The Role of Collaboration in Supporting Community Resilience Programmes in Post-Disaster Events

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UDK: 35.073.515.3:35.072.7
3.073.515.3:35.072.7
351.778.52:35.072.7
3.073.515.3:35.072.7
https://doi.org/10.31297/hkju.24.4.2
Original paper / izvorni znanstveni rad
Received / primljeno: 29. 3. 2023.
Accepted / prihvaćeno: 3. 10. 2024.

In recent years, the notion of resilience programs has been dragged into significant attention from public administration scholars due to massive disasters happening worldwide. In this case, the collaboration has been seen as one of viable solutions to increase the rate of success during the implementation of community resilience programs. This study aims to evaluate the cause and effect of the collaboration process to support community resilience programs during post-disaster events. In this study, we propose a questionnaire-based Partial Least Squares – Structural Equation Model (PLS-SEM) with latent variables of community resilience program (X), collaboration process (Y), and the impact on community (Z). The re-

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sults of this study confirm that the role of collaboration in supporting community resilience programs is minimal due to lack of commitment to participate and a notorious impression of collaboration history. This phenomenon has gradually caused a loss of trust of societies in stakeholders to the present day.

Keywords: community resilience, collaboration, build-back better, governance, post disaster events

1. Introduction

In recent years, the notion of resilience has been widely adopted to express a recovery process from a disrupted situation (Esbensen, 2022). In this case, the ability of an object to tolerate and recover from a disturbance has been extensively characterized as resilience, a term that originated in biophysics (Holling, 1973). The idea was then used as a metaphor to articulate how well people can endure and bounce back from upsetting experiences in the social sciences (Danar & Pushpalal, 2014). Furthermore, community resilience on a collective level is defined as shared activity in which individuals come together to respond to a common disaster (Morton & Lurie, 2013). It can either be seen as an ongoing process of adaptation, a simple absence of negative effects, the presence of a range of positive attributes, or a mixture of all three (Patel et al., 2017).

In addition to this terminology, the notion of community resilience has gained substantial attention these years as a fundamental construct of disaster preparedness, emergency response, and crisis recovery (Fenxia, 2022). One of the key components of community resilience programs is the emphasis on education and awareness. Sardi, Razak and Bakri (2019) highlight that education plays a critical role in fostering a culture of resilience within communities, enabling them to respond effectively to disasters. By providing training and resources, communities can enhance their preparedness and ensure that members are equipped with the necessary skills to handle emergencies. Similarly, Kim and Kim emphasize the importance of governmental support and the establishment of learning networks to enhance household disaster preparedness (Kim & Kim, 2022). This underscores the need for a collaborative approach that combines individual efforts with institutional support to achieve comprehensive disaster preparedness. Therefore, a collaboration arrangement is commonly

seen as a viable option and an alternative that can be utilized (Emerson, Nabatchi & Balogh, 2011).

Numerous empirical works have underlined the benefits of collaboration to the parties concerned such as Cromwell and Gardner (2020). Increased or improved collaboration will inevitably result in additional advantages for individuals, teams, and organizations (Gardner, Gino & Staas, 2012). Even though the collaborative mechanism has been trusted as a useful method to face limited capacity and resources problems, the model and implementation of collaboration, however, are still amorphous and inconsistent (Emerson, Nabatachi & Balogh, 2011). It has thus become a consequence that collaborative mechanism has various patterns and impacts on community resilience implementation.

Collaboration that is conducted virtually may generate positive contributions. In addition, it is also an effective strategy for addressing complex socio-ecological concerns, such as natural disasters and unexpected catastrophic events, to handle "wicked problems", which are described as complex, multiscale public policy issues requiring action beyond the scope of the nation-state alone, and so, collaborative governance was developed (Ansell & Gash, 2007).

However, numerous studies have also confirmed the ineffectiveness of collaboration on the implementation of community resilience programs. One of prominent examples explaining this case is the study of Bozeman and colleagues (2015), which confirms that collaboration will prolong the process of mitigation and might even result in negative contribution without appropriate implementation. In addition to this result, Emerson, Nabatchi and Balogh (2011) convey that not all problems will possibly be solved by a collaborative mechanism. In this regard, the series of empirical studies generate different impacts of collaboration. Accordingly, it is always interesting to explore the role of collaboration in different practices of implementation.

The Lumajang Regency (LR) in East Java has been identified as a disaster-prone area, facing various natural hazards such as floods, tsunamis, and volcanic eruptions (Qurbani, 2020). The impact of the eruption of Mount Semeru in LR has resulted in environmental damage and numerous fatalities (Viantry & Hari Raharjeng, 2022). Additionally, the region has experienced the devastating effects of the hot mudflow accident in the Sidoarjo area, which has led to ongoing land deformations and environmental impact (Sri Sumantyo et al., 2022). Furthermore, the coastal eruption from Mount Semeru areas in East Java, including Lumajang, are

vulnerable to tsunamis, posing significant risks to the local communities (Guntur et al., 2017; Hidayah, Nazilatul & Kusumo Wardhani, 2022). The complex geological structures in East Java provide opportunities for natural resource exploitation, but also harbour perils associated with natural disasters (Martha et al., 2017).

