Disaster risk reduction policies and regulations in Aceh after the 2004 Indian Ocean Tsunami

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Abstract. The 2004 Indian Ocean Tsunami that struck most of coastal cities in Aceh has motivated a numerous changes in the world of disaster risk reduction including to the policies and regulations at local level in Aceh. This paper is aimed at elaborating the changes of policies and regulations in Aceh captured and monitored during 12-year of the tsunami recovery process. A set of questionnaires were distributed to about 245 respondents in Aceh to represent government officials at 6 districts in Aceh. The districts were severely damaged due to the 2004 tsunami. Four aspects were investigated during this research, namely tsunami evacuation mechanism and infrastructures, disaster risk map, disaster data accessibility, perceptions on tsunami risks, and development of tsunami early warning at local level in Aceh. This research found that the spatial planning in several districts in Aceh have adopted tsunami mitigation although they were only significant in terms of land-use planning within several hundreds meter from the coastline. Perceptions of the government officials toward all investigated aspects were relatively good. One concern was found at coordination among disaster stakeholders in Aceh.

1. Introduction
People often regard their government and the disaster management agencies as bodies to provide safety and welfare [1]. The expectations are hard to meet in the case of unprepared institutions. Failure to accommodate such expectations may lead to another restive situations, such as what were found in the 2010 Haitian earthquake [3] and the 2008 Cyclone Nargis [2]. The 2004 Indian Ocean Tsunami should strongly motivate the increasing quality of the government agencies to cater the needs of the disaster-affected communities. The questions of the lessons learned on the institutional changes and disaster risk reduction contribution in the affected region are yet to be answered. This includes Aceh as the most affected area due to the 2004 Indian Ocean Tsunami.
Most of coastal cities in Aceh were severely damaged due to the 2004 Indian Ocean Tsunami. The tsunami caused almost 140,000 people lives and numerous of damaged infrastructures were resulted. The damages caused large disruption on local government services and operations in this area. In term of environment, the tsunami changed large area of coastal morphology [11]. Port and coastal structures were severely damaged and not functioning for several years after the tsunami. The vast impacts of the tsunami also gave opportunities to the government to re-plan its coastal areas and its regulation related to disaster management. To rehabilitate the tsunami affected area, one agency was established where its mandates include re-arranging the coastal area land-use and to help to re-activate the function of local government. The agency was named as Aceh Nias Rehabilitation and Reconstruction Agency (BRR Aceh Nias). The operation of the agency was set to run the recovery process in four years, started from April 2005 until March 2009. The changes at the level of institution after a severe impact of disaster were seen in several countries, such as Indonesia and Sri Lanka. Both of the countries were among the most tsunami affected countries. The changes from the perspective of institution were also followed by a series of regulations and policies afterward. At national level, the 2004 Indian Ocean tsunami did trigger massive changes in disaster management and multi-level arrangements and disaster governance in Indonesia [4]. The previous decentralization process after the resign of new order led by Soeharto and many disasters before the 2004 tsunami did not motivate any significant changes in disaster management in Indonesia. Although the changes are clear at national level, the local level preparedness in term of institutional capacity and disaster related policies have not been mapped for Aceh context.

This research is aimed at capturing institutional changes in Aceh and regulations made after the 2004 tsunami, which are related to disaster risk reduction. The research is expected to partly respond to the questions of the lessons learned of the 2004 tsunami adopted at policies and regulations sectors. This would help disaster practitioners to a better understanding towards creating a more resilience region.

2. Study area

Aceh is located at the northern part of the Sumatra Island. It is situated between the Andaman Sea at the north, the Malacca Strait at the east, and the Indian Ocean on the west. Figure 1 shows the study area. The study area comprises of six districts, i.e. Banda Aceh, Sabang, Aceh Besar, Aceh Jaya, West Aceh, and South Aceh Districts. All of the districts were affected by the 2004 tsunami with various levels of damages. The worst affected district was Banda Aceh. Prior to the 2004 tsunami, the population of the city was about 230,000. About 70,000 people were died in Banda Aceh or about one third of the city population. In comparison, the total reported death human casualties from the 2004 Indian Ocean were about 230,000 lives.

