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DISASTER MANAGEMENT SYSTEM IN INDONESIA

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ABSTRACT : This study aims to determine the disaster management system in Indonesia and focuses on the outcomes and impacts given to the community. There are three steps used in looking at the disaster management system in Indonesia, including: 1). look at natural disasters (earthquakes and tsunamis) that occurred in Indonesia in a span of 20 years (2001 – 2021); 2). look at the disaster management system in Indonesia using 3 out of 4 disaster management cycles (mitigation, preparedness and response); 3). see the outcome and impact of disaster management regulations using a performance information framework. The method used in this research is library research. The results found in this study are that the disaster management system in Indonesia has not been running well in terms of outcomes and impact on the community. Within a span of 12 years (2009 – 2021) after the disaster management regulation was made, it has not been able to minimize the loss of life and financial losses experienced by the community. The inputs, processes and outputs of regulations and disaster management systems are in accordance with what has been conceptualized. But, the implementation process as well as the lack of disaster management regulations are the things that cause the outcomes and impacts cannot be realized and cannot protect the community from the threat of earthquakes and tsunamis.

Keywords : Natural Disaster, Disaster Management System, Outcome, Impact

1. INTRODUCTION

This study aims to determine the disaster management system in Indonesia. The first step is to look at the natural disasters (earthquakes and tsunamis) that have occurred in Indonesia over a period of 20 years (2001 – 2021). The second step is to look at the disaster management system in Indonesia using the disaster management cycle, but the disaster management cycle that is used is only mitigation, preparedness and emergency response. The third or final step is to look at the performance of disaster management regulations using a performance information framework (input, process, output, outcome and impact), but only looks at the outcome and impact process resulting from the disaster management regulation.

Disaster is a natural event or event that has a major impact on mankind and the disaster is in the form of floods, earthquakes, volcanic eruptions, landslides and tsunamis [1]. Furthermore, it is explained that a disaster is a dangerous event that seriously disrupts the function of a community or society and causes losses in the form of human, material, economic and environmental which exceeds the ability of the community or society to overcome it using the community's own resources [2]. As for several natural disasters with a fairly severe / destructive level of damage including an earthquake centred in the Indian Ocean with a magnitude of 9.2 on the Richter Scale (SR) which resulted in the Aceh tsunami 2004 [3], the earthquake that occurred in Chile 2010 with 8.8 magnitude [4], an earthquake that occurred in Japan 2011 with a magnitude of 9.0 SR [5], an earthquake that occurred in New Zealand in 2016 with a magnitude of 7.8 SR [6] and an earthquake that occurred in Indonesia in 2018 with a strength of 7.2 SR [7].

To anticipate the occurrence of disasters, several countries seek to minimize disasters that will occur in the future with disaster management / disaster management strategies. Disaster management itself can be interpreted as an organization, resource management and responsibility for handling all aspects of humanitarian emergencies, especially preparedness, response and recovery to reduce the impact of disasters [8]. Furthermore, it is explained that disaster management includes all activities,

programs and actions that can be taken before, during and after a disaster which aims to avoid disasters, reduce the impacts that will be caused, and recover from losses suffered due to disasters [9]. According to Alexander (2002), Coppola (2007), King (2007), Moe & Pathranarakul (2006), and Quarantelli (2007), there are several important activities in the disaster management cycle, mitigation, preparedness, response and recovery [10].

- Mitigation : Efforts or an action taken to reduce the impact of natural disasters and disasters caused by humans [11]
- Preparedness : An action taken to minimize the adverse effects of a disaster through effective prevention, rehabilitation and recovery [12]
- Response : Response to a disaster requires various types of information, equipment and disaster management skills [13].
- Recovery : Recovery is divided into two parts, 1). Short term recovery; 2). Long term recovery [14]

Disaster management in several countries uses different methods, for example in Mexico using an early warning tool called SASMEX / Seismic Alert System of Mexico [15], Chile which makes a civil society protection system [16]. Japan can provide detailed disaster-related information to the public only 7 days after the disaster occurs [17].

In the South American region, Chile is a country with excellent disaster management management, where Chile has a first response agency in the event of a disaster and each first response agency has expert staff with knowledge and experience of different risk scenarios for each institution such as police and squads. other rescuers [18]. Meanwhile in East Asia, Japan is the country with the best disaster management and has the first position as the country with the best disaster management system in the world, which in just 5 minutes when a disaster occurs is able to provide information to the public through the Japan Meteorological Agency (JMA) so that it can be as soon as possible carry out the evacuation process to a safe place [19].

