Urban community perception on social vulnerability to disaster: the case of Bukit Antarabangsa, Malaysia

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Abstract. This article aims to determine the perception of urban communities living in Bukit Antarabangsa regarding the issue of social vulnerability (SV) to landslide and landslide-related disasters. Bukit Antarabangsa is widely known as one of the highly urbanized areas near the metropolitan of Kuala Lumpur which are highly susceptible to landslides. Few communities which currently under the SeDAR project (i.e., a join-community-based disaster risk reduction/CBDRR program between Selangor State Disaster Management Centre – JICA – Local NGO: SlopeWatch Bukit Antarabangsa) were selected as a case study. Focus Group Discussion (FGD) and household surveys were conducted during Conditional Movement Order (CMCO) on March 27th 2021 and April 11th 2021 to gather relevant information on the researched topic. The questionnaire for the survey was formulated based on the proposed detailed list of SV components, indicators, sub-indicators and weightage which was derived from a review of the literature and internal consultation among disaster experts. The data analysis process in this study served to achieve the objective of social and economic vulnerability assessment in general based on the usage of sub-indicators to point out the score value and level of performance of each sub-indicator based on the survey of local stakeholders. Results from data analysis were translated into spatial context through the production of an SV map of the study area. In summary, the integrated approach to the assessment of SV involving data analysis and mapping/spatial representation has offered some valuable insights towards strengthening local community resilient to disaster and should be considered for inclusion into the establishment of a long-term community-based disaster risk reduction (CBDRR) planning and assessment, and in formulating DRR strategies at local and/or municipal context.

Keywords: disaster, landslides, vulnerability

1. Introduction

The concept of social vulnerability within the disaster management context was introduced in the 1970s which incorporated discussions on socioeconomic factors as the main elements in addressing social vulnerability and resilience [1] [2]. In general, the term social vulnerability refers to the resilience of the community to address any potential harms caused by disaster or even disease outbreaks. The ability of

a person and his community to manage and/or reduce social vulnerability can potentially decrease socioeconomic loss as well as emotional loss and suffering [1] [3] [4] [6]. For a long time, the study on community vulnerability focused on hazard assessment analysis, for instance, the community's exposure to hazard agents such as landslides, floods, sea-level rise, etc., and the potential exposure of populations, businesses and the built environment (including infrastructure, road system, housing, etc.) [4] [7]. The findings from the hazard exposure and physical assessment provide information to researchers regarding the nature and distribution of disaster impacts. Factors that shape the variability in exposure and access to technology will assist the designing of mitigation measures at a later stage (e.g., impact-resistant building design, environmental-friendly seawall, etc.).

However, Masterson et al. [4] stated that assessment of community vulnerability requires more than hazard and physical assessment analysis of natural and built environment which has put forward the importance of understanding the community's social structures and processes because it also shapes vulnerability at large. Therefore, any information regarding the socioeconomic and demographic factors of a community is vital to determine the state of the community's social vulnerability (SV) whether they are highly likely to recover or less likely to recover after disaster, and also to determine the ability of a community to withstand any other adverse impacts from multiple stressors to which they are expose. SV, in its broadest sense, is defined as "the characteristics of a person or group in terms of their capacity to anticipate, cope with, resist and recover from the impacts of a natural hazards" [5]. Urban development patterns can be varied from one area to another and to some extent, might contribute to the isolation and segregation of different groups of people within the community particularly the vulnerable populations. For instance, the rich and the poor, owners and renters, and people from different economic statuses, races and religions are divided into different clusters, neighborhoods or housing schemes across the community. This "by-default design" (i.e., creating segregation) might put the vulnerable populations at greater risk during a disaster event [1] [3] [4]. Vulnerable populations are less capable to anticipate and respond from perceived threats due to a lack of socioeconomic capital/resources to fund their recovery, and limited access to information and technology hence will be less likely to bounce back after the disaster strikes.

In this light, this article is formulated to include the discussions on social vulnerability based on the list of common SV indicators/factors as proposed by Masterson et al. [4]. The list was then translated into list of questions for household survey involving selected communities in Bukit Antarabangsa i.e., one of the disaster-prone areas located near to Kuala Lumpur conurbation. The authors have adopted most of the SV factors as proposed by Masterson to suit the local issues and context. As a result, a list of more clusters detail, indicators, sub-indicators and weightage for SV is presented in Table 1. The determination of sub-indicators and selection of weightage for each indicator and sub-indicator resulted from a few rounds of consultation and in-depth discussions among experts in disaster. Prior to the consensus reached among experts, the final list as presented in Table 1 was transformed into the survey questionnaire for assessing the community's current sociodemographic, DRR-related practices and assessment of SV.

