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RESEARCH PAPER

Disaster risk reduction of Mount Kelud eruption based on capacity building: A case study in Kasembon District, Malang Regency

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Abstract. The ability to respond and recover from disasters is highly dependent on the community's capacity. This study assessed the community's capacity level in Kasembon District, an area that was impacted by the Mount Kelud eruption in 2014. Capacity level assessment is done by identifying pentagon asset components, covering human capital, social capital, financial capital, natural capital and physical capital. Bayem is a village with the medium capacity in spite of the low ownership of natural capital, financial capital and physical capital as it has been supported by the active participation of the community within the village organization. Pondok Agung, Kasembon, Sukosari and Pait are four villages which are almost the same with Bayem, but the involvement of the community is not as active as in Bayem. Based on the results of the research, villages that are socially active, tend to have a higher capacity.

Keywords: capacity; pentagon asset; capital; disaster

1. Introduction

Mount Kelud is administratively located in Malang, Blitar and Kediri Regency of East Java Province. Mount Kelud lastly erupted on February 14, 2014. The eruption of the volcano is an event that is difficult to predict accurately (Jumadi et al., 2015). The eruption of Mount Kelud in 2014 was not in line with the government's prediction because the wind which was predicted leading to Kasembon District did not occur in 2014 eruption. Kasembon District experienced the impact which was not as severe as it was predicted, but it was suffered from physical damage and there were people need to be evacuated (Table 1).

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Table 1. Impact and Damage due to the eruption of Mount Kelud 2014 in the District of Malang Regency Kasembon

Impact and Damage	Amount and Details
Refugee	3065 people
Building	268 houses damaged
Government Office Building	8 units broken
Roads and bridges	350 meters were damaged and one bridge broke
Clean Water	21 650 m of pipe damage
Field	715 ha were damaged or failed
Garden	558 ha damaged

Source: BPBD Malang Regency and UPT Balai Penyuluhan Kasembon District, 2016

In order to anticipate the loss, it is necessary to strengthen the capacity of the community in Kasembon District. The overall strengths, completeness and resources of the community, social group or organization that can be used to achieve particular objectives related to disaster risk reduction (including Kelud's urban village eruption) and the anticipation of a disaster is called capacity (Oxfam, 2012). The higher the community's capacity to cope with the disaster, the less the risk of a disaster (Sudibyakto & Priatmodjo, 2016). Based on the Equation (1) of disaster risk concept, the magnitude of disaster risk is directly proportional to the magnitude of the hazard and vulnerability, but is inversely proportional to the capacity. Therefore, the community capacity is an aspect that can reduce the magnitude of risk to a disaster.

$$Disaster\ risk \approx hazard * \frac{vulnerability}{Capacity} \quad (1)$$

In relation to the concept of disaster risk described (in the equation 1), this study aims to explore sustainable livelihood assets owned by communities which cover five aspects of capital ownership; covering social capital, human capital, physical capital, economic capital and natural capital (Mayunga, 2007). Asset or capital is defined as the ownership of the household property that represents the wealth gross of land, house, jewellery, savings, education and skills, inter-household relations, empowerment, and social capital (Vatsa, 2004, Stephen et al, 2009). The assessment of these sustainable livelihood assets is the root of community capacity analysis (Anderson & Woodrow, 1998). A sustainable livelihood asset is also regarded as a concept that can explain the community's ability to deal with the disadvantages of a disaster (Mileti, 1999, Tobin, 1999). Livelihood assets are used in calculating the capacity because livelihood assets can reflect the community's resilience measured by combining various assets owned (Martin & Lorenzen, 2016). The concept of resilience refers to the ability of the system both technically and ecologically to continue functioning or to remain 'resilient' when a change occurs (Holling, 1996). Identifying the owner of the five community's capitals of each household can be the basis for mapping the physical and non-physical capabilities of the community. Exploring the wealth and household information is useful for developing an adaptive framework or action that could fit the community's character in the study area (Saadat & Islam, 2011).