2. METHODS

The method used in this research is library research. Library research is a form of structured investigation with certain methods, rules and techniques [20]. The library research itself is used to obtain theoretical data by seeking written and systematic information from several experts which can broaden the horizons of thinking [21]. In this study, library research was used to obtain the necessary data, such data include data on natural disasters that occurred in Indonesia and data related to the disaster management system in Indonesia.

2.1. Natural Disaster in Indonesia

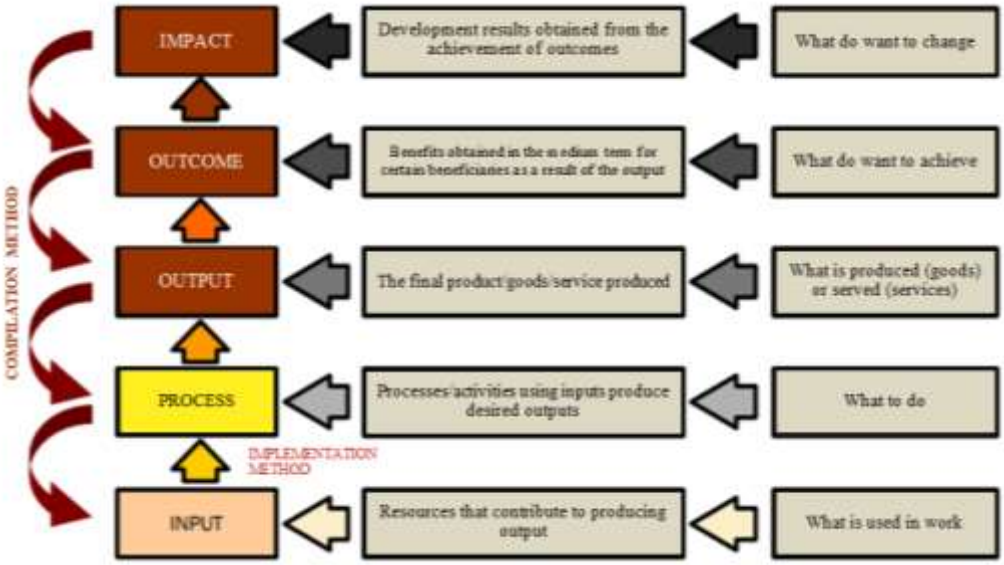
In the introduction has been explained that in several countries there have been destructive natural disasters. Referring to the research focus, namely Indonesia, this section will present natural disasters that have occurred in Indonesia in the last 20 years (2001 – 2021). It should be emphasized that the only natural disasters that will be the focus of research are earthquakes and tsunamis. In addition, the disaster seen must meet one of two criteria, including: 1). Earthquake with a strength above 7.0 SR, and; 2). Has a considerable impact on society.

2.2. Disaster Management System in Indonesia

Disaster management systems differ in each country. For this reason, this research will investigate the disaster management system in Indonesia. It should be emphasized that this research does not look at the entire disaster management cycle, but only looks at the mitigation, preparedness and response stages.

2.3. Performance of Disaster Management Regulations

Performance in disaster management policies needs to be known to see if the policy can run as expected. What is seen from the performance of a regulation is the results and impacts resulting from the implementation of the regulation itself. There is a part that looks before the outcome and impact of a regulation, which is contained in a system. The system is a set of interconnected components, with clear boundaries, that work together to achieve the same set of objectives by accepting input and producing an output in a measurable transformation process [22]. The system itself is divided into three parts, among others: 1). Inputs; 2). Process, and; 3). Outputs [23]. In viewing the performance of the policy as described above, you can use the performance information chart (figure 1) [24]. However, it should be emphasized that what will be seen is only the outcome and impact of the disaster management regulations on the community.



Picture 1. Log Frame (Input, Process, Output, Outcome and Impact)

3. RESULTS AND DISCUSSION

3.1. Natural Disaster in Indonesia

Throughout the history of human life there have been countless natural disasters, ranging from earthquakes, tsunamis, flash floods, landslides, storms and others. In Indonesia, this often happens. Indonesia is an archipelagic country located off the coast of mainland Southeast Asia in the Indian and Pacific Oceans, and is one of the countries in the ring of fire region [25-26]. In a span of 20 years (2001 – 2021), there have been natural disasters that have resulted in many casualties. The further explanation can be seen in the following table :

Table 1. Natural Disasters that Happened in Indonesia for 20 Years (2001 – 2021)