Table 1. Proposed clusters, indicators, sub-indicators and weightage for assessment

Component	Weight	Indicator	Weight	Sub-indicator	Weight
SOCIO DEMOGRAPHICS [SD]	0.14	SD1 Gender	0.03	Male	0.01
				Female	0.02
		SD2 Marital Status	0.03	Single	0.03
				Married	0.02
				Widower / Single Parent	0.03
				Divorcee	0.03

Component	Weight	Indicator	Weight	Sub-indicator	Weight
SOCIO ECONOMIC STATUS [SES]	0.29	SD3 Household Size	0.03	1-2 persons	0.02
				3-4 persons	0.03
				>5 persons	0.03
		SD4 Age Category	0.03	Children	0.02
				Adolescence	0.02
				Adult	0.01
				Elderly people	0.02
		SD5 Highest Level of Education	0.01	No formal education	0.00
				Primary school	0.00
				Secondary school	0.00
				Certificate	0.01
				Diploma	0.01
				Bachelor's degree and above	0.01
				Others	0.00
		SD6 Household with Disability	0.02	Yes	0.02
				No	0.01
		SES1 Employment Status	0.07	Full-time job	0.04
				Part-time job	0.05
				Independent job	0.07
		SES2 Having > 1 Job	0.04	Yes	0.01
				No	0.02
		SES3 Estimation of Household Monthly Income	0.07	B40 (RM4,849 and below)	0.07
				M40 (RM4,850 - RM10,959)	0.05
				T20 (RM10,960 and above)	0.03
		SES4 Household Savings	0.05	Minimum (equivalent to 6 months of salary)	0.04
				Moderate (equivalent to 1 year of salary)	0.03
				Good savings (equivalent to more than 1 year of salary)	0.01
		SES5 Insurance Coverage for Property	0.04	Yes	0.02
				No	0.04
		SES6 Recipient of Social Welfare	0.02	Yes	0.00
				No	0.01
COMMUNITY DRR AWARENESS AND PREPAREDNESS [CAP]	0.36	CAP1 Close Interaction between Neighbours	0.01	Yes	0.00
				No	0.00
				Not sure	0.00
		CAP2 Can Rely on Neighbours	0.02	Yes	0.00
				No	0.02

Component	Weight	Indicator	Weight	Sub-indicator	Weight
		at Times of Crises		Not sure	0.01
		CAP3 Good Communication between Stakeholders	0.03	Yes	0.00
				No	0.03
				Not sure	0.02
		CAP4 Open-Minded Community	0.02	Yes	0.00
				No	0.01
				Not sure	0.01
		CAP5 Strong Community Bonds	0.03	Yes	0.01
				No	0.03
				Not sure	0.02
		CAP6 Direct Participation and Control of Development Trajectories	0.01	Yes	0.00
				No	0.00
				Not sure	0.00
		CAP7 Attend DRR Training	0.02	Yes	0.00
				No	0.02
				Not sure	0.01
		CAP8 Involved in DRR Education and Awareness	0.02	Yes	0.00
				No	0.01
				Not sure	0.01
		CAP9 Empowerment of Women and Minorities	0.01	Yes	0.00
				No	0.00
				Not sure	0.00
		CAP10 Feeling Safe and Remain Optimistic	0.01	Yes	0.00
				No	0.00
				Not sure	0.00
		CAP11 Landslide Warning System	0.02	Yes	0.00
				No	0.01
		CAP12 Monitoring a Risk Area	0.02	Lead by community	0.01
				Lead by agency	0.01
				Collaboration between both	0.00
				Not sure	0.02
		CAP13 Previous Landslide Experience	0.01	Yes	0.00
				No	0.00
		CAP14 Access to Information (during & after)	0.03	No interruption	0.01
				Moderate interruption	0.01
				Significant interruption	0.02
				No access	0.03

