

Continuous flood risk reduction on MSMEs: Implementation of MACTOR program

Muzakar Isa*, Liana Mangifera

Faculty of Economics and Business, Universitas Muhammadiyah Surakarta, Surakarta, Indonesia

*Corresponding author: muzakar.isa@ums.ac.id

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Abstract

This study aims at analyzing the vulnerability of an area to flood and analyzing the relationship among stakeholders to reduce flood risk for the performance and sustainability of MSMEs in Klaten Regency, Central Java, Indonesia. The analysis is conducted using an indexing stakeholder analysis based on the MACTOR (Matrix of Alliances and Conflicts: Tactics, Objectives, and Recommendations) program. **Findings/Originality:** It finds that the vulnerability of the site is moderate. This condition has an impact on the sustainability of the Micro, Small and Medium Enterprises (MSMEs) in this area. MSMEs will grow well in areas with low levels of vulnerability to disasters. It also finds some stakeholders that have crucial roles in reducing the flood risk. The stakeholder's interests can be divided into income, environment, local development and safety. To reduce the flood risks, Regional Disaster Management Agency along with respective village leaders and volunteers play the central role, while universities provide the lowest contribution. These stakeholders have important roles in maintaining and improving the performance of MSMEs in flood-prone areas. The MSMEs have a vital role in supporting the economic growth.

Introduction

Micro, Small and Medium Enterprises (MSMEs) have a vital role in supporting the economic growth in which their number has reached 56.54 million units or approximately 99.99% of the total business actors in Indonesia. They contribute about 60% of GDP and provide a significant amount of employment (Setyawan et al., 2018). Nevertheless, they are the most affected units in case there is a hazard. The shortage of risk analysis and the complexity of post-disaster recovery are some significant issues for them.

Indonesia is one of the world's most disaster-prone countries, in which flood is one of disaster sources (Isa et al., 2018). The occurrence of such a hazard in 1815 to 2015 is 36.94% of the total natural disaster in Indonesia or as many as 5,903 occurrences (BNPB, 2016). Central Java Province is one of the provinces with high vulnerability to flooding (BNPB, 2016) and Klaten Regency is one of the most flood-prone areas in Central Java Province (BNPB, 2016; Isa, 2018). In 2011-2015, 20 floods with major impacts were recorded, including one victim died, 2,094 people were evacuated, seven houses and 605 ha were heavily damaged (BNPB, 2016)

The main risk of flood for MSMEs is the damage in production equipment and production site (Setyawan et al., 2018). The production site is usually integrated into the settlement; hence the priority of protecting the production site is simultaneous with protecting the residence. Eventhough MSMEs suffered the most losses due to flood, they have not taken extraordinary measures to anticipate flooding. In general, they merely set aside a small amount of

income to anticipate and devise work standard procedures (Wajdi, 2012). The impacts of flooding on MSMEs are the damage in production equipment and production sites.

The risk of flood for MSMEs should be managed. Otherwise, it would influence the local income and labor absorption, and ultimately on the regional economic growth (Isa et al., 2015). Nevertheless, regional economic growth is the primary indicator of the achievement of regional development. Isa et al. (2015) described that the frequency and duration of floods influence the magnitude of the risk of flooding. Inevitably, flood brings much damage to the factors of production and losses that positively affect economic growth. Flood risk reduction should be undertaken to maintain regional economic growth.

Swart & Raes (2007) explicated that the risk of flooding is linked to hazard and vulnerability. The vulnerability is a condition that causes the incapability of MSMEs in facing the peril of flood. It is assumed as a significant determinant of disaster risk since hazard does not necessarily bring any risk unless it interacts with the vulnerable physical, social and economic environment (McEntire, 2012). The attempt to reduce flood risk on MSMEs can be made by diminishing the vulnerability of a region. It requires the identification of regional vulnerability to the flood.

Optimal and continuous flood risk reduction involves the cooperation and synergy among stakeholders to decrease the vulnerability level of a region. Studies on the vulnerability aspects of Klaten regency over flood have not been conducted. Studies on the relationships among stakeholders in flood risk reduction have not been done as well. Each stakeholder has different interest which makes coordination and consolidation among stakeholders has been weak (Miles, 2012).

