The Sister Village Program: Promoting Community Resilience after Merapi Eruption

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Abstract

Local Government of Magelang Regency initiates the Sister Village Program after Mount Merapi Eruption in 2010. The idea of this program is to connect villages at risk from Merapi eruption to partner villages with less risk in the surrounding regions. This program is part of post-disaster recovery initiatives at the local level which includes planned evacuation routes, shelters, provision of food and other daily essentials. This paper aims to shed light on the role of sister village program in promoting community resilience after the volcanic eruption of Merapi. It is found that the system of sister village program can fulfill many aspects of community resilience components. Considering Indonesia is one of the most disaster-prone countries in the world, this program should be regarded as a good example to be replicated in other prone areas in the country.

Keywords: community resilience; eruption; Magelang; Merapi; sister village

1. Introduction

Natural disasters can cause impacts on socio-economic and physical damage (Arouri, Nguyen, & Youssef, 2015; Benson, 1997; De Haen & Hemrich, 2007; Lindell & Prater, 2003; Pelling, Özerdem, & Barakat, 2002). These impacts vary for different nations, areas, communities, and individual due to variability in their exposures and vulnerabilities to natural disasters (Arouri et al., 2015). It is also highly correlated with the level of resilience of communities to natural disasters.

Understanding how communities respond to and recover from natural disasters is essential not only for governments, academics, and researchers but also for communities themselves. Accordingly, the paper aims to shed light on the role of a program called "sister village" in promoting community resilience after the volcanic eruption of Merapi in Magelang Regency, Central Java, Indonesia. This paper also further explores how to build community resilience capacity through the sister village program in Merapi disaster-prone area (Hazard Zone/KRB III) by analyzing the correlation between components of community resilience including the characteristics of a disaster-resilient community and characteristics of the sister village program itself.

Mount Merapi is one of the most active stratovolcanos in Indonesia located in the border between Central Java and Yogyakarta (Surono et al., 2012). The explosive eruption of Merapi in 2010 was the largest in the last century (Surono et al., 2012) and had a severe direct impact on the area surrounding volcano. Following the 2010 eruption, Local Government of Magelang Regency through its Disaster Agency (BPBD)initiated Sister Village Program to increase the community's preparedness to deal with the future disaster. The idea of this program is to connect villages at risk from Merapi eruption to partner villages with less risk (RFCS, 2014).

Realizing that Indonesia is one of the most disaster-prone countries, it becomes critical to study the role of sister village program in promoting community resilience. This program has great potential to be used as an example in other disaster-prone areas in other regions in Indonesia.

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2.   Resilience Thinking

Resilience is a term that is widely used in the recent years in academic and policy discourse with multi-perspective explanations (Borda-Rodriguez & Vicari, 2014; Meerow, Newell, & Stults, 2016). Resilience has an attempt to increase capacity of the communities to deal with particular shocks and/or stresses. In this point of view, resilience is likely to accommodate a community-based approach, internally driven and also comprehensive to deal with the particular shocks and stresses (Barr & Devine-Wright, 2012).

The word "resilience" has roots in the Latin word resilio meaning "to jump back" or return to an original state (Klein, Nicholls, & Thomalla, 2003; Palekiene, Simanaviciene, & Bruneckiene, 2015). Mostly because resilience notion contains multidimensional aspects, it has been adapted into different scientific disciplines, including in disaster management.

Resilience is defined as the capability of a strained body to recover its size and shape after deformation caused by compressive stress or an ability to recover from or adjust easily to misfortune or change. In addition to that, resilience also emphasizes on the speed of recovery from any perturbations (Adger, 2000), or refers to the ability of systems to cope with shocks or significant changes in external circumstances (Barr & Devine-Wright, 2012).

2.1   Community Resilience

Resilience has a focus on how to put greater emphasis on how communities are able to enhance their capacities and also focusing on what communities can do for themselves to reduce their vulnerability to disaster (Twigg, 2009). With this regard, there is an increasing use of the term "community resilience."

The term 'community' emerged in the Middle Ages in the sense of fellowship, or joint ownership (Wisner & Kelman, 2015). Communities are complex, unique, and often not united. There will be differences in economic status, social status, and occupation between people living in the same area and there may be more severe divisions within the community (Twigg, 2009). It also means that there will be individuals or subgroups with more power, wealth and access to information, financial and material resources (Wisner & Kelman, 2015).

The spatial dimension of community is essential in identifying communities at risk (Twigg, 2009). However, this must be linked to an understanding of the socio-economic differentiation and dynamic condition within the area at risk, not only to identify vulnerable groups but also to understand the diverse factors that influence vulnerability (Twigg, 2009). Among those who are vulnerable in a particular emergency situation, it may develop acts of solidarity that involves interactions among individuals, subgroups, and groups in the community that usually result in collective action to enhance the capacities for recovering from a disaster (Imperiale & Vanclay, 2016; Wisner & Kelman, 2015). This leads to the development of the terms of 'community resilience.'

