

Post-Disaster Livelihood Management Strategy (Case Study of Farmers After Mount Kelud Eruption)

Rif'atul Imaniyah¹, Arief Rachmansyah², Harsuko Riniwati³

¹Master of Environmental Resource Management and Development, Graduate, University of Brawijaya, Jl. Veteran, Malang 65145, Indonesia

²Faculty of Engineering, University of Brawijaya, Jl. Veteran, Malang 65145, Indonesia

³Faculty of Fisheries and Marine Science, University of Brawijaya, Jl. Veteran, Malang 65145, Indonesia

*Corresponding author: rifatulimaniyah94@gmail.com

Abstract— An eruption of Mount Kelud in 2014 that dangerous in primary and secondary have caused damage, that affect the activities of farmers, eruptions cause damage to the installation of water pipes and irrigation canals, agricultural products experienced a crop failure, farmers lose business capital, and the pile material pyroclastic and mud lava flow on the farm cause farmer changes his livelihood and social interaction in the neighborhood farmers. The purpose of this study was to analyze the impact of the eruption of Mount Kelud in 2014 on the livelihood of farmers and analyze the post-eruption recovery strategy for the livelihoods of farmers. Based on the results of SWOT analysis, strategies that can be done to minimize a strategy ST (Strenghts-Threats). Efforts to do is plan a special regulation of the restoration for farmers livelihoods, involving all stakeholders in collaborative post-eruption management, improving farmer management and training systems through empowerment programs that are culturally appropriate, and enhancing relationships between farmers and government aid agencies (village).

Keywords— After the eruption, livelihood recovery, strategy, farmers.

I. INTRODUCTION

Mount Kelud is one of the active volcanoes located on Java, Indonesia. Mount Kelud is classified as a Strato type volcano, administratively located in the Kediri Regency, Blitar Regency and Malang Regency, East Java Province. Geographically, the peak is located at the position of 7056'00" SL and 112018'30" EL with an altitude of 1.713 at masl.

Throughout its history since 1901, Kelud recorded eruption has undergone seven times, namely in 1901, 1919, 1951, 1966, 1990, 2007 and 2014. This volcano is known in the world because of the disaster lava eruption that occurred in 1919 and has claimed lives of more than 5000 people. Mount Kelud included in this type of type strato volcano eruption St. Vincent with explosive eruptions characteristic. [1]

The study of the processes, types and products of the Mount Kelud eruption showed that the height of the eruption pile reached more than 10 km, could spew 150-200 million m³ of pyroclastic material in a relatively short time (less than 10 hours). Every eruption always ends with the formation of a lava plug in the hole of his head. The eruption of Kelud mountain always explosive. Based on a study of the sequence of the Mount Kelud eruption in 1990, on a volcano that has a crater lake, the eruption process is always preceded by a steam eruption (phreatic), then develops into phreatic-magmatic and

magmatic eruptions which settles the flow and fall of pyroclastic material then. Mount Kelud eruption results in VEI varying from a scale of 1 to 4 and occurring in a short time relatively (less than 10 hours). [2]

An eruption of Mount Kelud on February 13, 2014 resulted in much damage and loss of material and non-material. Damage to buildings, irrigation channels, roads, traditional markets, and also devastated rice paddies and fields owned by farmers in the region. Eruption causes deposits of volcanic material such as ash, sand, gravel to boulder in a farmer's agricultural area.

Based on the record of the Posko Induk Penanganan Bencana Gunung Kelud, the biggest losses occurred in the agricultural commodities, such as rice, corn, soybeans, peppers, tomatoes, potatoes, pineapples and roses reached 1.1 trillion. While the losses in the plantation sector reached 84 billion, with commodities such as cocoa, cloves, sugar cane [3]. Region Kelud in Malang, there are regions with the most severe impact of eruption of the Village Pandansari Ngantang. Dust and sand material mixed with gravel cover a total of crops and vegetables there. List of commodities including rice damage covering 1,395 ha, 2,053 ha of maize, carrots 48 ha, 129 ha of beans. For vegetables, namely potatoes 83 ha, 125 ha cabbage, red onions 185 ha, 175 ha of tomatoes, cabbage 45 ha, 158 ha of apples.

The focus of this study was to determine the impact of the eruption on the livelihoods of farmers and effort strategies that can be done to minimize the impact of the eruption of Mount Kelud.

II. RESEARCH METHODOLOGY

A. Location and Time

This research has been carried out in Pandansari Village, Ngantang District, Malang Regency. The data were collected on November until December, 2018.

B. Research Methods

The data were obtained through a interviews and questionnaire consisting of 85 respondents, with the characteristics of the respondents is farmers that affected by Mount Kelud eruption in 2014 who worked on private land, BPBD, Dinas Pertanian and NGO. And observations based on physical conditions and existing activities. Data collection techniques used in this study is a survey of primary and

secondary, through observations (observation), in-depth interviews and collecting data from relevant government agencies or institutions, books, and journals.

