training and facilitation programs such as risk assessment, hazard mapping, etc. to various BPBDs. For communities, various CBDRM programs were introduced such as Resilient Village, River School, Mountain School, etc.. Occasional drills and disaster simulation were also conducted based on priorities. Due to budget constraint, BNPB supports only around 20-40 BPBDs for every fiscal year.

[37] Head of BNPB Regulation No. 2 Year 2012 on General guideline for disaster risk assessment

Since 2017, BNPB promotes April 26[38] as the Disaster Preparedness Day. During this day, BNPB and BPBD conduct disaster drills to increase awareness of the residents. In 2018, this event got bigger since many related institutions outside BNPB and BPBD also participated to arrange their own independent drills between 10-12 AM by involving the communities in Indonesia. According to the BNPB website[39], where people can register their planned activities including how many participants will be involved, it was estimated that 30 million people participated during this day.

(4) Best Practice at Community-Based Activities (Case of CBDRM)

In 2016, BNPB launches the National DRR movement, by introducing the River School program, as the initial activity to promote and engage the local communities' participation in DRR (later in 2017 & 2018, BNPB expanded this activity by introducing Sea School, Mountain School, etc.). During this program, BNPB select 23 districts/cities as a pilot area, and one of them was District of Klaten, located in Central Java Province. With the main river called Dengkeng (40.75 km) and a lot of small rivers, flood became the main hazard for the resident. Between December 2015 to June 2016 alone, Klaten was flooded seven (7) times[40], which causes total losses of Rp. 17.75 billion[41] and a lot of damage to the paddy field and settlement area. Dengkeng River, as one of the tributaries of Bengawan Solo River, was under the responsibility of BBWS[42] Bengawan Solo. With more than 20,000 km^2 [43] of the river basin area to cover, BBWS was overwhelmed and had a limited budget to reduce the flood risk in Klaten by themselves. Therefore, local government (including BPBD), tried to utilize the River School program as a platform to gather all related stakeholders, including residents, to work together to overcome the flood risk. During the last 2 years, various activities had been conducted such as:

- Various flood awareness training and socialization programs.
- River tracing using boats along the Dengkeng River[44] to map and identify vulnerable embankments that potentially collapsed whenever the river overflows. The result was later provided to BBWS for further follow up.
- Several communal works with the principle "mutual help", in Bahasa called "Gotong Royong" (cooperation), to clean up rivers or to construct dikes along the river.

During this communal work, local residents participated on a voluntary basis. In February 2018, JICA's survey team was invited to observe and to join one of these activities, where local residents supporting BBWS to construct dikes during the weekend to protect the surrounding settlements area & paddy field (Figure 3-9).

Figure 3-9 Residents in Klaten repair river embankments

While BBWS was in charge for technical work (operating heavy equipment, provision of materials in some case), local residents (men groups), including military personnel and religious group providing support as the workforce on a voluntary basis. At the same time, women groups were operating public kitchen to provide free lunch for all participants. During the interview, local residents stated that they are aware that this activity

[38] Disaster Management Law No. 24 Year 2007 was issued on April 27, 2007.
[39] https://siaga.bnpb.go.id/hkb/
[40] Strategic Plan of Klaten's River School, Table 1
[41] Strategic Plan of Klaten's River School, Table 2
[42] Balai Besar WIlayah Sungai, River Basin Organization, under central PUPR
[43] http://bbwsbengawansolo.net/main/wilayah-admisitratif-2/
[44] http://klatenkab.go.id/kerap-banjir-puluhan-relawan-peduli-sungai-bakal-susuri-kali-dengkeng/

is for the protection of their livelihood and at the same time government have their budget limitation, so they are happy to contribute as well to make a better living environment for themselves. This sense of ownership and mutual help principle used to be very popular in the past in Indonesia, but as time progressed, it began to disappear.

In contrary to this situation, for Aceh case (according to BPBD staff), the program "cash for work" during tsunami recovery period had create a negative impact to the community level activities, where local residents have the mindset that their participation in every government initiative should be compensated, despite the fact that these activities were designed to support their livelihood.

3.4.3.2 Preparedness

(1) Early Warning and Monitoring System

For monitoring and early warning systems, one of the most noticeable is InaTEWS, a tsunami warning system develop with support from donors after Tsunami in Aceh and currently operated by BMKG. The system generates warning soon after a major earthquake (within 5 minutes) and distributes this to relevant institutions, such as BNPB, BPBD, media, etc.

For volcano, PVMBG has a dedicated monitoring post for almost all active volcanoes in Indonesia and continuously monitor the volcanic activity, provide warning information based on the predefined scale with hazard map, and then advise government for the evacuation of the communities whenever necessary.

For Landslide, BNPB in cooperation with UGM (Gajah Mada University) has installed a community-based landslide warning system in several locations throughout Indonesia.

In 2017, BNPB with support from donor launch the InaWARE, a decision support system for monitoring multi disaster hazard. The system is installed in BNPB's Emergency Operations Center and data is supplied by relevant agencies, such as BMKG for weather-related data or Ministry of Forestry for Forest Fire. At the local level, BPBD DKI Jakarta was supported by donor had installed the PetaJakarta.org, a cloud source platform to collect and display of flood occurrences at the local level. But despite all the available systems at the central level, the real utilization at the local & community level is still very challenging and has many aspects to be improved in the future.

(2) Contingency Plan, SOP & Other Related Document/Activities.

As part of their routine activities, BNPB supports various BPBD every year for formulating the contingency plan & SOP for various disaster type. In some occasion, simulation and evacuation drills were conducted to check the government capacity to manage the disaster situations. In addition, BNPB also installed disaster sign & information board in various locations every year. In Des 2015, Directorate of Preparedness, BNPB launch the book called "Profile of national preparedness resources in disaster management for the year 2015", which was aiming to collect all available resources at the national level including BNPB, PUPR, police, military, etc. as well as private company and NGOs. In 2017, Directorate of Preparedness initiates the establishment of a new unit called Pastigana (Analysis Centre for Disaster Preparedness Situation) which is currently developing the Multi-Hazard Early Warning Systems (MHEWS) to analyze the potential water-related disasters and provide necessary inputs for internal use inside BNPB and EOC (Emergency Operation Center) of BPBD[45].

(3) Measures by Other Agency (PUPR, MOHA, etc.)

Recently, PUPR has an internal unit called the Disaster Management Task Force[46], which is aiming to provide a quick response to protect/recover the PUPR related facilities/infrastructure. In the pre-disaster stage, a command post is established permanently in four (4) DGs[47] of PUPR and a disaster preparedness post is

[45] htttp://mhews.bnpb.go.id
[46] Minister of PUPR Decree No. 994/KPTS/M/2016 on disaster management task force in Ministry of PUPR
[47] Directorate General, including DG of Water Resources, Bina Marga, Cipta Karya and Housing Provider

established permanently at Balai (region) level, especially for those which are located in disaster-prone area. Besides this, a Quick Response Team also established under the command post (central PUPR) and/or disaster preparedness post (at Balai level). During the emergency response, an Emergency Response Task Force will be established at Balai level to conduct emergency recovery activities. During the implementation, this team must coordinate with BNPB/BPBD/local in-charge agency. To accelerate the early recovery process, Minister of PUPR issued the Circular letter[48] on how to use the PUPR internal emergency response fund.

In another ministry, disaster management units are also established, such as MOHA[49], who has one (1) dedicated directorate in charge of disaster management and firefighting. Ministry of Health has a Crisis Center[50]. Ministry of Social has a Directorate of social protection for natural disaster victims, and so on.

3.4.3.3 Response

Learning from the series of major disasters in 2004-2010, Government of Indonesia, including BNPB, has implemented various efforts to increase their capacity in responding to disasters. During the Aceh Tsunami, Yogyakarta & West Sumatera Earthquake, the response was mainly supported by many international donors. But from time to time, BNPB and other stakeholders has taken over this responsibility and shown good leadership during a critical situation.

Mt. Agung (Bali) eruption Nov. 2017 was a good example for a quick and anticipated response from both government as well as the citizens themselves. Since its last eruption back in 1963 that causes death toll around 1,100 people, Mt. Agung was dormant for more than 50 years. But local people in Bali, with good respect to their environment and cultural issues, were very aware that Mt. Agung is, in fact, a very dangerous volcano whenever it became active. Therefore, when the volcano started the series of volcanic earthquakes in early Aug. 2017, people were alerted and pay much attention to this. In Sep. 2017, the government decided to increase the alert level to "highest level (4)" and declare the evacuation zone in radius 12 km around the crater, (no eruption occurred yet). More than 100,000 decided to evacuate themselves to safe zone although some people remain in their houses because of the fear of losing their cattle. Elderly, women and children were evacuated directly, while some men stay to take care of their property, especially during day time and returning to evacuation shelter during night time.

Both central governments, through BNPB & PVMBG, as well as the local government responded very well and kept updating the information to residents. Local police and military were actively supporting the people during the evacuation. Temporary evacuation centers were open and maintain by local government and volunteers. Even in the surrounding communities outside the hazard area were open to receive and support the evacuee voluntarily into their own houses.

After a series of activities, Mt. Agung never really erupted during Sep. 2017 and reduced the active period drastically until the government decided to decrease the level to level 3 (highest level is 4, while 1 is normal) and most evacuees are went back to their houses.

In Nov. 21, 2017 when the first phreatic eruption occurred, it created a 700 m cloud ashes[51]. Around 30,000 people were evacuated to 270 shelters and resident houses outside the hazard area. A couple of days later, the first eruption occurred and lasted for weeks. Airport authorities decided to close the airport and the tourism sectors, which is the main income source for Bali was disrupted. But due to good preparation and coordination efforts among all stakeholders, no serious incident or victim was caused by this eruption. By the end of the year 2017, tourists were coming back to Bali after gaining trust seeing the good response of the authorities and could be sure of their safety. Mt. Agung was still active until July 2018 and erupted from time to time but fortunately, no significant damage occurred.

