

How to ensure sustainability of economic and social activities post earthquake a case study in Lombok West Nusatenggara Indonesia

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Abstrak.

Salah satu masalah serius akibat gempa Lombok pada 28 Juli 2018 adalah terhentinya aktivitas produktif masyarakat, sehingga kelangsungan hidup mereka terancam. Tujuan dari penelitian ini adalah membangun model pemulihan ekonomi pasca gempa di Lombok Nusatenggara Barat yang dapat digunakan sebagai model pemulihan ekonomi daerah pasca gempa di Indonesia. Metode analisis yang digunakan adalah SAST (*Strategic Assumption Surfacing and Testing*) dan AHP (*Analytical Hierarchy Process*). Hasil penelitian menunjukkan bahwa pemulihan mental masyarakat pasca gempa merupakan masalah terpenting sebelum pemulihan ekonomi. Untuk memulihkan perekonomian masyarakat, pengembangan industri rumah tangga berbasis gula kelapa dan kerajinan tangan merupakan kegiatan produktif yang paling potensial untuk menjamin kelangsungan hidup masyarakat. Kesimpulan dari penelitian ini adalah pemulihan mental dan pengembangan kegiatan produktif berbasis sumber daya alam unggulan daerah merupakan kunci utama pemulihan ekonomi.

Kata kunci: gempa bumi, mitigasi, pemulihan mental, industri rumahan

Abstract.

One of the serious problems caused by the Lombok earthquake on July 28, 2018 was the cessation of people's productive activities, so that their survival was threatened. The purpose of this research was to build a model of economic recovery post earthquake in Lombok, West Nusatenggara that can be used as a model for post earthquake regional economic recovery in Indonesia. The analytical methods used were SAST (Strategic Assumption Surfacing and Testing) and AHP (Analytical Hierarchy Process). The results of study showed that the mental recovery of the community after the earthquake was the most important problem before economic recovery. To recover the community's economy, the development of coconut sugar and handicraft-based home industries was the most potential productive activity to ensure the sustainability of people's lives. The conclusion of this study was mental recovery and the development of productive activities based on regional superior natural resources were the main keys to economic recovery post earthquake.

Keywords: earthquake, mitigation, mental recovery, home industry

1. INTRODUCTION

Geographically, Indonesia is one of the countries with the highest natural disaster, because it is located on three plates: Indo Australia in the south, Pacific Ocean in the east and Eurasia in the north. One of the most frequent disaster is earthquake (BNPB 2010). An earthquake is a natural disaster that cannot be predicted when it will occur, what time and where it will occur. Estimates of earthquake are only the magnitude and region such as in Java, Sumatra, etc. (Regulation of the Head of the National Disaster Management Agency Number 8 of 2011). Earthquake is also defined as shocks that occur on the surface of the

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earth caused by collisions between earth plates, active faults, volcanic activity or stone collapse, which impact on the destruction of various buildings, economic facilities and infrastructure, loss of life and environmental degradation (Lu *et al.* 2013; BNPB 2017; Aydan *et al.* 2018). There are several reasons why earthquake happens, namely: (1) the release of energy due to the shift of the earth's plate; (2) the motion of the earth's plates that are mutually distant. This will form a new plate between both of them which will be pressed causing the new plate to move downward. Therefore, it will produce an energy with tremendous strength which is the main cause of vibrations or shocks on the surface of the earth called an earthquake; (3) motion of the earth's plates that are approaching each other. The movement of the plates that come close together will form a new mountain which triggers an earthquake; and (4) because of the movement of magma developing a very large gas pressure in the crater blockage and causes an earthquake. There are 3 forms of earthquakes, namely: (a) tectonics, caused by the shifting of the soil plate due to convection currents that occur on earth; (b) volcanic, caused by the movement of magma, usually on volcanoes, followed by volcanic eruptions; and (c) artificial, caused by human actions such as nuclear accidents or dynamite (Amri *et al.* 2016).

The impacts of earthquakes in the developed and developing countries are different. In Japan, an earthquake-prone country, for example, Fukushima earthquake 2016 and 2011 and Kobe earthquake 1995 had very powerful impact but did not cause damage and loss as what happened in Indonesia such as Aceh 2004, Nias 2005, Yogya 2006, Padang 2007, North Sulawesi 2008, Tasikmalaya 2009 and Mentawai 2010 which caused damages to infrastructure, houses and economic centers as well as enormous human casualties. Regulation of the Head of the National Disaster Management Agency Number 8 of 2011 about standardization of disaster data states that earthquakes can cause damage to infrastructure facilities, public facilities, places of worship, destruction of economic facilities and human casualties. While WHO (2013), Ando *et al.* (2017) and Dwidiyanti *et al.* (2018) also stated that earthquake can also cause mental depression, fear of an earthquake, difficult to forget the event of echo and fear of entering the house.