2. Methodology

2.1. Population and sample

The study population is all the heads of households (KK) in Kasembon District. The population refers to the households because the individual capacity is related to the ownership of household livelihood assets. Livelihood assets are the capabilities in life including the ownership of assets and activities to support the individual life (Chen et al, 2017). The process of identifying the capacity level of the entire population is done by taking samples. The sampling technique used in this research is the random sampling. Random sampling is considered to be more representative than other sampling techniques because the entire populations are entitled to be the respondents. Random sampling further explains the condition of the population without being influenced by the element of subjectivity in choosing samples. Respondents in this study were determined based on Isaac and Michael's formula on Equation (2), to obtain the sample number (S) of 370. The unit of analysis in this research is the village, so the calculation result of the sample is well proportionated in every village and the distribution of the respondents' number in each village.

$$S = \frac{\lambda^2 \times N \times p \times (1-p)}{(d^2 \times (N-1)) + (\lambda^2 \times p \times (1-p))} \quad (2)$$
$$S = \frac{3,841 \times 9373 \times 0,5 \times (1 - 0,5)}{((0,05)^2 \times (9373 - 1)) + (3,841 \times 0,5 \times (1 - 0,5))}$$
$$S = \frac{9000,423}{23,43 + 0,96025} = 369,0173 \approx 370$$

Where

S : The number of samples.

λ : The value of chi-square table for one degree of freedom (dk) relative desired level of confidence $\lambda^2 = 3.841$ confidence level 0.95

N : Number of heads of KK

p : Population proportion, basic assumption of making table ($P = 0,5$)

d : The degree of accuracy, reflected by a tolerable error, is generally taken at a value of 0.05.

2.2. Capacity level of society in each village in Kasembon District

The community capacity level assessment is performed by identifying the human capital, social capital, financial capital, natural capital and physical capital (FAO, 2009). The variables which were identified in determining the capacity level are described in Table 4. The livelihood asset assessment which was conducted to families that spread in the villages in Kasembon District is described in the following stages.

First, the average data from questionnaire is calculated. The average answer is classified according to Equation (3) for the open questionnaire and classified according to Figure 1 if the questionnaire is a closed question, considering that each answer option has a value of 1 for answer a, value 2 for answer b, value 3 for answer c, etc.

Figure 1. Value range and answer classification of capacity questionnaire

After classifying each parameter, the lower parameter class is score 1, the moderate one is scored 2 and the high parameter class is scored 3. Each parameter score of each aspect is summed and its total score is classified according to Equation (3). Each parameter with a high class is assigned a value of 3, the class is assigned a value of 2 and the low grade is rated 1. Each capital value is presented in a pentagon diagram like Figure 2. Pentagon area of each village is calculated. The Pentagon is the combination of five triangles (Figure 3), so the area of the pentagon can be calculated using Equation (4). The increasingly large pentagon area shows the higher capacity of the village. The closer the border to the centre of the pentagon, the lower it's capital ownership. For example in Figure 2 the capacity B is greater than the capacity A, and the B's ownership of human capital is higher than the human capital of A (Saragih et al, 2007).

$$\text{length of class} = \frac{\text{Maximum value} - \text{Minimum value}}{3} \quad (3)$$

$$\begin{aligned} \text{Pentagon Area} = & \left(\frac{1}{2} ab. \sin 72^0 \right) + \left(\frac{1}{2} bc. \sin 72^0 \right) + \left(\frac{1}{2} cd. \sin 72^0 \right) + \\ & \left(\frac{1}{2} de. \sin 72^0 \right) + \left(\frac{1}{2} ea. \sin 72^0 \right) \end{aligned} \quad (4)$$

Figure 2. Illustrations of pentagon assets of A and B (Source: Saragih, 2007)

Figure 3. The part area of pentagon

3. Result and Discussion

3.1. Hazard of Kelud Eruption

Disaster Prone Area

Disaster-prone area (Kawasan Rawan Bencana/KRB) is an area which is affected or potentially affected by the eruption of Mount Kelud. According to the "Map of Disaster Prone Area of Kelud Volcano Disaster Map, East Java Province 2014", the withdrawal of disaster-prone areas to the material flow was carried out by considering the eruption of volcanoes, eruption history, types of hazard, erupted sediment spreads, geological structure and morphology of volcanoes, the development of technology volcanology and research findings of volcanology experts. KRB Kelud eruptions are classified into three groups, namely KRB I, KRB II and KRB III with the following explanation (PVMBG, 2014). KRB III is the high-impacted area of volcanic eruption and located at a radius of 0-7 km from the eruption centre. The minimum volcanic materials radius is 64 mm. None of the regions in Kasembon District reach the radius of 7 km or KRB III. KRB II is a moderate-impacted area. The stones are potentially thrown (incandescent) until that area (the maximum radius are 20 mm). KRB II is at the radius of 7-10 km from the crater. A village in Kasembon District which is included in KRB II is Pondok Agung. KRB I is the area that has a low impact on the eruption of Mount Kelud and is located between a radius of 10-14 km from the crater. The villages included in KRB I in Kasembon District are Bayem, Pait and Pondok Agung.