[48] No 10/SE/M/2017 on SOP for permission to use emergency response fund due to disaster or urgent activity of the Ministry of Public Works and Housing
[49] Ministry of Home Affairs
[50] http://pusatkrisis.kemkes.go.id/
[51] http://www.bbc.com/indonesia/indonesia-42066104

3.4.3.4 Recovery (Rehabilitation and Reconstruction)

Currently, for post-disaster planning, BNPB has a standard disaster damage assessment framework called JITUPASNA[52], or Post Disaster Need Assessment (PDNA), which was conducted in all major disasters in Indonesia. In BNPB, this activity is managed by Deputy 3 for Rehabilitation and Reconstruction.
JITUPASNA has a long history, starting in 2005 when World Bank introduced DALA (Damage & Loss Assessment) during Aceh's Tsunami (Dec. 2004) and Yogyakarta Earthquake (May 2006) through Bappenas. Since 2009, following the West Sumatera (Padang) Earthquake, BNPB combined DALA with HRNA (Human Recovery Needs Assessment)[53], introduced by UNDP, to form the current JITUPASNA. While DALA is more focusing on losses of the asset (value/how much), HRNA is more focusing on people needs for recovery (the result is for making policy & priority). JITUPASNA itself is regulated in Head of BNPB Regulation No. 15 the Year 2011 on Guidelines for Post-Disaster Needs Assessment.

In JITUPASNA, DALA is conducted by assessing five (5) sectors, namely: 1) Housing, 2) Infrastructure, 3) Economic, 4) Social and 5) Cross Sectors. For Damage, all asset loss in those five (5) sectors are estimated and calculated, while the Losses is mostly calculating the cost for cleaning up, additional cost for gasoline, loss of income, decreasing of production/harvest, etc. For HRNA, an assessment is covering 3 three (3) aspects, namely: 1) Access disruption, 2) Function disruption and 3) increasing of risk. For example, in Manado case, a survey was conducted to check disaster's victims' opinions on what kind of access disruption was the most concern and 62.4% of the responders answers pointed out the condition of damaged houses. As a conclusion, based on the previous findings, needs assessment will be conducted to calculate how much investment is necessary for the rehabilitation and reconstruction process (maximum 3 years). The whole process of JITUPASNA will involve other related leading stakeholders at the local level, such as Dinas PU for assessing housing and infrastructure sectors, Dinas Agriculture for paddy fields and estimation of crop productions, Dinas Trade for estimating losses because of market closure, etc.

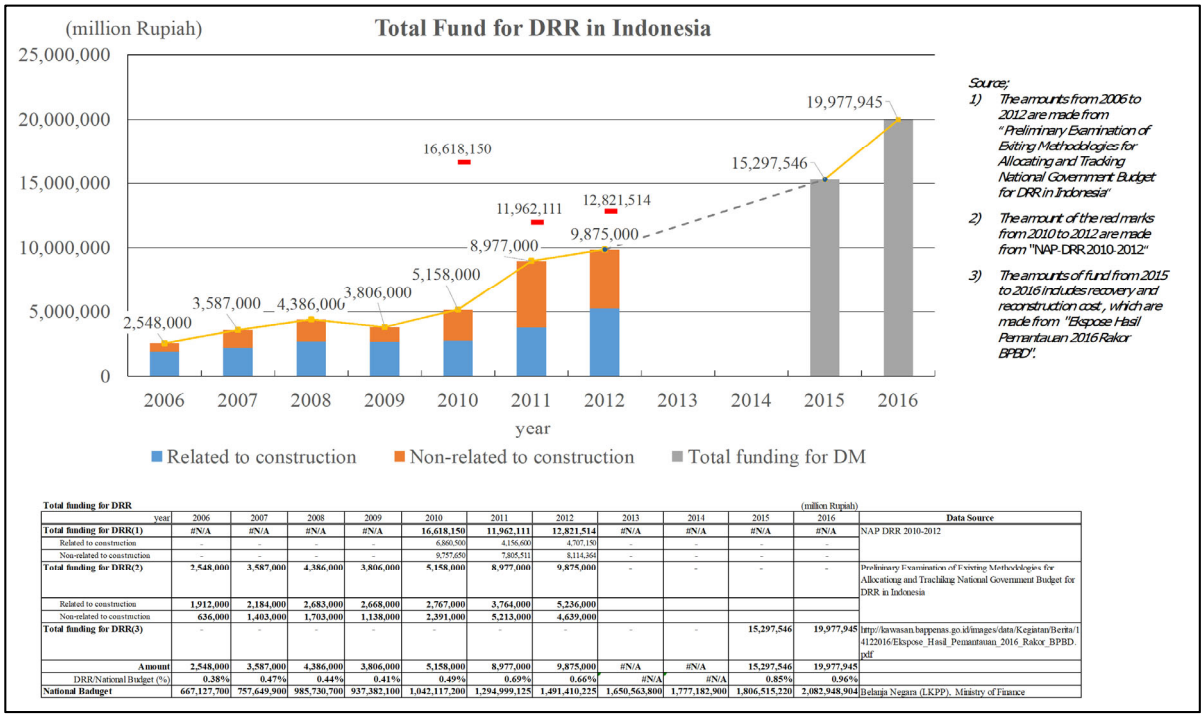
During the Manado Flood 2014, BNPB sent a team to stay in Manado and it worked closely with local governments to lead the preparation of JITUPASNA. Since the disasters (flood and landslide) also occurred in other neighboring districts/cities[54], BNPB prepared one common plan called "Action Plan for Rehabilitation & Reconstruction post Flood & Landslide on Jan 15, 2014, in North Sulawesi Province". This plan became the legal basis for the government to implement rehabilitation and reconstruction in Manado & surrounding area. One of the on-going activities is the relocation project at Pandu, where, in 2017, BNPB & local governments completed the 1,000 houses and will be continued in 2018 to construct additional 1,054 houses.

3.4.4 DRR Implementation & Budget

3.4.4.1 National Level

Indonesia's DRR budget is gradually increasing year by year. It is about to reach 1% of the national budget. As of 2012, the budget for structural measures and that for non-structural measures are almost balancing. Regarding the Indonesian national budget, there is no document that itemizes the DRR portion. The study team scrutinized existing reports and materials to clarify the figures of DRR budget. The figure has never been publicized by the Indonesian government.

[52] Abbreviation for Kajian Kebutuhan Paska Bencana
[53] Institutionalizing Post-Disaster Recovery: Learning from Mentawai Tsunami and Merapi Eruption, UNDP -2014
[54] Manado City, Tomohon City, Minahasa District, South Minahasa District and North Minahasa District.

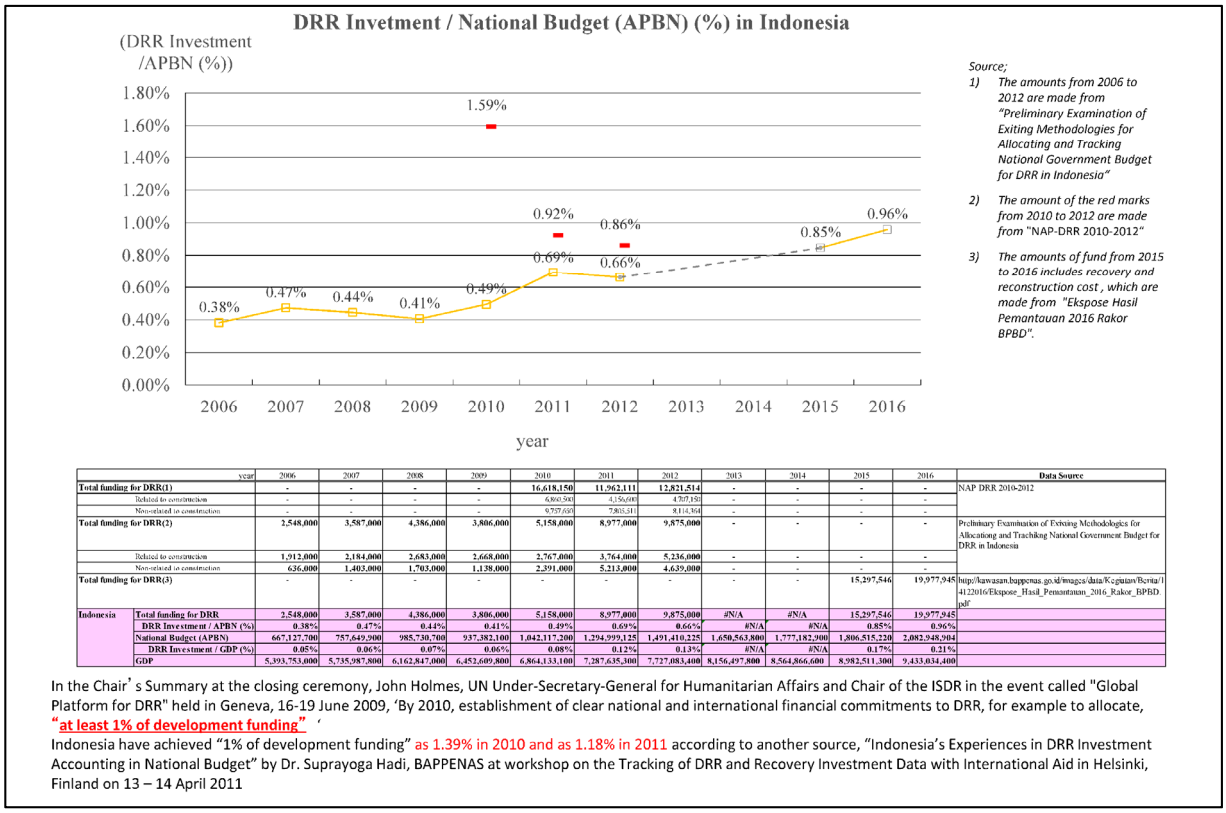


Total funding for DRR (million Rupiah)

year	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	Data Source
Total funding for DRR(1)	#N/A	#N/A	#N/A	#N/A	**16,618,150**	**11,962,111**	**12,821,514**	#N/A	#N/A	#N/A	#N/A	NAP DRR 2010-2012
Related to construction	-	-	-	-	6,860,500	4,156,600	4,707,150	-	-	-	-	
Non-related to construction	-	-	-	-	9,757,650	7,805,511	8,114,364	-	-	-	-	
Total funding for DRR(2)	**2,548,000**	**3,587,000**	**4,386,000**	**3,806,000**	**5,158,000**	**8,977,000**	**9,875,000**	-	-	-	-	Preliminary Examination of Exiting Methodologies for Allocationg and Trachking National Government Budget for DRR in Indonesia
Related to construction	**1,912,000**	**2,184,000**	**2,683,000**	**2,668,000**	**2,767,000**	**3,764,000**	**5,236,000**					
Non-related to construction	**636,000**	**1,403,000**	**1,703,000**	**1,138,000**	**2,391,000**	**5,213,000**	**4,639,000**					
Total funding for DRR(3)	-	-	-	-	-	-	-	-	-	**15,297,546**	**19,977,945**	http://kawasan.bappenas.go.id/images/data/Kegiatan/Berita/14122016/Ekspose_Hasil_Pemantauan_2016_Rakor_BPBD.pdf
Amount	**2,548,000**	**3,587,000**	**4,386,000**	**3,806,000**	**5,158,000**	**8,977,000**	**9,875,000**	#N/A	#N/A	**15,297,546**	**19,977,945**	
DRR/National Budget (%)	**0.38%**	**0.47%**	**0.44%**	**0.41%**	**0.49%**	**0.69%**	**0.66%**	#N/A	#N/A	**0.85%**	**0.96%**	
National Badnget	**667,127,700**	**757,649,900**	**985,730,700**	**937,382,100**	**1,042,117,200**	**1,294,999,125**	**1,491,410,225**	**1,650,563,800**	**1,777,182,900**	**1,806,515,220**	**2,082,948,904**	Belanja Negara (LKPP), Ministry of Finance

