Socio-economic adaptation strategy of farming communities after natural disasters

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Abstract. Indonesia is prone to natural disasters. It is being traversed by the meeting point of three tectonic plates, namely the Indo-Australian Plate, the Eurasian Plate, and the Pacific plate. The meeting point is in the sea. It will potentially cause a tsunami when there is a big earthquake happens. The earthquake and tsunami disaster that occurred in Central Sulawesi also caused liquefaction (moving land). Liquidations that coincide with the earthquake are found in Jono Oge Village, Sigi Biromaru District, Sigi Regency, Central Sulawesi Province. This incident caused some agricultural land, such as paddy, corn, and vegetable gardens, to move even to disappear. Some farmers lose the desire for farming, caused hampered to their socio-economic life. This study purpose of determining the social-economic conditions of the farming community after natural disasters. Also, to find out the strategies of the farming community to adapt to changes that happened. The research method used in this research is descriptive qualitative method with a case study approach. The data used are primary data obtained through observation, interviews, and documentation studies as well as secondary data from various related agencies. Data analysis will go through three stages, namely data reduction, data presentation, and drawing conclusions or data verification.

1. Introduction
Indonesia has a geographical position that is located in a circle of fire so that it is potentially and vulnerable to various natural disasters such as earthquakes, landslides, tsunamis, volcanic eruptions, and others [1]. The earthquake that was followed by a tsunami occurred once during the period 2014 - 2018. This earthquake and tsunami disaster occurred in Central Sulawesi Province in September 2018. An earthquake measuring 7.4 on the Richter scale caused a tsunami with a height of about 11.3 meters. This tsunami wave height is the second highest after the tsunami disaster in Aceh Province in 2004 [2].

Disasters can have adverse physical and psychological effects on victims of natural disasters as well as the large population around the scene [3]. The earthquake and tsunami disaster caused include deaths, injuries, trauma, damaged building conditions such as private homes, hospitals, educational facilities, worship facilities, and so on. In addition, some people have to lose their jobs, such as fishermen, ranchers, farmers, factory workers, and others. Fishers no longer dare to go to sea due to trauma and fear that if disaster strikes again, breeders lose much livestock, so they lack the capital to return to work, as usual, agricultural land is damaged so farmers cannot normally work again and lose
a lot of income and factory workers must feel Layoffs (Termination of Employment) because the factory building is damaged and can no longer be used.

The earthquake and tsunami also caused liquefaction. Liquefaction that coincides with the shock is found in Jono Oge Village, Sigi Biromaru District, Sigi Regency, Central Sulawesi Province. This incident caused some agricultural land, such as paddy, corn, and vegetable gardens, to move even to disappear.

When a community is hit by a natural disaster, the economic situation of the community changes and becomes equal, at first social class differences were evident in the community, but with an accident or natural disasters affected the economic situation of the people changed. In a sense, the district must be able to adjust the case at that time and not be separated from other communities that are automatically equal in economic conditions [4]. The shape of the farming community in Jono Oge Village, Sigi Biromaru District, Sigi Regency, is also the case. The community works hand in hand to restore the local socio-economic conditions together. This cannot be done immediately but requires adaptation first, considering the environmental conditions that are no longer the same after a disaster has occurred. Therefore an adaptation strategy is needed to restore the social and economic conditions of the farming community of Jono Oge Village, Sigi Biromaru District, Sigi Regency. An adaptation strategy is an effort to solve various kinds of life problems by utilizing the ability of all family members to manage their resources [5].

Changes in socio-economic conditions that occur in farming communities make researchers interested in knowing in detail. This research will explore and find out about any social changes that occur, socio-economic conditions in the community after the earthquake-affected by liquefaction, and how to adjust the community after social changes occur. These problems are the background of the preparation of this study with the title "Social and Economic Adaptation Strategies of Post-Natural Disaster Farmer Communities" (Case Study of Farmer Communities in Jono Oge Village, Sigi Biromaru District, Sigi Regency, Central Sulawesi Province). Therefore, the formulation of the problem in this study are as follows:

1. How is the social-economic condition of the farming community in Jono Oge Village after the natural disaster?
2. How is the strategy of the farming community in Jono Oge Village, adjusting to the changes that occur after natural disasters?

2. Methods
This research was conducted in Jono Oge Village, Sigi Biromaru District, Sigi Regency, Central Sulawesi Province, as an area affected by earthquake and liquefaction. The time of the research until the preparation of the research report is April - December 2019. The method used is descriptive qualitative research using the case study method. This research involved key informants and additional informants. Key informants are the farming community living in Jono Oge village, and the other informant is the Village Chief Jono Oge. In addition to the village head, additional informants for this study were also supplemented by volunteers who were still active in restoring the conditions of the people in Jono Oge Village. Volunteers are people who know most of the field conditions immediately after the disaster.