As the largest city in the Aceh Province, many of provincial government facilities and their organization were located in Banda Aceh. The massive damages due to the 2004 tsunami also affected the function of the provincial government and the city office too.
3. Methods

To assess the change in regulation and policies related to disaster risk reduction in this area, we employed a set of key questions, to capture the changes. There about 245 respondents were involved in this survey. The respondents come from disaster risk reduction related stakeholders, such as Aceh Disaster Management Agency (BPBA), Districts Disaster Management Agency (BPBD), Public Works Department (PU), Health Department, Hospitals, Education Department, District Development and Planning Agency, Transport and Communication Department (DISHUBKOMINTEL), Water Resources Department, Marine Affairs and Fishery Department. The targeted organizations were part of provincial or districts government units. The questions addressed to the respondents cover aspects as follows:

- Quality and Accessibility to disaster data.
- Openness of disaster data
- The uses of disaster risk map
- Tsunami risk understanding.

Assessment was also conducted to evaluate a number of disaster related documents produced between 2005 until early 2015. This research was conducted as part of the 10-Year Tsunami Recovery Process Assessment in Aceh performed between October 2014 until March 2015. The policies produced by the provincial government that adopt disaster mitigation were also studied using inventory procedure and mapping them in the disaster management cycle to identify the fulfilment and the gaps.

Focus of the analysis in term of the institutional changes was on the roles of Aceh Disaster Management Agency (BPBA) as a leading organization for disaster risk reduction in Aceh. This organization was part of the significant reform at national level on disaster management. It was established in 2010 based on a Qanun (by law product). The institutional set-up, regulation or Standard-Operating-Procedures (SOPs) and activities performed by the institution after the establishment are part of the logical framework analysed in this research. Figure 2 shows the logical framework employed in this research.
4. Results
Aceh has declared 10 development missions in its Mid-Term Development Planning for 2012-2017. One of the missions is on environmental quality and disaster management. To achieve this mission, the Aceh Provincial Government indicated three priorities, i.e.:

- Improvement of infrastructures that consider environmental quality and disaster mitigation.
- Increasing protection, critical area recovery, conservation and utilisation of natural resources and environment as part of development capitals in order to increase the quality of life.
- Disaster management including pre-disaster, emergency responses, rehabilitation and reconstruction process.

Provincial government units responsible to each of the activities in the priorities can be seen in Figure 3. The figure shows that BPBA has a central role in disaster management at Provincial level. Therefore, observing the roles and the operation of BPBA throughout the 10-year of the tsunami recovery process is pivotal to understand the policies and regulations changes related to DRR in Aceh.

4.1. Institutional Set-Up and Operation
BPBA was set-up on June 22, 2010. The legal basis of the BPBA establishment was referred to National Law No. 24 Year 2007 on Disaster Management, Aceh Qanun (by law product) No. 5 Year 2010 on Disaster Management, and Qanun No. 6 Year 2010 on The Establishment of BPBA Working Procedure and Organizational Set-up. Beside the Qanuns and the National Law, a more detail explanation on the operation and the functions of BPBA was stipulated in Aceh Governor Decree No. 7 Year 2011 on Details of Duties, and Function of Structural Officers in BPBA. In pre-disaster phase, BPBA is expected to conduct disaster management planning, DRR, to implement spatial planning, to coordinate efforts in conserving environmental function, to coordinate development planning, to
conduct disaster education activities, to compose disaster risk analysis, and to compose disaster management technical standards. A complete list of regulations produced at provincial level to govern disaster management in Aceh can be seen in Table 1.

**Table 1. Provincial Disaster Regulations in Aceh released between 2005-2015**

| Year   | Regulation Number                  | Title of Regulation                                                                 |
|--------|------------------------------------|-------------------------------------------------------------------------------------|
| 2008   | Governor Decree No. 74/2008         | Implementing of Loans to Empower Acehnese Business Persons Due to Earthquake and Tsunami in Aceh |
|        | Governor Decree No. 93/2008         | Amendments to Governor Decree No. 74/2008                                            |
| 2010   | Qanun No. 5/2010                   | Disaster Management                                                                  |
|        | Qanun No. 6/2010                   | The Establishment of Aceh Disaster Management Agency (BPBA)                           |
|        | Governor Decree No. 43/2010         | Tsunami Early Warning System and Emergency Responses in Aceh                          |
|        | Governor Decree No. 48/2010         | Aceh Local Actions Plan for Disaster Risk Reduction (2010-2012)                       |
| 2011   | Governor Decree No. 7/2011          | Details of Duties and Functions of Structural Officers at BPBA                         |
| 2012   | Governor Decree No. 49/2012         | A Guideline for Floods Contingency Plan at Disaster Management Prioritized Zones in Aceh |
|        | Governor Decree No. 87/2012         | Results of Analysis on Structural and Functional Officers at BPBA                      |
| 2013   | Governor Decree No. 64/2013         | Actions Plan on Rehabilitation and Reconstruction After Earthquake in Central Aceh and Bener Meriah Districts (2013-2015) |
| 2014   | Governor Decree No. 61/2014         | Amendments to Governor Decree No. 64/2013                                            |
|        | Governor Decree No. 87/2014         | Details of Main Duties and Functions of Steering Committee at BPBA                    |