Source: JICA study team

Figure 3-10 National DRR Budget as Advanced Investment



year		2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	Data Source
Total funding for DRR(1)		-	-	-	-	**16,618,150**	**11,962,111**	**12,821,514**	-	-	-	-	NAP DRR 2010-2012
Related to construction		-	-	-	-	6,860,500	4,156,600	4,707,150	-	-	-	-	
Non-related to construction		-	-	-	-	9,757,650	7,805,511	8,114,364	-	-	-	-	
Total funding for DRR(2)		**2,548,000**	**3,587,000**	**4,386,000**	**3,806,000**	**5,158,000**	**8,977,000**	**9,875,000**	-	-	-	-	Preliminary Examination of Exiting Methodologies for Allocationg and Trachking National Government Budget for DRR in Indonesia
Related to construction		**1,912,000**	**2,184,000**	**2,683,000**	**2,668,000**	**2,767,000**	**3,764,000**	**5,236,000**	-	-	-	-	
Non-related to construction		**636,000**	**1,403,000**	**1,703,000**	**1,138,000**	**2,391,000**	**5,213,000**	**4,639,000**	-	-	-	-	
Total funding for DRR(3)		-	-	-	-	-	-	-	-	-	**15,297,546**	**19,977,945**	http://kawasan.bappenas.go.id/images/data/Kegiatan/Berita/14122016/Ekspose_Hasil_Pemantauan_2016_Rakor_BPBD.pdf
Indonesia	**Total funding for DRR**	**2,548,000**	**3,587,000**	**4,386,000**	**3,806,000**	**5,158,000**	**8,977,000**	**9,875,000**	#N/A	#N/A	**15,297,546**	**19,977,945**	
	DRR Investment / APBN (%)	**0.38%**	**0.47%**	**0.44%**	**0.41%**	**0.49%**	**0.69%**	**0.66%**	#N/A	#N/A	**0.85%**	**0.96%**	
	National Budget (APBN)	**667,127,700**	**757,649,900**	**985,730,700**	**937,382,100**	**1,042,117,200**	**1,294,999,125**	**1,491,410,225**	**1,650,563,800**	**1,777,182,900**	**1,806,515,220**	**2,082,948,904**	
	DRR Investment / GDP (%)	**0.05%**	**0.06%**	**0.07%**	**0.06%**	**0.08%**	**0.12%**	**0.13%**	#N/A	#N/A	**0.17%**	**0.21%**	
	GDP	**5,393,753,000**	**5,735,987,800**	**6,162,847,000**	**6,452,609,800**	**6,864,133,100**	**7,287,635,300**	**7,727,083,400**	**8,156,497,800**	**8,564,866,600**	**8,982,511,300**	**9,433,034,400**	

In the Chair's Summary at the closing ceremony, John Holmes, UN Under-Secretary-General for Humanitarian Affairs and Chair of the ISDR in the event called "Global Platform for DRR" held in Geneva, 16-19 June 2009, 'By 2010, establishment of clear national and international financial commitments to DRR, for example to allocate, "at least 1% of development funding" '
Indonesia have achieved "1% of development funding" as 1.39% in 2010 and as 1.18% in 2011 according to another source, "Indonesia's Experiences in DRR Investment Accounting in National Budget" by Dr. Suprayoga Hadi, BAPPENAS at workshop on the Tracking of DRR and Recovery Investment Data with International Aid in Helsinki, Finland on 13 – 14 April 2011

Source: JICA 調査団

Figure 3-11 Ratio of DRR Budget to National Budget

3.4.4.2 Local Level

Over the past five years, the central government, including BNPB, has provided a large amount of efforts and budget directly to BPBD or communities to improve their capacity for disaster management. Support for risk assessment / disaster risk management planning, and training in resilience enhancement programs were conducted. However, due to the geographical spread of Indonesia and the large number of local governments (34 provinces, more than 500 districts and cities), it is impossible for BNPB to support all of the local governments simultaneously.

In order to implement sustainable countermeasures, efforts and investments in disaster risk management by the local governments are indispensable. To promote this, the Ministry of Home Affairs, which oversees the local governments, has revised the Local Government Law (No. 23/2014) so that disaster risk management is one of the basic services required of the local governments.

The law stipulates that all local governments in Indonesia create local administrative bodies for disaster risk management and allocate operating costs and budgets necessary for the implementation of specific disaster risk management activities. In January 2018, a government ordinance (No.2 / 2018) was issued on Standard Pelayanan Minum (SPM), a derivation rule of this law. According to Article 9 of the government ordinance, the following three points are shown as SPM for disaster risk management. In addition, facilities, personnel, technical guidelines, etc. necessary for implementing these services are to be prepared.

- Services for hazard information
- Services for disaster prevention and preparation
- Services for relief and evacuation of victims

As an example of disaster prevention investment at the local level, the breakdown of the budget of the BPBD in the Banda Aceh City (APBD) in 2017 is shown in the figure. Regarding the budget for disaster prevention for Banda Aceh City, BWS Sumatera 1, which is the basin management office of PUPR, the city's Public Works Bureau, and the provincial BPBD, also have their own budgets. NGOs participate in DRR in the city as well. Therefore, it is necessary to keep in mind that the budget of the municipal BPBD is a part of the investment on DRR

3.4.5 Efforts of DRR by Local Governments

3.4.5.1 Manado City

During the period of 2010 – 2013, DRR was not the focus of the city government. Although BPBD was established on 2011, they were responding to the disasters, that commonly occurred, such as fire, minor local inundation and landslide at a certain area. For flood monitoring, BPBD and other related institutions such as social agency & local amateur radio association were working closely to share information during the rainy season. Whenever it really happened, those agencies response based on their respective tasks and responsibilities.

From time to time, BNPB and donor, including JICA[55], provided various capacity training to BPBD. During the JICA project in North Sulawesi Province (2013 – mid-2014), hazard and risk maps were formulated, including the Local Disaster Management Plan (2014-2018). But due to the limited operational budget, BPBD conducted very limited DRR activities by themselves on regular basis. The common activity was public relations of disaster-related issues, such as regulations, community awareness, etc. Regarding water-related disaster prevention, local Dinas PU was maintaining the city drainage facilities and small rivers under

[55] Kota Manado was one of the 15 districts/city in North Sulawesi Province that participated in "The project for enhancement of the disaster management capacity of BNPB and BPBD (2011-2015)"

their authority. Main rivers such as Tondano & Tikala River were under the authority of central government managed by BWS Sulawesi 1, a river basin organization under PUPR.

In January 2014, Manado city was affected by a major flash flood, which caused a lot of damages to residential houses and city infrastructure. More than 10,000 houses, roads and bridges were damaged with total estimated damages of Rp. 1,277 billion (including economic losses)[56]. Many houses along the riverbanks were heavily damaged during this flood and the city government decided to relocate them to safer location permanently.

Soon after this flood, PUPR with support from JICA conducted the river improvement project[57] along the river mouth of Tondano River, which is one of the main economic centers in Manado city. The city had been hit seriously during 2014 flood. For small rivers and city drainages, local Dinas PU has a regular budget every year for maintaining the drainage system and normalization of tributaries. In 2017, this amount was Rp. 17 billion[58].

Currently, BNPB and BPBD (both province and city level) are organizing the construction of new 2,054 houses[59] for relocating both flood victims and those who lived illegally[60] on the riverbanks along the river in Manado city. In 2017, 1,000 houses were completed and additional 1,054 houses will be constructed in 2018. In 2018, BNPB also financed a disaster resilience village program for Manado city and will be implemented by BPBD. The city government installed several real-time monitoring CCTV to check the water level in various locations. It is connected directly with the command center. (please see Figure 3-12)

Source: JICA Survey Team

Figure 3-12 CCTV installed in Dendengan Luar district, Manado City CCTV

BAPPEDA as an city development planning agency is currently arranging various central government initiatives in Manado city, such as "Kotaku", the PUPR program to accelerate the management of urban slum areas in 269 districts/cities[61], design of several low cost rental apartments (Rusunawa), promoting the Manado Water Front City Initiative, which is aiming to develop areas along the river in Manado city in the future. All these activities are expected to solve the illegal housing problems along the riverbanks which compose the vulnerable population to flood.

3.4.5.2 Banda Aceh City

In December 2004, Kota Banda Aceh with several other cities along the coastline of Aceh and North Sumatera was hit by Indian Ocean Tsunami, causing more than 170,000 death toll in Aceh alone, and more than 220,000 death in total over whole the Indian Ocean. Major rehabilitation and reconstruction works were implemented for several years under the coordination of BRR[62]. Many donor & international NGOs introduced DRR activities during this period, including the UNDP's DRR-A project (2009-2012).

[56] Rehabilitation & Reconstruction Action Plan of Flood & Landslide on January 15,2015 in North Sulawesi Province - BNPB
[57] Urban Flood Control System Improvement in selected cities (project is still on-going).
[58] Dinas PUPR of City Manado as interviewed in April 2018
[59] Pandu Relocation site
[60] Based on PUPR regulation, it is illegal to live within 15 m from river border line.
[61] http://kotaku.pu.go.id/page/6880/tentang-program-kota-tanpa-kumuh-kotaku
[62] BRR Aceh-Nias (2005-2009), a temporary agency established by central government to coordinate all rehabilitation & reconstruction efforts by Indonesian government and international donors.

