Live Recovery After Post Earthquake and Tsunami: Economic Review Case Studies of Earthquake and Tsunami in Japan and Indonesia

Z Kurniasari¹*, K F Nieamah¹,² and W F Arum¹,³

¹ Transportation Management Department, Aerospace College in Yogyakarta
² Flight Attendant Department, Aerospace College in Yogyakarta
³ Aeronautika Departement, Aerospace College in Yogyakarta

Email: zenita.kurniasari@sttkd.ac.id*

Abstract. Natural disaster is a natural event that often gives such impact on the living things populations. The purpose of this research is to determine whether the occurrence of earthquake and tsunami has the potential to cause economic loss, thus, mitigation measures can be taken as an effort to reduce these losses. The method used in this research is quantitative. The data used are primary data from questionnaires, and secondary data were gained from various literatures. Data analysis was performed using Microsoft Excel. Based on the data analysis that has been conducted, the results show that earthquake and tsunami have a relation to the economy. All respondents agreed that earthquake and tsunami caused disruption to the public facilities operation. All respondents also agreed that the detriment after the earthquake and tsunami had an effect on fulfillment of needs and economic activities. This answer affirms that the damage of various facilities and production resources caused the increasing of limited satisfaction tools and scarcity arises, then resulting in economic problems.

1. Introduction

Natural disasters, are natural events that often gives such impact on the living things populations. Furthermore, natural disasters often have multi-dimensional impacts. Natural disasters that occur are including floods, volcanic eruptions, storms, earthquakes and tsunamis. Indonesia is one of the countries that has a high level of vulnerability to natural disasters, especially for earthquakes and tsunamis. Earthquakes often occur in Indonesia because Indonesia is located between three plates, which are Eurasia, the Pacific and Indo-Australia. The shifting and the movement of these plates lead to tectonic earthquakes. Most parts of Indonesia are susceptible to earthquakes, including Aceh, North Sumatra, West Sumatra, Bengkulu, Lampung, West Java, Central Java, Yogyakarta, East Java, Bali, Nusa Tenggara, Sulawesi, Maluku, North Maluku to Papua [1].

One of the real impacts of natural disasters is the disruption in the economy. The loss of production sources, both raw materials, human power, the damaged infrastructure and then lead to relay effect on the loss of Gross Domestic Product (GDP). Brata et al also said that human and social capital are important in explaining variation in economic growth [2]. Natural shocks or disasters such as earthquakes will affect the composition of the factors of production and then it will give negative affect on economic growth. The results of this research conducted by the Global Earthquake Model Foundation, which mapped which countries in the world had the greatest potential to experience earthquakes and calculated how fragile houses, schools, workplaces were, how compact the earthquake-prone areas were, and how many potential death, potential damage and economic loss put Indonesia in fifth place after China, Japan, Iran and the Philippines in the list of countries at risk of experiencing the highest losses from earthquakes [3].

Aceh, and Palu are areas in Indonesia that have experienced a quite powerful tectonic earthquake and also followed by a tsunami. The earthquake and tsunami in Aceh that occurred caused approximately 500,000 lives lost. Dozens of buildings were destroyed, especially in Meulaboh and Banda Aceh. In Banda Aceh, about 50% of all buildings damaged by the tsunami [4]. Sri Mulyani, as the Head of Bapenas at that time, revealed that the estimated loss because of the earthquake and tsunami waves in Nanggroe Aceh Darussalam and North Sumatra reached US $ 4-4.5 billion. The calculation
of losses and damages is still temporary based on field surveys. Damage data includes the destruction of physical buildings in the affected areas. "These losses is also including potential income lost due to damage," said Sri Mulyani in a seminar on planning for rehabilitation and reconstruction of Aceh and North Sumatra people [5].

A major earthquake disaster also happened in Yogyakarta on Saturday, May 27, 2006, measuring 5.9 on the Richter scale, a type of destructive earthquake with a damage scale of 7 MMI (Modified Mercally Intensity). The explosive power of energy is equivalent to 40 kilo tons of TNT or equal to twice of the explosion from the Hiroshima bomb [6]. Based on the data gained, the death casualties from this earthquake reached 5,700 people, injured more than 40,000 to 60,000 people, destroyed hundreds of thousands of homes and livelihoods. The calculation of losses due to this earthquake, without strengthening the damage to small companies, schools and clinics is estimated at Rp. 29.1 trillion (US $ 3.1 billion) [5].

At a different time and place, on March 11, 2011 an earthquake happened in Japan in the Tohoku region which was also accompanied by a tsunami. The earthquake was measured 9.0 SR and a 10-meter tsunami which destroyed Tohoku city. Based on Japanese government data as of March 2012, there were tens of thousands of dead casualties and damage to various public facilities such as railroads, nuclear reactors also triggering radioactive radiation threat. As a result, industrial production has decreased and the contribution of the tourism industry in Japan has decreased [7].