Table 2 and Figure 4 (a) show most of the areas in Kasembon Districts are outside the KRB. The total area outside the KRB is 67.3% while the total area in KRB I is 27.7% and the area in KRB II is 5%. The condition is in accordance with the existing situation when the eruption of Mount Kelud in 2014. Most of the areas in Kasembon District were not ejected with rock or gravel material but were mostly only impacted by sand and ash. Kasembon District was not thrown with gravel material because the wind direction during the eruption of Mount Kelud in 2014 was to the Southwest, while Kasembon District is in the Northern East of Kelud.

Table 2. The KRB area of each villages in Kasembon District

Village	Outside KRB (ha)	KRB I (ha)	KRB II (ha)	Total (ha)
Bayem Village	913.61	204.35		1,117.97
Kasembon Village	459.03			459.03
Pait Village	1,057.69	0.03		1,057.71
Pondok Agung Village		1,604.94	323.85	1,928.80
Sukosari Village	485.15			485.15
Wonoagung Village	1,482.38			1,482.38
Total (ha)	4,397.86	1,809.32	323.85	6,531.03

Source: The result of the administrative map overlaid with Map of Disaster Prone Area of Kelud Volcano Disaster Map, East Java Province 2014 (PVMBG)

Disaster Impact

The impact of the disaster analyzed based on the impact map of the eruption of Mount Kelud in 2014. The impact data is sourced from "Disaster Area Map Volcano Kelud, East Java Province 2014" published by PVMBG and combined with interview results. Kasembon District was a moderate to mild-impact zone, but the losses was considerable, as it destroyed buildings, roads, land, water networks and displaced people (Table 1). The impact of the eruption is also unpredictable precisely because it spreads in all directions depending on the wind direction (Wardhana, et al in Sartohadi & Pratiwi, 2014). Based on these considerations, Kasembon District areas deemed not to be affected by the "Disaster Area Map Volcano Kelud, East Java Province 2014" are classified as low impact areas. Below is an explanation of the classification of the impacted zones of Kelud eruption (PVMBG, 2014). High-impacted zone is an area experiencing pyroclastic flows/hot clouds, lava flows, volcanic ash dumps and accompanied by toxic volcanic gas impacts. The eruption of 2014 caused pyroclastic flows/hot clouds to strike Konto River passing Kasembon District with a sliding distance of more than 4 km. Based on the impact map (Figure 4 (b)) and Table 3, Kasembon District is not included in the severe affected zone although it is bypassed Konto River, since pyroclastic flow slides do not reach Kasembon District. Moderate-impacted zone is an area that has a character like a severely affected area, but does not experience the effects of poisonous volcanic gas. The eruption of 2014 caused Pondok Agung Village, Kasembon District, especially Dusun Mendalan and Gobed to have fallen volcanic material with maximum size of 20 mm material. On the map of Figure 4 (b) it is known that the impact is only in a small part of Kasembon District, which is in Pondok Agung Village. Low-impacted zone is an area experiencing lava flows and throw/fall of ash rain. The eruption of 2014, causing the mildly affected areas to experience cold lava floods that carry rocks and ash rain until the thickness reaches 15-20 cm which cover the foliages and roads. Kasembon District is almost entirely within a mildly affected zone (Table 3 or Figure 4 (b)). The area of Kasembon District with mild impact reaches 6519.31 ha or 99.8%.

Figure 4. Mapping the Hazard of Eruption of Mount Kelud

Table 3. Impacted Area of Each Village in Kasembon District

Village	Impacted Area (ha)	
	Low	Moderate
Bayem Village	1,117.97	
Kasembon Village	459.03	
Pait Village	1,057.71	
Pondok Agung Village	1,917.08	11.72
Sukosari Village	485.15	
Wonoagung Village	1,482.38	
Total	6,519.31	11.72

Source: The result of the administrative map overlaid with the map of KRB Mount Kelud 2014 (PVMBG)

The Determination of Hazard Level of Mount Kelud Eruption

The KRB Map (Figure 4 (a)) is overlaid with the impacted of Mount Kelud Eruption map (Figure 4 (b)) in accordance with the illustration in Figure 4. The result of KRB overlays and impacts map is obtained by Kelud eruption hazard level. The medium and low hazard can be seen in Figure 4 (c) and each of the extents listed in Table 4.