In trying to reach a deeper understanding of community resilience, there are still pro and cons on what constitutes 'a resilient community' (Pendall, Foster, & Cowell, 2010; Skerratt, 2013; Steiner & Atterton, 2015). However, in general, the term could be understood as the capacity of a system in the community 'to deal with the negative impacts of the changes and reorganize while changing to retain essentially to the same function, structure, identity, and feedbacks' (Steiner & Atterton, 2015).

According to the RAND Corporation, community resilience is a concept to enhance the capacity of the community to utilize available resources, to respond, to withstand, and to recover from adverse situations (Resilient Monroe, 2013). Communities that are resilient can learn from adversity and adapt rapidly to change (Resilient Monroe, 2013). In brief of Community and Regional Resilience Institute, explain that community resilience is the capability to anticipate risk, limit impact, and bounce back rapidly through survival, adaptability, evolution, and growth in the face of turbulent change (CARRI, 2013). Thus, resilience could be considered as an attribute with adaptability at its core. It indicates the desired trajectory which enables communities to determine how resilient they are and to take actions to improve their resilience.

There are three key components of community resilience. Those three components are economic characteristic, the social aspect, and environmental feature (Steiner & Atterton, 2015). In order to develop more sustainable and resilient communities, these dimensions should be addressed integratively to improve the adaptive capacity of the respective community.

Regarding economic resilience component, it has been argued that local economy with diverse businesses and employment opportunities will support community resilience. In addition, a diverse and innovative local economy will help to retain money circulating within the community, and in turn, contributes in growing the private sectors and increasing the resilience of local economies and the communities that depend on them. In contrast, research evidence found that at times of economic downturn, over-reliance on a single form of employment potentially make communities to be extremely vulnerable (Steiner & Atterton, 2015).

While economic resilience is perceived as concrete and can be observed, the social resilience component is less tangible. The social dimension of resilience is related to the ongoing ability of a community to embrace change through social transformation and lifestyle change to survive and thrive from external shocks (McManus et al., 2012; Skerratt, 2013; Steiner & Atterton, 2015). It is a participatory process with the sense of belonging that involve the entire community members to take part actively in looking for solutions to their local problems to mitigate against community decline. Some important components of social resilience are local leadership, social connection and support, personal experience and individual actions and belief (Steiner & Atterton, 2015).

In addition to economic and social components, environmental factors are also influencing community resilience. Community resilience is closely related to the environment in which a community is located. It must be realized that human activities impact on the resilience of ecosystems, and at the same time, the environment also plays an important role in influencing community wellbeing. Hence, this open up opportunities and challenges for the community to maintain and improve environmental quality, to mitigate and to adapt with climate change and to relate ownership and management of a variety of assets (Steiner & Atterton, 2015).

Places with strong economic, social, and environmental capital are likely to be more resilient rather than places with only one or incomplete components of these factors are present (see Figure 1).
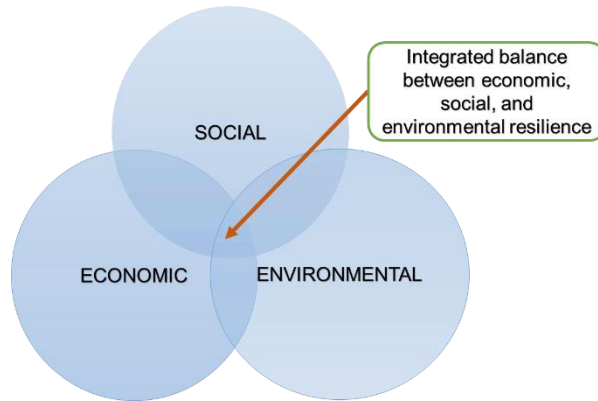

Figure 1. Key Components of Community Resilience
(Source: Steiner and Atterton, 2015)

2.2   Thematic Areas of Community Resilience

Based on Hyogo Framework for Action, a global blueprint for disaster risk reduction 2005-2015, which then has been adopted to be the Sendai Framework for Disaster Risk Reduction 2015-2030 by the UN Member States, there are five main areas relating to community resilience which are called thematic areas (Twigg, 2009). The thematic areas are intended to cover all aspects of community resilience. The five Thematic Areas are as follows:

1. Governance
2. Risk Assessment
3. Knowledge and Education
4. Risk Management and Vulnerability Reduction
5. Disaster Preparedness and Response
   Each thematic area is subdivided into a set of its main components of community resilience.