The disaster-prone nature of East Java, including the LR, has significant implications for various aspects of the region, i.e. the prevalence of disasters in East Java has consequences on human health, particularly in highly disaster-prone areas such as East Java and North Sumatra (Lestari et al., 2022). Moreover, the development of tourist cities in East Java, including Batu City, is intertwined with the possibility of natural disasters, highlighting the need for comprehensive disaster management strategies.

This research aims to reveal the role of collaboration toward community resilience programs conducted by the government of LR located in East Java, Indonesia. The community resilience program has been implemented to minimize the impact of Mount Semeru eruption as one of the heaviest disaster factors in LR, which frequently causes disaster catastrophes. In other words, the community resilience program in LR has been intended to manage post-disaster events. It applies a quantitative method intended to gather the local community response regarding the impact of collaboration toward community resilience programs. It is thus expected to retrieve genuine information and comprehensive illustration of practical implementation.

2. Theoretical Discussion

1.1. Community Resilience and Collaboration Process

Community resilience is not only about how to deal with the occurrence of a disaster and overcome vulnerability so that the community can survive in the disaster-affected environment. Resilience is related to the adaptations and preparations made before the occurrence of a disaster. Similarly, resilience means taking action to mitigate risks before an event and ensuring rapid recovery after a natural disaster (Danar & Pushpalal, 2014). One of the foundational elements of community resilience is recognizing existing strengths within communities. This perspective aligns with the findings of Huang, Wong and Fu (2019), who emphasize that community

economic resilience, defined as the financial capacity to recover from disasters, is crucial for understanding how communities respond to adversity. By focusing on these intrinsic strengths, resilience programs can build a solid foundation for effective disaster management.

On the other hand, community resilience affects economic and social resilience. The economic resilience of a community is related to the economic condition of the community in meeting primary and secondary needs. Meanwhile, social resilience is a key factor in the adaptation of individuals and social groups to environmental changes (Adger, 2000). Similarly, resilience makes a specialty of the intention, a way to reduce or prevent human, social, economic, monetary, and asset loss and damage (Danar & Pushpalal, 2014).

In publication by Patel and colleagues (2017), community resilience is defined as a continuous process of adaptation, the lack of negative consequences alone, the presence of a variety of good characteristics, or a combination of all four. This paper is inspired by the community resilience framework posited by Patel and colleagues (2017) in the section below: 1) strengthening local knowledge, 2) community networks and relationships, 3) communication, 4) health, 5) governance and leadership, 6) resources, 7) economic investment, 8) preparedness, and 9) mental outlook. In analysing the case of Lumajang, this study only used 4 variables that support the situations that occurred, which are (1) strengthening local knowledge, (2) community networks and relationships, (3) health, and (4) governance and leadership.

With regard to local knowledge, if a community is aware of its current vulnerabilities, both short and long-term effects of a disaster may be mitigated. Three sub-elements have been identified within this. The first is factual expertise as the base of the community. The second is training and education. The third sub-element found is collective efficacy and empowerment.

When it comes to community networks and relationships, positive outcomes for a community and its members can occur for the duration of a disaster when its individuals are well-connected and form a cohesive entirety. The connectedness of a community, on occasion referred to as its social community, is defined by linkages within a network.

The pre-existing health of a community and the delivery of health services after a disaster are important for community resilience. Understanding and addressing health vulnerabilities can build resilience before a disaster and mitigate long-term issues afterwards.

Governance and leadership shape how communities deal with crises. We have identified sub-factors within governance and leadership, which include: 1) infrastructure and services; 2) public involvement and guidance through a community's infrastructure and offerings; 3) their effectiveness, performance, and 4) capability to respond quickly have all been cited as critical.

In other words, community resilience affects the improvement of community resilience after disasters. Insufficient attention to risk reduction exacerbates the devastation from natural disasters faced by communities (Mannakkara, Wilkinson & Potangaroa, 2014), i.e., considering the lives lost as a result of residing in high-risk locations with inadequate bushfire protection during the Victorian bushfires, recovery operations have tried to realize the goal of vulnerability reduction with recommendations to include disaster risk-reduction strategies in reconstruction. According to Build-Back Better (BBB) ideas, hazards can be minimized by better land-use planning and structural designs (Mora & Keipi, 2006; Pathiraja & Tombesi, 2009). Risk reduction, community recovery, and implementation are the three basic categories into which the key BBB principles can be divided, while community recovery is concerned with restoring the social and economic aspects of the community. Risk reduction refers to enhancing a community's physical resistance to natural calamities. The process of risk reduction and community healing is referred to as implementation (Mannakkara, Wilkinson & Potangaroa, 2014).

1.2. Conceptual Model and Hypotheses

This study analyses the factors of local knowledge, community networks and relationships, health, and governance and leadership. The following research model was established to determine how these factors affect disaster risk reduction.

Hypothesis 1 (H1): Strengthening local knowledge has a direct impact on disaster risk reduction.

Hypothesis 2 (H2): Community networks and relationships have a direct impact on disaster risk reduction.

Hypothesis 3 (H3): Health has a direct impact on disaster risk reduction.

Hypothesis 4 (H4): Governance and Leadership have a direct impact on disaster risk reduction.