The flood risk reduction efforts for MSMEs have not been optimal. The issues related to flood risk reduction are very complex such as weak governance (Setyawan et al., 2018; Subarudi, 2008) and high vulnerability (Isa, 2016; Margono et al., 2014). This study aims at analyzing the vulnerability of MSMEs in Klaten Regency, Central Java, Indonesia, identifying stakeholders involved in existing institutions, analyzing the significance and influence of stakeholders in flood risk reduction, and analyzing the relationships among stakeholders in flood risk reduction.

Methods

This research uses a mixed method approach. The respondents were selected through a snowball sampling method by considering its suitability for identifying respondents who directly related to the study site and the efforts of flood risk reduction. Based on the method, 102 respondents are selected for indexing the regional vulnerability, and 15 respondents are selected as key informants of flood risk reduction analysis.

In-depth interviews were carried out to obtain specific information to answer research problems. The interviews were conducted on selected key informants who deliberately selected based on their involvement and their knowledge on issues related to the flood risk reduction.

In this research, the analysis included vulnerability index and stakeholder analysis. The indexing was done through assessment and weighting of all vulnerability aspects, i.e., exposure, sensitivity, and adaptive capacity. The index of flood vulnerability of an area is determined by the equation developed by (Weis et al., 2016) as follows:

$$\text{Vulnerability Index} = \sum_{i=1}^3 (W_1 \times X_1) + (W_2 \times X_2) + (W_3 \times X_3)$$

where vulnerability index is an index of vulnerability of an area; W_1 is Exposure Weight, X_1 is Exposure Score, W_2 is Sensitivity Weight, X_2 is Sensitivity score, W_3 is Adaptive Capacity Weight,

and X_3 is Adaptive Capacity Score. The results of the index of flood vulnerability of an area were classified into three categories, i.e., low (≤ 0.33), moderate (0.34–0.66) and high (≥ 0.67).

A stakeholder analysis is employed to analyze the stakeholders who are involved in the effort of flood risk reduction. Godet (1991) and Hermans & Thissen (2009) suggested stakeholder analysis as a study undertaken to identify and map stakeholders based on their role and impact in flood risk reduction. The goal is to identify complex multi-stakeholder and to determine the most significant stakeholders in association with flood risk reduction. The stages performed in stakeholder analysis is first, to identify the involved stakeholders and their roles, second to classify stakeholders based on their interests and influence, and third to define relationships among stakeholders. This process used the Matrix of Alliances and Conflicts: Tactics, Objectives, and Recommendations (MACTOR) program.

Results and Discussion

Klaten is one of the regencies in Central Java province situated in the coordinates 7°32'19"-7°41'33"S 110°26'14"-110°47'51" E. It borders on Boyolali regency in the north, Gunung Kidul regency of Yogyakarta Special Region in the south, Sukoharjo regency in the east and Sleman regency of Yogyakarta Special Region to the west.

Administratively, Klaten regency is divided into 26 sub-districts, 391 villages and ten administrative villages. The Regency can be classified into three main landscapes, namely the Slope of Merapi, the Limestone plateau and Lowland. The slope of Merapi spans on the west covering a small area in the north of Kemalang, Karangnongko, Jatinom and Tulung sub-districts. The Limestone Plateau extends on the south covering a small area in the south of Bayat and Cawas sub-district. Lowland plains span in the middle covering all districts in Klaten, except those included in the slope of Merapi and Limestone plateau. Based on the Spatial Plan of Klaten regency in 2011-2031, as many as 11 sub-districts are prone to flood, namely Bayat, Cawas, Ceper, Gantiwarno, Juwiring, Karangdowo, Pedan, Prambanan, Trucuk, Wedi, and Wonosari sub-districts. There are a lot of MSMEs in these areas. These MSMEs are in the industry of agricultures, manufacturing, trades and services. The MSMEs' businesses and their sustainability are vulnerable to flood.

The analysis shows that Klaten regency can be categorized as a moderate area in terms of flood vulnerability. It also shows that sensitivity become the highest aspect followed by adaptive capacity and exposure.