The analytical method used is quantitative descriptive analysis method. In the execution of the descriptive analysis presented through tables and graphs as tools in its explanation. And SWOT analysis as a basic reference in the planning of management strategies after the eruption.

III. RESULTS AND DISCUSSION

Land has an important position for the owner. For a farmer who has no other source of livelihood, land is a major life capital in pursuit of agriculture in order to fulfill the survival of children and their families, so cause of that no land affecting a farmer can not do farming. Generally, farmers do not have any other skills to earn a living, so when agricultural business stopped, it is difficult for a farmer to shift in other livelihood. [4]

Pandansari Village was one of the villages located in Ngantang District, Malang Regency, East Java Province. Distance of the village from the center of the District of Ngantang is 12 Km. The village is divided into 7 hamlets. They are Plumbang, Bales, Munjung, Sambirejo, Wonorejo, Klangon and Sedawun Hamlets. Geographically located at an altitude of 600 – 1350 masl with a slope of 15-55⁰. Meanwhile, Kebonrejo Village was one of the villages in Kepung Subdistrict, Kediri Regency, East Java Province. Kebonrejo village is a village that is directly adjacent to the forestry area which is the closest to the Gunung Kelud crater area of ± 8 Km. The village is divided into 4 hamlets. They were Tambaksari, Tegalorejo, Panggungsari and Kebonrejo. Kebonrejo village is located at an altitude of 400-750 masl with a slope of up to 35⁰.

The Eruption of Kelud on February 13, 2014 caused a lot of damage and loss both material and non-material. Volcanic material affected farmers through volcanic ash, which bursts into space and then descended on agricultural land that covered rice plants, crops, horticulture in various thicknesses and areas, and volcanic mud flow that physically damaged agricultural crops with different levels of severity and extent that caused problem for farmers' socio-economics. So that the impact received by farmers was quite severe, besides the loss of property, it also caused the lose of their livelihoods and farming.

When Mount Kelud erupted again on February 13, 2014, ash, sand and gravel were recorded to reach a radius of 30 kilometers, especially from the west to southwest of the Mount Kelud crater. The report of the Meteorology, Climatology and Geophysics Agency (BMKG) showed that ash and sand in the 1.500 m layer in the air carried wind to the northeast, in the 5.000 m layer carried to the northwest, and at 9.000 m carried to the westward. Although the wind carrying ash and sand seemed to have a certain pattern, from the monitoring of various mass media, ash rains were reported spreading in all directions, covering the northern part of East Java, Central Java and West Java. Ash and sand seemed to cover the surface of the land and buildings in Pasuruan,

Surabaya, Sumenep, Solo, Boyolali, Yogyakarta, Cilacap, Ciamis, Bandung, and Sukabumi.

1. Post-eruption of Mount Kelud in 2014 in Pandansari Village

An eruption of Mount Kelud, followed by volcanic mud flow resulted in some areas, one in the village Pandansari, Malang regency which is the most severely affected villages. The damage occurred in various sectors which are permanent, semi-permanent and non-permanent. Damage due to volcanic mud flow ash material damage the housing, transport infrastructure, economic, productive, social, education, health, governance, security and order. Munjung Hamlets, Wonorejo (Pait), Sambirejo (Kutut) which is the most severely affected areas as a result of this eruption in Pandansari Village.

Eruption has caused houses were damaged, most of the houses with the kind of permanent and semi-permanent houses suffered minor damage and a small portion was severely damaged (non permanent home) due to the building structure is not able to withstand loads of sand erupted material and pumice with a diameter of 1-2 cm with a thickness of 2-3 cm, causing damage to the strained under the weight of heavy material. Mount Kelud eruption also caused some village roads to be damaged due to being hit by slides and heaps and volcanic mud flow flood. One of them causes Klangon Bridges and Sambong bridge which is a liaison between the hamlets in the Pandansari village were damaged.

An eruption of Mount Kelud in 2014 also led many clean water network managed by the public community get damage (Table 1), whereas the slopes of Kelud is an area of water resources, and a source of irrigation water for the people in Ngantang and Kasembon District, Malang Regency. Previous society independently build a network of water through the spring. This activity was done in an effort to suit the needs of clean water that is partly used for agriculture and fisheries. Eruption has caused problems, not only the installation of the pipeline even in the water source affected. Most Dam is also not functioning. In the village of Sambong Dam, Sedawun Dam and Klangon dam damaged.