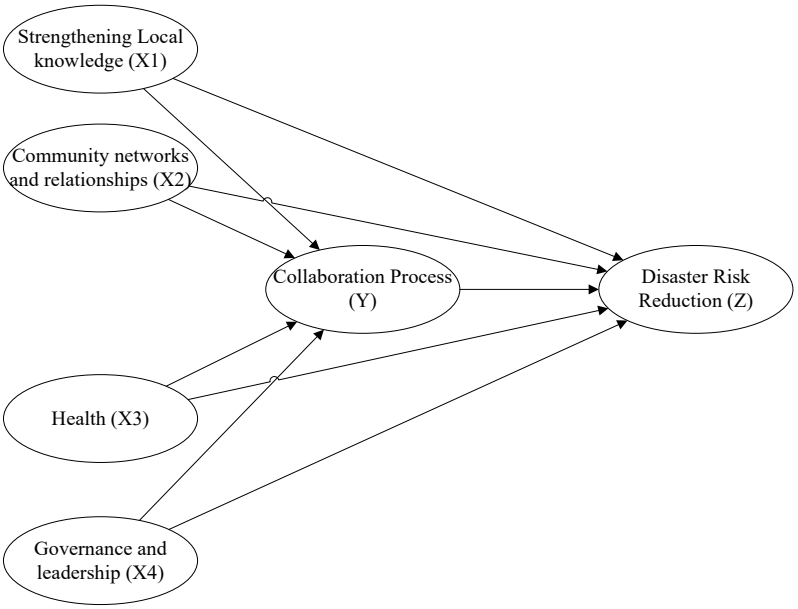
Hypothesis 5 (H5): Strengthening local knowledge has an indirect impact on disaster risk reduction through collaboration.

Hypothesis 6 (H6): Community networks and relationships have an indirect impact on disaster risk reduction through collaboration.

Hypothesis 7 (H7): Health programs have an indirect impact on disaster risk reduction through collaboration.

Hypothesis 8 (H8): Governance and leadership have an indirect impact on disaster risk reduction through collaboration.

Figure 1: *Research model*



Source: Author.

3. Research Methodology

2.1. Data Collection and Sample

Cross-sectional information was gathered from respondents in response to questions about the implementation of disaster governance and collaboration indicators in this study, 169 Lumajang residents served as the

sample. Based on the 169 completed questionnaires, it has satisfied the requirements of the Central Limit Theorem (Hair et al., 2014; Nicácio et al., 2019) for normally distributed values. Additionally, the Maximum Likelihood Estimate (MLE) is the most popular SEM estimation method. According to simulation studies, MLE can produce reliable results with a sample size as low as 50 under the right circumstances (Hair et al., 2014). The surveys were administered in September 2022, and the study was carried out in Lumajang, Indonesia. Additionally, all replies from respondents were used, and predictive mean matching was used to fill in the gaps left by missing data (PMM). All of the question items used a five-point Likert scale, with the choices being Strongly agree (5 points), Agree (4 points), Neither agree nor disagree (3 points), Disagree (2 points), and Strongly disagree (1 point). SmartPLS Version 3.0, a statistical software program for SEM analysis, was utilized to examine the data that had been gathered.

2.2. Statistical Analysis

This research performed a Partial Least Squares – Structural Equation Modeling (PLS-SEM) predicting the effect of disaster governance variables on the impact on community resilience, using collaboration as a mediating variable. PLS-SEM is a variant of structural equation modelling that uses an Ordinary Least Squares regression-based method (OLS) in contrast to the maximum likelihood estimation procedure in covariance-based structural equation modelling. PLS-SEM is a variance-based approach; PLS-SEM should be used in situations where theory is less developed, and the aim is to predict and explain target constructs.

PLS-model estimation was performed using SmartPLS. As the item scales are comparable, a standardization of the data is not necessary, so that model estimation was performed on original data. It is widely recognized that covariance-based and least variance-based techniques, CB-SEM (Covariance-based structural equation modelling) and PLS-SEM, are the most widely used types of SEM modelling. Although they both come from the same base, they differ significantly; CB-SEM was preferred by previous studies, while PLS-SEM gained rapid popularity over the last few years due to its ability to operate multiple variations.

The PLS-SEM method is a soft-modelling technique that requires the least residual from the distribution, number of samples, and the scope of measurement. It can extract all the invisible characteristics from the

found data (Bagozzi & Yi, 2012). In comparison, the CB-SEM reduces the divergence between the estimated data and the sample covariance matrix to a minimal degree by estimating the model parameters, whereas the PLS-SEM method outperforms the partial way of assessing model relationships in the usual iterative ordinary least square regression (OLS) so that the explained variance of the endogenous latent variables can be maximized. Basically, the latter modelling approach is built on regression, and uses a component-centred method to create a directional sketch between variables (Hair et al., 2010).

PLS-SEM is assessed using the coefficient of determination (R^2) of each of the latent constructs. R^2 is used to describe the overall goodness of fit of an estimated model with one or more independent variables. R^2 ranges from "0" and "1". If it implies that there is a perfect fit, that is $\hat{Y}_i = Y_i$. If $R^2 = 0$ it implies that there is no relationship between the estimator and the estimate, that is $\hat{Y}_i \neq Y_i$. Similarly, if $R^2 > 0.5$, it implies that there is a good fit of the model to the given data, and if $R^2 < 0.5$, it implies that there is no good fit of the model to the given data. Alternatively, R^2 can be evaluated as the square of the coefficient of correlation.

$$R^2 = \frac{ESS}{TSS} = \frac{\sum\left(\hat{Y}_i - \overline{Y}\right)^2}{\sum\left(Y_i - \overline{Y}\right)^2} \tag{3.1}$$

or

$$R^2 = 1 - \frac{RSS}{TSS} = 1 - \frac{\sum\left(Y_i - \hat{Y}\right)^2}{\sum\left(Y_i - \overline{Y}\right)^2} \tag{3.2}$$

where:

Y_i = Actual value
$\overline{Y}$ = The mean of actual value
$\hat{Y}$ = The estimated value

4. Findings

3.1. Measurement Model Assessment

The following Table 1 demonstrates the validity and reliability of the measurement model by presenting the Average Variance Extracted (AVE),

Composite Reliability (CR), Rho-A value, Cronbach's Alpha (CA), and Factor Loading (FL).

