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Strategies of Adaptation Capacity Improvement Among The Natural Disaster Victims

Sri Suharyono✉ *and Kurnia Suci Indraningsih*
Indonesian Center for Agricultural Socio-Economic and Policy Studies
✉*Correspondence Email: srisuharyono@gmail.com*

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Abstract

The natural disaster eruption of Mount Merapi in 2010 had relocated several farming communities. Building a new life after a disaster in an unfamiliar environment posed a tough challenge and required an adaptation strategy. This study aimed to investigate the adaptive capacity possessed and its improvement strategy among Mount Merapi eruption victims. The current study was conducted in the permanent shelter of Kuwang and Randusari, Argomulyo Village, Cangkringan District, Sleman Regency, Yogyakarta. Qualitative descriptive method applied to analyze the data. Eighty study participants from different household were selected purposively. Findings revealed that the adaptive capacity of the institutional memory, innovative learning, and connectedness was in poor, poor, and good category, respectively. Community adaptation strategy included three aspects, namely: physical adaptation by house renovation, economic adaptation through job diversification, and social adaptation by social activities involvement.

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INTRODUCTION

One of several natural disasters that commonly occur in Indonesia is volcanic eruptions. The eruption of Mount Merapi in 2010 had destructed the agricultural land in the slopes of the mountain. Further, it initiated the relocation of the settlements due to the damaged caused by the volcanic material of Mount Merapi.s

Permanent shelter was a new place of residence for the relocated victims. It began to be occupied at the end of 2014 (Mei *et al.*, 2016). The shelter was situated in Sleman Regency, spread over 18 regional points covering three sub-districts, namely Cangkringan, Ngemplak and Minggir. The location of the shelter still potential to be exposed to the eruptions. This situation requires the community to be able to adapt, not only to the threat of the eruption, but also to the new atmosphere of life in the shelter.

Local community in the slopes of Mount Merapi are farmers who highly depend on the natural resources of Mount Merapi for their livelihood. Farming is a culture that has been unified in their life. The bond between the local community life and the natural resources of Mount Merapi is extremely firm (Tan, 2012). The sustainability of their farming business depends on the natural resources served the Mount Merapi. Budiyanto (2021) found that that sustainable agricultural systems in the Mount Merapi area could be applied to improve soil sustainability and crop productivity.

Several studies related to community adaptation to natural disasters have been conducted. Studies of the water crisis disaster identified two types of adaptation: the structural and cultural (Kusumartono, 2012). Structural adaptation reffered to means done due to intervention brought by outside parties, such as government policies and aids. Cultural adaptation is the traditional patterns used by the community to cope with difficulties based on their beliefs from generation to generation. Hardoyo *et al.* (2011) and Syah (2012)) examined the community's adaptation strategy in dealing with tidal natural disasters. This study found that the local community physically coped with the post-disaster damaged, such as renovating their house (through making embankments or elevating the house position).

Iswardoyo (2013) had demonstrated the community adaptation to the *lahar* (*pyroclastic flow*) of flood disaster in Kemiren village, Srumbung, Magelang, Central Java from the perspective of the actors (the authority figures and community members). Sabo technology was introduced by the authorities to adapt with the situation. In the other hand, the local community developed an institution to facilitate the village natural and potential management. A more specific study on the adaptation of relocated natural disasters victims done by Ibrahim & Khairulyadi (2019). They investigated the disaster adaptation among fishermen population after the relocation due to the tsunami.

The novelty of this studies included the examination of the adaptive capacity of Mount Merapi eruption victims by using the concept of Longstaff et al. (2010). They explained that adaptive capacity consists of three components: institutional memory, innovative learning, and connectedness. The aims of this study were: 1) to identify the adaptive capacity among Mount Merapi eruption victim in the shelters, 2) to identify strategies adaptive capacity improvement among Mount Merapi eruption victim in the shelters.

RESEARCH METHODS

Study Location and Duration

This study was conducted at the permanent shelter of Kuwang and Randusari, Argomulyo Village, Cangkringan District, Sleman Regency, Yogyakarta in October 2019. This area was severely affected by the Mount Merapi eruption. Kuwang and Randusari purposively selected as the study location due to its diverse community characteristics. We expected the diversity on their social and economic situation. Permanent shelter of Padukuhan Kuwang was occupied by resident from the area of Padukuhan Bakalan and Gadingan. Permanent shelter of Padukuhan Randusari was populated by resident from the area of Padukuhan Bronggang, Suruh, Banaran, Jetis, Jaranan, Karanglo, Cangkringan, Panggung, Kliwang, and Teplok.