Component	Weight	Indicator	Weight	Sub-indicator	Weight
PERCEPTION OF VULNERABILITY [PV]	0.21	CAP15 Having Second Home Elsewhere	0.01	Yes	0.00
				No	0.00
		CAP16 Presence of Strong Local Leaders	0.03	Yes	0.01
				No	0.03
				Not sure	0.01
		CAP17 Strong and Workable Local Organization	0.02	Yes	0.00
				No	0.02
				Not sure	0.01
		CAP18 Strong Authority Structure at Multiple Level	0.01	Yes	0.00
				No	0.00
				Not sure	0.00
		CAP19 Good and Transparent Authority	0.01	Yes	0.00
				No	0.00
				Not sure	0.00
		CAP20 Special Fund for Disaster Victims	0.01	Yes	0.00
				No	0.00
				Not sure	0.00
		PV1 Access to Local Transportation Service	0.03	No disruption	0.01
				Minimal disruption	0.02
				Significant disruption	0.03
		PV2 Access to Local Public Amenities	0.05	No disruption	0.01
				Minimal disruption	0.04
				Significant disruption	0.05
		PV3 Power/Water/ Telecommunication Disruption	0.05	No disruption	0.01
				Minimal disruption	0.04
				Significant disruption	0.05
		PV4 Access to Alternative / Evacuation Routes	0.00	Yes	0.00
				No	0.00
				Not sure	0.00
		PV5 Easily Recover After Disaster	0.05	Agree	0.02
				Somehow agree	0.03
				Disagree	0.05
		PV6 Spending for Repair / Recovery	0.04	Significant spending	0.03
				Moderate spending	0.02
				Minimal spending	0.01

2. Research Methodology

A few communities in Bukit Antarabangsa, Selangor which is currently under the SeDAR project (i.e., a join-CBDRR program between Selangor State Disaster Management Centre – JICA – Local NGO "Slope Watch Bukit Antarabangsa" have been selected as a case study. The study area covers the jurisdictional area of the State Assembly Area *(Dewan Undangan Negeri, DUN)* Bukit Antarabangsa, which stretches from the edge of Ukay Perdana to the north and Taman Dato Ahmad Razali and Bandar Baru Ampang to the south. The northern end comprises mostly natural slopes (communities bordering on the Titiwangsa Range), while the southern end is more flat land. However, the southern end may have new or existing developments of man-made slopes. Therefore, it will be interesting to determine the nature of the responses from these two different areas (Figure 1).

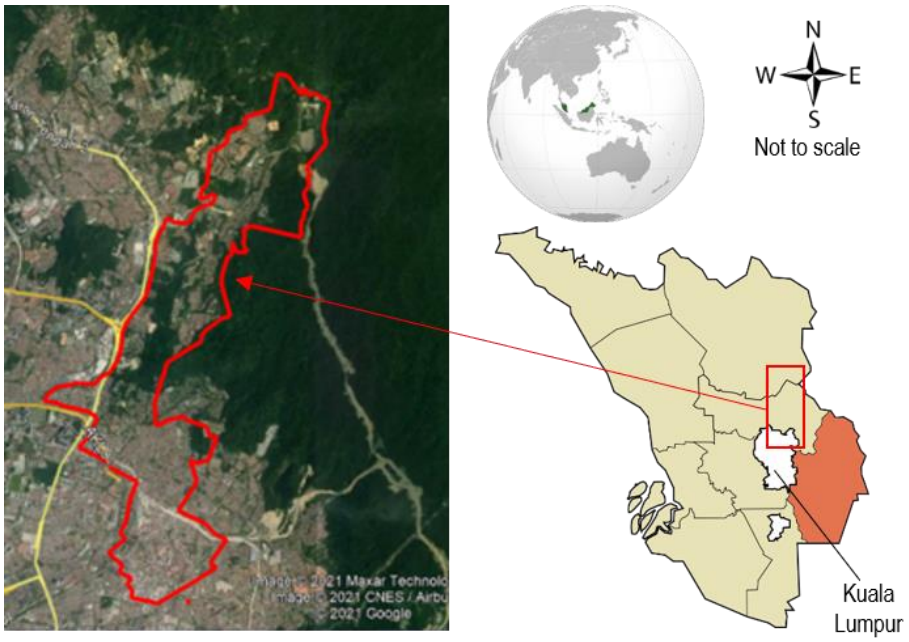

Figure 1. AOI Bukit Antarabangsa (470.31 acre) in Selangor State, Malaysia.