Based on the previous explanation, the problem that will be examined in this study are the effect of the earthquake on the affected areas and the earthquake and tsunami disaster mitigation system in the economic sector. The specific objective of this research is to produce an appropriate mitigation system for natural disasters like earthquakes to potential tsunamis in Indonesia by studying the mitigation systems in Japan. The urgency of this research is the importance of finding the right earthquake and tsunami mitigation system for Indonesia so that it can reduce detriment, especially in the economic sector

2. Research Method

Research on the impact of the economy after the earthquake and the potential for a tsunami in the Tokyo and Bantul areas was conducted using quantitative descriptive methods. The quantitative research method is a research method based on the philosophy of positivity, used to research on certain populations or samples, the sampling technique is carried out randomly, data collection uses research instruments, the data analysis is in the form of quantitative.

Sources of data in this study use primary data and secondary data. Secondary data were obtained through data in literacy studies, while primary data were obtained through questionnaires where the questionnaire sample was selected using the non-probably sampling method using purposive sampling technique, where samples were obtained based on characteristics. This technique was chosen because the population and sample taken have certain characteristics which include: People who have experienced an earthquake and a potential tsunami in the Tokyo or Bantul area, ≥ 17 years old. Other primary data were gained through interviews conducted with 3 sources that were used to strengthen the research results in terms of the impact of the earthquake, especially in terms of the economy and disaster mitigation in Japan for the Tokyo and Indonesia (Yogyakarta) regions.

Data analysis was conducted with the help of Microsoft Excel by recapitulating the answers from the questionnaires that had been distributed. The next step is to draw conclusions from the most dominant answer. After the conclusion is found, it will be strengthened by the results of interviews and literacy studies.

3. Result and Discussion

Natural disasters often cause impacts such as loss of population, damage to public facilities and infrastructure, damage to production facilities and production resources which then result in economic problems, both for individuals, an economic entity to the scope of the state. Based on this view, a series of efforts to reduce damage need to be pursued in order to minimize losses.

In relation to research on the impact of the earthquake and tsunami in Japan and Indonesia from this economic review, based on the results of questionnaires that have been distributed to samples from two regions, namely Japan and Indonesia, it shows that there is an influence between the occurrence of an earthquake and tsunami on the economy. All respondents agreed that the earthquake and tsunami caused
disruption to the operation of public facilities. All respondents also agreed that the losses after the earthquake and tsunami had an effect on fulfillment of needs and economic activities. This answer affirms that the damage of various facilities and production resources caused the increasing of limited satisfaction tools and scarcity arises, then resulting in economic problems.

The earthquake and tsunami in Japan (Tohoku) on March 11, 2011 with a magnitude of 9.0 SR and a tsunami as high as 10 meters, based on Japanese government data as of March 2012, recorded tens of thousands of casualties and damage to various public facilities such as railroads, reactors nuclear and trigger the threat of radioactive radiation. The result is that industrial production has decreased and the contribution of the tourism industry in Japan has decreased [6]. Another source, the Japanese Police, stated that the earthquake had killed 12,431 people and 15,153 people were missing, then 163,000 people had to be displaced, 46,027 buildings were damaged, swept away by the tsunami, or burned down, 164,059 houses in the northern region of Japan were not electrified by the Tohoku Electric Power Co., 170,000 houses in eight prefectures with water shortages according to the Ministry of Health, and from an economic point of view the Japanese government revealed losses due to the earthquake and tsunami amounting to 16-25 trillion yen or around IDR 2,536 trillion, which is the largest loss due to natural disasters in history [8].

Meanwhile for the earthquake in Indonesia in this case the earthquake in Yogyakarta, from a national point of view, the loss of economic activity in the affected area only has small. Before the 11th earthquake the affected districts / cities contributed around 2.2% to national GDP and, out of all five experienced low damage and losses. The two worst affected districts are Bantul and Klaten, which contribute around 0.4% of the national GDP. The main impact on the national economy is likely coming from the costs of the reconstruction effort and its implications for central government finances [5]. Next, in regional and individual scope the most severe impacts were including the manufacturing, energy, water and sanitation, and services industries. This is then estimated to have contributed to the loss of approximately 130,000 jobs, which represents about 4% of the total pre-earthquake workforce in the earthquake-affected areas. As the result, the unemployment rate is estimated to increase from 7% to around 11% after the earthquake [5]. Elnashai, A et al in their report also said there are affected area because of earthquake with prosentase 16% agriculture and 26% industry. Tourism also affected with prosentase almost 18% [9].

3.1. Earthquake Disaster Mitigation in Japan and Indonesia

Seeing the big impact of both physical and economic losses arising from the earthquake and tsunami that may have followed, it is necessary to have a series of efforts to reduce the impact of disaster risks, both through physical development and awareness and increased ability to encounter the threat of disasters that occur which is then called mitigation. The main objective of mitigation is to reduce the risk of death and injury to the affected population, while the secondary objective is to reduce the damage and economic losses occurred as a result of disasters to public sector infrastructure and reduce private sector losses to the extent that these are possible to influence society as a whole [10]. A series of mitigation strategy which including economic value, several technical measures, spatial planning, social inputs, and management will be required to produce effective disaster mitigation [10].