TABLE 1. Damage to the pipeline in Pandansari Village

Hamlet	Length (m ²)
Plumbang	3500
Bales	4000
Sambirejo, Munjung, Wonorejo	22500
Klangon	7000
Sedawun	9000

Source: BPBD Malang

For the productive economic sectors, eruption and volcanic mud flow flood that occurred has paralyzed economic activities in the surrounding area of Mount Kelud. Especially for farmers because the majority of the villagers are farmers, although there are some who also works as a miner. The presence of volcanic material have destroyed large areas of farmland in the village of Pandansari. All were heavily damaged that farmers suffered heavy losses due to crop failure. The thickness of ash up to 30 cm makes the condition of the land covered with volcanic ash and damages crop

production, gardens damaged, causing hollow in vegetable plants, an old rice plants harvesting time mixed with sand, so this make decreases the selling prices. And the presence of volcanic mud flow that hit agricultural land and the lack of assistance for farmers whose lands were completely destroyed, caused some farmers in Pandansari Village turn their livelihood into miners, while their agricultural land was able to be cultivated with makeshift tools.

2. *Social and Economic Conditions of Farmers After Mount Kelud Eruption*

Settlers on the slopes and valleys of the volcano not only regard volcanoes as disasters, but consider the presence of volcanoes as a blessing. The extent of the area used as agricultural land serves to support developments in the agricultural sector. By utilizing existing agricultural land, it can support farmers' livelihoods.

Throughout the history of Java, the mountains of Java have always been populated with settlements because they are a source of life, fertilizing agriculture from water, volcanic ash and minerals contained in it. On the other hand, volcanoes are a source of catastrophic deaths between hot clouds, lava and their eruptions [5]. Table 2 shows the conditions in Pandansari Village.

TABLE 2. Pandansari Village condition

Condition	Pandansari
Material eruption of Mount Kelud	Volcanic ash, sand and rocks with a diameter of 1-2 cm with a thickness of 2-3 cm and volcanic mud flow
Agricultural conditions after the eruption	Agriculture disturbed and total crop failure as a result of the closing of land by rocks and sand, rice field boundary is lost, damaged irrigation installations
The majority of rural livelihoods	Farmer
Origin of water for agriculture	Irrigation
Rather livelihoods of farmers after the eruption	As a result of some of the material covered farmland and volcanic mud flow eruption cause several farmer turned into miners
Liveliness and farmer institutions after the eruption	Administratively, there are groups of farmers, but the farmers' participation in activities decreased after disaster
Times farmers stopped working after the eruption	The majority of farmers stopped working 1-2 months, focus on improving the house, cleaning material on agricultural land
Capital farming for survive after the eruption	Family loans, banks and government aid
Help farmers obtained after the eruption	Seeds, fertilizers, cultivators, hand tractor, tax exemption in the first year after the eruption
Education facility	Only primary

2014 eruption of Mount Kelud impact on the activities of farmers constrained. House damaged farmers and agricultural production and crop failures. Eruption occurred either cause damage to the physical, environmental, social and economic. Lost sources of income / production resources. Moreover, the lack of preparation of farmers in the face of the impact of the eruption of Mount Kelud will be very severe. Agricultural activity stopped after the eruption, due to agricultural land

entirely covered by the eruption of material in the form of volcanic ash and pumice.

Most farmers in the village of Pandansari planting onions as agricultural commodities. According to farmers, it needs a long time to restore the agricultural land to be replanted. Even to this day there is still agricultural land in the village of Pandansari that can not be cultivated due to the impact of volcanic mud flow, so that the majority of farmers whose land covered eruption material change their work as a miner. Those who work as sand miners decided to work for a while until the land can be replanted. Because the direction of changes in land use of farmers is inseparable from the factors that affect both physically and non-physically [6].

Farmers who own land experience crop failure due to the eruption of Mount Kelud in 2014, no production can be harvested. Farmers experience loss of planting capital. In the form of seeds, medicines and maintenance costs. The eruption caused a huge loss. In general, the business capital used by farmers to survive a disaster is a bank loan through special requirements that must be met and must be returned immediately. In their daily lives, farmers use business capital from bank loans, family loans, own capital or a combination of them. However, some farmers expressed no feeling of loss from their livelihoods due to eruption because the assistance was felt to be sufficient to meet their daily needs. The help of food ingredients and building materials greatly helps farmers to survive after the eruption. Repairing a house is the main thing that is generally done by farmers, then cultivating agricultural land to support family needs.

After the disaster, it also causes changes in social interactions within the farmers' environment. In Pandansari village there was a decrease in interest of farmers to participate in activities. This change was caused by the large amount of assistance that came in so that farmers experienced dependency in assistance. In addition, there is also a result of inequality in the acquisition of aid and overlapping and is considered not on target, causing misunderstanding. The inactivity of farmer groups after the eruption was also felt to affect the condition of farmers after the eruption. And from the research founded the majority of farmers are in the productive age of work. The existence of human capital in productive age helps the post-disaster adaptation process relatively faster.