Table 1. The index of flood vulnerability of Klaten regency

	Exposure		Sensitivity		Adaptive capacity		Vulnerability index
	Score	Value	Score	Value	Score	Value	
	0.39	0.35	0.68	0.30	0.42	0.35	
Vulnerability index	0.14		0.20		0.15		0.49

Sensitivity is an aspect of vulnerability that explains the level of individual conditions within a society, and the environment condition when there is a flood (Adger, 2006; Luers, 2005). This aspect depicts the condition of an individual who suffers from the flood. The income and frequency of treatment in Klaten regency were in high vulnerability categories, while access to clean water and migration were classified in moderate vulnerability. One reason for the high vulnerability of this region is the low level of income of MSMEs. MSMEs must be empowered to increase their level of income. The increase in the level of MSME income will affect MSMEs to optimize or improve their business performance to be more resistant to flooding.

Adaptive capacity is an aspect of vulnerability that explains the ability of a system, region and community in the efforts of flood risk reduction (Allen, 2005; Füssel H. M. & Klein, 2006). The evacuation route was classified into high vulnerability. Rivers, embankments, floodgates, flood-prone maps, educational level, and distance to health services, number of NGOs, number of camps, insurance, and number of early warnings were categorized into moderate vulnerability. The evacuation sites for victims, access to flood information, emergency services, socialization, and training, were in low vulnerability category. Based on the categorization, several aspects should be highlighted for the optimization of flood risk reduction, including the provision of evacuation routes; the condition of river, embankment, floodgates; the existence of flood-prone map, the education level, the distance of houses to health services, the number of NGOs, the number of flood camps, and the early warning system.

Exposure is an aspect of vulnerability that explains the extent to which people are affected by floods related to vulnerable communities, location of the settlement, and flood conditions (Weis et al., 2016). This paper found that flood duration, the height of inundation and distance of settlement to flood source (river) were in high vulnerability category. Meanwhile, the flood frequency and the number of elderly and toddler population were in low vulnerability category.

MSMEs in flood-prone areas have a moderate level of vulnerability. This means that the MSMEs are vulnerable to uncertainty from flooding, so coordination and cooperation from all stakeholders is needed to maintain the sustainability of MSMEs in this region. A low vulnerability provides better chance for MSMEs to develop. To have such a low vulnerable state, good and professional institutions are needed.

Optimizing the reduction of regional vulnerability level whose aspects are mentioned above should be supported by well-managed institutions (Reed et al., 2009; Rees & MacDonell, 2017). Stakeholders must synergize and continuously undertake different activities to eliminate the most significant multiplier effects for flood risk reduction; one of them is to reduce the damage to buildings and equipment for MSMEs, and losses due to flooding because they cannot operate. The results of analysis showed that there were 15 key actors (stakeholders) who have the most significant role in flood risk reduction. The stakeholders were: (1) Regional Planning, Research and Development Agency (Bappeda), (2) Regional Disaster Management Agency (BPBD), (3) Health office (Dinkes), (4) Department of Public Work (DPU), (5) NGOs, (6) University/higher education (PT), (7) Head of Sub-district (Camat), (8) Village Head (Kades), (9) Farmers (Petani), (10) MSMEs, (11) Community Leaders (Relawan 1), (12) Volunteers (Relawan 2), (13) Indonesian Red Cross (PMI), (14) SAR Team, and (15) TNI and POLRI.

Figures 1 and 2 demonstrate that BPBD is the stakeholder with the highest impact in reducing flood risk. It has high competitiveness and a central role in the effort to reduce flood risk in Klaten regency. It is followed by two stakeholders with highest influence on flood risk reduction, namely the local village chief and volunteers (local community). The universities have a low influence along with the head of sub-district, TNI-POLRI, DPU, Bappeda, and SAR Team, which are in one quadrant with both low influence and low dependence. Stakeholders with low influence and high dependence level are MSMEs.

The results of the in-depth interview analysis suggested that each of the informants has various interests in the flood risk reduction efforts. There are four main interests, namely, income, natural and artificial environment conservation, regional development and public safety.