Table 4. Hazard Area of Each Village in Kasembon District

Village	Hazard Area (ha)	
	Low	Moderate
Bayem Village	1,117.97	
Kasembon Village	459.03	
Pait Village	1,057.71	
Pondok Agung Village	1,604.94	323.85
Sukosari Village	485.15	
Wonoagung Village	1,482.38	
Total	6,207.18	323.85

Source: The result of KRB map overlaid with impact map

3.2. The Capacity

The classification of each aspect of the capital ownership is based on Table 5. The classification of each parameter (Table 5) and capital ownership aspect (Table 6) is calculated using Equation (3). Community capacity is calculated based on these parameters through the livelihood asset assessment stage (Ellis, 2000, Smith et al, 2001).

Table 5. Classification parameters of capital ownership

Capacity Sub Variables	Parameters	Class-based on Average Answers of Respondents in Thei Questionnaire		
		Low (1)	Moderate (2)	High (3)
Human capital	The Average score of villagers knowledge about disasters	<2.34	2.34-3.67	>3.67
	The percentage of community who joined one or more trainings	<7.88	7.88-15.74	>15.74
Natural capital	The wide of fields/land (m ²)	<1,518.18	1,518.18-2,340.58	>2,340.58
Social capital	The Average convenience's value of the access to clean water	<2.34	2.34-3.67	>3.67
	The average frequency of the intensiveness following routine discussions	<2.34	2,34-3,67	>3,67
	The percentage of active activities within the village/residence organization (%)	<43.04	43.04-63.87	>63.87
	the average intensity values of routine discussions related to how to face disasters	<2,34	2,34-3,67	>3,67
	The intensity of the discussion about the access to the assistance in anticipating the eruption of Mount Kelud	<2.34	2.34-3.67	>3.67
	The average value of the public trust to the key actor (local government/religious leaders/community leaders)	<2.34	2.34-3.67	>3,67
Physical capital	The percentage of homeowners who more than one unit (%)	<1.96	1.96-3.93	>3.93
	The number of vehicles ownership	<3	3-4	>4
Financial capital	The average income (Rp)	<1,868,893	1,868,893-2,280,743	>2,280,743
	The livestock	<3	3-4	>4
	Saving ownership (Rp)	<97,961	97,962-149,444	>149,444
	The ease of getting credit	<2.34	2.34-3.67	>3.67

Table 6. The classification of total capital ownership score and area of pentagon to determine the capacity

Aspect	Class		
	Low (1)	Moderate (2)	High (3)
Human Capital	≤3	4	>4
Natural Capital	<5	5	≥6
Social Capital	≤6	7	≥8
Physical Capital	<3	3-4	>4
Financial Capital	<8	8-9	>9
Capacity			
*Based on pentagon area (unit)	<8,08	8,08-9,96	>9,96

The Social Capital

The social relations among the villagers in Kasembon District were assessed by intensively following routine discussions, activities in the village/residence organization, the intensity of routine discussions about how to face disasters, the intensity of discussing the access to the assistance in anticipating the eruption of Mount Kelud and the public trust on the key person (local government/religious leaders/community leaders). People who actively follow the organization and carry out their programs in higher intensity are considered to be socially connected with communities around them because such people will be easy to organize when disaster comes. People who are active in the organization in their residence can also obtain information from the meeting. The trust in the key person is also considered important because, in Kasembon District, the disaster management is commanded and decided by the village leader then is decentralized to the village staffs including the head of the hamlet, the Kelud Corps members (a disaster risk reduction community in the Kelud area), the religious leaders in the villages, and the chairman of the PKK (a program in the village level to educate women on various aspects of family welfare).

The opinions taken from the respondents living in Kasembon District show that Bayem has the high social capital (Table 7). The condition is affected by the involvement of the community in Bayem in various organizations which is evidenced by the proportion of respondents who participated in the organization around the village were 84.7%. The activeness of organized communities in Bayem is evidenced by their high participation in PKK organizations, religious assemblies, Kelud Corps, some youth clubs, Bangser and village art organizations. The village organization has the role not only in Bayem but also in all villages. It becomes a forum for the community to hold discussions, even PKK and youth often work together with Kelud Anchor to discuss disaster risk reduction measures in the villages and sub-districts. In addition to the Kelud Anchor, in Pait, there is SIBAD (a village level disaster alert organization) to tackle the disaster in Pait, but the communities who are involved are only the village cadres and village apparatus.