7.0 magnitude earthquake striking Lombok on July 28 and August 5, 2018 resulted in both huge economic losses, reaching IDR 10.1 trillion which included economic infrastructure (school buildings, residential houses, business centers, roads, markets) and ecological damage (ecosystems, flora and fauna). The number of victims reached 564 people died and 390,529 people were relocated, not to mention it caused 167 thousand houses were damaged (BNPB 2018). North Lombok Regency is a red zone with the most severe damage, there are 466 victims death or 82.6% of the total death, 829 people were seriously injured,

134,236 people were relocated and 23,098 houses were damaged, more than 45% of infrastructures were damaged, so most of the community's productive activities stopped and disrupted people's livelihoods.

Generally, earthquake disrupted people's lives, such as the earthquake and tsunami in Aceh on December 26, 2004 which caused damage the infrastructure and destruction of community housing as well as caused a mental depression in the community. Information system support that can provide an information quickly and precisely is needed to take the right response when an earthquake occurs (Prenger-Berninghoff *et al.* 2014), while Lubkowski (2014) stated that understanding how these hazards impact on the built environment is a key factor in understanding how the effect of earth quake can be countered. The results of the Tentama study (2014) show that social support in post-disaster communities is closely related to the recovery of psychological trauma in the community. Meanwhile, Ashley and Swick (2019) conducted a study on 23 people affected by post traumatic disorders and 23 control members of the military showing that traumatic causes slow response time, difficulty in concentrating, decreased endurance, irritability/ease and difficulty in communicating, so that social life in society is disturbed. Until September 2018, two months after first earthquake, there have been 825 aftershocks which are 13-15 times a day. People are haunted by fear and insecurity and experience deep mental depression, so that they cannot live comfortably and quietly (BNPB 2018). This also happened to Japanese people after the 2011 earthquake, around 10.0-53.5% experienced PTSD disorders, 3.0-47.5% experienced mental depression (WHO 2013; Ando *et al.* 2017). Dwidiyanti *et al.* (2018) showed that out of 88 community respondents after the earthquake in Lombok, 85% experienced symptoms of neurosis, 64.7% experienced symptoms of PTSD and 25% experienced symptoms of psychotic. According Cheng *et al.* (2014), the most impact of the earthquake is physical illness, lack of income and lower social support were associated with PTSD symptoms, as well as housing and office buildings, educational facilities and pressure on the community economy which caused its growth to slow down (Yanti *et al.* 2017).

Mental recovery is an important activity to regain self-confident normally, it's a process of managing the illness and its effects over time and "reclaiming (one's) right to a safe, dignified and personally meaningful and gratifying life in the community. The key factor for the success of post-earthquake recovery is the involvement and high commitment of all central and local stakeholders (private, community, NGOs and government) (Daly *et al.* 2012; Meilianda *et al.* 2017). One of the important roles of the government needed in economic recovery is to provide motivation and guidance to business actors (Emrizal 2015). Besides that, Collaboration between local governments and other institutions with

international institutions such as the international humanitarian community is needed in recovering of the earthquake (CFE-DM 2018).

Economic growth, especially in North Lombok, experienced a very serious slowdown. Various real sectors of society, especially those based on agriculture, home industries such as the manufacture of coconut sugar, creative industries (handicrafts), clove oil refining, etc., which previously became the mainstay of people's livelihoods could not operate because of the damage of infrastructure facilities and the difficulty in getting raw materials. This will greatly disrupt the sustainability of regional and the development of human resources particularly for education and health in the future, so the sustainability of people's lives is threatened.

Community involvement or public participation in post earthquake social and economic recovery is very necessary. The development in all respects will succeed if the community is involved; participation also means community involvement not only in the implementation of development but also in the identification of community potential, policy formulation and evaluation (Adi 2007). There are several factors that influence community participation, such as knowledge, opportunity, encouragement, value of benefits from activities and appreciation and the existence of support (Slamet 2003; Ife and Tesoriero 2008; Hardianti *et al.* 2017).