The competitiveness scale with objectives as shown in Figure 3 illustrates that the revenue environment, regional development, and public safety obtained a positive response from all actors in which all actors approved this objective. In general, the actors involved in flood risk reduction activities were more concerned about personal income or profit. Based on the real interests, three

interests have strong relationships, namely public safety, environment, and regional development. Income is insignificant for stakeholders in reducing the flood risk.

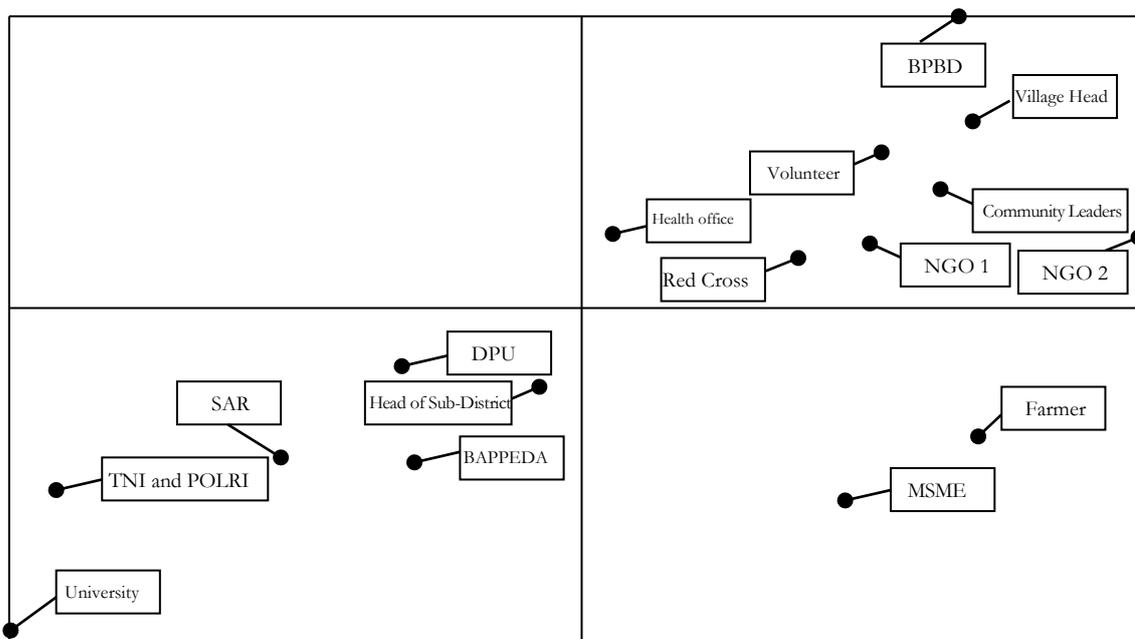


Figure 1. Map of stakeholders' influence and relationship in flood risk reduction