Learning from this disaster, the Indonesian government implemented various disaster prevention activities such as:

- Installation of Early Warning System: Tsunami early warning in Aceh is part of InaTEWS managed by BMKG. In Aceh, BMKG installs 6 sirens along the coastline of Banda Aceh city and Aceh Besar District[63]. Every month on 26th, a regular system check will be conducted by BMKG. In the real disaster situation, activation of the sirens is under the authority of BPBA as part of Aceh provincial government.
- For tsunami evacuation, there are several existing Tsunami escape building in Banda Aceh city, namely: 1) supported by JICA (3 buildings)[64]; 2) TDMRC Office, funded by BRR; 3) Rooftop of Tsunami Museum and 4) newly constructed building in front of BPBD Office (2017, partly supported by Japanese private company).
- BPBA (provincial level BPBD, established in 2010), with support from DRR-A project, had prepared several preparedness documents such as SOP for tsunami, SOP for escape buildings, risk maps, etc. In addition to this, earthquake and tsunami drills were introduced and conducted many times before by involving various development partners.
- To transfer the memories of tsunami disaster as well as to increase the people awareness, several tsunami museums & monuments were established in Banda Aceh city, such as Museum Tsunami Aceh at Sultan Iskandar Muda Street, PLTD Apung, Kapal Apung Lampulo, etc.

At city level, BPBD Banda Aceh city was established in 2011 and **w**ith support from donors, BPBD had prepared various disaster planning documents, such as Local Disaster Management Plan (2017-2021), Disaster Risk Map, Flood Contingency Plan (2017) and 3 (three) SOPs for Banda Aceh city: 1) for disabilities, 2) for emergency response and 3) for disaster information system in emergency response.

Since the completion of Kreung Aceh Floodway supported by JICA Loan in 1992, no major flood[65] has occurred in the city of Banda Aceh. According to JICA evaluation report[66], there were 2 (two) flood events after the project completion in 1995 and 2000. In addition to this, BPBD officers mentioned about the critical situation in 2014, when water level almost exceeded the existing dikes at selected locations. Since no real flood occurrenced, BPBD didn't have any record on this event. All government officers interviewed during this data collection survey were satisfied with the performance of the floodway to protect Banda Aceh City from the flood. Despite all this success story, BWS Sumatera-1, as the agency resiponsible for this structure, is concerned with its current condition. At the tsunami 2004, some parts of the original structures were damaged. The watergate to prevent infiltration of seawater were missing. This might lead to salinization in Kreung Aceh as the main source for drinking water in Banda Aceh City. Another issue is sedimentation that has decreased the river capacity, for which immediate dredging has been required.

Contrary to the previous achievement supported by various donors, the current situation shows that DRR investment by the local government is very limited and need to be increased to promote the resilience of the communities.

From total Rp. 5 billion BPBD's budget in 2017, only 7% (Rp 350 million), was used for implementing DRR projects, while the rest was spent on other non-disaster related activities for such as salary, routine office operation. For the DRR projects themselves, only 2 activities were conducted as shown in Figure 3-13, namely: 1) observation & sharing the information of potential disaster (Rp. 100 million ± 29%) and 2) funding the Quick Response Team (logistics & medicine procurement (Rp. 250 million ± 71%).

[63] https://bpba.acehprov.go.id/index.php/news/read/2017/12/26/37/bpba-dan-bmkg-aktivasi-suara-sebenarnya-sirine-tsunami-26-desember-2017.html
[64] Located in Desa Lambung, Deah Glumpang dan Deah Teungoh
[65] Based on interview with BPBD Kota Banda Aceh, BWS Sumatera 1, BPBA and TDMRC
[66] Kreung Aceh Urgent Flood Control Project – Oct 2002

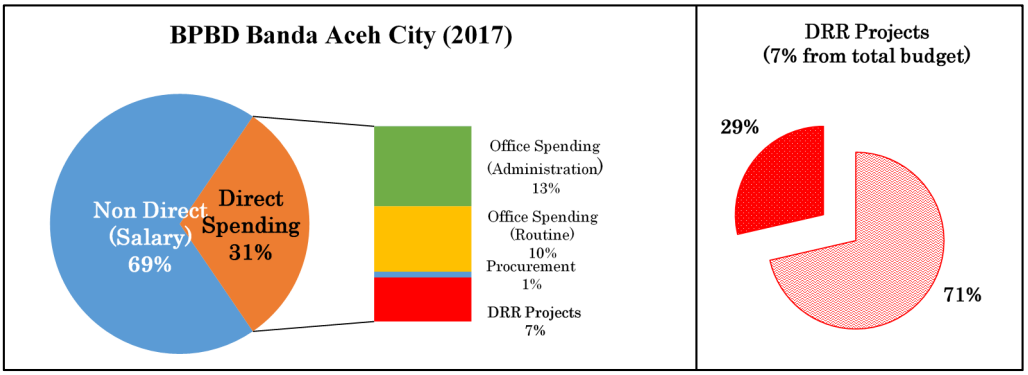


Figure 3-13 DRR Budget of BPBD Banda Aceh City (2017)

3.5 JICA Assistance in DRR

According to the latest JICA Report[67], as of December 2017, there were at least 57 DRR[68] related projects that have been implemented with the support of the Japanese Government since the 1960s in form of technical cooperation, development studies, ODA loans, grant aid, and SATREPS[69] projects. These projects are summarized below based on the implementation period:

- From the 1970s to 1990s: comprehensive support for sabo, river basin development & management and Flood control in several cities.
- From the end of the 1990s: large scale disaster response
- From the end of the 2000s: development of a comprehensive system for DRR.

Figure 3-14 shows the commitment amounts of ODA loans and grant aids and the number of technical cooperation projects by decades. The decade of the 2000~2010 was the peak due to the fact that there were many loans put into recovery support from major disasters, including Aceh Tsunami, Yogyakarta Earthquake, and Merapi eruption.

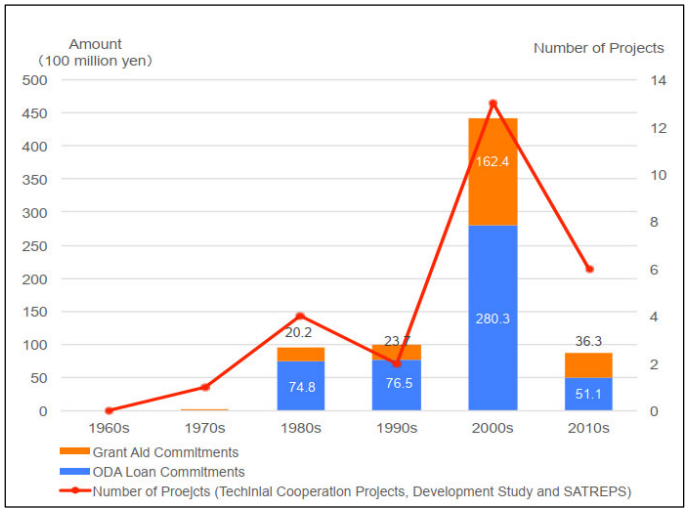


Figure 3-14 Amounts of ODA Loans and Grant Aid (E/N basis) and the number of Projects

[67] Review of Indonesia's Development and Japan's Cooperation: Its Past, Present and Future in the Republic of Indonesia – Final Report (JICA, June 2018)

[68] Projects in the area of (post disaster recovery, sabo & DRR). Projects on Flood control (2 technical cooperation projects, 17 development studies and 38 ODA loans) are not included since it is included in "River Basin Development Management" sector. Also not included are inundation projects in Jakarta & Surabaya as part of drainage & sewerage improvement projects.

[69] Science and Technology Research Partnership for Sustainable Development

In Table 3-2, some examples of major activities that had been implemented in accordance with the aforementioned period can be seen. For the detail coverage, JICA Report "Review of Indonesia's Development and Japan's Cooperation: Its Past, Present and Future in the Republic of Indonesia" (June 2018) is to be refered.

Table 3-2 Sample of major activities supported by the Japanese government in DRR sector

No	Period	Sample of Major Activities
1	1970s to 1990s	**1)** Support for volcanic sediment control
		Dispatch of experts in the early 1970s and establishment of Sabo Technical Centre, including the development of its human resources for more than 30 years. As for ODA loans, several projects were implemented to mitigate sediment flow, e.g.: Volcano and Sabo Control Technology Centre (VSTC) Project (1982-1989); Sabo Technical Centre (STC) Project (1992-1997), etc.
		2) River Basin Development & Management Project and Flood Control
		Various flood control projects along with river basin development & management for large-scale rivers were implemented. They are Brantas River, Jeneberang River, Solo River, and other rivers that run through large cities such as Jakarta and Surabaya.
2	From the end of the 1990s	**1)** Major Earthquake off the Coast of Sumatra and Tsunami in the Indian Ocean
		Dispatch of Japan Disaster Relief Teams soon after the earthquake. In addition, series of projects were implemented, including: development of a master plan for the recovery of Banda Aceh, 12 community recovery support projects, urgent infrastructure restoration, non-project type grant aid for roads, drains, and community buildings. Loans for infrastructure restoration in the transportation and water resource sectors.
		2) Central Java Earthquake (Yogyakarta EQ)
		Dispatch of Japan Disaster Relief Team to Yogyakarta, conduct initial recovery need assessment and implement a technical cooperation project, "Central Java and DIY Earthquake Reconstruction Program Advisory Team" (2006-2007). Besides the project, various activities were conducted, e.g.: eight community recovery support projects, local industry restoration support, rebuilding and designing of elementary/secondary schools & health centers, dispatch of Japan Overseas Cooperation Volunteers in the health sector, etc.
		3) The eruption of Mt. Merapi
		During the eruption in June 2006, to prevent the debris flow that could create serious damages in the lower area, Loan was utilized for urgent construction of sabo dams in the upstream area.
		4) Support for erosion control
		During this period, previous technical cooperation & loans project were continued and several projects were implemented, e.g.: Integrated Sediment Disaster Management Project for Volcanic Area (2001-2006), Integrated Disaster Mitigation Management for "*Banjir Bandang*" (2008-2011), etc.
3	From the end of the 2000s	**1)** Policy change on DRR and Development of DRR system at central & local level
		After the series of a major disaster in 2004-2006, the Indonesian government started to change its DM policy from post-disaster to pre-disaster, and preventative measures. Related to this, DM Law was enacted in 2007, and BNPB was established. JICA support through a development study, "The Study on Natural Disaster Management in Indonesia," (2007-2009) and followed by "The Project for Enhancement of the Disaster Management Capacity of BNPB and BPBD" (2011-2015). Another related assistance such as capacity building for early tsunami alert was also provided through JICA Partnership Program (JPP).
		2) Beginning of preventative DRR measures
		During this period, a series of technical cooperation projects were conducted such as: "Project on Capacity Development for National Center of Indonesian Tsunami Early Warning System" (2007-2009) (BMKG), and the "Project on Building Administration and Enforcement Capacity Development for Seismic Resilience" (2007-2011) and Phase 2 (2011-2015) (PUPR) that aimed to disseminate seismic resilient buildings nationwide. During the Great East Japan Earthquake, Indonesia provided various support to Japan. Taking this opportunity, inter-city

No	Period	Sample of Major Activities
		interaction began through a JPP project between the Higashimatsushima City of Miyagi Prefecture and Banda Aceh City.
		3) Support for the eruption of Mt. Merapi
		Dispatch of Japan Disaster Relief Team during the eruption in 2010, followed by support through loans ("Urgent Disaster Reduction Project for Mount Merapi (II) – 2014), JPP, etc.
		4) Disaster reduction through SATREPS[70]
		From the end of the 2000s, various mutual benefit SATREPS projects have been implemented such as "Multi-disciplinary Hazard Reduction from Earthquakes and Volcanoes in Indonesia", "Project for Integrated Study on Mitigation of Multimodal Disasters Caused by Ejection of Volcanic Products", etc.