Table 1: *Validity and reliability of the measurement model*

Construct	Code	SL	CA	Rho-A	CR	AVE
Strengthening Local Knowledge			1.000	1.000	1.000	1.000
	X1.1					
	X1.2	0.791				
Community Network and Relationship			0.864	1.282	0.928	0.866
	X2.2	0.977				
	X2.3	0.882				
Health			0.793	0.810	0.905	0.827
	X3.1	0.711				
	X3.2	0.884				
	X3.4	0.893				
	X3.5	0.926				
Governance and Leadership			1.000	1.000	1.000	1.000
	X4.1	0.823				
	X4.2	1.000				
Collaboration Process			0.805	0.806	0.886	0.722
	Y1.1	0.903				
	Y1.2	0.776				
	Y1.3	0.854				
Disaster Risk Reduction			0.760	0.760	0.863	0.679
	Z1.2	0.860				
	Z1.3	0.887				
	Z1.4	0.715				

AVE = average variance extracted; CA = Cronbach's alpha; CR = composite reliability; Rho-A = Spearman rank correlation coefficient; SL = score loading.
Source: Author.

As presented in Table 1, all the items have a factor loading of more than 0.5, which means that all items are accepted into the model. The reliability and validity of the indicators were then determined. This process exam-

ined both discriminant and convergent validity based on the reliability of each indicator, then average variance sampling (AVE) was performed to determine internal consistency and validate the model.

3.2. Structural Model Assessment

The analysis of the inner model was conducted using the bootstrapping method for the significance of the correlation to analyse the correlation between endogenous and exogenous variables. This research was analysed using a Structural Equation Model (SEM) with the help of the SmartPLS software. Testing for structural models can be carried out through the value of R Square, which is a coefficient of the determination of endogenous constructs that shows to what extent an endogenous construct is described by an exogenous construct (Hair et al., 2010).

Table 2: *R square values*

	R Square	Adjusted R Square
Collaboration Process	0.294	0.277
Disaster Risk Reduction	0.654	0.643

Source: Author.

Based on Table 2 above, it can be seen that the R Square value of the Collaboration Process variable is 0.294. This shows that 29.4% of the Collaboration Process is explained strongly by strengthening local knowledge, community network, relationship, health, and governance and leadership. Similarly, the Disaster Risk Reduction variable has an R Square value of 0.654; this indicates that 65.4% Disaster Risk Reduction is strongly explained by strengthening local knowledge, community network and relationships, health, governance and leadership, and collaboration processes.

In addition to testing R Square values, structural model measurements can also be used to measure hypotheses involving original sample values (β), which are estimates for path coefficients. Furthermore, it uses the values of t-statistics (t) and p-values (*P*) to indicate whether the influence of endogenous constructs on exogenous constructs is significant. The outer loading results contained in the table below show that the existing variables have significance or are insignificant, where the items are significant to the construct with a t-statistical value of > 1.96 and a p-value of < 0.05.

In the table below, it can be seen that from the 8 hypothesis tests conducted, there are 5 (five) hypothesis testing results that have the results accepted and 3 (three) test results that have the results rejected.

Table 3: *Structural estimates*

Hypothesis	Prediction	β	t	P	Decision
H1	Strengthening Local Knowledge –> Disaster Risk Reduction	-0.092	1.209	0.227	Rejected
H2	Community Network and Relationships –> Disaster Risk Reduction	-0.051	0.915	0.361	Rejected
H3	Health Programs –> Disaster Risk Reduction	0.281	5.620	0.000	Accepted
H4	Governance and Leadership –> Disaster Risk Reduction	0.422	4.912	0.000	Accepted
H5	Strengthening Local Knowledge –> Collaboration –> Disaster Risk Reduction	-0.010	3.644	0.000	Accepted
H6	Community Network and Relationships –> Collaboration –> Disaster Risk Reduction	0.139	0.260	0.795	Rejected
H7	Health programs –> Collaboration –> Disaster Risk Reduction	0.111	4.235	0.000	Accepted
H8	Governance and Leadership –> Collaboration –> Disaster Risk Reduction	0.102	3.246	0.001	Accepted

β = standardized beta coefficient; P = probability; t = t-statistic
Source: Author.

3.3. Importance-Performance Matrix Analysis (IPMA)

Based on the matrix, the results of the first hypothesis (H1), namely a direct estimate between Strengthening Local Knowledge (X1) on its impact on Disaster Risk Reduction (Z), show that the results are rejected,

where the p-value of 0.227 is greater than the alpha 0.05 or the error level a = 5%. Thus, it can be assumed that in order to build the resilience of a community in LR, there is a lack of community participation concerning government programs related to monitoring and disseminating information on potential natural disasters, communication of disaster response cadres, disaster response jamborees, natural disaster field rehearsals, and management of vulnerable areas to flooding control.