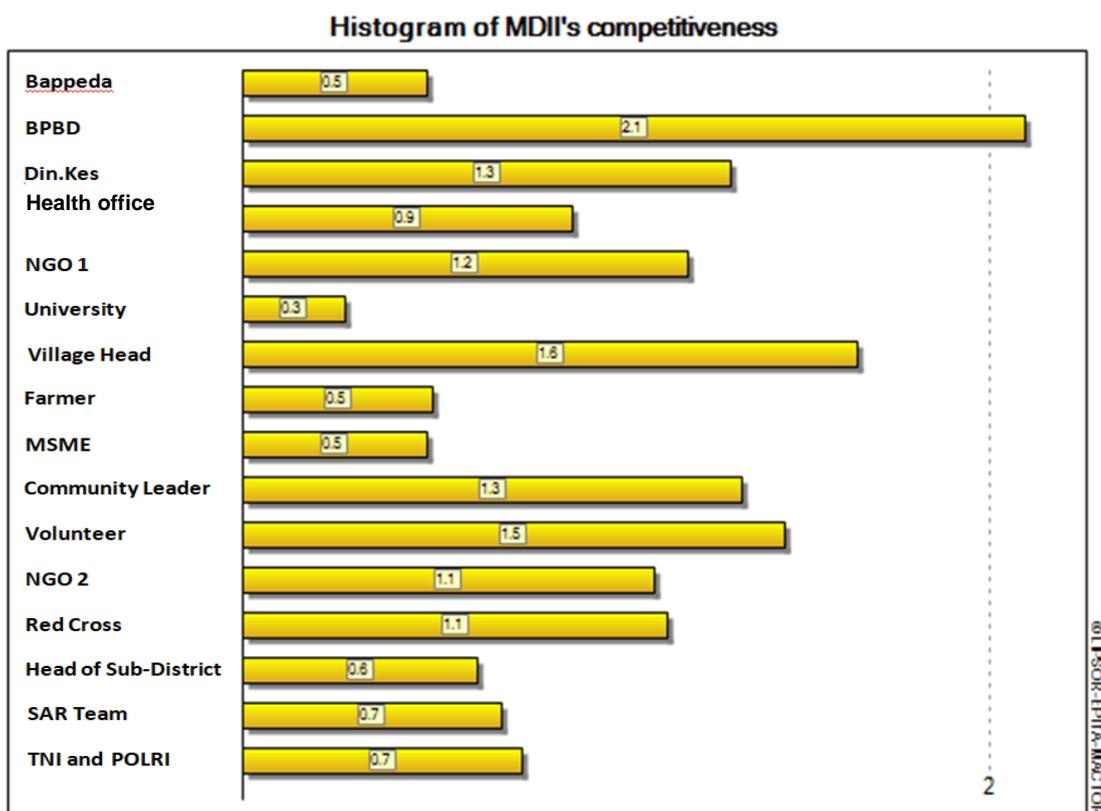


Figure 2. Actors' competitiveness in flood risk reduction

Various flood risk reduction efforts in Klaten Regency still focus on three objectives, namely public safety, the environment, and regional development. Business aspects or MSMEs have not become a priority for stakeholders in this area in efforts to reduce flood risk. MSMEs must get priority in efforts to overcome flooding because MSMEs play an important role in improving regional and national economies.