The expected activities are inter-related to other agency/government unit’s working area. For an example, spatial planning is a mandated to Provincial Development and Planning Agency (BAPPEDA Aceh). Although BPBA was included in consultation process, the role of BPBA is not dominant. In practice, the role in conserving environmental function is run by Environmental Impacts Control Agency (BAPPEDAL) and by Forestry Department (DISHUT). Although there are duties of BPBA mentioned in Strategic Planning of BPBA for 2013-2017, it is not clear how all the duties have been performed and being communicated to other agencies/organizations. To perform its operation, BPBA has organizational structure as shown in Figure 3.
During 10-year of the tsunami recovery process, BPBA has encountered a number of disasters. Some of significant disasters were:

- Twin earthquakes, 8.5 Mw and 8.0 Mw, occurred on April 11, 2012.
- A 6.2 Mw earthquake on July 2, 2013.
- Massive floods in December, 2015 along the western coasts of Aceh
- Floods in December, 2014 around eastern coast of Aceh.

The disasters were real tests to the functions of BPBA after its establishment. In 2012 twin earthquakes, BPBA was not involved in activating tsunami alarm punctually [8]. The earthquakes created massive panic in the study area. Although the giant earthquake did not generate any tsunami, the central system of tsunami early warning in Jakarta operated by BMKG sent message of potential tsunami. During the first five minutes after the earthquake, BMKG successfully performed its function to send the message to the potential affected area. However, the message was not responded properly. Part of the reasons was untrained staffs of BPBA at that period to align with the tsunami early warning system. This will be discussed in later section.

A 6.2 Mw earthquake in central region of Aceh that occurred on July 2, 2013 caused about 34 people died, 92 people were severely injured, and displaced about 48,000 people from two districts, i.e. Central Aceh and Bener Meriah districts. The impacts of the earthquakes were identified in the two districts [9]. It is interesting to learn that despite three years after the establishment of BPBA, the rehabilitation and the reconstruction process in the affected areas was led by BAPPEDA instead of BPBA. This was stipulated in Aceh Governor Decree No. 64 Year 2013 about Action Plan on Rehabilitation and Reconstruction Process After Earthquake in Central Aceh and Bener Meriah District. The Provincial BAPPEDA was expected to run the process within 2013 until 2015. Further
confusing matters were seen when National Disaster Management Agency (BNPB) put a similar action plan for the affected area with the duration of the process between 2013 and 2014 [BNPB 2013]. Notwithstanding with the action plans, the role of BPBA in this process was not central yet.

At the end of 2010, all districts in Aceh have established their District Disaster Management Agency (BPBD). All BPBDs were established based on District Qanun. However, by the early 2010, 7 out of 23 BPBDs did not have a strategic planning to perform their operation and only two of them have detail regulation on their functions [6]. After decentralization of the Indonesia government, the role of district levels government units are important and more powerful. Therefore, a sufficient capacity to perform disaster management by BPBD at district level is crucial.

4.2. Tsunami Evacuation Infrastructure and Mechanism

Indonesia tsunami early warning system is basically divided into two parts, i.e (1) structural dimension consisting of early detection, analysis, broadcasting, and warning messages system; (2) cultural dimension comprising public announcement at city level, siren towers, and evacuation procedure [10]. Here, in this study, we studied the cultural dimension, which is under local government management. In this case, the local government were the Governor of Aceh and BPBA. All of the six districts studied in this research all of them have developed their tsunami evacuation procedures. However, infrastructures to facilitate tsunami evacuation differ from one district to another. Banda Aceh has the most complete facilities compared to others. It has 6 designated evacuation buildings, three major evacuation roads perpendicular to the coastline of Banda Aceh, and has about 7 siren towers that can cover most of coastal areas of the cities. However, other districts, such as West Aceh District only has two siren towers and one evacuation building. It is difficult for most of the districts to finance their facilities using the district’s annual budget.