Population and Sample

The study population were head of family in the Kuwang and Randusari, with a total of 260. Eight participants then purposively selected to participate in this study.

Data Collection

Quantitative and qualitative approaches were enrolled in this study. A survey method applied to gather the quantitative data. Survey method widely known as a technique of data collection from a respondent who were a sample of one population by using a semi-closed questionnaire (Singarimbun & Effendi, 1989). Qualitative data were collected through observation and interview sessions. We also complemented our analysis by involving secondary data that obtained from several well-established institutions, such as the Regional Disaster Management Agency of Sleman Regency, Argomulyo Village Government, Head of Village of Bakalan and Gadingan Padukuhan, and other related sources.

Data Analysis

Qualitative descriptive analysis employed to address the first and second aims. Quantitative data was collected through questionnaires and processed by using Microsoft Excel 2010. Qualitative data analysis conducted in four stages: data collection, data reduction, descriptive data presentation, and the formulation of conclusion (Miles & Huberman, 1992).

RESULTS AND DISCUSSION

Adaptation capacity of victims of the eruption of Mount Merapi

Adaptation capacity is the capability to adapt to changes after a disaster occurence. Longstaff *et al.* (2010) explained that adaptive capacity was a function of the ability of individuals or communities to: 1) store and recall experiences (institutional memory); 2) use memory and experience to learn, innovate and reorganize memory and experience as resources for learning, adjusting to the demand of a changing environment (innovative learning); and 3) connected with other people, within and outside the community (connectedness).

The majority of resident's occupation in shelter of Kuwang and Randusari were mostly agricultural and livestock farmers (31.25%). In addition, 21.25 percent and 16.25 percent of residents were working as entrepreneur and sand miner,

respectively. Sand and stone (*sirtu*) were natural resources that can be utilized by the community. *Sirtu* from the eruption of Mount Merapi is known as a good for building materials. Table 1 shows the distribution of occupation among the residents.

Tab1e 1. The Number and Percentage of Participant According to the Main Occupation

No	Type of Works	Amount	Percentage (%)
1	Farmer	23	28.75
2	Livedtock Farmer	2	2.50
3	Entrepreneur	17	21.25
4	Civil Servant	4	5.00
5	Private Employee	13	16.25
6	Sand Miner	16	20.00
7	Unemployed	5	6.25
	Total	**80**	**100.00**

Source: Primary Data (2019)

Profitable sources of livelihood were sand mining, livestock farming, and agriculture. Sand mining activities had attracted many people because it provided instant and regular income (Nofrita & Krol, 2014).

Institutional memory

Institutional memory is defined as the ability to recall the past experiences into current or future knowledge. Public knowledge about the eruption was obtained from the eruption events that had happened to their life. Longstaff *et al.*(2010) referred institutional memory as the accumulation of local experience and knowledge that was passed down from generation to generation.

The 2010 eruption of Merapi is an upredictable event. Residents who came from Bakalan and Bronggang Padukuhan have never been affected by the flow of Merapi's hot clouds. Mei *et al.* (2016) stated that based on the collective memory of residents, prior to the 2010 eruption, Bakalan and Bronggang Padukuhan area have never been damaged by volcanic disasters (*pyroclastic flows*). Study by Umaya et al. (2020) showed that the south to southeast region was experiencing the most severe eruption and the largest eruption in the last 140 years. Livelihoods include livestock, farming, tourism and mining activities had been destructed by the eruption. The eruption in 2010 had destroyed their village and triggered traumatic responses. This institutional memory classified into poor memories.

Innovative learning

Innovative learning is defined as the ability to utilize knowledge from past experiences to create or develop new method of adaptation to adjust with the existing changes. The eruption has caused several environmental changes that require people to be more innovative in utilizing natural resources, especially to meet their daily life need. One of the economic issues arose in the shelter was the difficulty to get

appropriate occupation after the disaster. Table 2 reveals their perspective toward the job opportunities after the disaster.