Table 7. The Ownership of the Social Capital of Villages in Kasembon District

Social Capital Parameters	Villages					
	Bayem	Kasembon	Pait	Pondok Agung	Sukosari	Wonoagung
The average frequency of the intensiveness following routine discussions (SC1)	1,72	1,39	1,79	1,69	1,16	1,59
The percentage of active activities in the village/residence organization (SC2)	84,7%	38,9%	41,7 %	59,7%	56,9%	22,2%
The average value of the intensiveness of routine discussions about how to face disasters (SC3)	1,51	1,19	1,04	1,43	1,16	1,11
The intensiveness of the discussion about the access to the assistance in anticipating the Mount Kelud eruption (SC4)	1,3	1,03	1,02	1,15	1,08	1,05
The average value of the public trust in the key person (SC5)	2,7	2,75	2,68	2,65	2,6	2,81
Score SC1	1	1	1	1	1	1
Score SC2	3	1	1	2	2	1
Score SC3	1	1	1	1	1	1
Score SC4	1	1	1	1	1	1
Score SC5	2	2	2	2	2	2
Total Score	8	6	6	7	7	6
Social Capital	High	Low	Low	Moderate	Moderate	Low

The Human Capital

The knowledge about disasters is important to be reviewed at human capital, as it reflects people's perceptions and capabilities to recognize the dangers of a disaster including how to overcome it. In addition, training is also important to build the community's understanding on facing the catastrophic eruption of Mount Kelud. Based on this, the average community ownership of the human capital of the villages in Kasembon District can be assessed. The data recapitulation of the questionnaire shows that the average knowledge of the people affected by the disaster in Wonoagung, Sukosari, Kasembon and Pait is low, while the community in Bayem and Pondok Agung have knowledge of disasters in the medium category (Table 8).

The data obtained from the interviews with the respondents showed that the community in Kasembon District understood the material presented in the training from the first training, i.e. the training on the evacuation simulation which was conducted on

February 10, 2014. Based on this, the community conducting one or more training became an indicator of the community's capital human. The recapitulation of respondents' answers regarding disaster-related training shows that the percentage of people who participated in the training in Pondok Agung Village and Bayem Village was more than one (Table 8). This condition results from the effort to put Pondok Agung and Bayem as the priority of disaster handling by the government of Malang Regency and Kasembon District.

The simulation and the material instruction to the people in Kasembon District before the eruption of Mount Kelud in 2014 was arranged by the local government cooperated with Kasembon District government, Regional Board for Disaster Countermeasure (BPBD) Malang Regency, and disaster risk reduction organization of Kelud eruption. In Pondok Agung, the material was combined with self-sustaining simulation, while in Bayem, the only material was given, and in other villages, only the status of Kelud which was shown to community representatives. The materials submission and simulation aim to improve public readiness to face the eruption of Mount Kelud. Based on the questionnaire related with the community's level of knowledge and participation in training, two villages which were included in the high human capital category are Bayem and Pondok Agung, while other villages have the low human capital.

Table 8. The ownership of the human capital of villages in Kasembon District

The Parameters of Human Capital	Villages					
	Bayem	Kasembon	Pait	Pondok Agung	Sukosari	Wonoagung
The average score of villagers' knowledge about disasters (HC1)	2,98	2,21	1,87	2,76	1,71	1,7
The percentage of community involving in one or more training (HC 2)	23,61%	8,33%	0%	23,61%	4,17%	0 %
HC 1	2	1	1	2	1	1
HC 2	3	2	1	3	1	1
Total Score	5	3	2	5	2	2
Human Capital	High	Low	Low	High	Low	Low