2.1. Research approach

2.1.1. Primary Data. The research techniques at this stage are observed interviews and records documents that support the research process. The data collection techniques that will be carried out by researchers are as follows:
Table 1. The data needs of research in the village of Jono Oge 2019.

| Types of Adaptation Strategies                  | Required data                                                                 |
|-------------------------------------------------|-------------------------------------------------------------------------------|
| Activated Socio-Economic Adaptation Strategies   | Productive assets (agricultural land area, agricultural business equipment); Capital assets (houses, agricultural business buildings, physical health conditions, farming skills); Labor assets (income of the head of the family, income of family members (wife, children, others). |
| Passive Socio-Economic Adaptation Strategies     | Food and non-food expenses such as education, clothing, household appliances. |
| Social Economic Adaptation Networking Strategy   | Formal relations (borrowing money from financial institutions such as banks, LKMA, etc.); informal relations (borrowing money from neighbors, relatives, and so on). |

In this study, researchers used semi-structured interviews. This research will use guide questions that have been prepared. Still, in its implementation, the interviewer may give items outside of the guide questions but even adjust to the information needed in the study. Documentation study, researchers collect images of research locations before the disaster and post-disaster, pictures during the interview process, photos about the conditions of residence of the informant, and other pictures needed.

2.1.2. Secondary Data. Secondary data collected by examining documents held by the Village Chief Jono Oge relating to the post-earthquake and liquefaction events. Also, data compiled by volunteers who were still active in the community recovery process after the earthquake and liquefaction. Document requirements include the number of farming communities affected by disasters, the amount of land lost or displaced, the average losses due to accidents, and other data deemed to support this research.

2.2. Data analysis method

Data analysis activities consist of three activities that co-occur, namely, data reduction, data presentation, and drawing conclusions/verification. Happened simultaneously means that data as something which intertwined and process of cycles and interactions at the time before, during, and after data collection in a parallel form that builds a comprehensive insight called "analysis" [6]. Data analysis techniques used in this study are:

2.2.1. Data Reduction. Data reduction is a form of analysis that sharpens, classifies, directs, discards unnecessary, and organizes data in such a way that the conclusions can finally be drawn and verified. So this research can be simplified and transformed in various ways:

- Researchers conduct a rigorous selection of data obtained from observations, interviews, and documentation studies. The data are parsed and selected according to the issues and problems to be analyzed.
- The data is summarized and focused on being analyzed
- Researchers classify the data obtained into a broader pattern that will be used as a reference for the analysis of research results

2.2.2. Data Presentation. The presentation of data is a collection of information that is arranged, which will give the possibility of drawing conclusions and taking action. The presentation of data in qualitative can also be done in various types of matrices, graphs, networks, and charts. All of them are designed to combine information that is arranged in a coherent and easily accessible form (Personal,
2018). Researchers collected information about how the socio-economic conditions of the farming community, such as whether there was trauma or fear of returning to farming, how much loss was experienced by the post-disaster farming community, whether the farming community still had the capital to return to farming and so on. The next research problem is how the strategies of the farming community in adapting to the post-disaster environment, whether the farming community has to switch jobs or the farming community starts to involve family members in earning a living and so on. Overall information collected by this researcher is presented in the form of a descriptive narrative.

2.2.3. Withdrawal of Conclusions. The third analysis activity is drawing conclusions and verification. When data collection activities are carried out, researchers look for the meaning of the information collected, noting regularities, patterns, explanations, causal flows, and propositions. Initially, unclear conclusions will increase in more detail. Final conclusions will emerge depending on the size of the collection of field notes, retention, and retrieval methods used and the level of researcher's ability. The results of this data inference are then used as material for analysis in compiling this study. The conclusions also become a reference to determine suggestions for improvement of the problems found.

3. Results and discussion

3.1. Activated Socio-Economic Adaptation Strategies

Data used to determine active adaptation strategies are productive asset data (agricultural land area, and business equipment); capital assets (houses, agricultural business buildings, physical health conditions, farming skills); labor assets (family head income, family member income (wife, children, others).

3.1.1. Earning Assets. Some assets owned by farmers are classified as productive if used in the production process and can be used to make adjustments or develop specific strategies in maintaining survival [5]. Productive assets owned by respondent farmers are in the following Table 2.

| Types of Earning Assets | Before the Disaster (Ha) | Percentage (%) | After the Disaster (Ha) | Percentage (%) | Condition | Percentage (%) | Description |
|-------------------------|-------------------------|----------------|-------------------------|----------------|-----------|----------------|-------------|
| Agricultural land       |                         |                |                         |                |           |                |             |
| 0.5 – 1                 | 57.14                   | 0 – 0.5        | 21.43                   |                |           | 64.29          | Some of the damaged farming tools are hoes, tanks, sickles, parasols, and tractors |
| >1 – 2                  | 14.29                   | >0.5 – 1       | 35.71                   |                |           |               |             |
| >2 – 3                  | 14.29                   | >1 – 1.5       | 7.14                    |                |           |               |             |
| >3 – 4.5                | 14.29                   | >1.5 – 2.5     | 35.71                   |                |           |               |             |
| Total                   | 100.00                  | Total          | 100.00                  | Total          | 100.00    |                |             |

Source: primary data after processing, 2019.