To encourage public participation, recovery activities must be able to touch and be felt by the community. One aspect that can be felt by the community is economic recovery through the development of home industry. Home industry is a productive activity carried out by women. Characterized by the location of activities is integrated with their homes. Smith (2014) states that the role of women in home industry development is crucial. Meanwhile, Kholil *et al.* (2017) state that the role of women through the home industry is very large in supporting the family economy, to support the sustainability of studies, health and family harmony. Home industry development often faces problems such as: (1) limited capital, (2) untrained workforce, (3) low technology and (4) limited market coverage. However, home industry has a very large role in improving people's welfare and providing employment (Zuhri 2013). To ensure business continuity, the development of home industry must be based on local superior potential (Zuhri 2013; Kholil *et al.* 2016). Prayitno (1987) states that the government must pay attention to activities that are able to absorb labor, especially women, in the countryside. To ensure the sustainability of development and economic growth, the social and economic recovery of post earthquake areas in accordance with objective conditions becomes very important (Coppola 2007).

To restore the socio-economic life of the community, the government has carried out a recovery and reconstruction process, by building infrastructure facilities such as houses, roads, markets, bridges and irrigation. However, the process was very slow and the community was not involved, so the recovery process needed a very long time and its causing low sense of belonging for local community. The main problem in post-disaster recovery without involving the community is the incompatibility of development with the needs of the real community, so that the infrastructure that is built has less real impact on the economic recovery of the community.

The purpose of this study is to identify the most important and definite strategic aspects in rebuilding the socio-economic community in the post earthquake area and building a model of community participation that is appropriate to the objective conditions of the community after the earthquake.

2. METHODOLOGY

The research was conducted on April-October 2019 in North Lombok Regency, one of the worst areas affected by the earthquake on July 28 and August 5, 2018. An approach method used in this study was a combination of experts-based and empirical-based approach. Expert-based approach was chosen regarding the complexity of the problems faced in economic and social recovery, which involve multi actors: policy maker, business actors, community, academics and NGO. There are 9 experts as the resource persons in this research, each represented by two people, except NGOs only 1 person. While empirical-based approach was conducted considering that statistical data are needed to support expert-based analysis. Data analysis using SAST (Strategic Assumption Surfacing and Testing) and then followed by an ECM (exponential comparison matrix) analysis and AHP (Analytical Hierarchy Process). SAST was used to find out what strategic assumptions that must be considered in economic and social recovery and ECM to select the most priority aspect should be done before economic recovery. ECM method uses the formula as shown in **Equation 1**:

$$TN_i = \sum_{j=1}^m (RK_{ij})^{TKK_j} \dots\dots\dots(1)$$

Description:

TN_i : i-th alternative value

RK_{ij} : j-th alternative importance for i-th alternative decision

TKK_j : alternative criteria for j-th decision, where $I_j \geq 0$

While AHP was used to choose the most appropriate strategy in accordance with objective conditions. Based on expert discussion, hierarchical structure to be analyzed using the AHP method is shown in **Figure 1**.

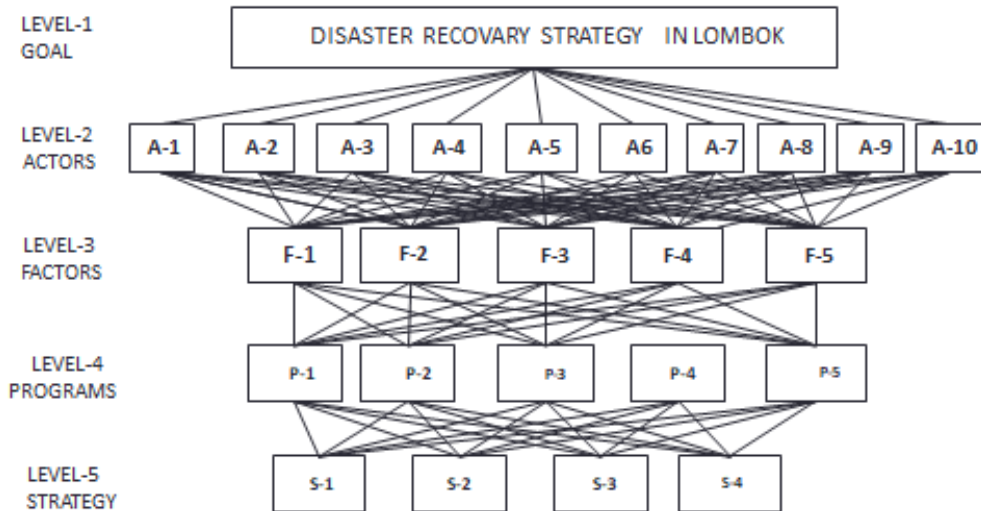


Figure 1. Hierarchical structure of disaster recovery strategy in Lombok.