3.6 Other Donor's Assistance in DRR [71]

(1) Related with BNPB

During the implementation of Hyogo Framework for Action (HFA, 2005 – 2015), BNPB as a newly established institution received many supports from international donors in order to implement and to achieve the HFA targets as well as to enhance their capacity as a whole. During this period, 4 (four) main donors actively supported BNPB by implementing their own dedicated projects, namely UNDP, AusAID, JICA and World Bank[72]. USAID also funded various activities such as the development of InaWARE (still on-going) and various responses during actual disasters. In 2014, New Zealand Aid in cooperation with Gajah Mada University (UGM) started to support several local governments in DRR by launching the STIRRD project (still on-going). Another activity is funding the preparation of Indonesian Disaster Response Framework (who do what during emergency response), of which result was submitted to BNPB in February 2018. Table 3-3 indicates the projects/activities related to BNPB supported by donors.

Table 3-3 Summary of projects/activities with the related units in BNPB

Main Leading / related Unit in BNPB	Donor / International Agencies	Name of Project / Activities	Status	≤ 2015	2016	2017	≥ 2018
Deputy 1 (Prevention & Preparedness)	UNDP	SCDRR Phase 1 & 2	Finished	●			
	AusAID	1) AIFDR	Finished	●			
		2) AIPDRM	On-going	●	→	→	→
		3) AIFDR Phase 2	Planning			●	→
	JICA	1) Study on Natural DM in Indonesia	Finished	●			
		2) Capacity Enhancement of BNPB & BPBD	Finished	●			
		3) Next TC	Planning			●	→
	NZAid	Stirrrd	On-going	●	→	→	→
	China	MHEWS	Planning			●	→
	USAID	InaWARE	On-going	●	→	→	→
	World Bank	GFDRR	Finished	●			
Deputy 2 (Emergency Response)	NZAid	Disaster Response Framework	Finished		●	→	→
	USAID	funding various support during emergency response (through Internasional NGO such as Mercy Corps, IOM, etc.)	Finished	●			
Deputy 3 (Rehabilitation & Reconstruction)	UNDP	DR4	Finished	●			
	World Bank	DALA (Damage & Loss Assessment) & Risk Financing	Finished	●			
		Replication & mainstreaming Rekompak	On-going	●	→	→	→
Deputy 4 (Logistic & Equipment)	WFP	Logistic Distribution System	On-going				●
Training Center	USAID	1) support the training curriculum	Finished	●			
		2) ICS trainings.	Finished	●			
Data & Information Center	UNDP	DIBI (2008).	Finished	●			

[70] Science and Technology Research Partnership for Sustainable Development
[71] Data collected through literature reviews, including web research. For the upcoming project (under planning), the name and schedule are tentative.
[72] The Preparatory Study on Disaster Management Program for Indonesia, JICA, Final Report – 2010

(2) Related with PUPR

For water-related disaster, JICA, ADB, and World Bank are having a long history of cooperation with PUPR. Various projects have been implemented since 1970, although not solely intended for DRR, but more for water management and water security. During the last 10 years, Korean and the later the Chinese government commenced the cooperation with the Indonesian government through PUPR. To have an overview of the past, regariding current and on-going projects in PUPR, please refer to Appendix 2, Table 2.

3.7 Challenges in DRR Sector in Indonesia

Since the establishment of DRR Law back in 2007, Indonesia had made a lot of progress and achievement in DRR fields, including the fact that former President SBY had been awarded as DRR Global Champion for DRR by UNISDR in 2011. Despite all these progress, in order to maintain and to make a sustainable DRR implementation in the future, there are many remaining issues to be solved. These issues include:

a) In recent years, economic development in the region had triggered a massive land-use change. Without proper land use management & sufficient DRR efforts, the exposed population was increasing significantly. In the last five years, major flash flood occurred almost every rainy season in all of Indonesia: Ambon – Maluku Island (2013), Manado – North Sulawesi (2014), Pasaman – West Sumatera (2015), Garut – West Java (2016), Pacitan - East Java (2017), etc. Combine with climate change issues, the risk of water-related disasters will be doubled and keep increasing from time to time.

b) In RPJMN 2015-2019, for PUPR related projects as the main focal point for water-related structural measures, Flood control projects are having a minor portion compare with 3 other national priority programs (food/water security, connectivity, and housing). National Strategic Projects[73] under the management of DG of Water resources are mostly concentrated on Dams[74] & Irrigation with NCICD[75] (coastal defense project) as the only one flood control project. This means in every fiscal year, the proposal of flood control projects will need to compete with other prioritized projects to get approval in accordance with the available budget in PUPR.

c) Lack of synergy & cooperation between DRR related agencies. Especially at the pre-disaster stage, coordination and cooperation between disaster-related agencies need to be enhanced in order to create an efficient & cost-effective result. For example, the current status shows that utilization of risk assessment results (by BNPB) for infrastructure development projects (by PUPR) is very limited, or vice versa, the effect of newly constructed disaster facilities for decreasing the risk level is minimally accommodated during the risk assessment. The same condition occurred at the local level, where BWS and Dinas PU (Province, District, and City) as the implementation agency for the flood control project. To achieve this target with them and BPBD, to increase their partnership is needed.

d) Current methodology for risk assessment is focusing on increasing the local capacity level, with the assumption that hazard & vulnerability level is very hard to change. For assessing the capacity level, BNPB introduces the "71 Resilience Indicators" to assess the current capacity of 136 high priority local governments as targeted in RPJMN 2015-2019. This is a "Yes-No" type of question, where every "Yes" answer will get a point based on a specific calculation method. Each question (indicator) will be divided further into 4 questions in order to identify at which level the responder currently positioned. Majority of the questions are related to soft component parts, such as availability of DM institutions, regulations, plans, etc., 4 questions related to structural measures and only 1 for flood control structure. With this methodology, any flood control project can not significantly contribute to decreasing the flood risk in that area (1 from 71 indicators). While previous experience with the construction of Floodway in Aceh shows that this structure had decreased the flood occurrences to almost 100% every rainy season since its development (1992-2018), except for 1995 & 2000.

[73] Presidential Regulation No. 3 Year 2016 on the acceleration of national priority projects
[74] Main purpose of Dams construction is for water security, not flood control.
[75] National Capital Integrated Coastal Development (NCICD) - Stage A

e) Insufficient DRR Budget at the local level. To create sustainable DRR efforts, the participation of local governments are inevitable. DRR investment needs to be made not only by the central government, but the local government also needs to increase its DRR budget as part of providing public services. At local level (unfortunately no official publication on DRR budget), limitation of budget can be compensated by creating a synergize of activities between disaster stakeholders, e.g. utilizing existing public centers such as mosques & other high rise facilities as tsunami shelters (after confirmation of safety issues) than constructing a new dedicated building, utilizing mosque's sound system for community early warning, combining regular community events with DRR socialization, etc. In addition to this, Local Government Law reform (now still waiting for the ministerial level regulation on the list of activities) is expected to give positive contribution on DRR budget issue at the local level in the near future.

f) BNPB as the focal point in disaster management needs to record and publish regularly all DRR related efforts by other institutions (ministries/agencies/ NGOs, etc.) in order to identify current & future DRR investment. Targets and achievements in DRR sectors also need to be identified, updated and published on a regular basis.

Chapter 4. Data Collection and Analysis Based on Disaster Types

4.1 Earthquake and Tsunami

4.1.1 Characteristics of Recent Earthquake and Tsunami Damage

4.1.1.1 Active Seismic Zones around Indonesia due to Complicated Tectonic Plate Setting

Indonesia is located at the boundary area where several tectonic plates meet, which generate a number of major earthquakes often accompanied with large scale tsunamis (Figure 4-1). The India-Australia Plate moves toward the Sunda Plate at the rate of 50-70 mm/year, forming a subduction zone along the southern coasts of Sumatra and Java Islands. In the north of New Guinea, the Pacific Plate moves west toward the fractions76 of the Sunda Plate at the rate of circa 120 mm/year. The movement of the Philippine Sea Plate on the east side of the Philippines also affects these fractions of plates, and contributes to the high seismic activities in this area.

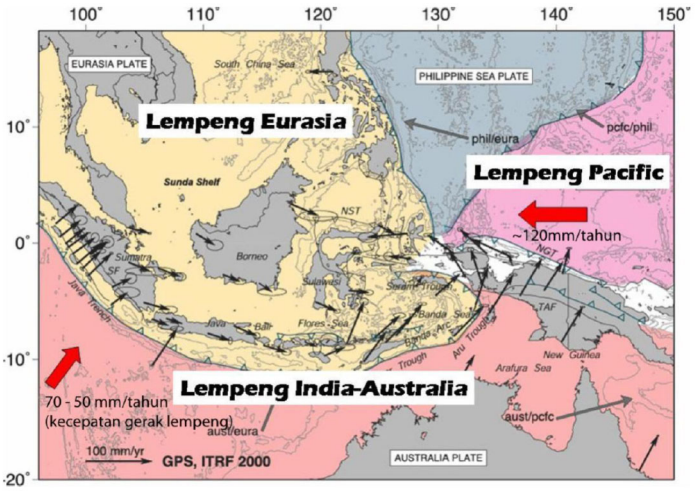


Figure 4-1 Tectonic Plate Setting around Indonesia

These tectonic movements cause not only earthquakes that occur at the boundary surfaces of the tectonic plates (Interplate Earthquakes) but also those occurring within the tectonic plates (Intraplate Earthquakes, e.g. active faults) due to the stress accumulated. In general, a major intraplate earthquake occurring within a continental plate is smaller in its size (i.e. smaller magnitude) and less frequent (i.e. longer recurrence period) compared to a major interplate earthquake occurring in the ocean trenches. However, the continental intraplate earthquakes tend to cause stronger ground shaking and thus heavier damage for their magnitude level, since they are typically shallow crustal faults near the ground surface and thus located nearer to the cities and populated areas.