Table 1 explain the components of community resilience for each thematic area.

Table 1: Thematic Areas of Community Resilience

Thematic Areas	Components of Community Resilience
Governance	- Policy, planning, priorities and political commitment - Legal and regulatory systems - Integration with development policies and planning - Integration with emergency response and recovery - Institutional mechanisms, capacities, and structures; allocation of responsibilities - Partnerships - Accountability and community participation
Risk Assessment	- Hazards/risk data and assessment - Vulnerability/capacity and impact data and assessment - Scientific and technical capacities and innovation
Knowledge and Education	- Public awareness, knowledge, and skills - Information management and sharing - Education and training - Cultures, attitudes, motivation - Learning and research
Risk Management and Vulnerability Reduction	- Environmental and natural resource management - Health and well being - Sustainable livelihoods - Social protection - Financial instruments - Physical protection; structural and technical measures - Planning regimes

Table 1 Continued

Thematic Areas	Components of Community Resilience
Disaster Preparedness and Response	- Organizational capacities and coordination - Early warning systems - Preparedness and contingency planning - Emergency resources and infrastructure - Emergency response and recovery - Participation, voluntarism, accountability

Source: Twig (2009)

3. The Sister Village Program

The Sister Village Program that has been initiated by Local Government of Magelang Regency aims at enhancing community resilience after Mount Merapi Eruption by increasing community's preparedness to face future disaster. The role of sister village program in building community resilience capacity can be explored by analyzing the components of community resilience including the characteristics of a disaster-resilient community and characteristics of the sister village program. These components and its character are organized under five thematic headings, based on a framework developed by the UN International Strategy for Disaster Reduction (UN ISDR): the Hyogo Framework with some modifications. This scheme has been followed because the HFA is generally accepted by UN and other international agencies, most national governments, and many NGOs. Furthermore, a qualitative approach has been followed in this case study. Research techniques were review of available literature, interviews with key stakeholders, focus group discussions; and field observation.
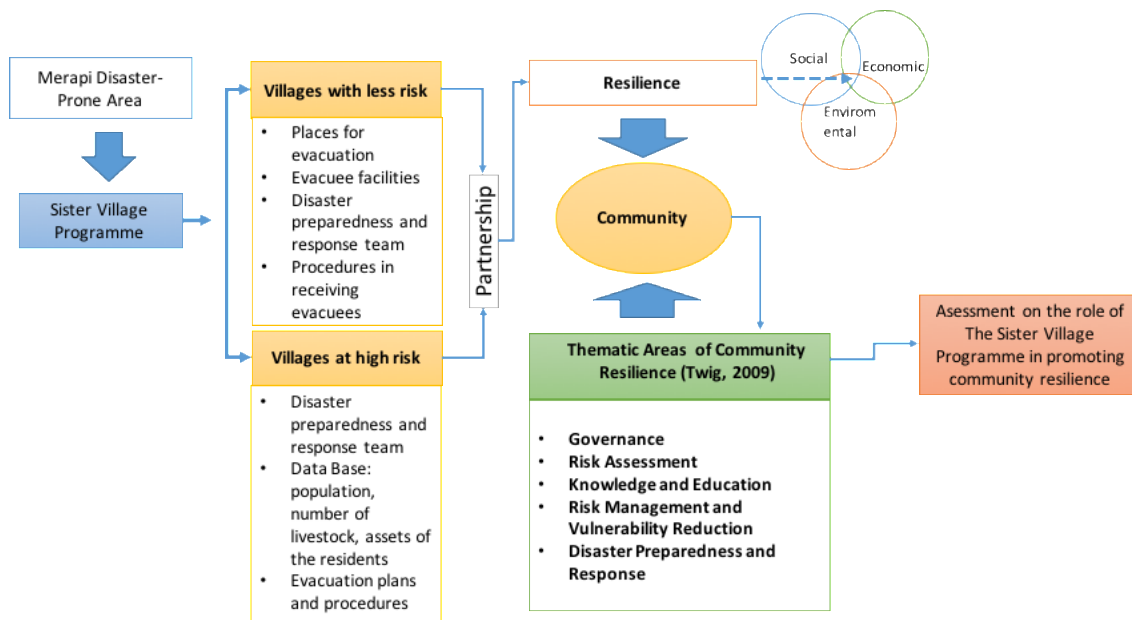

Figure 2. Framework of Assessment

3.1 Volcanic Eruption of Merapi

Located at the height of 2,980 m above sea level, Mount Merapi is a stratovolcano that spans an area spread across four regencies in two provinces in Java Island, namely Magelang, Klaten, and Boyolali in Central Java Province and Sleman in Yogyakarta Province. Merapi also becomes one of the most active volcanos in the world (Surono et al., 2012). It is located 25 km north of the urban area (see Figure 3).