Description:

Level-2

A1 : Ministry of public work and housing
 A2 : Ministry of foreign affair
 A3 : Provincial government
 A4 : District government
 A5 : Regional people representative
 A6 : Businessman
 A7 : High education
 A8 : Bank
 A9 : NGO
 A10: Local community

Level-3

F1 : Manpower
 F2 : People's welfare
 F3 : Business Sustainability
 F4 : Social life
 F5 : Regional development

Level 4

P1 : Home industry development
 P2 : Capital assistance
 P3 : Development of joint venture cooperative
 P4 : Infrastructure development
 P5 : Mental and social rehabilitation

Level5

S1 : Licensing deregulation
 S2 : Development of home industry center
 S3 : Networking development
 S4 : Development home industry based on leading resources

3. RESULTS AND DISCUSSION

North Lombok Regency is a district expansion which was inaugurated on July 1st, 2008, with an area of 776.25 km², a population of 233,691 people and divided into 5 sub-districts. North Lombok is very located in very strategic geographical area, on tourist destinations such as Mount Rinjani, three Gili islands, Sendang Gile Waterfall, etc. Before the earthquake occurred, agriculture, tourism and home industry were mainstay for the community in which these sectors have developed and become the support of people's lives. Some home

industries that have developed here include making coconut sugar, clove oil refining, honey farming, handicrafts (pottery and souvenir) and food & beverages (especially from cashew). Since the earthquake striking this area on July 28, 2019, the productive activities of the community have largely stopped due to damage of production facilities and equipment. A lot of people suffered from the mental pressure which was still difficult to eliminate. In addition, they are currently living in a temporary home.

Based on 35 respondents selected, there were several main problems faced by the community due to the earthquake: (1) mental stress (51.4%), (2) clean water (28.6%), (3) Housing (15.5%) and the others (4.5%). Most of Lombok people are shocked and panicked when an earthquake occurred, then the panic continued because the earthquake occurred almost every hour for two months. Lombok earthquake caused 87% of infrastructures damage and destroyed clean water supply facilities, so the people have difficulty getting clean water. Before carrying out economic recovery, according to most respondents (88.56%) mental rehabilitation is the most important needs to be done, because it is not possible to carry out economic activities in a state of mental stress. 86.5 of 35 respondents stated that they still felt deep mental pressure so they could not carry out normal activities.

This result is in line with the results of a study by Dwidiyanti *et al.* (2018) on the emergence of people experiencing mental disorders after the Lombok earthquake, mental disorders in post-tsunami among Acehese people (Fourianalistyawati 2010) and the emergence of psychosocial disorders for the people of Klaten after the 2006 Yogyakarta earthquake (Masykur 2006).

SAST analysis results showed that the most important strategic considerations in economic and social recovery are clean water, government policy and financial aid, as shown in **Figure 2**. Based on that figure there are three aspects that have a very high level of importance and certainty, namely Clean water facilities (A), Government policy (B) and Financial support (J), while Road infrastructure (C), Public involvement (E) and Human resources (K) are the three aspects with high level of certainty but low level of importance. But raw material (H) and local value are the two important aspects and low level of certainty. Thus, the most strategic aspect to support local economic recovery after earthquake in Lombok are A, B and J.

The results of ECM analysis showed that the most urgent activities in economic recovery post earthquake in Lombok is traumatic recovery due to mental stress (181.84) and then government policy support (162.03), as shown in **Table 1**.