3. *Management Strategy After the eruption of Mount Kelud*

Recovery of post-disaster areas is the responsibility of affected local governments along with the central government, the community and the business world. A rehabilitation and reconstruction action plan is needed that correlates with development programs and activities that have been determined by the local government. Post-disaster rehabilitation and reconstruction activities are principally efforts to restore the living conditions and the affected environment to better conditions than before.

Farmers in Pandansari Village are forced to use a defensive strategy, in addition to capital and land issues, especially farmers in Pandansari Village using the sand that accumulates in their fields. Some of them even prefer to migrate outside the area in hopes of getting a better life.

Farmers' way to survive from the devastation caused by disasters through activities to become sand and stone miners, become farm laborers, change and reduce their agricultural commodities, become construction workers / projects, rent and cultivate land in other villages.

The reconstruction and rehabilitation strategy in managing farmer's livelihood after the eruption was analyzed using SWOT. SWOT analysis will interpret strengths, weaknesses, opportunities, and threats in post-disaster management efforts by determining the weight and rating in each assessment.

Based on the results of the matrix space analysis in figure 1, it is known that the post-disaster management strategy position is in quadrant II. So that the relevant parties can use existing internal forces to overcome the threats that arise. The strategy that must be implemented in an effort to minimize the impact of eruption is a diversification strategy.

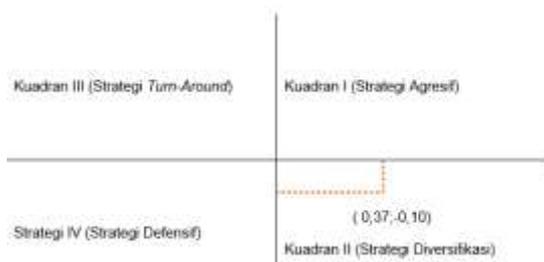


Fig. 1. SWOT Matriks resulted for livelihood after eruption

During the crisis period, farmers became dependent on aid. Even though the existing assistance cannot last long, especially if the assistance does not fulfill all the long-term needs of life and restore the condition of the farmer in time. Therefore, safeguards are needed so that farmers feel safe and return the livelihoods of farmers by immediately restoring their livelihoods.

Based on the conditions of damage and losses due to the eruption and cold lava of Mount Kelud, especially in the villages of Kebonrejo and Pandansari Village which affected all sectors. Therefore, the rehabilitation and reconstruction action plan will cover the affected sectors, especially social and economic sectors. Recovery is carried out based on disaster risk mitigation and reduction with the aim of minimizing losses that will arise if a disaster recurs in the future.

For the economic sector the program can be done through recovery of agricultural land immediately and improvement of water supply, as well as the supply of subsidized production materials. This is done so that the farmer does not stop working too long. Whereas for the social sector the need to increase education as a forum for gathering farmers and providing appropriate education, both in the management of land and plants that are appropriate for the purpose or new livelihood activities program. The assistance to be provided must be through a pattern of community empowerment by paying attention to local wisdom, character and culture of the local community in accordance with the established mechanism.

There is encouragement and support for the rehabilitation and reconstruction of physical infrastructure in the economic and social fields such as the provision of village markets to maintain stable prices in farmers, stimulants for the economic recovery of farmers oriented towards medium and long-term development, encouragement and facilitation needed to support farmers in accessing banking and non-banking financing, providing facilities in loan restructuring through rescheduling, postponing debt payments in accordance with OJK (Financial Services Authority) regulations and tax deductions for farmers and indispensable provision of assistance in business recovery including providing entrepreneurship training new livelihood opportunities). As well as the need for a disaster risk reduction institutional forum at the hamlet and village level to maintain the continuity and transparency of the disaster risk reduction process. To maximize the rehabilitation and reconstruction efforts that will be carried out, the government also needs to build and develop partnerships with various parties, including non-governmental parties. For this reason, the government needs to coordinate, consolidate and consult with related parties.

IV. CONCLUSION

After the catastrophic eruption of Mount Kelud 2014 impacted farmer activities, as a result of damage to water pipe installations and irrigation channels, crop production failed, farmers loss of business capital, and pyroclastic and mud lava flow deposits on agricultural land caused changes in livelihoods and social interactions in the farmer's environment.

Based on the results of the SWOT analysis, the strategy that can be done to minimize the impact of the eruption on farmers' livelihoods is the ST (Strengths-Threats) strategy. Efforts can be made is planning specific regulations related to the restoration of farmer livelihoods, involving all stakeholders in collaborative management after eruption, improving the management system and skills of farmers through empowerment programs in accordance with culture, and increasing coordination between farmers and the nearest government institution (village).

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