The record shows that Merapi erupts regularly since 1548. Small-scale eruptions usually occur with average intervals of 4 to 6 years while massive eruptions happen every one or two centuries (Surono et al., 2012). The 26 October 2010 eruption of Merapi, has been estimated as the largest and the most explosive eruption of Merapi in the last century compared to five previous eruptions that happened in 1994, 1997, 1998, 2001 and 2006 (Tasic & Amir, 2016). The eruption was triggered by tectonic movements in the region (Amir, Ghapar, Jamal, & Ahmad, 2015; Surono et al., 2012). The severe eruption process started since late September 2010, and this volcano activity then continued for more than a month (RFCS, 2014).

The 2010 eruption had a severe direct impact on the area surrounding the volcano which resulted in damage and disruption of the local community. Pyroclastic flows and lahars (mud and debris flow) were ranging from 8 to 16 km, and even ash-fall was reported in the areas distanced up to 240 km (Surono et al., 2012). Even during the peak of crisis, the Adi Sutjipto Airport of Yogyakarta was closed.
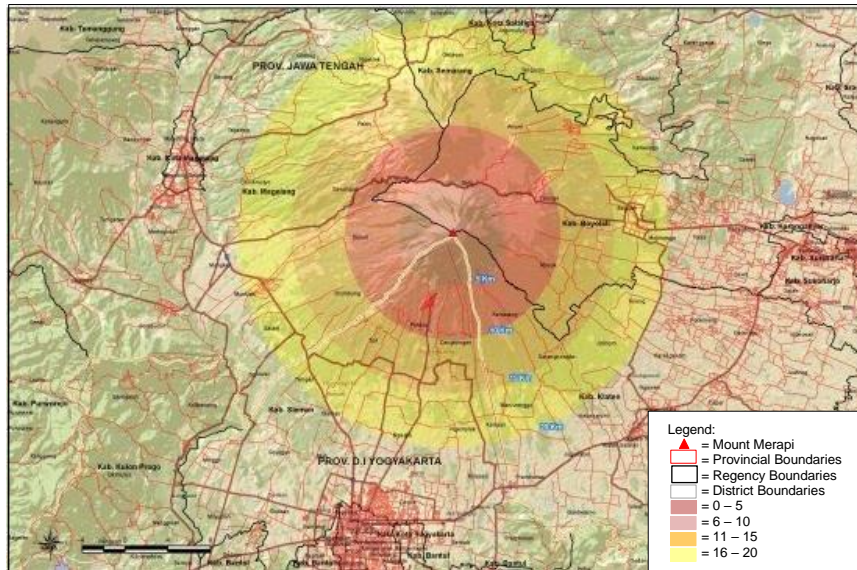
Figure 3. Location of Mount Merapi
(Source: BPBD, 2015)

That last huge eruption of 2010 claimed 277 lives in Yogyakarta and 109 lives in Central Java (RFCS, 2014). It razed over 150,000 buildings, bringing an estimated loss of more than US$300 million (Tasic & Amir, 2016). Heavy damage was also inflicted on livelihood facilities, roads, bridges, educational, health and public service facilities. Moreover, approximately 400,000 people had to be evacuated from the surrounding areas to refugee camps (Tasic & Amir, 2016).

Considering to the vulnerability of Merapi Eruption, the government distinguished the disaster-prone areas surrounding the volcano into three different categories of KRB (Kawasan Rawan Bencana/ Hazard Zone): Hazard Zone III, Hazard Zone II, and Hazard Zone I. Then, as it is mandated by Law No. 24/2007 concerning Disaster Management and Law No. 26/2007 concerning Spatial Planning, the spatial planning should be based on hazard mitigation and as a consequence, the Merapi Hazard Map published by Centre for Volcanology and Geological Hazard Mitigation (see Figure 3) as a reference.

Based on the map, the dark pink, pink and yellow indicates Hazard Zone III, II, and I respectively. According to this classification, the Hazard Zone III is the most dangerous areas since this area is located closest to the mountain. It is mostly affected by pyroclastic flow, lava, heavy ash fall and direct blast. Hazard Zone II is affected by pyroclastic flow and ash fall whereas lava hazard is concentrated in Hazard Zone I (BVMBG, 2002).

Prediction of volcanic eruption event has a significant role in the prevention of volcanic disaster. Therefore, a clearly and easily understood warning system as stages should be given to people who live in Volcano Area. The stages of volcanic eruption warning system are explained in Table 2.