Some initiatives were made as attempts to suffice the needs of the tsunami evacuation buildings. For example, West Aceh District Government ask double storeys buildings along tsunami affected area to allow their roofs to be functioned as evacuation points, as temporary alternatives before the district has enough financial resources to build a new one. Figure 4 show examples of tsunami shelters developed at double storeys building in Meulaboh city, the capital of West Aceh District. The West Aceh District has assigned its evacuation mechanism since 2012. As same as the other districts who have established their SOPs for Tsunami Evacuation, the clarity of the procedures can be seen in evacuation routes, evacuation location/buildings, and job description of staffs involved in the evacuation process. However, all the evacuation mechanisms have yet to have clarity on what would be the tsunami estimated time of arrival expected for each districts. Syamsidik et al. [5] published a data base for tsunami estimated times of arrival (ETA). They were developed based on a number of generated tsunami events around Aceh Province and the ETA recommended to be considered in the evacuation was based on the shortest ETA. Gaps are identified at all districts included in this study. For example, Banda Aceh still has about 25 minutes of a city-wide tsunami evacuation duration compared to the shortest ETA for the city, which is about 35 minutes. With the existing condition, the overall situation in the study area is still facing serious challenges to accommodate and to facilitate a smooth and fast tsunami evacuation process.
Figure 4. Double Stories Buildings in Meulaboh City of West Aceh District were made as alternatives to Tsunami Evacuation Building.

4.3. Government staffs perceptions on DRR

Based on the 245 returned questionnaires distributed in the six districts, they revealed that the perceptions of the government officials at provincial and at district levels are generally at good levels. Figure 5 shows the perceptions of the government staffs on four aspects described in section 3.

Figure 5. Perception of government staffs in Aceh on four elements in disaster.

Comparisons of the condition before 2004 and at the present were made individually by the respondents. Selected respondents were interviewed to understand reasons behind the perceptions. Quality and disaster data accessibility has been improved significantly after the introduction of Aceh Disaster Information and Data (DIBA) in 2011. The DIBA system was later implemented nationally by BNPB through its Indonesian Disaster Information and Data (DIBI). It has been made accessible to public through an online system. Efforts made by media and government agencies to report fast and accurate information on disaster events have also made the disaster information openness become
better compared to the condition before the 2004 tsunami. Due to fast the development of internet infrastructures in Aceh, online media outlets have made the report of disaster event reach wider communities. Local printed newspapers in Aceh are not many. However, the circulation of the printed media every day has made possible to include disaster related news to communities who have no access to internet.

In 2011, Tsunami and Disaster Mitigation Research Center (TDMRC) of Syiah Kuala University, funded by Multi Donor Trust Fund through its program named Disaster Risk Reduction for Aceh (DRR-A), has collaboratively composed the first disaster risk map for Aceh. The map was later named as Aceh Disaster Risk Map which is now accessible through online (tdmrc.unsyiah.ac.id/drmis). The risk map has been considered in a number of development planning documents, such as Aceh Spatial Planning and Aceh Mid-Term Development Planning (RPJMA).

The perceptions on tsunami risk at the government staffs are considered at good condition. The 2004 Indian Ocean tsunami has taught many lessons learned to the staffs. Some significant changes in the government organizations and working flows have made them aware of tsunami risk posed by this region.

5. Conclusions

This study reveals that the 10-year tsunami recovery process has brought Aceh and its districts new practices in disaster management. The institutional changes and a number of policies/regulations made have enabled this region to demonstrate disaster risk reduction efforts. Notwithstanding the achievements, there are gaps identified at evacuation mechanism and facilities in several districts. The capacity of BPBA as the focal point agency for disaster management in Aceh has been upgraded significantly. Yet, serious challenges need to be highlighted at BPBA capacity to handle reconstruction and rehabilitation process should any disaster struck again. The rehabilitation and reconstruction process led by other agencies than BPBA is put under questions since the core function of BPBA also includes rehabilitation and reconstruction process. Overall present perceptions of Aceh Government staffs at provincial and district levels are in good level compared to the condition before the 2004 tsunami. Process of integrating disaster risk map into some of development planning documents has been performed. The accessible disaster risk map has also helped a number of government units to include the risk information into their working area.

6. References

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