4.1.1.2 Significant Earthquake and Tsunami Damage in Recent Years

The table below summarizes the major earthquakes and tsunamis after 1990. Apart from the 2004 Indian Ocean Earthquake and Tsunami, there were 45 other earthquakes and/or tsunami events counting more than one thousand deaths and missing, which derives two times per decade on average. The annual average of deaths and missing is approximately 6,500 when including the 2004 event, and around 650 without counting

[76] Small plate fractions (such as Birds Head Plate, Molucca Sea Plate, Banda Sea Plate, and Timor Plate) around the boundary area of the Sunda Plate, Philippine Sea Plate and Pacific Plate, surrounded by Sulawesi Island, Timor Island and New Guinea. The plate interaction in this area is thus complicated.

the 2004 event. The Central Sulawesi earthquake on the 28th of September 2018 was especially notable due to a large number of victims caused by the liquefaction landslide (Nalodo) incurred by the earthquake.

Table 4-1 Major Earthquakes and Tsunamis in Indonesia after 1990

Earthquake / Tsunami	Date	Eq. Magnitude	Max. Tsunami Height	Deaths/ Missing	Injuries	Houses Destroyed	Houses Damaged	Damage in million USD
Sunda Tsunami[77]	2018/12/22	Volcano	-	447	31,943	-		-
Central Sulawesi[78]	2018/09/28	M7.5	9m	4,340	4,438	68,451		-
Lombok[79]	2018/07/29 2018/08/05 2018/08/19	M6.4 M7.0 M7.0	- 0.13m -	560	1,469	83,392		-
Aceh	2016/12/7	M6.5	-	104	600	245	18,752	233
Aceh	2013/07/02	M6.1	-	42	2,500	20,401		-
Indian Ocean	2012/04/11	M8.6/8.2	1m	10	12	-	-	-
Mentawai	2010/10/25	M7.8	7m	431	-	700	-	300
Papua	2010/06/16	M7	-	17	-	2,556		-
Sumatra	2009/09/30	M7.5	0.27m	1,117	1,214	-	181,665	2,200
West Java	2009/09/02	M7	-	81	1,297	-	-	250
Sumatra (Bengkulu)	2007/09/12	M8.4	1m	25	161	56,425		-
Sumatra	2007/03/06	M6.4	-	67	826	43,719		160
Java (Pangandaran)	2006/07/17	M7.7	10m	802	498	1,624	-	55
Yogyakarta	2006/05/27	M6.3	-	5,749	38,568	127,000	451,000	3,100
Sumatra (Nias-Simeulue)	2005/03/28	M8.6	3m	1,303	340	300	-	200
Indian Ocean	2004/12/26	M9.1	50.9m	167,540	-	-	-	3,000
Papua (Nabire)	2004/11/26	M7.1	-	32	130	328	-	55
Kepulauan Alor	2004/11/11	M7.5	1-2m	34	400	781	16,712	-
Papua (Nabire)	2004/02/05	M7	-	37	682	2678	-	-
Enggano / Bengkulu	2000/06/04	M7.9	-	103	2,174	-	-	6
Central Sulawesi	2000/05/04	M7.6	6m	46	264	10,000		30
Biak	1996/02/17	M8.2	7.7m	164	423	5,043		4.2
Sumatra (Jambi)	1995/10/06	M6.8	-	84	1,868	17,600		?
Java	1994/06/03	M7.8	13.9m	238	423	1,500	-	2.2
Liwa	1994/02/15	M6.9	-	207	2,000	6,000		170
Flores	1992/12/12	M7.8	26.2m	2,500	500	31,785		100

Source: The JICA Survey Team based on Natural Hazards Viewer (NOAA), NatCatSERVICE (Munich Re), etc.

4.1.1.3 Amplified Earthquake Damage due to Vulnerable Buildings

The number of victims due to earthquakes and tsunamis has been increasing in Indonesia. The total number of deaths and missing from 1990 to 2004 (i.e. before the 2004 Indian Ocean Tsunami) is about 3,500, while the number after 2004 (excluding the 2004 Tsunami victims) is around 15,000. It is true that comparing the numbers of victims in the time range of tens of years requires careful consideration and interpretation since the major earthquake and tsunami events normally have much longer recurrence periods and thus they should be compared in a longer timeframe. However, it should be noted that most of the victims after the 2004 event were caused by the buildings or houses that were damaged or collapsed due to the ground shaking. There were several earthquakes after 2004, such as the 2006 Yogyakarta Earthquake (M6.3) and 2009 Sumatra Earthquake (M7.5), which resulted in more than one thousands victims in each event. The main contributor of the heavy building damages and thus a large number of victims was the high vulnerability of the buildings or houses in Indonesia rather than the significance of the earthquake intensities (i.e. how strong the ground shakes).

[77] Based on the BNPB information as of January 14th, 2019
[78] Based on the BNPB information as of February 5th, 2019 (Max Tsunami Height is the estimation of JICA Study Team)
[79] Based on the BNPB information as of August 29th, 2018

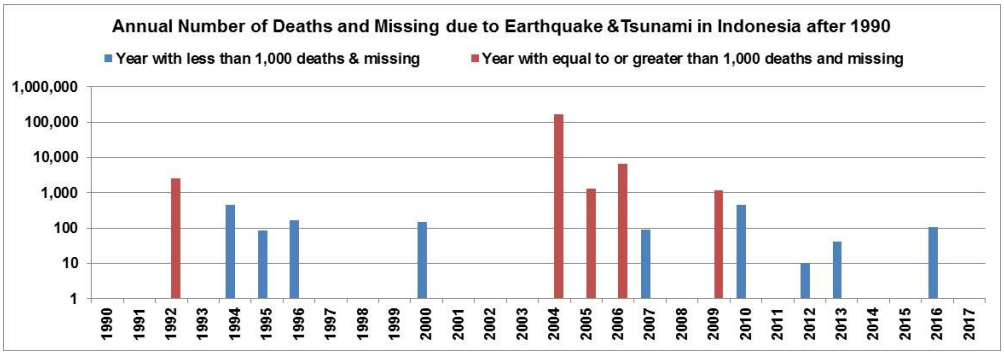


Figure 4-2 Death and Missing due to Earthquakes and Tsunami in Indonesia after 1990 (April 2019)

The 2009 Sumatra Earthquake (M7.5) is considered to be an Intraplate earthquake occurred in the ocean area (thus did not induce any major tsunami) around 60 km offshore from Padang. Despite the size of the earthquake (M7.5) and the distance from the epicenter, significant building damages and victims were observed in Padang. If an Intraplate earthquake with the size of M8 or greater occurs in the same area, there would be a risk of huge tsunami and also the shaking intensity at Padang would be much stronger than that in the 2009 event. It normally takes a long time to make cities resilient to earthquakes (i.e. make buildings resistant to earthquake), and therefore it is more than obvious that any measures should be implemented as soon as possible to reduce and mitigate the potential damage of future earthquakes.

It should be also noted, even after the 2004 Indian Ocean Tsunami, there has been a number of tsunami victims in Indonesia, such as in the 2006 Java (Pangandaran) Earthquake (M7.7) and the 2010 Mentawai Earthquake (M7.8). It is especially concerned that there is an imminent risk of a major earthquake at the Interplate area of offshore Padang, since this area is known to produce major Interplate earthquakes every hundred of years and there has been no major one occurred since 1797 (M8.7) and 1833 (M8.9). This potential Interplate seismic source can produce an M8.7 earthquake, with a high possibility of a large tsunami, and thus the implementation of both structural and non-structural measures for tsunami DRR measures is also a matter of urgency in the Padang area.

4.1.1.4 Earthquake and Tsunami Risks from Sulawesi to Papua

The Sumatra and Java Islands are well known to be subjected to earthquake and tsunami risks, witnessed in the 2004 Indian Ocean Tsunami that devastated Aceh, and the heavy building damages in the 2006 Yogyakarta Earthquake. On the other hand, the seismic and tsunami activities in the areas from the Sulawesi Island to the New Guinea Island, caused by the movement of the Pacific Plate and the Philippine Sea Plate, tend to be forgotten, though these areas have also experienced a major earthquake and tsunami disasters in the past. It should be reminded that these areas are subject to a risk of earthquake and tsunami when determining the national priority in implementing DRR measures.

4.1.1.5 Non-earthquake Tsunamis with Less Frequency

There was no significant tsunami in Indonesia caused by any non-earthquake sources, such as landslide induced by a volcanic eruption or submarine landslide, until the one occurred on December 22nd, 2018 due to the volcanic eruption and landslide induced by the eruption of Krakatau in Lampung Province, which resulted in more than 400 victims. The eruption of Krakatau in 1883 induced a huge tsunami and resulted in nearly 40,000 deaths. A similar type of tsunami resulted in numerous victims, has been observed in the eruptions of 1815 Tambora, 1871 Ruang, 1892 Awu and 1928 Paluweh (Rokatenda) [80]. Indonesia is located in the Ring of Fire with lively volcanic activities. Many volcanos in Indonesia are quite active today

[80] Natural Hazards Viewer (NOAA)

including, but not limited to, Mt. Sinabung, Merapi and Agung. Volcanic activities along the coast, especially in volcanic islands, should be carefully monitored with respect to a potential of the tsunami.

Although submarine landslide (i.e. landslide under the sea) inducing major tsunami is infrequent, one occurred offshore Lomblen Island produced a tsunami of maximum 9m high, causing 1,239 deaths and missing. This type of tsunami is in general difficult to predict and give an early warning unless installing a localized observation and monitoring system based on a stability assessment of seafloor. It is desirable that such a monitoring system is developed in the area of high risks.

4.1.1.6 Seismic Gap Offshore Padang

As already described, a mega earthquake accompanied by a huge tsunami is repetitive along the megathrust of Sunda Trench, as best represented by the 2004 Indian Ocean Earthquake.

The Mentawai-Siberut segment of the Mentawai megathrust (Figure 4-3), offshore Padang and beneath the Mentawai Islands, can produce an earthquake of maximum M8.7. Moreover, it is considered imminent, since this segment has not produced any major earthquake since 1797 (M8.7) and 1833 (M8.9).