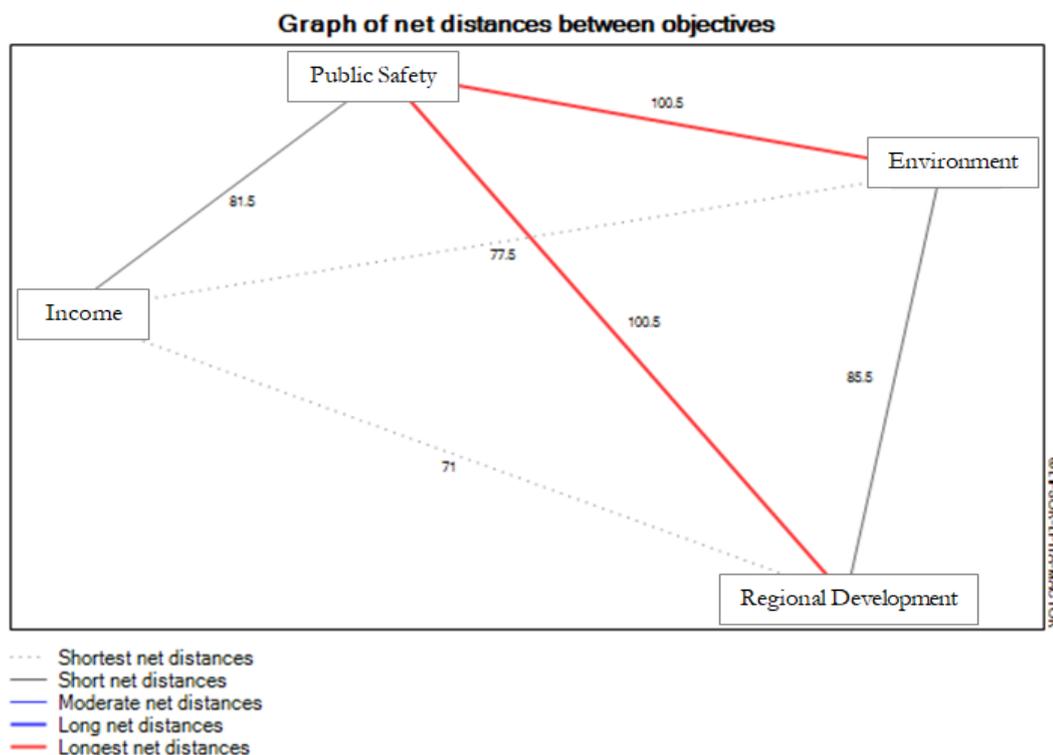


Figure 3. The net distance between the actors in flood risk reduction

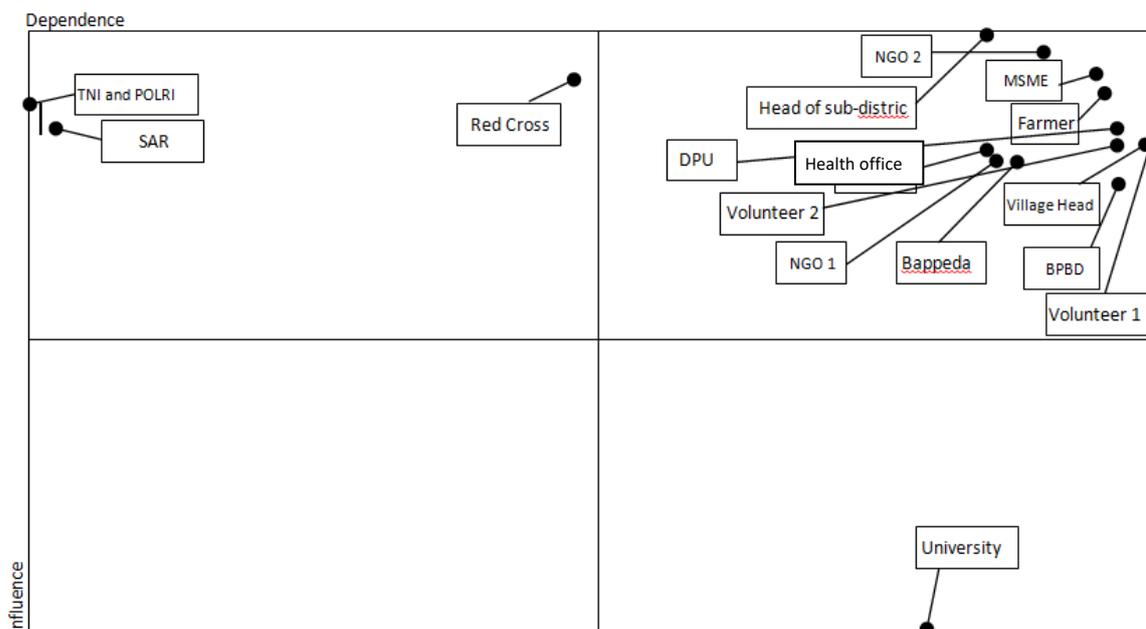


Figure 4. Map of inter-stakeholder relationship in flood risk reduction

Figure 4 shows the categorization of stakeholders in flood risk reduction based on the proximity of relationships among stakeholders and their objectives. The convergence among actors in flood risk reduction indicates strong values (Isa et al., 2015). The largest and most potent stakeholder group consists of Bappeda, BPBD, Health Office, DPU, head of sub-district, the village head, NGOs, volunteers, and business actors. This group is a central one due to the members' high common interest level. Stakeholders with the lowest convergence level are TNI-POLRI, PMI, SAR, and university. The convergence level is low because the actor has a relationship with one of the objectives or interests that are different from the others.

Based on Figure 4, the convergence of stakeholders is grouped into three major groups. The first group consists of Bappeda, BPBD, Health Office, DPU, head of sub-district, the village head, NGOs, volunteer, and business actors. The second group consists of TNI-POLRI, PMI, and SAR. The third group is the university. The last group is a peculiar phenomenon due to its absence of contribution to flood mitigation.