One significant aspect of local knowledge is its integration into environmental decision-making processes. Studies have shown that local knowledge can complement scientific knowledge, leading to more effective environmental management strategies. For example, Putra, Susetyo and Ngimba (2022) highlight that social capital, derived from local ecological knowledge, aids in making informed decisions regarding environmental issues in the Bompon Watershed Community. Similarly, Corburn (2003) emphasizes the importance of incorporating local knowledge into environmental planning, particularly for communities facing severe environmental and health risks. This integration fosters a collaborative approach that respects and utilizes the unique insights of local populations, thereby enhancing the effectiveness of conservation efforts and policy implementations. In addition, it is also influenced by the public's assumption that the authority of a Divine Creator is still a firmly inherent understanding among them. If God has willed, man cannot reject it. A different point is explained by the United Nations Development Programme and the Government of Indonesia (2012), which stated that disaster risk reduction actively involves at-risk communities by studying, analysing, handling, monitoring, and evaluating disaster risks to reduce their vulnerability and increase their capacity.

Strengthening local knowledge plays a crucial role in disaster risk reduction (DRR) and can significantly impact the management of volcanic eruptions in Lumajang. Local knowledge, also known as indigenous knowledge, has been increasingly recognized as a valuable asset in reducing disaster risks and enhancing community resilience (Hiwasaki et al., 2014; Dube & Munsaka, 2018; Iloka, 2016). This is particularly relevant in the context of volcanic eruptions, where traditional practices and local knowledge can provide insights into early warning signs, evacuation routes, and culturally appropriate disaster response strategies (Griffin & Barney, 2020; Iloka, 2016). Integrating local knowledge with scientific approaches can lead to more effective DRR strategies, as it enhances the understanding of community-specific vulnerabilities and capacities (Rozaki et al., 2021; Ngwese et al., 2018).

Furthermore, the Sendai Framework for Disaster Risk Reduction 2015–2030 emphasizes the importance of understanding disaster risk at the local level and promoting a multi-sectorial approach to managing emergencies and disasters (Bieh et al., 2021). This framework underscores the significance of local knowledge in disaster risk understanding and reduction. Additionally, the involvement of local communities in the assessment and mitigation of disaster risk has been recognized as essential for fostering resilience (Mercer et al., 2012). Therefore, efforts to strengthen local knowledge in Lumajang, should involve active participation and collaboration with the local communities to ensure that their perspectives and traditional practices are integrated into DRR initiatives.

Incorporating local knowledge into disaster management plans tailored to the specific context of Lumajang, can contribute to the development of effective strategies and policies for volcanic eruption preparedness and mitigation (Radel, Sukumaran & Daniels, 2023). This may involve initiatives such as community-based information systems, evacuation procedures, and mitigation strategies that align with the cultural and environmental context of the region (Ayuningtyas et al., 2021). Moreover, the collaboration between various stakeholders, including government agencies, academic institutions, businesses, and local communities, as observed in the pentahelix collaboration in East Java, can further strengthen the integration of local knowledge into DRR efforts (Windiani, 2021).

Meanwhile, different results were obtained by the researcher based on the results of hypothesis testing 5 (H5). The results estimated Strengthening Local Knowledge (X1) on its impact on Disaster Risk Reduction (Z) through Collaboration (Y) as a mediation variable, which shows that the results are accepted, where the p-value of 0.000 is less than the alpha 0.05 or an error level of a = 5%. This confirms that the local community improvement program in LR can be better if there is a collaboration that can engage certain people to drive community participation. This supports research conducted by Cooper and Nguyen (2019) stating that collaborating local knowledge can have a significant impact on people's ability to reduce disaster risk. This is because this collaboration allows the community to collect local knowledge from various aspects of collaboration and realize disaster risk reduction more comprehensively. Through collaboration, they can better prepare themselves when there is a disaster. Therefore, local knowledge can also positively affect the mentality and ability of people who respond to disasters.

Strengthening local knowledge plays a crucial role in disaster risk reduction (DRR) through collaboration, particularly in the context of volcan-

ic eruptions in Lumajang. Local knowledge, often rooted in indigenous practices and traditions, can significantly contribute to enhancing community resilience and reducing the impact of volcanic disasters (Vergara-Pinto & Marín, 2023). Integrating local ecological knowledge into DRR is essential for systematizing community coping mechanisms and adaptation strategies during volcanic cycles, as communities often rely on indigenous knowledge for disaster risk reduction, especially in safeguarding their livelihoods (Vergara-Pinto & Marín, 2023). Furthermore, cultural-based models of community disaster resilience have been shown to provide a strong foundation for understanding local impacts of disasters and building resilience, particularly in developing countries like Indonesia (Nuryanti et al., 2021).

Collaboration is also vital in leveraging local knowledge for DRR. The pentahelix collaboration approach, involving government agencies, volunteers, academia, businesses, and communities, has been identified as an effective model for disaster risk reduction forums in East Java (Windiani, 2021). This collaborative approach facilitates the pooling of diverse expertise and resources, which is essential for addressing the multifaceted challenges posed by volcanic eruptions. Additionally, partnerships between practitioners and scientists have been highlighted as crucial for strengthening effective disaster risk management, particularly in understanding the legitimate and credible aspects of local risk contexts (Weir et al., 2023).