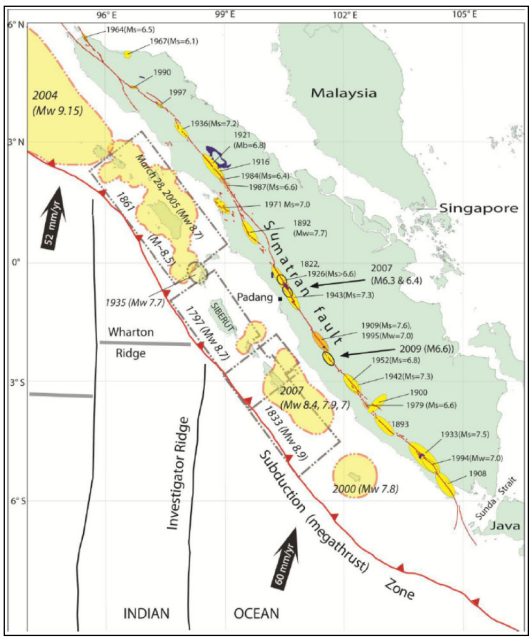


Figure 4-3 Mentawai~Siberut Plate Segment

According to BNPB, after the 2009 Sumatra earthquake (M7.5) offshore Padang, some structural measures were taken in Padang (e.g. construction of a bridge for evacuation, making schools and hospitals earthquake resistant). However, these were only minimum measures for the reconstruction following this moderate earthquake, and there is still a long way to make Padang resilient to earthquake and tsunami, especially for the big one likely in the near future.

4.1.2 The effort of the Government of Indonesia

In this section, the efforts that the Government of Indonesia (GoI) has made with regard to earthquake and tsunami DRR are described in four different categories, (1) Legal Framework / Standards and Guidelines, (2) Institution / Institutional Collaboration (incl. Capacity Development), (3) DRR Planning and Implementation, and (4) DRR Budget. Most of the GoI's efforts have been made with the financial and/or technical support from the development aid donors and the international organizations. Therefore, this section also touches on the cooperation from the donors. The next sections (4.3.3 JICA's Cooperation, 4.3.4 Cooperation of Other Donors) will provide just an overview of the cooperation, in order to avoid duplication.

4.1.2.1 Legal Framework / Standards and Guidelines

(1) Development of Building Law & Regulations, and Seismic Design Codes (PUPR)

The basic building laws and regulations of Indonesia are the Law No.28 / 2002 and the Government Regulation (PP) No.36 / 2005. The Law No.28 / 2002 is aimed at (1) ensuring that the buildings are functionally based on their layouts and environments, (2) ensuring technical reliability of the buildings in terms of safety, health, convenience, and simplicity, and (3) ensuring legal certainty for building management. It defines the functional requirements for buildings and the requirements on building construction permit of local governments in terms of building management. The Government Regulation (PP) No.36 / 2005 is the detailed enforcement regulation of the Law No.28 / 2002.

Table 4-2 Building and Special Laws / Regulations

Laws & Regulations		Contents
Building Laws & Regulations	Law No.28 / 2002	Basic law for building (Definition of Building, Building Function, Building Requirements, Building Management, etc.)
	Government Regulation (PP) No.36 / 2005	Detailed enforcement regulation of the above law
	PUPR Ministerial Regulation No.29 / 2006	Technical guideline on building functions, categories, and technical requirements
	PUPR Ministerial Regulation No.16 / 2010	Guideline on periodical building inspection
	PUPR Ministerial Regulation No.6 / 2017 (Revision of PUPR Ministerial Regulation No.5 / 2016)	Technical guideline on building construction permit
Spatial Laws & Regulations	Law No.26 / 2007	Basic law for spatial planning
	Government Regulation (PP) No.13 / 2017 (Revision of PP No.26 / 2008)	National spatial plan (RTRWN)

PUPR has also developed three technical guidelines on building functions and requirements (PUPR Ministerial Regulation No.29 / 2006), on periodical inspection (PUPR Ministerial Regulation No.16 / 2010) and on construction permit (PUPR Ministerial Regulation No.6 / 2017). These guidelines define the basic policies that the local governments should implement, requiring each Kabupaten or Kota to develop a local regulation (PERDA) on building in order to implement the building administration.

Building construction in a high-risk area of natural disaster including earthquake and tsunami is restricted, as defined in the spatial laws and regulations listed in the table above. Space is categorized into "Cultivation Area" and "Conservation Area". Development is not allowed in "Conservation Area", and the disaster-prone area will be designated as a "Conservation Area" restricting human activities there.

Table 4-3 Building Codes

Design Code	Contents
SNI 1726:2012	Earthquake resistance planning procedures for building structures and non-buildings
SNI 1727:2013	The minimum load for building and other building structures
SNI 1729:2015	Specification for steel building structure
SNI 2847:2013	Structural concrete requirements for buildings
SNI 7973:2013	Design specifications for wood construction
SNI 1725:2016	Loading for Bridge
SNI 2833:2016	Standard of earthquake resistance planning for bridges
SNI 8369:2016	Implementation of buildings and steel bridges (AISC 303-10, IDT)

PUPR has developed design standards or codes for building and civil structures as part of the Indonesia National Standard (SNI). They were prepared based on the advanced US or Australian codes and standards and optimized to reflect the specific local conditions in Indonesia (e.g. seismic hazard, construction materials).

The Indonesian structural codes and standards themselves do not have any legal binding power (i.e. not mandatory to apply them). It is the local government regulation that should define the mandatory application of the structural codes and standards along with the building administration (i.e. building construction permit).

(2) Promotion of Earthquake Resistant Buildings through Building Construction Permit (PUPR)

As described above, PUPR has developed the seismic design codes for the building structures and the building construction permit process under the PUPR Ministerial Regulation No.5 / 2016[81] , which defines that the local governments (Kabupaten / Kota) are responsible for implementing the process by mandating the application of the seismic design codes in order to ensure the building safety against earthquake. The process consists of four major phases, namely (1) Pre-application, (2) Application, (3) Issuing, and (4) Administrative Services (Figure below).

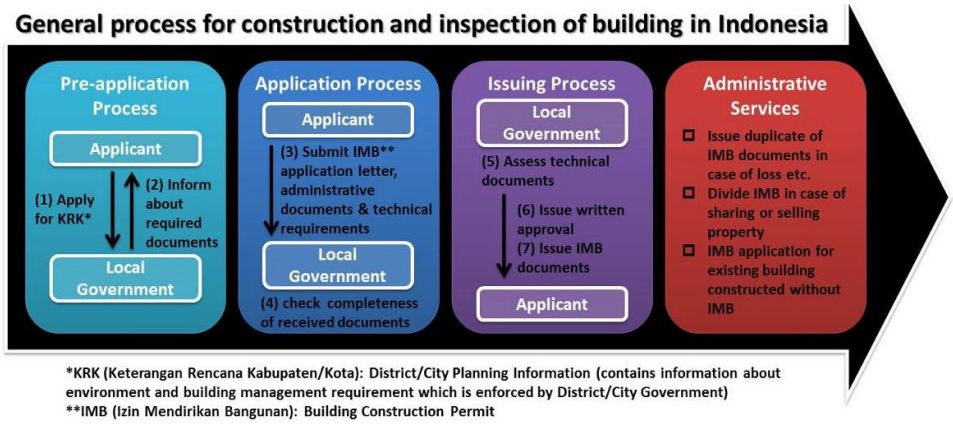


Figure 4-4 Process for Construction and Inspection of Buildings in Indonesia[82]

The process is also defined by the types of buildings, depending on the structure, construction method and technical complexity as shown below.

Table 4-4 Details of Building Construction and Inspection in Indonesia

Type	Category
Simple Building (building using simple structure, construction method and technology)	One-story Building
	Two-story Building
Complex Building (building using complex structure, construction method and technology)	Public Building
	General Building
Special Building (building using special structure, construction method and technology)	

The actual implementation of the building construction permit process is the responsibility of the local governments (Kabupaten / Kota). Each local government shall develop and issue a local building regulation (Building PERDA) following the PUPR Ministerial Regulation No.5 / 2016 in order to implement the process. The local governments are currently developing the building PERDA. The progress is rather well in the pilot areas where the JICA's cooperation project (The Project on Building Administration and Enforcement Capacity Development for Seismic Resilience Phase I and II, 2007-2014) was implemented. On the other hand, PUPR does not have a good grasp of the progress and situation in the other regions.

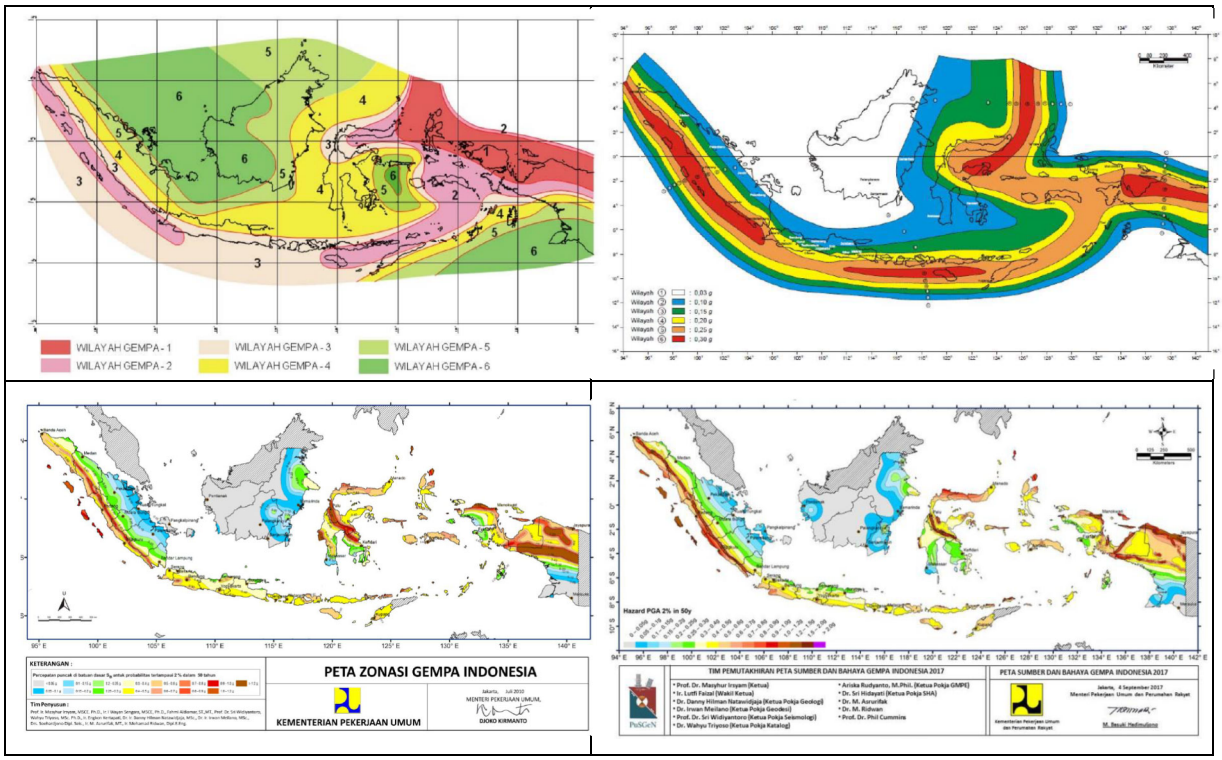
4.1.2.2 Institution / Institutional Collaboration (incl. Capacity Development)

(1) Development of National Seismic Hazard Map (Relevant Ministries and Universities)

[81] Revised through PUPR Ministerial Regulation No.6 / 2017
[82] Drawn by JICA Survey Team based on PUPR Ministerial Regulation No.5 / 2016

The first nation-wide seismic hazard map in Indonesia dates back to 1983, the one attached to the "Indonesia Earthquake Resistant Planning Rule for Building 1983"[83]. In the 2002 Indonesia Building Seismic Design Code (SNI-03-1726-2002), a full probabilistic seismic hazard map was attached, showing the Peak Ground Acceleration (PGA) with 500-year return period. A more detailed seismic hazard map was developed in 2010. Based on this map, the 2012 Indonesian Building Seismic Design Code (SNI-03-1726-2012) adopted the PGA (at bedrock) with 2% exceeding probability in 50 years as Maximum Considered Earthquake (MCE) to be used for building design, referring to the practice in the US International Building Code (IBC). In 2017, the hazard map was updated based on the findings of the recent geological surveys on the active faults[84]. The seismic code is being prepared for revision to reflect the update of the seismic hazard map.