Based on the data in Table 2, the area of land in Jono Oge Village has decreased significantly. Before the disaster, farmers in Jono Oge village still had more than 3 hectares of land, but after the disaster, the most extensive area of farmers was only 2.5 hectares. This happened because of a liquidation disaster that shifted farmers' lands. The decrease in the area of land affects the level of income of farmers in the village of Jono Oge. This is in line with Assis et al. [7], which states that land area is the only factor that has a significant effect on monthly income for farmers, so if land area increases, farmer income will increase. The same thing happened in Thailand, Myanmar, India, Sri Lanka, and...
the Maldives. When natural disasters occur, agricultural lands cannot be used anymore, and farmers choose to move to safer areas, and this positively affects their income [8].

Other productive assets, namely agricultural equipment, also suffered damage such as hoes, tanks, sickles, parasols, and tractors. Agricultural equipment is also sufficient to support agricultural activities in Jono Oge Village. Agricultural equipment or technology is a driving factor for agricultural activities to be more productive and efficient. Research Mulyani [9] states that technology has a significant effect on income.

3.1.2. Capital Assets. Capital assets in the form of physical buildings both as a residence or as agricultural buildings such as warehouses and others, health conditions, and farming skills. Respondent farmers in the study area did not have individual buildings for the purpose of agriculture that they were involved in so that the buildings referred to in the following Table 3 were building assets for housing. Aside from being material, capital assets also include physical health and farming skills, so information about these matters is also listed in Table 3 as follows:

| Types of Capital Assets | Physical building | Health | Skills |
|------------------------|-------------------|--------|--------|
| Condition              | Percentage (%)    | Condition          | Percentage (%) | Condition | Percentage (%) |
| Damaged                | 78.57             | Physical disability | 7.14       | Reduced | 42.86       |
| Good                   | 21.43             | Mental Disability (Trauma) | 28.57 | Similar | 57.14 |
|                        |                   | Physical and mental health | 64.29 |        |              |
| Total                  | 100.00            | Total              | 100.00     | Total   | 100.00     |

Source: primary data after processing, 2019

Physical buildings in Jono Oge Village were mostly affected by disasters. Based on the data in Table 3, the damage reached 78.57 percent, which was damaged by the farmers' dwellings. In addition, the table also presents the health conditions of the respondent farmers; most of the respondent farmers experienced mental disabilities (trauma) due to the disaster. Some farmer respondents have lost their land, family, and even a place to live. In terms of skills, it is quite influential at 42.86% because some of the respondent farmers experience mental and physical disabilities, which ultimately affect the level of farmers' skills.

3.1.3. Labor Assets. Labor assets include the income of all family members, including heads of families, wives, and children. The labor assets referred to in the following Table 4 are assets after a natural disaster occurs.

| Description     | Average Revenue per Month (Rp) | Percentage (%) |
|-----------------|-------------------------------|----------------|
| Head of household | 607,142.86                   | 31.38          |
| Wife            | 700,000.00                   | 36.18          |
| Children        | 627,747.25                   | 32.44          |
| Total           | 1,934,890.11                 | 100.00         |

Source: primary data after processing, 2019.

After natural disasters, material needs in the form of money are essential for respondent farmers. As explained earlier, some building assets and agricultural equipment were damaged, requiring initial
capital to rebuild the business. These essential needs make some family members also look for work to increase the income of the head of the family. As seen in Table 4, the highest percentage for family member income is wife income. The type of work done by the respondent's farmer's wife is selling cakes and snacks. The average income from this work is IDR 700,000 per month, so that it can contribute 36.18 percent of the total family income after the disaster. In addition to the wife, the respondent's farmer's child also does some work to generate additional income. These types of work include working as a mechanic, a trader, a construction worker, a factory worker, and cleaning service in offices that lost workers due to the disaster. The income earned is 32.44 percent of the total family income.

The primary income from respondent farmers is from farming activities. Some commodities cultivated before the disaster are dragon fruit, red chili, and tomatoes. Revenues earned before the disaster reached Rp 1,044,642.85 per month. Whereas after the disaster, the commodities that can be cultivated change are cauliflower, long beans, and cucumbers. Changes in the type of commodity planted area due to reduced land area and also because the type of commodity is more easily cultivated and harvest time is faster so that capital turnover faster. Revenues earned after the disaster only reached Rp. 607,142.86.