Based on the results of hypothesis test 2 (H2), from the results of direct estimation between Community networks and relationships (X2) and its impact on Disaster Risk Reduction (Z), the results are rejected, where the P-value of 0.361 is greater than alpha 0.05 or an error rate of a = 5%. It can thus be assumed that there is a lack of community participation in disaster relief and wildfire control. Meanwhile, the same results were also obtained by researchers based on the results of hypothesis 6 (H6) testing from the results of indirect estimation between Community networks and relationships (X2) and Disaster Risk Reduction (Z) through Collaboration (Y) as a mediation variable. This test showed that the results are rejected, where the p-value of 0.795 is greater than alpha 0.05 or an error level a = 5%. Thus, it can be assumed that there is a lack of commitment and initiative in involving all parties to implement strategies for disaster risk reduction.

Knowledge dissemination is another critical aspect of community networks. Liu et al. explore how knowledge is shared within community networks, noting that these networks play a vital role in facilitating the flow of information among members (Liu et al., 2010). The effectiveness of

knowledge dissemination can be influenced by the network's structure, as well as the interpersonal relationships that exist within it. Tonn et al. (2001) further argue that integrated resources and programs within community networks can enhance community dialogue and engagement, thereby improving the overall quality of communication and information sharing. Meanwhile, in the implementation of community relations in LR, the participation of the community has not been utilized optimally. Similarly, Shaw's (2014) opinion reveals that community relationships have proven to be effective and beneficial in disaster risk reduction.

Community networks and relationships indeed play a crucial role in disaster risk reduction for volcanic eruptions in Lumajang. The establishment of strong community networks and relationships contributes to resilience, preparedness, and effective response and recovery mechanisms, ultimately enhancing the overall capacity of communities to mitigate the impact of volcanic disasters.

Norris and colleagues (2007) emphasize the significance of social support and social capital within community networks, highlighting the importance of relationships between individuals and their larger neighbourhoods and communities. This underscores the role of community networks in providing essential support and resources during disaster events, contributing to the overall resilience of the community.

Wu and colleagues (2022) also emphasize the importance of community resilience in mitigating natural disaster risks, highlighting the potential of resilient communities in reducing the impact of volcanic eruptions. This underscores the critical role of community networks and relationships in building resilience and reducing vulnerability to volcanic disasters.

Moreover, the concept of community resilience plays a pivotal role in shaping disaster risk reduction strategies. Miles, Green and Svekla (2011) advocate for a resilience-based framework that emphasizes the interconnectedness of all actors within a community network, moving beyond traditional preparedness and response measures to a more holistic approach. This perspective is supported by Cui and Han, who note that community resilience is closely linked to disaster risk management activities, reinforcing the need for interventions that enhance local capacities (Cui & Han, 2019). By building resilient communities, stakeholders can ensure that local populations are better equipped to handle disasters and recover more swiftly. Moreover, Spiekermann and colleagues (2015) emphasize the need to address knowledge fragmentation and strengthen individual and institutional learning to effectively address pressing issues of disaster risk

reduction, including the role of community networks in climate change adaptation. This highlights the importance of leveraging community networks and relationships to facilitate knowledge sharing and learning, ultimately contributing to more effective disaster risk reduction strategies.

Based on the results of hypothesis test 3 (H3) from the results of direct estimation between Health (X3) and its impact on Disaster Risk Reduction (Z), this hypothesis shows accepted results, where the p-value of 0.000 is smaller than alpha 0.05 or an error level of a = 5%. Thus, it can be assumed that the community fully supports government programs related to providing logistics and medicines for victims of natural disasters and facilitating and stimulating the establishment of temporary hospitals during and after natural disasters. This supports the research of Wright, et al., (2020) stating that the existence of emergency response health services has been shown to have a significant influence on disaster risk reduction through programs created by the government to support the provision of adequate health services. Similarly, the effects of Health (X3) on Disaster Risk Reduction (Z) through Collaboration (Y) with results that support the research of Adhikari and colleagues, (2003), namely through a collaboration of health services, can have a good impact on disaster risk governance.

This can be seen through the results of testing hypothesis 7 (H7) based on the mediation of the Collaboration variable, showing accepted results, where the p-value of 0.000 is less than alpha 0.05 or an error level of a = 5%. Thus, it can be assumed that there is a presence of a collaboration process and strong support provided by the community. However, when viewed from the value of the statistical t-coefficient, it is known that health is better if it is held without collaboration on disaster risk reduction. Therefore, it is better to apply it through the direct effect of health on disaster risk.

Health is a critical aspect to consider in disaster risk reduction, particularly in the context of volcanic eruptions in Lumajang. The impacts of volcanic eruptions on health can be extensive in affecting the well-being of population; i.e., studies have shown that volcanic eruptions can lead to a reduction in summer precipitation, impacting the overall health of the affected regions (Man, Zhou & Jungclaus, 2014). These health-related factors are crucial to consider in disaster risk reduction efforts, as they can exacerbate the overall impact of volcanic eruptions on the community's well-being.

In addition to direct health impacts, volcanic eruptions can also have indirect effects on health through their influence on the environment and

climate; e.g., eruptions can lead to changes in atmospheric circulations, which in turn can affect vegetation and carbon uptake, potentially impacting air quality and human health (Yong et al., 2023). Moreover, the impact of volcanic eruptions on drought events can further exacerbate health risks, particularly in regions already susceptible to water scarcity (Chen et al., 2022).