Table 2 Perspective of Job Opportunities After the Disaster

Description, Level of Satisfaction	Amount	Percentage (%)
Unsatisfied	11	13.75
Poor	41	51.25
Moderate	15	18.75
Satisfied	13	1.25
Very Satisfied	0	0
Total	**80**	**100**

Source: primary data (2019)

Table 2 shows that 51.25 percent of participants were not satisfied with the job opportunity. This finding indicated that participants may encounter challenging time in obtaining proper occupation. Study by Aminay & Sahay (2011) had stated that relocation had an impact on the loss of productive sources including land, income, and livelihoods. The locations of work, fields for farming, and rivers for sand mining became more distant after the disaster. It would require more transportation costs. The impact of the eruption also affected their economy. Umaya *et al.* (2020) highlighted the extreme changes on the ecosystem and the economy field brought by the eruption; resulting a transition from the livelihoods from livestock farmer to tourism service businesses.

We also noted their efforts in obtaining a better occupation as their main or side job to meet their daily life need. This was shown by the presence by several grocery shop business, laundry business, and mushroom cultivation business in the area of shelter. Some housewives also tried to pursue their side income from working as helpers.

In addition, aid for economic recovery had been delivered by the authorities. Although some residents were forced to sell their livestock due to meet their daily life need. Agriculture and livestock farming still had the potential to be developed. Nofrita & Krol (2014) had suggested farming activities as main livelihood for the community in the Merapi area. However, the potential of the farming activities had not been utilized in optimal way. Further, issues encountered in the livestock business was the communal size cage. The capacity of the communal cage could not be expanded, but the number of livestock cattle was kept increasing. Also, the location cattle feed was quite distant.

Currently, there are several private sand mining companies operating around the Gendol River area. This situation added to the variety of jobs in the shelter area. They were working as a porter (lifting and unloading sand into trucks), a truck driver for a sand mining company, or being a security guard in the mining area.

Another potential is the natural tourism sites, especially those that situated in Bakalan Padukuhan. Buildings affected by the eruption were used as a nature museum for tourism and educational purposes. This potential has been developed by the Sleman Regency Government under the name of Sleman Volcano Park. This finding was supported by a study by Dillashandy & Panjaitan (2019) that highlighted

the potential of a tourism activity as a new area of work among the eruption victims. Merapi Lava Tour is a natural tourism activity involving a tour through the areas of hot clouds by driving a *Jeep*. This tour is located in the Kinahrejo area with a famous object, "Museum Hartaku". The management of this tourism activity was run by the local community itself. Related authorities only performed as the supervisors, advisors, and authorization providers (Mulyowati & Shanti, 2016).

The majority of the residents found to be returned to their old jobs after seven years living in the shelter. New jobs besides farming and sand mining have not been carried out and tend to be conducted personally, not collectively. Hence, their innovative learning aspect was quite poor. They did not show good quality of collective coping mechanism in dealing with post-disaster life. They tended to cope with their problem individually, not in collective ways. This was in line with the finding of Maharani *et al.*(2016). This study discovered that social vulnerability mostly affected the relocated community and women population after the Mount Merapi eruption. Muir *et al.*(2019), revealed that relocation was a strategy for survival in overcoming the disasters, but those who returned to their places of origin had showed a better level of mental health.

Connectedness

Connectedness is defined as a connection, namely the establishment of social interaction between residents of the temporary shelter and with local residents. Connectedness is viewed from two components: social relations and leadership. The social interaction of the victims of the eruption of Mount Merapi who currently lived in Kuwang and Randusari Shelter was quite open. They had tendency to exposed themselves to outsiders, especially during the daily social activities. Many external donors provided aids, both individually and coordinated through institutions during the disaster response period. Formal leadership, namely the head of the village or *padukuhan* (*dukuh*) played as an actor to disseminate and enforce the national or local policies.

The majority of residents of Kuwang and Randusari shelter stated that they were quite satisfied with the relation with outside parties with a percentage of 68.80 percent. The residents of the Kuwang and Randusari shelters were still relatively friendly. Social interactions spotted in several locations such as patrol posts, mosques, and communal cages. Social interactions were becoming closer and requent due to the distance between houses.

The quality of the social interaction of the shelter residents could be perceived externally from the level of satisfaction towards the connection between the shelter residents and external parties (Table 3).

Table 3. The number and percentage of respondents based on the level of satisfaction with the external connection between the residents of Kuwang and Randusari Shelter

Level of Satisfaction	Number	Percentage (%)
Unsatisfied	1	1.20
Poor	9	11.30
Moderate	55	68.80
Satisfied	14	17.50
Very Satisfied	1	1.20
Total	**80**	**100.00**

Source: Primary Data (2019)

Social interaction between residents of the temporary shelters is also maintained through a social media platform, such as Whatsapp (WA). They organized a WA group for Sedulur Bakalan as a media to sustain their social interactions in Padukuhan Bakalan. Randusari Huntap also had a WA group, named Paguyuban Huntap Randusari.