Table 2: The Stages of Volcanic Eruption Warning System

| Stages	Interpretation
Level 1; *Aktif Normal* (normal activity)	Green code: No eruption in the foreseeable future.
Level 2: *Waspada* (be careful)	Yellow Code: Magmatic, tectonic or hydrothermal disturbance, no eruption imminent
Level 3: *Siaga* (be ready)	Orange Code: If the trend of increasing unrest continues, eruption possible within two weeks.
Level 4: *Awas* (danger)	Red Code: Eruption possible within 24 hours.

Source: PVMBG (2002)
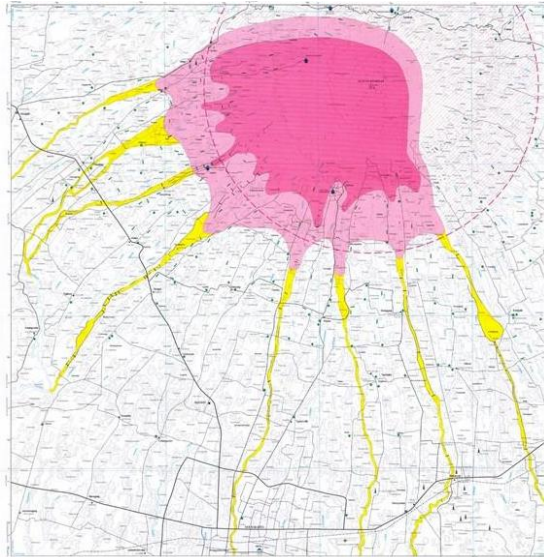
Figure 4. Volcanic Hazard Map of Merapi Volcano
(Source: PVMBG, 2002)

3.2 Increasing the Community's Preparedness to Face Future Disaster through a Sister Village Program

During the Merapi eruption in 2010, people on the area surrounding the volcano were not ready. They were shock and panic, thus, had no idea what to do. They were evacuated to some villages nearby, and then they live temporarily scattered in many different sites. Even many of them were separated from their family (Pickup, 2016). Besides, there was chaos regarding evacuee management, especially logistics management (BPBD Kabupaten Magelang, 2016).

Following that 2010 eruption, Local Government of Magelang Regency through Magelang Disaster Mitigation Agency (BPBD) has initiated The Sister Village Program. The idea of this program is to connect villages at risk from Merapi eruption to partner villages with less risk. This sisterhood system made it easier to identify the disaster-prone villages that needed to be temporarily relocated to the safer villages (RFCS, 2014).

The sister village program is intended to increase community's preparedness to face future disaster. As part of post-disaster recovery programs at the local level, this program includes planned evacuation routes, shelters, provision of food and other daily essentials. It is also supported by training in disaster emergency response system for members of the sister village, organized training in new livelihood skills to encourage communities to diversify their sources of income (RFCS, 2014).

The sister village system is established through a participatory process. Villages at high risk of impact from the eruption of Mount Merapi choose one or more partner villages that are considered safe from the threat of eruption, where previously both village heads (the disaster-prone village and the partner villages in a safer location) have coordinated and then made an agreement. The sister village program brings together two pairs of villages or more in a relationship that is instituted.

There are some considerations in choosing partner village in the sister village program. Previous evacuation experiences, the close relationship between the disaster-prone village and its partner village, or other needs that are considered to be met by its partner village are some of those considerations. Thus, not only the physical interests that are taken into account but also the need for feeling safe and comfortable during the evacuation.

The placement of evacuees in their sister villages varies. They can be placed in village hall, houses, or tents set up in the open field, all depending on the condition of the partner village. In preparing for the implementation of this sister village program, the partner villages will work hard. Residents in their "sister" villages have to provide shelter, food, and other daily essentials when the next disaster strikes. However, they seemed enthusiastic in preparing for the fulfillment of the basic needs of evacuees who came to their village. Moreover, between villages in disaster-prone area and their partner villages also look agreeable in preparing the implementation of sister village program.

In preparing the implementation of sister village program, the village in disaster-prone areas should prepare a variety of data such as population, number of livestock, and assets of their residents. Also, these villages have to form disaster preparedness and response team and also have to prepare evacuation plans and procedures. As for the partner villages, it is necessary to prepare a place for evacuation, evacuee facilities, a team of disaster preparedness, evacuation of livestock, and also procedures in receiving evacuees.

Figure 5. Illustration of the Sister Village Program
(Source: BPBD Magelang, 2016)

The sister village program involved villages (kelurahan) throughout Magelang regency that consists of disaster-prone villages (KRB) III and their partner villages. Disaster-prone villages in KRB III of Magelang Regency consist of 3 (three) sub-districts, namely Sawangan Sub-district, Dukun Sub-district, and Srumbung Sub-district.