3.2. Passive Socio-Economic Adaptation Strategies
Data used to determine passive adaptation strategies are data on food expenditure and non-food expenses (education, clothing, household equipment, etc.).

| Description          | Before Disaster (Rp) | After Disaster (Rp) | Difference (Rp) |
|----------------------|----------------------|---------------------|-----------------|
| Food                 | 1,596,428.57         | 1,285,714.29        | 310,714.28      |
| Education            | 664,285.71           | 1,014,285.71        | -350,000.00     |
| Clothes              | 141,071.43           | 79,166.67           | 61,904.76       |
| Household appliances  | 35,119.04            | 2,976.19            | 32,142.85       |

Source: primary data after processing, 2019.

Based on Table 5, it is known that three of the four types of expenditure have decreased after the disaster. Some assistance provided by humanitarian agencies is mostly in the form of food assistance so that the expenditure of respondent farmers to procure food is reduced. In addition, after the disaster, some of the respondents farmers chose to save money on food purchases. This is consistent with research that states that the condition of farmers after natural disasters will try to save on food expenditure [10]. The strategy used is to process food at a minimum where the food comes from the garden. The condition of the respondent farmers at the study site is also the same; farmers choose to reduce the type of food that is usually consumed with the aim of saving. Farmer respondents chose to buy more affordable side dishes such as tofu, tempeh, and or salted fish. Beef and chicken meat consumption began to be reduced, considering the price of these side dishes is quite high. Unlike the case with rice, almost all farmers in the research location no longer buy rice because of the large amount of aid in the form of rice from institutions that focus on humanitarian missions.

Spending on clothing and household appliances also declined. Apart from the large amount of assistance received by respondent farmers, the need for clothing and household equipment is no longer a top priority. Unlike the need for education that does not change. Expenditures for education actually increased because, after the disaster, most of the children of the respondent farmers who had attended college at the University were moved temporarily to other universities in Indonesia. This causes farmers as parents to send monthly money to their children who are outside the city, such as Makassar (Hasanuddin University and Makassar State University), Bogor (Bogor Agricultural Institute), Jakarta (University of Indonesia), Bandung (Bandung Institute of Technology), Malang (Malang State
University), Yogyakarta (Gadjah Mada University), Gorontalo (Gorontalo State University), and several other regions in Indonesia.

3.3. Social Economic Adaptation Networking Strategy
Data needed to find out social network adaptation strategies are formal relations data (borrowing money from financial institutions such as banks, LKMA, and so on); informal relations (borrowing money from neighbors, relatives, and so on). The loans referred to in the following Table 6 are loans made after the disaster.

|                      | Formal relations |                      | Percentage (%) | Informal relations |                      | Percentage (%) |
|----------------------|------------------|----------------------|----------------|-------------------|---------------------|----------------|
| Hold a loan          | 14.29            | Hold a loan          | 7.14           |                   |                     |                |
| Not holding a loan   | 85.71            | Not holding a loan   | 92.86          |                   |                     |                |
| Total                | 100.00           | Total                | 100.00         |                   |                     |                |

Source: primary data after processing, 2019.

Based on Table 6, it is known that 14.29 percent of respondents farmers chose to borrow funds from formal financial institutions, namely Banks. One of the main reasons was that the respondent farmers lacked the capital to start a business again after the disaster, so that the loan offer from the Bank was a new opportunity to try again. The role of financial institutions is vital to support small businesses, especially rural communities and agriculture, which are mostly small farmers with land ownership or land tenure that is narrow, scattered and fragmented so that the possibility to accumulate material capital is improbable [11].

Not much different from borrowing formal financial institutions, respondent farmers also lend capital to informal relations, even though only 7.14 percent. The intended giver of capital is nothing but a relative or close relative of the respondent farmer so that it does not require many requirements in the loan stage undertaken. The average loan amount is IDR 7,642,857, which will be paid back during the harvest season.

Most of the respondent farmers chose not to make loans either to financial institutions or relatives on the basis that the financial condition after the disaster had worsened, and it was not possible to take risks by borrowing money. In addition, the amount of post-disaster assistance in the form of material and immaterial from several agencies makes respondent farmers feel comfortable and sufficient to continue living.

4. Conclusion
After the disaster faced by respondent farmers in Jono Oge village, there are three types of social and economic strategies that are carried out to continue to survive, namely active, passive, and social network strategies. The active strategy shows the ability of the respondent farmers to earn income while still working. Not only respondent farmers who do the work, but their wives and children also work to increase family income. Passive strategies were also carried out by respondent farmers to reduce daily spending (food, clothing, education, and household equipment) to save money. Finally, the social network strategy is carried out to maintain social relations with the community. In addition, the social network was also used by respondent farmers to make loans.

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