Table 4 reveals that the majority of social interaction (36.30%) conducted in direct way. This way of interaction was common among older residents. They had limitations in using communication tools. In addition, adjacent spaces between houses had made more frequent social interaction.

Table 4 Number and percentage of types of media for social interaction between residents in Kuwang and Randusari Shelter

Media Type	Amount	Percentage (%)
Direct contact	29	36.30
Electronic devices	46	57.50
Flyer	1	1.20
Others	4	5.00
Total	**80**	**100.00**

Source: Primary Data (2019)

The strong community ties are also supported by their kinship blood relations. Most of the residents living in Kuwang and Randusari shelter were relatives. The division of housing in the shelters is also done based on their area of origin. This situation served a stronger social tie between residents. This kinship also had a massive role during the occurance of Mount Merapi eruption. Aristianti & Christiawan (2019) showed that kinship connection was related to the evacuation destination and the presence of relatives.

Social activities together are commonly and frequently conducted, especially during a *hajatan* (celebration event), *gotong royong* (communal work), and *ronda* (patrols). These social-based activities fostered the spirit of collectivity and a "authentic" role played by the community. Relation among members in the community had an important role in facilitating disaster preparedness (Sagala et al., 2009).

Strong social ties also foster a sense of belonging among the residents. This condition was in line with the concept of shelter development which from the beginning of the planning used a community empowerment approach. The goal to establish a sense of ownership among the residents. Widodo (2019) stated that the shelter development policy with a community empowerment approach had estblish the community as an object and subject in the implementation of the shelter development policy. The local community is assisted to contribute their active role in the initial to the end of the stage.

In addition to social interaction, connectedness is also supported by leadership. A good leadership that was capable to manage the community during a disaster or post-disaster to reduce the adverse of the disaster (Demiroz & Kapucu, 2012). Bakalan residents used to lead by a *dukuh*. *Dukuh* served a major role, especially to direct the time and provide place for the evacuation. Aids was also channeled through the *padukuhan*. Istikasari (2017) also highlighted the role leadership in disaster planning and management, communication and utilization of appropriate information technology, organization of appropriate decisions, and collaboration.

The existence of *paguyuban* (association/organization) also assisted the leadership management in the shelter area, especially in the Randusari. *Paguyuban* aimed to facilitate the coordination of residents that came from different regions. *Paguyuban* led by a head of *paguyuban* who would mobilize collective social action for residents such as mutual cooperation, clean water management, and other social activities.

Based on the findings, the connectedness between residents were quite well. They supported by quality social interaction and good leadership. Good community connectedness would build a better community (Longstaff *et al.*, 2010).

Adaptation Capacity Building Strategies

The improvement of adaptive capacity is delivered through three aspects, namely: physical, economic, and social.

Physical Aspect

The shelter building is a housing area, a house with the type of 36 with an area size of 100 m^2, adjacent to each other, and had no yard. Contrary with the shelter situation, their previous house was quite spacious with yards and separated in quite distant space with other houses. During the construction of shelter, the local government granted 30 million for each house to residents who were willing to be relocated. Resident who refused to be relocated would use their own money to build houses. The majority of participants stated that they applied the compensation funds from the dead livestock to build houses and purchase their temporary living expenses (Setyadi *et al.*, 2016).

Residents with extra funds had modified the housing area to be more comfortable living area. However, resident with limited funds had not conducted any changes on their house. Residents in Kuwang and Randusari shelter had remodeled their houses. Some residents added more rooms and second floor in the existing building. This finding was in line with Mei *et al.* (2016) that found 47 percent of the residents of Kuwang shelter had renovated their house to make a more comfortable spaces of living.

Economic Aspect

Economic adaptation could be observed by resident's daily activity. Most of the residents have not experienced change in terms of work. This condition was in line with a study conducted by Suprapto et al. (2016) on post-disaster community in the Pagerjurang shelter. They found that most residents still do the same livelihood as before moving to the shelter, namely agricultural and livestock farmer.

Distance has been a major concern for the farmer. They needed additional costs or energy to find to their agricultural field. Utami *et al.* (2018) suggested that the concept of post-eruption land management needed to be formulated based on land configurations. This concept was related to local conditions such as topography, hydrology, meteorology, and natural drainage systems.

Older farmers were quitting their cultivation activity, handed it to their heirs, or let other farmer cultivated in their land. Livestock farmer should will to spend more time to discover feed for their livestock due to the relocation.