Year	Time and Location of Disaster Occurrence	Explanation
2004	Aceh (December 26, 2004)	The earthquake which was centred at 250 KM southwest in northern Sumatra with a magnitude of 9.3 SR became one of the largest earthquakes recorded in history and caused a tsunami along the north and west coasts of Sumatra [27]. The Indonesian government estimates that 129.775 people died, 38.786 people have not been found and around 504.518 were displaced due to the tsunami that occurred in Aceh [28].
2005	Nias – Simeulue (March 28, 2005)	The 8.6 magnitude earthquake caused by the partial rupture of the Sunda megathrust off the northern coast of Sumatra [29], killed more than 1.300 people [30].
2006	Bantul (May 27, 2006)	The earthquake that occurred in Yogyakarta or more precisely centred in Bantul Regency with a magnitude of 6.3 on the Richter Scale caused more than 1.1 million people to be affected by the earthquake [31-33]. The death toll from the earthquake was 37.927 people who were seriously injured and 5.716 people died [34].
2007	Bengkulu (September 12, 2007)	The earthquake that occurred in Bengkulu with a magnitude of 8.5 on the Richter Scale [35] generated a tsunami with a wave height of 50 KM to the northwest of Bengkulu [36].
2009	Padang (September 30, 2009)	The earthquake that occurred in Padang with a magnitude of 7.6 on the Richter Scale resulted in the destruction of dozens of buildings, 1.688 people suffered minor injuries, 1.214 people suffered serious injuries and 1.117 people died [37-38].

2010	Mentawai (October 25, 2010)	The 7.8 SR earthquake that occurred in Mentawai was at a depth of less than 6 KM and caused a tsunami as high as 5 to 9 meters with a total loss of 509 people [39-40].
2012	Sumatera (April 11, 2012)	The earthquake centred off the coast of Sumatra was the largest of the large intraplate earthquakes with a magnitude of 8.6 which was rare in the instrumental era [41]. The earthquake did not result in a large tsunami like the 2004 earthquake [42].
2018	Lombok (July 29, 2018 - August 19, 2018)	The Lombok earthquake occurred 4 times large earthquakes within 1 month, where the first earthquake occurred on July 29, 2018 with a magnitude of 6.4, the second earthquake occurred on August 5, 2018 with a magnitude of 7.0 on the Richter Scale, the third earthquake occurred on August 9, 2018 with a magnitude of 6.2 SR and the fourth earthquake occurred on August 19, 2018 with a magnitude of 6.9 SR [43]. The damage caused by the series of earthquakes was that 71.962 houses were damaged, 417.529 people were displaced, 7.733 people were injured and 460 people died [44].
	Palu (September 28, 2018)	The earthquake that occurred in Palu City with a magnitude of 7.2 on the Richter Scale (some researchers believe that the earthquake had a magnitude of 7.5 on the Richter Scale) caused a tsunami with a height of 4 to 7 meters [7] [45-46]. The casualties caused by the earthquake and tsunami were 2,112 people died, 4.612 were injured and 1.309 people were declared missing [47].
	Situbondo (October 11, 2018)	An earthquake with a magnitude of 6.4 on the Richter Scale was centred 61 KM northeast of Situbondo with a depth of 10 KM below sea level [48].
2019	Halmahera (July 14, 2019)	The earthquake that occurred in Halmahera with a magnitude of 7.2 on the Richter Scale was located on land at a distance of 63 KM east of Labuha City, North Maluku Province, at a depth of 10 KM [49].
2021	Mamuju (January 15, 2021)	The earthquake that occurred in Mamuju with a magnitude of 6.2 on the Richter Scale was centered in the Northeast of Majene with an epicenter depth of 21 KM [50]. The earthquake resulted in the destruction of the West Sulawesi Governor's office, people's homes and the death toll of 27 people [51].

Based on the table above, it is shown that there were several natural disasters (earthquakes and tsunamis) which were quite destructive and claimed lives from 2004 to 2021 (if calculated from 2001 – 2021). Based on data released by the Meteorology, Climatology and Geophysics Agency (BMKG) it was recorded that the disasters that had occurred in Indonesia (1821 – 2018) were more than 100,000 times [52] and throughout 2020 there were 8,264 earthquakes [53].

3.2. Disaster Management System in Indonesia

The disaster management system in Indonesia is regulated in Law Number 24 of 2007 concerning Disaster Management [54] and the implementation process is regulated in Government Regulation Number 21 of 2008 concerning the Implementation of Disaster Management [55]. The supporting regulations that improve the disaster management system at the pre-disaster stage (mitigation and preparedness) are Presidential Regulation Number 93 of 2019 concerning Strengthening and Development of Earthquake Information Systems and Tsunami Early Warning [56].