The Natural Capital

The natural capital in the research was discovered by assessing the ownership of community access to land and water resources. The majority of respondents have the large areas of low land, while the access to clean water was an inmoderate category (Table 9). Based on these two parameters, the high natural capital is found in Wonoagung (Table 9), because the average land ownership is higher compared to the average land ownership in other villages and the accessibility of clean water. The water in Wonoagung and Pait was not suffered from the disturbance occurring either in normal condition or during Kelud eruption. The water quality in Wonoagung and Pait is also always in clean condition. The people in Pait and Wonoagung have three water sources, which are Hippam, wells,

and rivers. In Wonoagung and Pait, water is easy to obtain when the ground is excavated to a depth of 19-23 meters. The condition of Pondok Agung is different from Pait and Wonoagung. The distribution of clean water was disturbed for five days due to the broken pipe at its main source. The condition of the access to clean water in Sukosari, Bayem and Kasembon was also different from that of in other villages, because the majority of people utilize well water or rivers in the vicinity of residence, because the clean water canals from springs do not reach the majority of settlements in Bayem, Kasembon and Sukosari.

Table 9. The Ownership of the Natural Capital of Villages in Kasembon District

The parameters of natural capital	Villages					
	Bayem	Kasembon	Pait	Pondok Agung	Sukosari	Wonoagung
The average area of fields/land in m ² (NC1)	2006,25	778,43	1593,87	695,77	755,2	3162,96
The average convenience value of the access to clean water (NC2)	3,06	3,23	3,85	3,49	3,02	4
NC1	2	1	1	1	1	3
NC2	2	2	3	2	2	3
Total Skor	4	3	4	3	3	6
Natural Capital	Low	Low	Low	Low	Low	High

The Financial Capital

The financial capital of villages in Kasembon District is assessed to find out the ability of the community to recover from the impact of Mount Kelud eruption in terms of financial. When a disaster happens, villages with populations with the good financial condition (in the high category) can solve their financial problems independently or can be more easily recovered due to the possessions they have. Two villages with high financial capital classification are Wonoagung and Pait (Table 10).

The villagers in Wonoagung and Pait have higher income, livestock and savings compared to the communities in other villages in Kasembon District. The income of the community in Wonoagung and Pait villages is 2.3-2.6 million rupiah per month, while the average savings is 188-200 thousand rupiah/month per family (Table 10) and the total ownership of livestock is 3-4 tails per family and ownership of poultry is 7-8 tails per family. High earnings offset by high savings ownership will affect the recovery process from the impact of the catastrophic eruption of Mount Kelud to be faster than those who do not have savings. In order to get back to farming, most people working in the agricultural sector in Pait and Wonoagung used their savings as the capital to recover their farm after the harvest was a failure due to the eruption of Mount Kelud. Through this self-sustaining effort, the community can re-run their job as before.

Table 10. The financial capital ownership of villages in Kasembon District

The Parameters of Financial Capital	Villages					
	Bayem	Kasembon	Pait	Pondok Agung	Sukosari	Wonoagung
The Average income in Rupiah (FC1)	1.616.617	2.284.314	2.346.939	1.457.042	1.883.562	2.692.593
Livestock (FC2)	2	2	6	5	3	6
Saving ownership in Rupiah (FC3)	114.583	207.843	188.776	46.479	132.466	200.926
The Ease of getting credit (FC4)	3,23	3	3,4	2,97	2,68	2,2
FC1	1	3	3	1	2	3
FC2	1	1	3	3	2	3
FC3	2	3	3	1	2	3
FC4	2	2	2	2	2	1
Total score	6	9	11	7	8	10
The Financial Capital	Low	Moderate	High	Low	Moderate	High

The Physical Capital

The physical capital is an ownership aspect of physical goods either houses or vehicles. The parameter in determining the value of the physical capital of home ownership is the number of homeowners with more than one unit of a house, while a physical capital value of vehicle ownership is based on the number of their vehicles which are distinguished based on either it is two-wheeled or four-wheeled. Based on these two parameters, the high category of the physical capital vehicle ownership is found in Kasembon and Wonoagung (Table 11).

Table 11. The ownership of the physical capital of villages in Kasembon District

The Parameters of Physical Capital	Village					
	Bayem	Kasembon	Pait	Pondok Agung	Sukosari	Wonoagung
The percentage of homeowners whose more than one unit (%) / PC1	0	5,88	4,08	0	2,74	3,7
The score of vehicles ownership (PC2)	2	6	4	2	3	5
PC1	1	3	2	1	2	2
PC2	1	3	2	1	2	3
Total Score	2	6	4	2	4	5
Physical Capital	Low	High	Moderate	Low	Moderate	High

Kasembon has the high score both in the aspects of houses and vehicles ownership. Wonoagung has a high score on vehicle ownership parameters. The ownership of vehicles can help the mobilization of the community to support their daily activities including working and obtaining food. In emergency situations, four-wheeled vehicles owned by the community can be utilized in the evacuation process. This is evident when Mount Kelud erupted, families with four-wheel vehicles could independently evacuate themselves and even their neighbours to reach a safer place.