Respondents for this study consist of the residents within the Area of Interest (AOI) identified for the study. Residents shall be defined as "any persons physically living at the registered address within the AOI." They can be homeowners, renters, boarders, and business operators. Absentee landlords and homeowners may carry less weightage as they live outside the AOI and may not give quality responses. Respondents shall represent a household, and they comprise heads of households (either male or female). This is to ensure one response per household. Thus, this survey will target a group of residents ranging from local community leaders to community champions and influencers to mosques and temples to members of the communities.

In addition, potential respondents may also include technical and non-technical people, so the words and terminology of the survey questions shall be simple and easy to understand. The survey shall be administered in bilingual languages (English and Bahasa Malaysia), as there are non-Malaysian residents living within Bukit Antarabangsa (and along Ulu Klang). While they may have a functional grasp of Bahasa Malaysia, it may be useful to offer an English language option for faster survey response time. The sampling size of the population to be surveyed for the entire AOI area has been determined using Raosoft Sample Size Calculator which is available online and widely used by social scientists to determine sample size in their studies. Based on an unpublished report by SlopeWatch [8], the population of the nine major Taman/residential areas within Bukit Antarabangsa is 26,131 people. This

information has been key-in into the Raosoft calculator, together with 85% "confidence level" and 15% "margin of error," which resulted in 24 samples (respondents) for the data collection stage.

Due to the need for compliance with strict SOP during a pandemic, only a small number of local people have attended the survey and FGD sessions which were conducted on 27 March 2021 at Taman Bukit Mulia community hall and on 11 April 2021 at JKKK Kuala Ampang community hall. Both sessions were organized by Disaster Preparedness and Prevention Centre (DPPC) UTM with the assistance and representatives of SlopeWatch, MPAJ Council members and officers from MPAJ (Ampang Jaya Municipal Council). In total, 17 respondents have participated in the discussion and questionnaire-based survey consisting of local leaders from each *Taman*, and local stakeholders including local residents and those involved in the landslide monitoring team at the community level.

3. Result and Discussion

3.1. Socio-demographic profile of respondents

Results from the socio-demographic survey show that respondents consist of 71% male and 29% female. The higher number of male participants during FGD and survey sessions was due to the arrangement of the survey to be conducted during weekends (Saturday and Sunday) which allowed heads of households (mainly male) to be available for the program. The majority of respondents (71%) are married and have less than five members of the household that live together. Only 23% of respondents were categorized as older people (age above 60 years) with the largest portion of the respondents are adults aged between 18 to 59 years. The frequency analysis indicates that all respondents were highly educated with the minimum level of diploma. It is worth mentioning that the respondents' level of education might reflect their work/occupation and household's monthly income (this notion will be discussed further in the following section). In terms of special needs populations, only one respondent (6%) indicates their family member with a disability.

3.2. Mapping of community socioeconomic vulnerability to landslides

Based on the four clusters of socioeconomic landslides vulnerability; socio-demographic (SD), socio-economic status (SES), community DRR awareness and preparedness (CAP), and perception of vulnerability (PV), each of the cluster is visualized in the form of maps as illustrated in Figure 2 until Figure 5. As shown in Figure 2, the landslide vulnerability map for SD contains 30 polygons and each of the polygons have been assignment with a specific landslide SD vulnerability index and class as specified in Table 1 (SD1-SD6). Based on data analysis, 19/30 polygons (63%) are categorized as a 'low' class of vulnerability, followed by five polygons (17%) and six polygons (20%) as 'Moderate' and 'High' vulnerability class respectively.