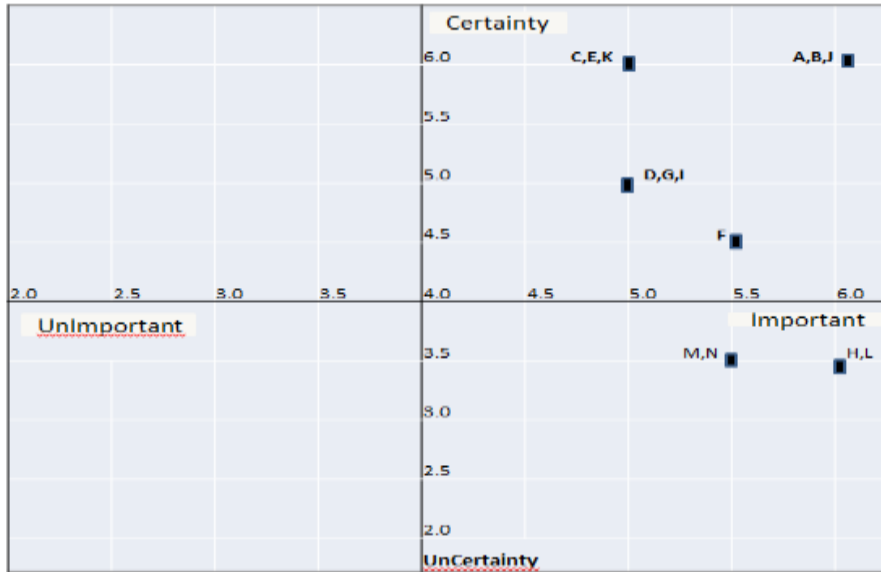


Figure 2. Strategic assumptions of economic recovery in North Lombok after the earthquake.

Descriptions:

A : Clean water facilities

B : Government policy

C : Road infrastructure

D : Superior resources

E : Public involvement

F : Regional economic institution

G : Market

H : Raw material

I : Human resources

J : Financial

K : Human Resources

L : Local value

M : Social institution

N : Saving and loan cooperative

Table 1. Priority activities in economic recovery post earthquake.

Alternative	Level of criticality	Social aspect	Economic aspect	Cultural aspect	Political aspect	Total value	Rank
Traumatic recovery	2.75	62.05	55.69	55.69	8.42	181.84	1
Entrepreneurship training	2.50	35.16	50.63	50.63	7.66	144.06	3
Capital aid	2.25	27.56	56.25	56.25	2.25	142.31	4
Networking	2.00	18.00	40.50	40.50	6.13	105.13	6
Home industry development	2.25	24.50	36.13	36.13	2.00	98.75	7
Saving and loan cooperative	1.75	20.25	36.00	36.00	2.25	94.50	8
Raw material	2.25	24.61	31.61	31.61	5.36	93.19	9
Construction of business facilities	2.25	31.64	50.77	50.77	6.89	140.06	5
Government Policy	2.50	45.16	50.63	50.63	15.63	162.03	2
Business development center	1.75	21.44	21.44	21.44	1.75	66.06	10

Another aspect that must be addressed in the recovery of communities after the earthquake is the strengthening of the community's economy. The economic empowerment of the community must be related with the local superior potential, the competency and culture of the community, the availability of labor and the culture of the people, so that community will be easier to adopt the innovations provided.

Community economic recovery does not have to be done uniformly for each region but should be based on the superior potential in each region. The One Village One Product (OVOP) system can be an option, so that each region in the future has its own advantages. North Lombok was characterized by an agricultural areas and tourist destinations. Most people depend on agriculture and plantations such as developing horticulture, developing coconut sugar, developing cashew-based foods and drinks and honey livestock. However, since the earthquake on July 28th, most productive activities stopped because the facilities and production facilities were damaged. While Gili Trawangan, Air Terjun Sendang Gile and Mount Rinjani are the famous tourist destination in North Lombok. The livelihood of the people around this area depend on tourist activities. The results of discussions with the community showed that most people (87.6%) wanted economic activity to recover as soon as before. This means that economic recovery must be in accordance with the objective condition of region.

AHP analysis results showed, that district government (A4) has the highest value (0.212), meaning that local government is the actor who has the most role in economic recovery post earthquake, followed by provincial government (0.176). Both of these government have direct responsibilities. Then, peoples's welfare is the most priority indicator (0.315) in economic recovery, with the main program is mental rehabilitation (0.258) and then capital assistance (0.256). While development of home industry based on superior resources is the most appropriate strategy in accordance with riel condition (0.334), as shown in **Figure 3**.

Among the potential superior resources, the coconut sugar home industry and handicraft were the most appropriate resources for people's economic recovery. The coconut sugar home industry is one of the home-based industries that has developed and absorbed a lot of labor in the North Lombok area. As the main yield of plantations, almost every community has a coconut plantation and has processed it into coconut sugar. Reviving the coconut sugar home industry meant that there were a large part of the North Lombok community and wide employment opportunities, so that the economic life of the community could recover soon.