No country is as prepared as Japan in encountering the disaster. This expression is not without cause. The 1,500 average earthquake shocks per year experienced by Japan demand that State of Sakura have a comprehensive mitigation system to minimize the impact of an earthquake which is not impossible to be followed by a tsunami wave. The various efforts that were then made by Japan were that from an economic perspective, the Japanese government had budgeted more than USD 2 billion for disaster mitigation and preparedness. This amount is more than the total annual government profits of half of the world's nations [10]. Funding for mitigation means investing in the economy, but the opposite is a loss if the infrastructure that has been built is damaged due to a disaster. Realizing this, several things were then done by Japan, including after among others, after the 2011 Tohoku Earthquake as a disaster mitigation measure as stated by Nato Tada, an expert in Disaster Prevention, Japan International Corporation Agency at a Press Conference at Graha BNPB, East Jakarta, quoted from gatra.com, among others:

1). The Japanese government is serious about improving by making an estimate of the level of potential disaster impacts followed by the formulation of a law that targets the reduction of the risk of victims within the next 10 years.
2). The targeting of earthquake resistant houses across Japan has reached 90% by 2020.
3). Relocation of vital buildings to higher ground in order to avoid the possibility of tsunami and constructing shelters, such as a 22 meter high tower with a capacity of more than 230 people.
4). Socialization of disaster response to the community which is conducted massively for a quite long time so that people are aware of potential disaster.
5). Collecting data to each head of the family, including persons with disabilities in the family, how many people can be assisted to the closest efficiency route. Several other things that were then done by Japan in relation to disaster mitigation quoted from journal.sociolla.com are: 1. Preparation of the survival kit. 2. Trains with earthquake gear sensors. 3. Earthquake warnings via cell phones and television broadcasts.

Apart from Japan, Indonesia as a country that is prone to earthquakes and potential tsunamis also has a disaster mitigation system. These are the disaster prevention and mitigation efforts in Indonesia [11]:
1). Optimizing public awareness strategies to develop community participation in implementing disaster prevention and mitigation
2). Developing applied research with a structured framework and aiming at increasing the cost-benefit ratio and always consider the process of adapting indigenous knowledge in the community using the research results
3). Spatial and land management in most of the national priority areas based on the management plan for water, land and forest resources in accordance with the results of disaster risk studies and Regional Strategic Environmental Studies.

4. Conclusion
The earthquake and the potential of tsunami that occurred in Japan and Indonesia also had an impact on the economy, both in the national scope and on the individual. Japan and Indonesia, which are countries with the potential for earthquakes and tsunamis with high intensity, require both countries to have a good disaster mitigation system to minimize losses, where it is realized that adequate budgeting for disaster mitigation is the same as investment. Preventive measures need to be taken, such as providing a legal protection and issuing a law on buildings and environmental management to minimize casualties and economic losses due to damage and loss of production resources.

5. References
[1] Nailufar, N.N. 2020. Mengapa di Indonesia Sering Terjadi Gempa. Diakses dari Kompas.com Pada 13 September 2020
[2] Brata, A., Groot, H., Zant, W. The Impact of the 2006 Yogyakarta Earthquake on Local Economic Growth. EconDiaCilCha (2018) 2:203–224
[3] Andriani, R. S. 2018. Diakses dari Bisnis.com pada 13 September 2020
[4] Hermansyah, D. 2017. Setelah 13 Tahun Gempa dan Tsunami Aceh, Sudahkah Kita Siap Menghadapi Bencana Alam. Retrieved from https://www.kompasiana.com/amp/hermqndaualay/5a420a56f0334414000509ac2/setelah-13-tahun-gempa-dan-tsunami-aceh-sudahkah-kita-siap-menghadapi-bencana-alam
[5] BAPENAS, Pemprov DIY, Pemprov Jateng, Mitra Internasional. 2006. Penilaian Awal Kerusakan dan Kerugian Bencana Alam di Yogyakarta dan Jawa Tengah.
[6] BBC. 2018. Tsunami Selat Sunda_ Korban kini 430 tewas, sementara Krakatau masih status waspada - BBC News Indonesia. Retrieved from BBC News website: https://www.bbc.com/indonesia/indonesia-46684200
[7] Miana, S., & Subagio, D. D. 2012. Gempa Bumi Besar Jepang Timur Dan Tsunami Maret 2011 : Upaya Pemerintah Jepang Untuk Memulihkan. Retrieved from http://lib.ui.ac.id/naskahringkas/2016-04/S46939-Surfa Miana
[8] Asegaf, F. 2011. Dampak Gempa dan Tsunami di Jepang. Diakses dari dunia.tempo.co Pada 15 September 2020
[9] Elmarshai, A.S., Kim, S.J., Yun, G.J and Sidartaa, D. The Yogyakarta Earthquake of May 27, 2006. MAE Center Report No.07-02
[10] Coburn, A.W., Spence, R.J.S., Pomonis, A. 1994. Mitigasi Bencana. Edisi.2. Cambridge Architectural Research Limited: UK
[11] Renas. 2014. Disaster Management