One of the foundations that led to the creation of this regulation was the earthquake and tsunami in Aceh in 2004, the Nias – Simeulue earthquake in 2005 and the Bantul earthquake in 2006. Further explanations regarding the disaster management system at the mitigation, preparedness and response stages are:

3.2.1. Mitigation

Disaster mitigation is an activity carried out to reduce the risk and impact of disasters on people living in disaster-prone areas [54-55]. Mitigation itself does not only look at empirical potential, but also includes plans that can be implemented in the form of programs/activities or actions aimed at reducing disaster risk, either caused or related to hazards due to human behaviour and natural hazards [57].

Referring to the explanation that mitigation is an effort made to reduce the impact of natural disasters and disasters caused by humans [11], it can be explained that the mitigation process is carried out to anticipate future disasters. In Indonesia, the disaster mitigation process is prepared by the National Disaster Management Agency (BNPB). Disaster alerts issued by BNPB in the mitigation process are :

- Earthquake : Construction of earthquake-resistant houses, improving the earthquake early warning system and establishing an earthquake early warning system (tie objects that hang tightly) [58].
- Tsunami : The construction of a tsunami early warning system [59], in which one of the earthquake and tsunami detectors was named InaTEWS Buoy (Indonesian Tsunami Early Warning System Buoy) [60].

3.2.2. Preparedness

Preparedness is a series of activities carried out to anticipate disasters through organization and through appropriate steps [54]. Disaster preparedness refers to the actions taken to prepare for and reduce the impact of a disaster, predict and prevent disasters, reduce their impact on vulnerable populations, respond to and cope with the consequences effectively [61].

Referring to the explanation which says that preparedness is an action taken to minimize the adverse effects of a disaster through effective prevention, rehabilitation and recovery [12], it can be explained that the preparedness process refers to preparedness or actions to be taken in the face of a disaster. will happen. Like the mitigation stage, the preparedness stage is also prepared by the National Disaster Management Agency (BNPB). Disaster alerts issued by BNPB in the preparedness process are:

- Earthquake : Socialization related to the causes of earthquakes, carrying out a simulation process in the event of an earthquake and preparing a disaster preparedness bag containing basic necessities for survival in the event of a disaster [58].
- Tsunami : Increase public knowledge by conducting socialization related to tsunamis and the process of self-rescue in the event of a tsunami [59], construction of tsunami evacuation shelters and development of evacuation route facilities and infrastructure [56].

3.2.3. Response

Response or emergency response is an activity carried out at the time of a disaster to deal with the impacts, including evacuation, fulfilment of basic needs, protection of displaced victims, rescue and restoration of facilities and infrastructure due to disasters [55]. Referring to the explanation that emergency response to a disaster requires various types of information, equipment and disaster management skills [13] and also taking real emergency actions to protect oneself and property [62], it can be concluded that emergency response is an action that will be taken to save oneself in the event of a disaster. The emergency response process in the event of a disaster is as follows:

- Earthquake : Take shelter in a safe place during an earthquake, stay away from surrounding buildings, stay away from the beach in anticipation of a tsunami and seek or listen to information to anticipate aftershocks [63].
- Tsunami : Stay away from the coast at the time of the earthquake (because a tsunami will occur in less than 40 minutes after a fairly strong earthquake) and report immediately to the relevant agencies if you know any signs of an impending tsunami [59].

3.3. Performance of Disaster Management Regulations

As previously explained, to find out whether the performance of disaster management regulations is running well, it is necessary to know the outcomes and impacts received by the community regarding the existence of these regulations.

The disaster management process is a system created to cope with disasters contained in the disaster management cycle. Refers to the explanation that says that the system is an interconnected component, with clear boundaries, which work together to achieve the same set of objectives by accepting input and producing an output in a measurable transformation process [22] and refers to Figure 1 It can be seen that in order to know the outcome and impact, one must first know the inputs, processes and outputs. For this reason, in this section, the inputs, processes and outputs of disaster management regulations in Indonesia will be presented first before further explaining the outcomes and impacts received by the community.