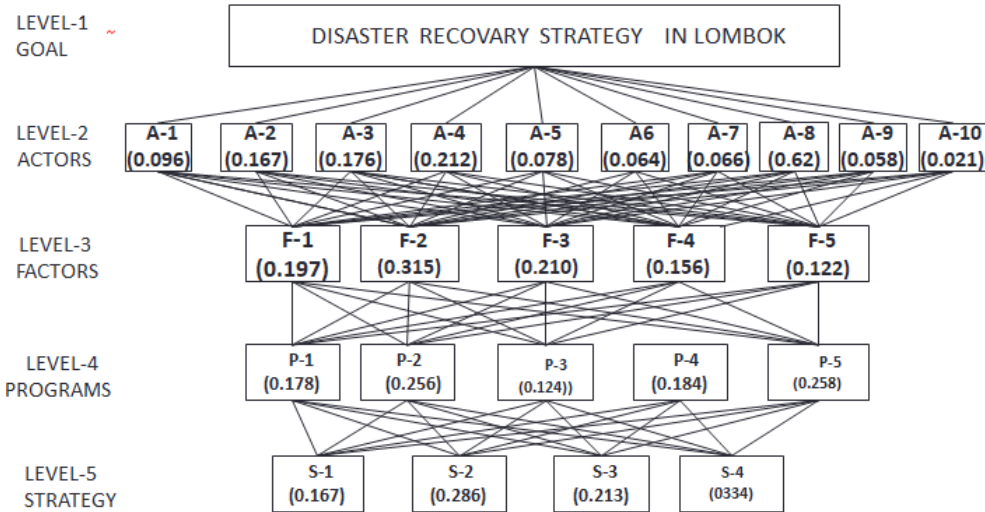


Figure 3. Priority strategy for economic recovery post earthquake.

Making coconut sugar is part of the community’s activities that has been handed down for generations. Coconut raw materials are available and it needs simple processing systems without special skills and special technology. Coconut production in all North Lombok reaches 66,500 tons, while in North Lombok only it reaches 14,639 tons/month with an area of 10,573 ha, involving 10,917 households (BPS Kabupaten Lombok Utara 2017). Meanwhile, coconut products have not been processed and the seeds are sold at very cheap prices Rp1,000/seed. By processing coconut into coconut sugar, it will increase the income of most people as well as absorb considerable employment. Broadly speaking, the production of coconut sugar. Broadly speaking, coconut sugar production process is shown in **Figure 4**.

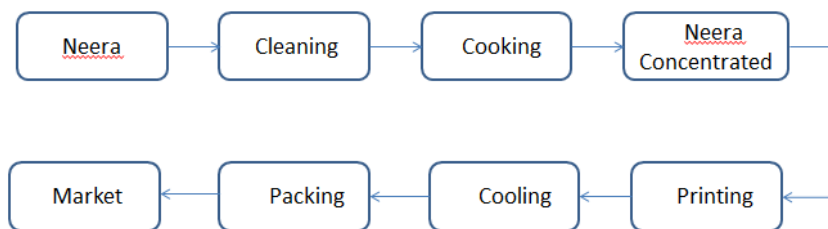


Figure 4. Coconut sugar production process.

The coconut sugar production process is quite simple. First, coconut sap is cleaned, cooked, printed into the mold, cooled for a while, then packaged in the desired size and then marketed. From the makers/craftsmen, coconut sugar is collected by collectors and sold through retail sales at the market. This process shows that coconut sugar supply chain also opens up employment. However, a

joint venture cooperative has not yet been formed which allows the craftsmen to have a bargaining power against middlemen at a better price. Therefore, to guarantee a price that is more reasonable and profitable for craftsmen, it needs to be formed together. Based on the results of the field survey, the coconut sugar chain supply model before the earthquake is shown in **Figure 5**.