The 2017 update was initiated in 2015 by the relevant government agencies and universities, based on the needs to update the map after 5 years from the last version issued in 2010. The discussions were started following the BNPB Head Decree No.92-6/2015 (Formation of 2016 Team to update the Indonesian Seismic Hazard Map). The first stakeholders' meeting was held on the 8th of September, 2015. After several meetings and discussions, PUPR Ministerial Regulation No. 364.1 / KPTS / M / 2016 (Establishment of Team for Seismic Sources and Seismic Hazard Map of Indonesia 2016 and for preparation of National Center for Earthquake Studies PuSGeN[85]) was signed on the 10th of June, 2016. Then about one year later on September 2017, the Seismic Sources and Seismic Hazard Map of Indonesia 2017 was issued.



Source: Seismic Hazard Maps (Top Left: 1983, Top Right: 2002, Bottom Left: 2010, Bottom Right: 2017)[86]

Figure 4-5 Earthquake Hazard Map

Through the discussions, it became a common understanding and was proposed that the National Center for Earthquake Studies (PuSGeN) should be established, so that the-state-of-the-art and most up-to-date

[83] Peraturan Perencanaan Tahan Gempa Indonesia Untuk Gedung 1983
[84] 81 active faults were modelled in 2010 hazard map, while 251 faults are considered in "Seismic Sources and Seismic Hazard Map of Indonesia 2017 (Peta Sumber dan Bahaya Gempa Indonesia Tahun 2017)"
[85] National Center for Earthquake Studies (PuSGeN: Pusat Studi Gempa Nasional), planned to be an inter-organizational structure of PUPR, Ministry of Energy and Mineral Resources, Ministry of Research, Technology and Higher Education, BMKG, BNPB, LIPI and BIG. PUPR Puskim is expected to be the secretariat.
[86] "Seismic Sources and Seismic Hazard Map of Indonesia 2017 (Peta Sumber dan Bahaya Gempa Indonesia Tahun 2017)", (2002 map shows PGA with 500-year return period at bedrock, 2010 and 2017 maps show PGA at bedrock with 2% exceedance probability in 50 years)

knowledge and expertise in Indonesia regarding earthquake research and seismic mapping could systematically and periodically be gathered and reflected in the codes and standards. Regrettably, PuSGeN has not been approved and established to date.

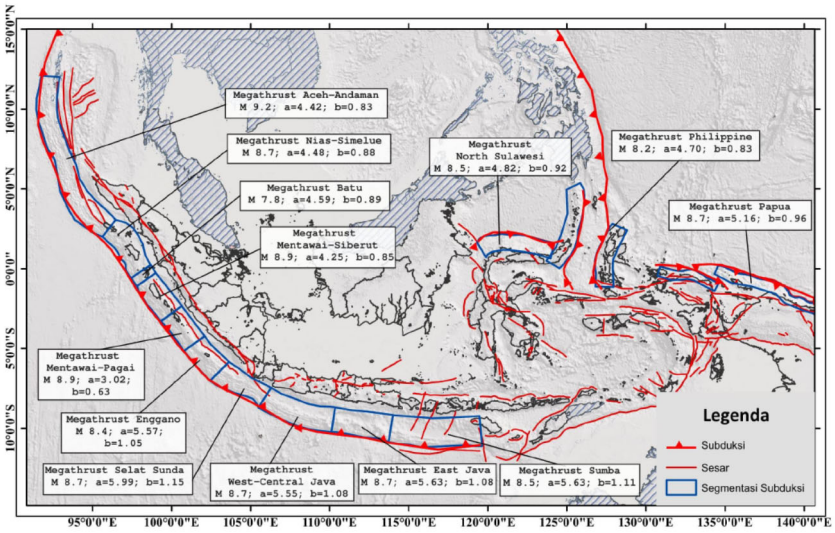


Figure 4-6 Seismic Sources in Indonesia 2017

(2) Development of Tsunami and Seismic Hazard Maps by PVMBG

The Ministry of Energy and Mineral Resources is responsible for the development of tsunami and seismic hazard maps, according to the Presidential Decree No.9 of 2016 "Acceleration of the implementation of One Map Policy at the level of map accuracy on a scale of 1:50,000". This One Map Policy aims to develop a single basis for mapping, which enables to formulate various development plans in a coordinated and consistent manner. PVMBG under the Ministry of Energy and Mineral Resources is charged for the development of volcano, tsunami and seismic hazard maps.

Table 4-5 Development of Disaster Hazard Maps (Extract of Presidential Decree No.9 / 2016)

Output	Target Completion Time	Responsible Organization	Related Agencies
a. Geological Map 1:100,000 b. Volcano Hazard Map 1:50,000 c. Seismic Hazard Map 1:50,000 d. Landslide Hazard Map 1:50,000 e. Tsunami Hazard Map 1:50,000 f. Hydrogeological Map 1:100,000	Stage 1 (17 Provinces), December 2016 Stage 2 (17 Provinces) December 2017	Ministry of Energy and Mineral Resources	1. Ministry of Agriculture 2. Ministry of Agrarian Affairs and Spatial Planning / National Land Agency 3. Ministry of Environment and Forestry 4. BIG 5. LAPAN 6. BNPB

PVMBG has developed 27 tsunami hazard maps since 2013 and continues the development targeting to produce 2 maps every year. According to PVMBG, the activities have been self-funded within the available budget. The tsunami simulation (oceanic wave transmission) has been performed with the technical support of Geoscience Australia under the Australia-Indonesia Facility for Disaster Reduction (AIFDR) - Risk and Vulnerability Program (2008-2015), including the use of software and hardware for simulation developed by Geoscience Australia. The outcomes of the simulation were summarized in "A National Tsunami Hazard Assessment for Indonesia (2013)", where probabilistic tsunami heights along the coast of Indonesia were calculated.

PVMBG has participated in the development of the national seismic hazard map of Indonesia described above. Apart from this national map, PVMBG developed more detailed maps (1m grid) at the level of

Province in 2016. However, since these maps were not based on the latest information on the seismic sources used in the 2017 national hazard map, they plan to update them in the next two years.

(3) Development of Disaster Information Tools and Database (BNPB)

BNBP has been developing various tools and databases for displaying or transmitting observation data and disaster risk information gathered from domestic government agencies and international organizations (see Table below). BNPB is promoting disaster prevention and risk reduction, through the use of collected and shared disaster information especially in the local governments when developing disaster prevention and risk reduction plans. BNPB has developed an overall risk assessment methodology that integrates the multi-hazard assessment with vulnerability and capacity assessments of each local district. The risk assessment results are then translated into Risk Index, which has been utilized as the indicator for Disaster Risk Reduction (DRR) in the National Disaster Management Plan 2015-2019. For calculating the Risk Index, the Capacity assessment has been performed in each local district. According to BAPPEDA of Aceh Province, the Risk Index for Aceh is referred in the RPJM2017-2022 of the Aceh Province as a target or indicator for DRR[87].

In general, we could not find many examples that those tools and databases developed by BNPB are utilized in the DRR planning of local governments. This may indicate that the tools and databases are not necessarily optimized for such purpose, i.e. to support detailed risk analysis and DRR planning of local governments.

Table 4-6 BNPB Tools for Disaster Information Management

Name	Support	Purpose	Function
InaSAFE	AusAID / World Bank - GFDRR	To assist better DRR, preparedness and emergency response planning, via disaster scenario analyses, under the slogan of "Better planning saves lives"	Display results of scenario analyses using QGIS derived from overlaying GIS data (hazard and exposure) provided from communities, local governments and research institutes with impact functions (or damage functions)
DIBI	BAPPENAS / KEMENDAGRI UNDP / UK DFID / UNFPA	To enhance the DRR capacity of government agencies and local governments, by providing historical disaster information	Based on collaboration with DesInventar. A database storing disaster data (number of victims, number of damaged buildings etc.) and population data. Statistical data can be displayed on a web browser.
InAWARE	USAID / PDC (Pacific Disaster Center)	To assist decision making in a disaster situation, by integrating various early warning systems into a web-based solution	Based on DisasterWARE developed by PDC. Facilitate information sharing between government agencies and local governments, through web integration of hazard information and warning systems from various sources
InaRISK	UNDP	◆ To assist DRR planning using disaster risk index ◆ To accelerate the implementation of DRR measures through risk monitoring using disaster risk index ◆ To share GIS data and provide spatial information to WMO - Multi-Hazards Early Warning System (MHEWS), UNDP - Global Center for Disaster Statistic (GCDS)	Storing and sharing of disaster risk assessment results using ArcGIS server and web GIS technology. Display Hazard, Vulnerability, Capacity and Risk regarding flood, flash flood, extreme weather, extreme wave, earthquake, forest fire, drought, volcanic explosion, landslide and tsunami. The disaster risk index is calculated based on risk assessment results (hazard, affected population, physical damage, environmental impact). Implementation of DRR measures can be reflected in risk assessment (i.e. risk index will be lowered).

[87] The target is set to reduce the Risk Index of Aceh to 130 by 2022 compared to the baseline value of 146.9 in 2016