In 2013, one pair village (Ngargomulyo Village in Dukun Sub-district and Taman Agung Village in Muntilan Sub-district) was selected as pilot villages in the hope that sister village program could be appropriately developed in these villages and could be replicated in other locations. The pilot villages were selected based on risk level criteria of the village in KRB III, the close relationship between the two villages, the readiness of the partner village, accessibility, potentials for development and sustainability, and security (BPBD Kabupaten Magelang, 2016). BPBD Magelang has planned that in 2019, it will be formed 19 pairs of sister villages in Magelang Regency.

Table 3: 19 Pairs of Sister Villages in Magelang Regency

Sub-district	No	Villages in KRB III	Partner Villages
Sawangan	1	Wonolelo	Banyuroto (Sawangan)
			Pogalan (Pakis)
	2	Kapuhan	Mangunsari (Sawangan)
	3	Ketep	Podosuko, Wulunggunung (Sawangan)
			Ketundan (Pakis)
Dukun	4	Sengi	Butuh, Tirtosari, Jati (Sawangan),
			Treko and Senden (Mungkid)
	5	Sewukan	Ambartawang (Mungkid) and Rambeanak (Mungkid)
	6	Paten	Gondang, Bumirejo and Paremono (Mungkid)
			Banyurojo and Mertoyudan (Mertoyudan)
	7	Krinjing	Deyangan,(Mertoyudan)
	8	Kalibening	Adikarto and Tanjung (Muntilan)
	9	Sumber	Pucungrejo, (Muntilan)
	10	Ngargomulyo	Tamanagung (Muntilan)
	11	Keningar	Ngrajek (Mungkid)
Srumbung	12	Kaliurang	Jamuskauman, Pakunden, and Bligo (Ngluwar)
	13	Kemiren	Salam (Salam)
	14	Ngablak	Kradenan, Kadiluwih, Someketro and Tirto (Salam)
	15	Nglumut	Sucen (Salam)
	16	Tegalrandu	Bringin, Pabelan (Mungkid) and Wanurejo (Borobudur)
	17	Mranggen	Gunungpring and Sokorini (Muntilan)
	18	Ngargosoko	Gulon (Salam)
	19	Srumbung	Baturono and Tersangede (Salam)

Source: BPBD Magelang (2016)

3.3 Building Resilience through the Sister Village Program

In order to explores how to build community resilience capacity through the sister village program in Merapi disaster-prone area (Hazard Zone III), the components of community resilience including the characteristics of a disaster-resilient community and characteristics of the sister village program is examined based on the Hyogo Framework developed by the UN International Strategy for Disaster Reduction (UN ISDR) with some modifications. This framework consists of five thematic areas: governance, risk assessment, knowledge and education, risk management and vulnerability reduction, disaster preparedness, and response. Every thematic area has its components of community resilience. Focus group discussion and interviews with key stakeholders were designed based on these components. The tables below show findings on the sister village program based on components of community resilience and characteristics of a disaster-resilient community.

Table 4: Thematic Area 1 (Governance)

Components of Community Resilience	Findings on the Sister Village Program based on Characteristic of a disaster-resilient community
1. Policy, planning, priorities and political commitment	1.1. The vision of the sister village program plans informed by an understanding of underlying causes of vulnerability and other factors outside community's control. 1.2. Committed, effective and accountable community leadership of the sister village program planning and implementation. 1.3. The sister village program developed through participatory processes put into operation and updated periodically.
2. Legal and regulatory systems	2.1. The community understands relevant legislation, regulations and procedures, and their importance. 2.2. The community is aware of its rights and the legal obligations of government and other stakeholders to provide protection.
3. Integration with development policies and planning	3.1. The sister village program was seen by all local stakeholders as integral part of plans and actions to achieve wider community goals (e.g., poverty alleviation, quality of life).
4. Integration with emergency response and recovery	4.1. The sister village program incorporated into the official (and internationally supported and implemented) post-disaster reconstruction plans and actions.
5. Institutional mechanism, capacities, and structures; allocation of responsibilities	5.1. Representative community organizations dedicated to the sister village program 5.2. Local NGOs, CBOs, and communities of interest engaged with other issues capable of supporting the sister village program. 5.3. Responsibilities, resources, etc., defined in the sister village program 5.4. Access to government and other funding and resources for the sister village program
6. Partnerships	6.1. Local stakeholders committed to genuine partnerships (with open and shared principles of collaboration, high levels of trust). 6.2. Clear, agreed and stable of the sister village partnerships between the disaster-prone village and its partner(s). 6.3. Community and local groups/ organizations can recruit, train, support and motivate community volunteers for sister village program, and work together to do so.
7. Accountability and community participation	7.1. Devolved of the sister village program structures facilitate community participation. 7.2. Trust within the community and between community and external agencies. 7.3. High level of volunteerism in the sister village program activities.