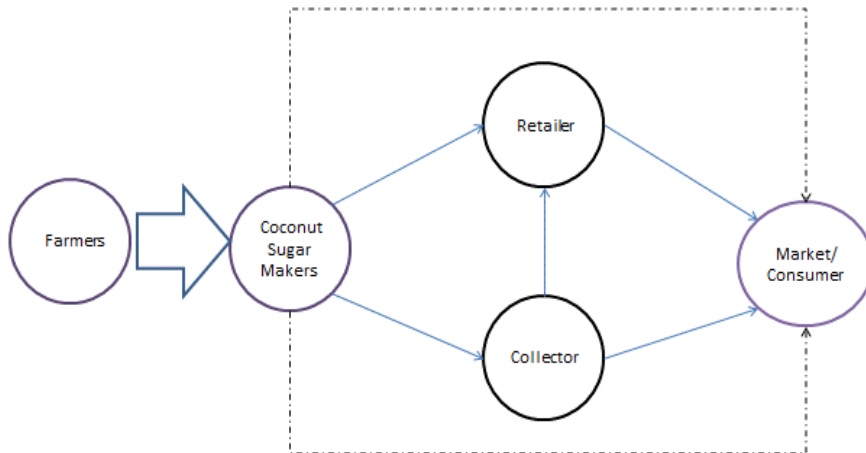


Figure 5. Coconut sugar supply chain model in North Lombok Regency.

Tappers give the neera to the craftsman or make their own sugar. The product is deposited to the collector or to the retailers. The retailers are also supplied from village collectors and then from retailers or sugar collectors distributed to buyers on the market. This system opens employment, both at the level of craftsman, collectors and retailers. Value chain occurs at retailers and collectors, with a range of Rp100-300/kg. However, since the July 28 earthquake, production and the activities of collectors and retailers stopped.

Besides the potential of the home industry's coconut sugar and handicraft (pottery), North Lombok as the national tourist destination area is well known by both foreign and domestic tourists. North Lombok has the natural tourism (Gili Terawangan, Sendang Gile, Gunung Rinjani, etc.). Pottery handicrafts and other accessories are very well-known, more than 500 accessories craftsmen with an average of 3 workers spread in North Lombok. Accessories products have become a special attraction for tourists. Like the activities of coconut sugar craftsmen, the organizers of the accessories have also stopped since the earthquake.

Economic recovery of the community must be in accordance with the needs of the community. The results of interviews in the field show that almost all of them expected the return of productive activities as before the earthquake. Therefore, the community will fully support and be actively involved in the process of economic and social recovery. The community-based economic

recovery model is based on objective conditions and the results of the analysis can be described as shown in **Figure 6**.

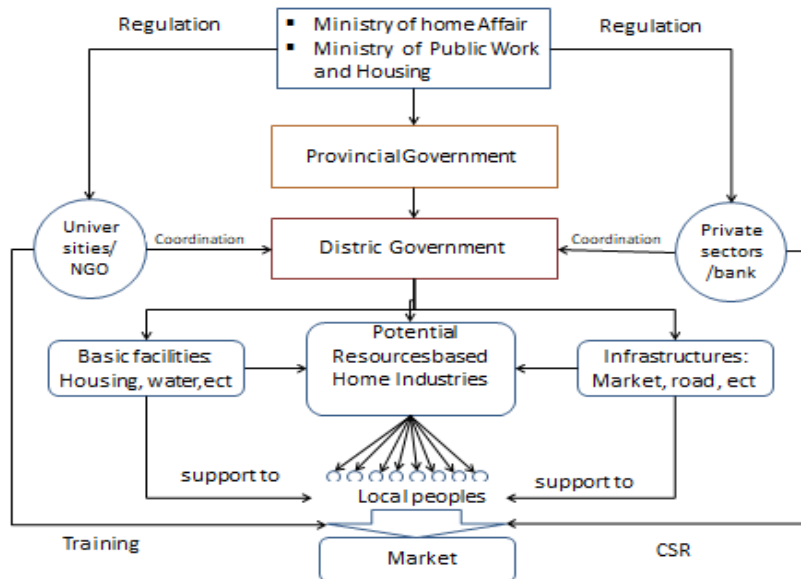


Figure 6. Model of economic recovery for the community after the earthquake.

4. CONCLUSION AND SUGGESTION

The most urgent factor to recover the social and economic life of the community in the post earthquake area is the mental health of the community. Mental pressure/depression due to the earthquake that has not been recovered will disrupt the recovery process. Community involvement in economic recovery through the development of the home industry is the most appropriate strategy. The most suitable potential home industry in accordance with the objective conditions of the people of North Lombok after the earthquake is the development of home industries based on potential resources such as coconut sugar, accessories, food and drink. To develop a coconut sugar home industry, it is necessary to provide capital assistance by involving private companies through CSR program and improve community skill in the term of the production process, market access and business governance through training and business assistance.

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