A study of Rahman et al. (2019) found that relocation had limited the opportunities to engage in various economic activities (which were once important), and has also restricted the married and adult from owning their property. People who are living in new residentials have difficulty accessing new land and property around their new area. It usually happens because of its high prices and crumbly structre of the land to build an housing area.

Adaptive strategies engaged were the diversification of income sources. We aimed to add more source of income in the shelter, such as service-based businesses, food stalls, tourism activities, *ojek* (driver), and mining. Some participants in Kuwang Shelter stated that they had opened a laundry business at home, operated a grocery shop, and run a mushroom cultivation business.

Social Aspect

Social adaptation is essential to manage the social constraints in the shelter. Social constraint arises along with the higher intensity of social relations. The distance between houses were quite far and relatively separated from each other before the disaster. This situation produced lower intensity of social interaction between residents. Further, the majority of the resident spent most of their times in their agricultural land, cultivating their plant. Their free times usually filled with gardening activity in their house yard. However, the distance between houses was quite close and only separted by a wall in the current shelter. No house yard available in the shelter. This situation created more frequent social interaction between residents.

New issues such as competition between the residents, social jealousy, and conflict might occured. Social jealousy commonly arose due to unfair perception of aids delivered by the authorities, eg. cattle. The close distance between houses also increased the social costs associated with the habit of *amalan* (giving donations). The adaptation strategy organized to deal with this issue was related to social bonds enhancement between residents. Activities such as *yasinan* (a local religious ceremony), *amalan* (donation), *gotong royong* (communal work), social gathering, and *ronda* (night patrol in a small-scale of area) could be applied as strategies to increase the social adaptation capacity among the residents.

These finding was in line with by Syapitri & Hutajulu (2018) that had highlighted the adaptation behavior revealed residents of Gurukinayan Village during the eruption of Mount Sinabung, the psychological aspect. The majority of the residents admitted their sadness after the eruption. However, they set a positive mindset to survive. They also found an adaptive coping in the socio-economic aspect. The attachment and social interaction between the residents were very strong and solid. This situation pushed them to stay positive about their life. The element of infrastructure improvement also identified as an adaptive behavior. Residents were putting their time to repair houses and land after the eruption.

This finding was also asupported by a study conducted Bakkour *et al.*(2015). They mentioned several issues on post-disaster situation: lack of appropriate infrastructure, complex interactions between authorities, dependency on funds from external parties, and limited quantitative documentation on losses. material and human. These issues hindered the adaptive capacity of the system.

The strategy for adaptive capacity improvement among communities affected by natural disasters is illustrated in Table 5 below.

Table 5. Adaptive capacity improvement in the permanent shelter

No.	Description	Current Situation	The Expected Situation
1.	Adaptation Capacity		
	a. Institutional Memory	Poor	Disaster mitigation understanding
	b. Innovative Learning	Poor	Utilizing natural resources for a better life
	c. Connectedness	Good	Good connection between the community and authorities
	1) Social Relations	Similar social relations with the previous residence	Closer social relations
	2) Leadership	There was only one head of area in the previous residence, while the permanent residence had several head of areas	A leader who capable managing community with diverse characteristics
2.	Adaptation Capacity Building Strategy		
	a. Physical Aspect	The house has been partially developed	The capability to design and build a comfortable housing
	b. Economic Aspect	Livelihood of farming and livestock	The capability to diversify their livelihoods, including: mining, natural-based tourism, household-based business
	c. Social Aspect	Routine social interactions lead to jealousy	Strong and harmonious internal and external social interactions of the residents

Source: Primary Data (2019)

CONCLUSION

The adaptive capacity of the victims of the natural disaster of the Mount Merapi eruption in the aspect of institutional memory, innovative learning, and connectedness was classified in poor, poor, and good category, respectively. Community adaptation strategy included three aspects, namely: physical adaptation by house renovation, economic adaptation through job diversification, and social adaptation by social activities involvement.

RECOMMENDATION

Policies that manage the community business activities of employment diversification need to be well regulated in Regional Regulations. Regional Regulations would provide a legal foundation for the certain amount of budget required to help disaster victim cope with their post-disaster life. The development of the tourism sector should have considered the safety factor. Even so, the fulfillment of the community needs also required more attention to alleviate their burden of life after the disaster. The relocation policies need to be complemented by adaptive capacity improvement through disaster mitigation training in improving their resilence in dealing with disaster.

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