Table 5: Thematic Area 2 (Risk Assessment)

Components of Community Resilience	Findings on the Sister Village Program based on Characteristic of a disaster-resilient community
1. Hazard/risk data and assessment	1.1. Community hazard/risk assessments carried out which provide a comprehensive picture of all major hazards and risks facing community (and potential risks). 1.2. Hazard/risk assessment is participatory process including representatives of all sections of community and sources of expertise 1.3. Assessment findings shared, discussed, understood and agreed among all stakeholders, and feed into community disaster planning 1.4. Findings made available to all interested parties (within and outside the community, locally and at higher levels) and feed into their disaster planning. 1.5. Ongoing monitoring of hazards and risks and updating of assessments 1.6. Skills and capacity to carry out community hazard and risk assessments maintained through support and training.
2. Vulnerability/capacity and impact data and assessment	2.1. Community vulnerability and capacity assessments are participatory process including representatives of all vulnerable groups. 2.2. Assessment findings shared, discussed, understood and agreed among all stakeholders and fed into community disaster planning 2.3. Community vulnerability and capacity assessments used to create baselines at start of sister village program
3. Scientific and technical capacities and innovation	3.1. Community members and organizations trained in hazards, risk and Community vulnerability and capacity assessments techniques and supported to carry out assessments. 3.2. Use of indigenous knowledge and local perceptions of risk as well as other scientific knowledge, data and assessment methods.

Table 6: Thematic Area 3 (Knowledge and Education)

Components of Resilience	Findings on the Sister Village Program based on Characteristic of a Disaster-Resilient Community
1. Public awareness, knowledge, and skills	1.1. Whole community has been exposed to/taken part in ongoing awareness campaigns, which are geared to community needs and capacities
2. Information management and sharing	2.1. Information on risk, vulnerability, disaster management practices, etc., shared among those at risk.
	2.2. The information related the sister village program publicly available and widely understood
3. Education and training	3.1. Community members and organizations trained in relevant skills to support the implementation of the sister village program
	3.2. Community experience of coping in previous events/crises, or knowledge of how this was done, used in education and training to prepare the implementation of sister village program.
4. Cultures, attitudes, motivation	4.1. Shared community values, aspirations and goals (and positive sense of the future, commitment to the community as a whole, agreement of community goals).
	4.2. Cultural attitudes and values (e.g., expectations of help/self-sufficiency, religious/ideological views) enable communities to adapt to and recover from shocks and stresses
5. Learning and research	5.1. Documentation, use, and adaptation of indigenous technical knowledge and coping strategies

Table 7: Thematic Area 4 (Risk Management and Vulnerability Reduction)

Components of Community Resilience	Findings on the Sister Village Program based on Characteristic of a Disaster-Resilient Community
1. Environmental and natural resource management (including natural capital, climate change, adaption)	1.1. Community understanding of characteristics and functioning of local natural environment and ecosystems
2. Health and well-being (including human capital)	2.1. Food supplies and nutritional status secure through the sister village program
	2.2. Access to sufficient quantity and quality of water for domestic needs during crises through the sister village program
	2.3. Community health care facilities and health workers, equipped and trained to respond to physical and mental health consequences of disasters and lesser hazard events, and supported by access to emergency health services, medicines, etc. in the sister village program
3. Sustainable livelihoods	3.1. Local trade and transport links with markets for products during crisis is supported in the sister village program
4. Social protection (including social capital)	4.1. In the sister village program, mutual assistance systems that co-operate with the community and other formal structures dedicated to disaster management.
	4.2. The sister village improves community access to basic social services (including registration for social protection and safety net services).
	4.3. Collective knowledge and experience of management of previous events (hazards, crises).
5. Financial instruments (including financial capital)	5.1. Costs and risks of disasters shared through collective ownership of group/community assets
	5.2. Community disaster fund to implement the sister village activities is facilitated
6. Physical protection; structural and technical measures (including physical capital)	6.1. Safe locations: community members and facilities (homes, workplaces, public and social facilities) not exposed to hazards in high-risk areas within locality and relocated away from unsafe sites in the sister village program
	6.2. Infrastructure and public facilities to support emergency management needs (e.g., shelters, secure evacuation and emergency supply routes) is prepared in the sister village program
7. Planning regimes	7.1. Community decision making regarding land use and management, taking hazard risks and vulnerabilities into account. (Includes micro-zonation applied to permit/restrict land uses).
	7.2. The sister village program plans feed into local government development

Table 8: Thematic Area 5 (Disaster Preparedness and Response)

Components of Community Resilience	Findings on the Sister Village Program based on Characteristic of a Disaster-Resilient Community
1. Organisational capacities and coordination	1.1. Local organizational structures for the sister village program (including disaster preparedness/evacuation committees)
	1.2. Sister village organizations are community managed and representative.
	1.3. Roles and responsibilities of the sister village organization and their members defined, agreed and understood.