- The input in this section refers to what is used in work and the resources that contribute to producing the output [24]. The further explanation is :
  - Disaster management regulations (Law Number 24 of 2007 concerning Disaster

Management, Government Regulation Number 21 of 2008 concerning the Implementation of Disaster Management and Presidential Regulation Number 93 of 2019 concerning Strengthening and Development of Earthquake Information Systems) are instruments or tools used in work.
  - The Meteorology, Climatology and Geophysics Agency (BMKG), the National Disaster Management Agency (BNPB) and the Agency for the Assessment and Application of Technology (BPPT) are resources that contribute to producing output.
- The process or activity in this section refers to what is done and the process / activity uses inputs to produce the desired output [24]. The further explanation is :
  - Implementation of disaster management regulations (Law Number 24 of 2007 concerning Disaster Management, Government Regulation Number 21 of 2008 concerning Implementation of Disaster Management and Presidential Regulation Number 93 of 2019 concerning Strengthening and Development of Earthquake Information Systems) refers to what will be done in disaster management process.
  - The Meteorology, Climatology and Geophysics Agency (BMKG) provides reports related to disasters that occur specifically by paying attention to the location of the disaster and the impact caused by the disaster and the National Disaster Management Agency (BNPB) will respond to the report to deal with disasters that occur with reference to mitigation , preparedness, emergency response and recovery (disaster management cycle) or in disaster management regulations in Indonesia, namely pre-disaster, emergency response and post-disaster. The Agency for the Assessment and Application of Technology (BPPT) is tasked with creating tools to support the disaster management system. What is done by BMKG, BNPB and BPPT is a process / activity using inputs to produce the desired output.
- Output in this section refers to what is produced or served and the final product/goods/services produced [24]. The further explanation is :
  - Disaster management system that aims to reduce the impact of disasters, activities carried out during a disaster and after a disaster occurs. It refers to what is produced / served.
  - The products / goods / services produced are providing disaster-related information to the public as well as a tsunami early warning system created to reduce the impact of the tsunami.

Input, process, output, outcome and impact are part of the performance information chart (figure 1) [24]. After explaining the inputs, processes and outputs, the next step will be to explain the outcomes and impacts of disaster management regulations.

3.3.1. Outcome

Outcome is a result or benefit received from the output and the goals that are expected to be achieved [24]. Referring to disaster management regulations, it is known that the goal to be achieved is to ensure the implementation of disaster management in a planned, integrated, coordinated, and comprehensive manner in order to provide protection to the community from threats, risks and impacts of disasters [55]. From this explanation, it can be seen that the government has a goal to protect the community from the threat of disasters, so Law Number 24 of 2007 concerning Disaster Management and Government Regulation Number 21 of 2008 concerning the Implementation of Disaster Management are made.

However, more than 10 years when the disaster management regulations were made did not show significant results in protecting the community from the threat of disasters. In 2009 to 2021 a disaster occurred which resulted in casualties, material losses in the form of destruction of regional infrastructure and the destruction of people's residences [37-51] could not be minimized with existing regulations. This is reinforced by the statement that local tsunamis that arrive between 10 – 60 minutes make it difficult to disseminate tsunami early warning information, which will have a direct impact on evacuation procedures and very short evacuation times [64]. Supposedly with the disaster management regulations and disaster management systems that have been made to anticipate this, but in reality it is still far from what is expected.

3.3.2. Impact

Impact refers to the results obtained from the achievement of outcomes [24]. The impact received by the community with the disaster management system has not been felt well. This is because the outcome cannot be realized in accordance with what is expected. The initial goal of the government which is to organize a disaster management process in a

planned, integrated, coordinated and comprehensive manner to provide protection to the community from the threats, risks and impacts of disasters [55] is not appropriate at the time of its implementation. The causes for this are the lack of supporting regulations for Law Number 24 of 2007 concerning Disaster Management, less than optimal budget support, slow process of disaster management funds, slow mitigation and disaster emergency response efforts and weak coordination between relevant agencies [65].

4. CONCLUSION

Based on what has been explained above, it can be concluded that the disaster management system in Indonesia has not been running well in terms of outcomes and impact on the community. Disaster management regulations that aim to ensure the implementation of disaster management in a planned, integrated, coordinated, and comprehensive manner in order to provide protection to the community from threats, risks and impacts of disasters cannot be felt by the community. Within a span of 12 years (2009 – 2021) after the disaster management regulation was made, it has not been able to minimize the loss of life and financial losses experienced by the community.

Inputs, processes and outputs from regulations and disaster management systems are in accordance with what has been conceptualized. But, the implementation process as well as the lack of disaster management regulations are the things that cause the outcomes and impacts cannot be realized and cannot protect the community from the threat of earthquakes and tsunamis.

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