The capacity of the Villages in Kasembon District

After calculating each capital in the Pentagon asset, the value is visualized in the Pentagon (Table 12). Based on Table 12, all villages have no equilibrium in capital ownership because the Pentagon is not in a regular square shape. It shows that all villages have an emphasis on certain capital ownership, as in Bayem, the villagers only focus on human and social capital only. The Pentagon indicates that the capital ownership in Kasembon District is unbalanced, so in its development, some aspects of certain capitals which are considered low need to be improved. Based on the Pentagon area in Table 12, it is identified that the village with high capacity is Wonoagung, the medium capacity village is Bayem and Kasembon and the rests are a low capacity. The classification of results is illustrated in the capacity map of Figure 5.

Wonoagung has the high capacity due to the high ownership of natural capital, financial capital and physical capital, but it got the low hazard of an eruption of Mount Kelud because its distance to the eruption centre of Mount Kelud is much farther than other villages in Kasembon District (Table 13). Wonoagung also has the low ownership of human capital and social capital. The low human capital in Wonoagung is because the community has the low understanding about the danger and the action that must be done when the eruption of Mount Kelud occurred, due to the absence of socialization about the eruption of Mount Kelud and the government does not involve the community when it happens. The low social capital is due to the fact that the majority of Wonoagung villagers do not actively involve in the routine discussion.

Pondok Agung has the same capacity as Sukosari, Pait and Kasembon; is located lower than Wonoagung and Bayem, but the hazard of Mount Kelud eruption is even higher than in other villages (Table 13). That condition suggests Pondok Agung be the target of disaster risk reduction priority in Kasembon District by increasing the capacity of the community. Comparing the level of asset ownership of each villages, it can be seen that all levels of capital ownership of Bayem and Pondok Agung have some similarities except in the social capital ownership aspect. Pondok Agung has the lower social capital than Bayem, Kasembon and Pait. As the low-capacity villages, they also have the low social capital. The cause of that difference is while Bayem has the ownership of social capital, other villages lie in the aspects of community activeness in the organization in the village. The low involvement of the community in the organization in the village causes the number of meetings and discussions among the people to be lower. Therefore, the delivery of disaster management materials and disaster-related training outside Bayem runs less effectively indicating that the majority of people's knowledge about disasters is lower than in Bayem Village (Table 8).

Table 12.The pentagon asset of villages in Kasembon District

Village	Bayem	Kasembon	Pait
Pentagon
Pentagon Area	8,08 Units	6,18 Units	6,18 Units
Capacity	Moderate	Low	Low
Village	Pondok Agung	Sukosari	Wonoagung
Pentagon
Pentagon Area	6,18 Units	6,18 Units	11,89 Units
Capacity	Low	Low	High

Table 13. Hazard and Capacity to Eruption of Mount Kelud

Village	Hazard	Capacity
Bayem	Low	Moderate
Kasembon	Low	Low
Pait	Low	Low
Pondok Agung	Moderate and Low	Low
Sukosari	Low	Low
Wonoagung	Low	High

Figure 5. The capacity map of Mount Kelud eruption in Kasembon District

4. Conclusion

The capacity of villages in Kasembon District was identified by reviewing the ownership of social capital, human capital, natural capital, financial capital and physical capital of the community through a questionnaire given to 370 respondents in Kasembon District. The result of identification shows that there are differences of capital ownership in each village. Bayem has the medium capacity despite the low ownership of natural capital, financial capital and physical capital as it has been supported by the active participation of the community within the village organization. Pondok Agung, Kasembon, Sukosari and Pait are almost the same with Bayem, but the community's involvement is not as active as the community in Bayem Village. Therefore the most effective step to improve the capacity of the villagers in Kasembon District is to encourage the community to participate actively in the organisation within the village such as PKK, SIBAD, Kelud Corps and so on. If there are more communities actively involving in the organization, it can become a more effective forum for the community to do discussion and give education, since previously the organization in the village has been utilized with training and delivery of disaster risk reduction materials.

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