Table 8 Continued

Components of Community Resilience	Findings on the Sister Village Program based on Characteristic of a Disaster-Resilient Community
	1.4. Emergency facilities (communications equipment, shelters control centers, etc.) available and managed by community or its organizations on behalf of all community members
	1.5. A sufficient number of trained organizational personnel and community members to carry out the relevant task (e.g., communication, search and rescue, first aid, relief distribution).
	1.6. Regular training (refresher courses and new skills) provided by/for local organizations; regular practice drills, scenario exercises, etc. to support the implementation of the sister village program
2. Early warning system (EWS)	2.1. Community-based and people-centered EWS at local level in the sister village program
	2.2. EWS messages presented appropriately so that they are understood by all sectors of community
	2.3. EWS provides local detail of events and takes local conditions into account
	2.4. EWS based on community knowledge of relevant hazards and risks, warning signals, and their meanings, and actions to be taken when warnings are issued.
3. Preparedness and contingency planning	3.1. Plans co-ordinated with official emergency plans and compatible with those of other agencies.
	3.2. Roles and responsibilities of different local and external actors defined, understood and agreed – and appropriate in the sister village program
	3.3. Planning process in the sister village program builds consensus and strengthens relationships and coordination mechanisms between various stakeholders
	3.4. Contingency planning informed by understanding of broader local planning provisions and facilities
4. Emergency resources and infrastructure	4.1. Community organizations capable of managing crises and disasters, alone and in partnership with other organizations
	4.2. Safe evacuation routes identified and maintained, known community members
	4.3. Emergency shelters (purpose-built or modified): accessible to local community (distance, secure evacuation routes, no restrictions on entry) and with adequate facilities for all affected population
	4.4. Emergency shelters for livestock
	4.5. Secure communications infrastructure and access routes for emergency services and relief workers.
	4.6. Two-way communications systems designed to function during crises.
	4.7. Emergency supplies (buffer stocks) in place, managed by community alone or in partnership with other local organizations
5. Emergency response and recovery	5.1. Community capacity to provide effective and timely emergency response services: e.g., search and rescue, first aid/medical assistance, needs and damage assessment, relief distribution emergency shelter, psychosocial support, road clearance
	5.2. Community and other local agencies take lead role in co-ordinating response and recovery
	5.3. Response and recovery actions reached all affected members of community and prioritized according to needs
	5.4. Community knowledge of how to obtain aid and other support for relief and recovery
	5.5. Community trust ineffectiveness, equity, and impartiality of relief and recovery agencies and actions
	5.6. Community/locally led recovery planning and implementation of plans linking social, physical, economic and environmental aspects and based on maximum utilization of local capacities and resources
	5.7. Agreed roles, responsibilities and coordination of recovery activities (involving local and external stakeholders)
6. Participation voluntarism accountability	6.1. Local leadership of development and delivery of contingency response, recovery plans in the sister village program
	6.2. Whole-community participation in development and delivery of contingency, response, recovery plans; community ownership' of plans and implementation structures.
	6.3. High level of community volunteerism in implementing the sister village program
	6.4. Organised volunteer groups integrated into community local planning structures in the sister village program.
	6.5. Self-help and support groups for most vulnerable (e.g., elderly, disabled).
	6.6. Mechanisms for disaster-affected people to express their views, for learning and sharing lessons from event

4. Conclusion

The Sister Village Program is an innovative idea initiated by Local Government of Magelang Regency through its Disaster Agency in responding to a risk because of Mount Merapi eruption. It connects villages at risk from Merapi eruption to partner villages with less risk in the surrounding region. This program is intended to promote community resilience in the surrounding area of the Mount Merapi.

The sister village system is established through a participatory process. Therefore, in implementing this program, it requires collaboration and cooperation among all stakeholders involved. In order to achieve its goal of enhancing community resilience, villages at high risk of impact from the eruption and its partner village(s) should have a strong commitment in implementing the sister village program. All requirements should be fulfilled and well prepared. There is also an important role of Local Government of Magelang Regency through Magelang Disaster Mitigation Agency in facilitating this program.

No single group or any community can address every aspect of community resilience. Nevertheless, based on components of community resilience and the characteristics of a disaster-resilient community, it is found that the system of sister village program can fulfill many aspects of these community resilience components. To conclude, considering Indonesia is one of the most disaster-prone countries in the world, this program should be regarded as a good example to be replicated in other prone areas in the country.

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