Understanding the health implications of volcanic eruptions is essential for effective disaster risk reduction. By considering the prevalence of parasites, antimicrobial resistance, and the broader environmental and climatic impacts of eruptions, stakeholders can develop more comprehensive strategies to mitigate the health-related risks associated with volcanic activity in Lumajang.

Based on the results of hypothesis test 4 (H4) from the results of direct estimation between Governance and Leadership (X4) and their impact on Disaster Risk Reduction (Z), the hypothesis shows accepted results, where the p-value of 0.000 is smaller than the alpha 0.05 or an error level of a = 5%. Thus, it can be assumed that the development of disaster-resilient villages and the preparation of profiles of disaster-prone areas get full support from the community. Meanwhile, the same results were also obtained by researchers based on the results of hypothesis testing 8 (H8) from the results of direct estimates between Governance and Leadership (X4) and Disaster Risk Reduction (Z), showing accepted results, where the p-value of 0.001 is smaller than alpha 0.05 or a level of error a = 5%. Thus, it can be assumed that the collaboration fully supports the development of resilient villages and the preparation of profiles of disaster-prone areas.

Governance and leadership play a crucial role in managing and mitigating the impact of natural disasters such as volcanic eruptions. In the context of the eruptions in Lumajang, collaborative governance has been recognized as a mechanism to bring together public and private stakeholders for consensus-oriented decision making (Ansell & Gash, 2007). This approach can be instrumental in coordinating efforts to address the challenges posed by the eruptions. Additionally, the influence of leadership style on organizational culture, employee motivation, and performance has been studied in the context of the Government Bureau and Regional Autonomy of Regional Secretariat of East Java Province (Brasrinanto & Sukiman, 2022). Effective leadership is essential for fostering a positive organizational culture and motivating employees, which are critical factors in responding to the potential eruptions.

Furthermore, the value chain governance in East Java, particularly in the context of Robusta coffee estates, has been influenced by green strategies, emphasizing the importance of sustainable practices in the region (Winarno & Harijani, 2022). This highlights the significance of environmentally conscious governance in the aftermath of the eruption. Moreover, the impact of the eruption on the community, as evidenced by the analysis of community perception on the impact of sand mining in Mujur River and Regoyo River, Pasirian District, LR, East Java, underscores the need for effective governance and leadership to address the concerns of the affected population (Sari & Sudarti, 2021).

Moreover, the geological and environmental aspects of the eruption, such as the utilization of locally available organic matter to improve chemical properties of pyroclastic materials from Mt. Kelud of East Java, are critical for understanding the environmental impact and subsequent governance strategies (Utami et al., 2017). Additionally, the influence of seismicity on the Lusi mud eruption in East Java, Indonesia, emphasizes the importance of scientific understanding in informing governance and leadership decisions in response to the eruption (Rudolph et al., 2015).

4.4. Discussion

The findings of this paper have actually contributed towards several implications of theoretical thought and practical implementation. At least there are four points of implication; firstly, the collaboration mechanism has not always contributed to a positive impact on community resilience programs. It can be seen from the evidence that it can fail to facilitate a networking aspect as part of a community resilience program. Thus, it is theoretically an opposing argument to that of Emerson, Nabatchi and Balogh (2011), who convey that collaboration might strengthen the networking aspect. The reason behind this phenomenon is the fact that the collaboration process for community resilience in LR has had a notorious history.

Secondly, the collaborative feature will not always provide direct benefit, e.g. when the stakeholders have merged their capacities under a collaborative scheme. The consensus decision- making might sometimes become an inhibiting factor. Under this circumstance, some actors may have a higher demand for benefit sharing and the rest of them may disagree about it. The findings of this study reveal that a longer period of the bargaining process of decision-making has prolonged the policy and program

execution. In short, it might be effective on one hand but will sacrifice efficiency on the other hand.

The third implication has been observed from the users' perspective: direct participation of the local community toward community resilience programs does not guarantee equal participation of collaboration. This phenomenon has been recognized in that the collaboration process sometimes fails to gear up with the object or host of problems. In this study, the practice of collaboration has revealed its at times extensive proportions in one aspect, but it is lacking in others. This theoretical implication therefore suggests to the upcoming researchers to conduct a preliminary study regarding the correlation between a collaborative scheme with the main object or host of the problem. Finally, the role of the existing liaison or network becomes important, because these networks often promote trust between partners and give legitimacy to key stakeholders. Scholars call this the degree of structural attachment (Ring & Van de Ven, 1992). If the previous relationship does not exist, then the partnership will emerge gradually and begin with a small informal agreement that does not require great trust (Gulati, Mayo & Nohria, 2017; Ring & Van de Ven, 1992).

5. Conclusion

Based on the results of the conducted analysis, it can be concluded that the use of PLS-SEM has succeeded in providing an overview of the results of the implementation of disaster risk reduction in terms of community resilience programs, both directly and through collaboration. The findings show that not all collaboration processes have a positive effect on community resilience programs; however, this can be influenced by other variables considered in this study. The above results provide a basis for stakeholders in various regions to develop strategic policies in accelerating the disaster management process. This study can be extended using indicators from other areas to help make better policy interventions.

The effect of collaboration on the community resilience program for the people in LR shows different effects for each variable. The variable "Strengthening local knowledge" will be better achieved through collaboration because collaboration can bring several communities to work together to collect local knowledge from various aspects.