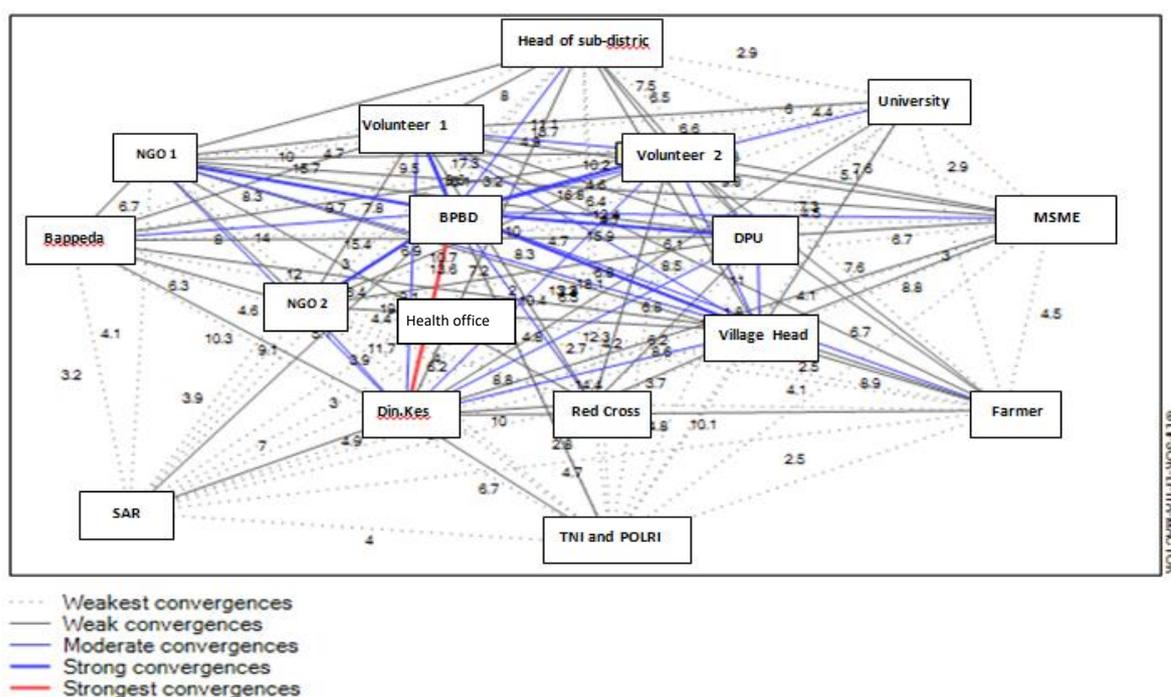


Figure 5. Relationships between stakeholders in flood risk reduction

Based on Figure 5, the main actors in flood risk reduction in Klaten regency are BPBD, village officers, volunteers, and community leaders, NGOs, Health Office, and DPU. These stakeholders serve as critical factors in flood risk reduction. In the arrangement of flood risk reduction institutionalization, these seven stakeholders should be positioned as the main actors due to their significant roles so that these stakeholders have an important role in improving the performance of MSMEs.

MSMEs are the spearhead of the regional economy, both as a source of regional income, economic growth, and as a source of employment. On the other hand, MSMEs as the most vulnerable business units when there are floods must be empowered so that they are stronger and healthier. The sustainability of MSMEs in Klaten Regency must be carried out comprehensively by all stakeholders. They have their respective roles in efforts to reduce flood risk, one of which is reducing damage to buildings and equipment for MSMEs and losses due to inability to operate.

Conclusion

Klaten regency can be classified in a moderate flood vulnerability level. Sensitivity is a critical aspect that determines the region vulnerability, followed by adaptive capacity and exposure. This condition has an impact on the performance and sustainability of MSMEs in this area. MSMEs will grow well if they are in areas with low level of vulnerability to disasters.

There are 15 key actors in flood risk reduction in Klaten regency. They have four main goals in the flood risk reduction agenda, i.e., income, environment, regional development, and public safety. BPBD has a central role together with the local village head and volunteers (local community) in the effort of flood risk reduction. Meanwhile, the university has the lowest contribution. These stakeholders have an important role in maintaining and improving the performance of MSMEs in flood-prone areas. The MSMEs have a vital role in supporting the economic growth.

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