Based on our findings, if strengthening local knowledge is not carried out through collaboration, it will have an opposite impact, i.e., it will fail to

have an impact on disaster risk reduction. This is because the level of community participation related to government programs for monitoring and communicating disaster response is still relatively low and has not been applied optimally. In addition, there are also the thoughts of some people in LR who are less open to disaster management readiness. Therefore, strengthening local knowledge will have a significant effect if collaboration is added to the community's capability to reduce disaster risks.

On the other hand, different results were found in the community network and relationship variables, where the influence of community network relationships on disaster risk reduction, either directly or through collaborative mediation, still has a non-significant effect. Since the case of LR is still in preparation for disaster risk management, it has not involved community relations or collaboration with the authorities regarding the need for disaster risk management. The community should be formed based on the place, interaction, as well as characteristics and interests. In reality, this has not yet been implemented by the people of LR. Therefore, it is necessary to take other alternative actions to prepare disaster risk reduction for the Lumajang community in addition to implementing community network relationships and encouraging collaboration.

In the context of the influence of variables on health and governance and leadership, either directly or mediated by the collaboration variable, the results are equally significant. So, the existence of emergency response health services, as well as the development of disaster-resilient villages and the preparation of a profile of disaster-prone areas, either directly or through the collaboration of various authorities, can have an impact on disaster risk reduction. However, if viewed from the results of the analysis above, it is found that collaboration can have a greater influence on disaster risk reduction. Therefore, collaboration can improve the community's ability in supporting emergency-response health service programs as well as the development of disaster-resilient villages and the preparation of a better and more comprehensive profile of disaster-prone areas.

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THE ROLE OF COLLABORATION IN SUPPORTING COMMUNITY RESILIENCE PROGRAMMES IN POST-DISASTER EVENTS

Summary

The impact of collaboration on the community resilience program for residents of Lumajang Regency varies. For the variable "Strengthening local knowledge", collaboration is preferable since it allows different communities to cooperate in gathering local information from different perspectives. According to our research, if local knowledge is not strengthened through collaboration, it will actually have the reverse effect—that is, it will not have an impact on catastrophe risk reduction. This is due to the community's still limited and underutilized participation in government programs for monitoring and communicating the catastrophe response. Different findings were made for the community network and relationship variables, where the influence of relationships within the community network on disaster risk reduction is still non-significant, whether directly or indirectly through cooperative mediation. Because LR is preparing for disaster risk management, community relations or engagement with the authorities regarding the necessity of disaster risk management have not yet been involved. The location, interaction, traits, and interests should all be taken into consideration when forming the community. In fact, LR residents have not yet put this into practice. The findings are similarly important when considering how different variables, either directly or through the collaboration variable, influence leadership, governance, and health. Therefore, disaster risk reduction may be impacted directly or indirectly by the presence of emergency response health services, the creation of disaster-resilient villages, and the creation of a profile of disaster-prone locations. But according to the data above, collaboration can actually have a bigger impact on disaster risk reduction.

Keywords: *community resilience, collaboration, build-back better, governance, post disaster events*

ULOGA SURADNJE U PODRŠCI PROGRAMIMA OPORAVLJIVOSTI ZAJEDNICE NAKON PRIRODNIH KATASTROFA

Sažetak

Utjecaj suradnje na program oporavljivosti zajednice za stanovnike regije Lumajang varira. Za varijablu 'jačanje lokalnog znanja' suradnja je poželjnija jer omogućuje različitim zajednicama da surađuju u prikupljanju lokalnih informacija iz različitih perspektiva. Prema našem istraživanju, ako se lokalno znanje ne ojača suradnjom, to će zapravo imati obrnuti učinak, to jest, neće imati utjecaja na smanjenje rizika od katastrofe. To je zbog još uvijek ograničenog i nedovoljno iskorištenog sudjelovanja zajednice u vladinim programima za praćenje i komuniciranje odgovora na katastrofu. Nađeni su različiti nalazi za varijable 'mreže zajednice' i 'odnosa', pri čemu je utjecaj odnosa unutar mreže zajednice na smanjenje rizika od katastrofa još uvijek neznatan, bilo izravno ili neizravno putem kooperativnog posredovanja. Budući da se regija Lumajang priprema za uspostavu sustava upravljanja rizicima od prirodnih katastrofa, odnosi zajednice ili angažman s vlastima u vezi s nužnošću upravljanja rizikom od katastrofe još nisu uključeni. Prilikom formiranja zajednice treba uzeti u obzir lokaciju, interakciju, osobine i interese. Zapravo, stanovnici regije Lumajang to još nisu primijenili u praksi. Nalazi su jednako važni kada se razmatra kako različite varijable, bilo izravno ili putem varijable suradnje, utječu na vodstvo, upravljanje i zdravlje. Stoga na smanjenje rizika od katastrofa može izravno ili neizravno utjecati prisutnost zdravstvenih službi za hitne slučajeve, stvaranje sela otpornih na katastrofe i stvaranje profila lokacija sklonih katastrofama. Međutim, prema gore navedenim podacima, suradnja zapravo može imati veći utjecaj na smanjenje rizika od katastrofa.

Ključne riječi: *oporavljivostak zajednice, suradnja, obnoviti nabolje, javno upravljanje, slučajevi prirodnih katastrofa*