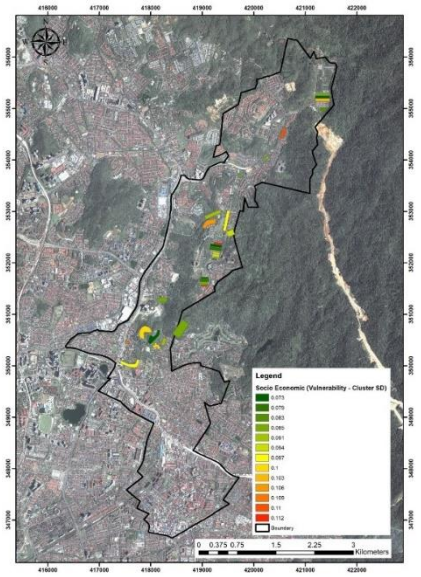

Figure 2. Socio-Demographics (SD) vulnerability cluster map

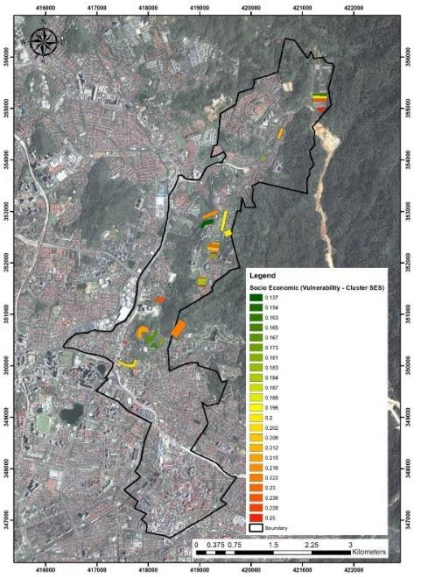

Figure 3. Socio-Economic Status (SES) vulnerability cluster map

Figure 3 shows the landslide vulnerability map for SES contains 30 polygons and each of the polygons has been assignment with a specific landslide SES vulnerability index and class as specified in Table 3 (SES-SES6). Based on data analysis, only 11/30 polygons (36%) are categorized as 'low' class of vulnerability, followed by nine polygons (30%) as 'Moderate' vulnerability and ten polygons (34%) as 'High' vulnerability class respectively. Based on the survey, among indicators wtih weak resilience are including dependency on a single full-time job, low household savings (<12 months), and lack of access to social protection programs.

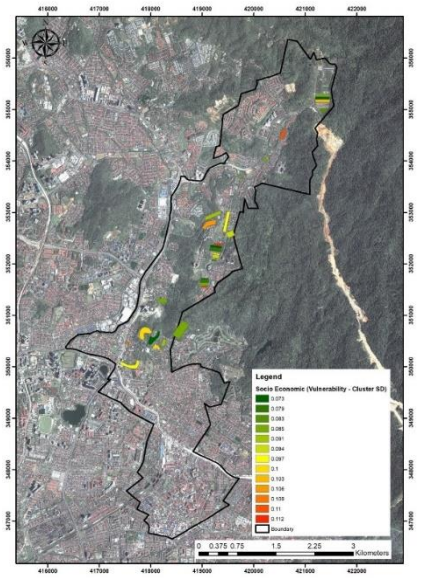

Figure 4. Community DRR Awareness and Preparedness (CAP) vulnerability cluster map

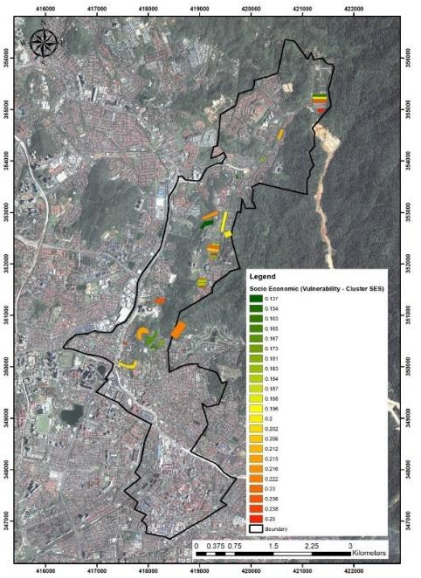

Figure 5. Perception of Vulnerability (PV) vulnerability cluster map

The result of the landslide vulnerability map for CAP (community DRR awareness and preparedness) (Figure 4). From a total of 30 polygons identified for 20 indicators (CAP1-CAP20), 15/30 polygons (50%) are categorized as 'low' class of vulnerability, followed by ten polygons (33%) as 'Moderate' vulnerability and five polygons (17%) as 'High' vulnerability class respectively. Based on the survey, among indicators with strong resilience are including interaction among residents, ability to rely on neighbors during an emergency, open-minded community, strong community bonding and presence of good leadership at the community level. The landslide vulnerability map for perception on vulnerability (PV) will be based on six indicators (PV1-PV6) (Figure 5) as specified in Table 1. Based on data analysis, 15/30 polygons (50%) are categorized as a 'low' class of vulnerability, followed by eight polygons (25%) respectively as 'Moderate' and 'High' vulnerability class respectively. Based on the survey, among indicators with weak resilience are including limited access to transportation services during and after landslides and a weak ability to quick recovery from disaster.

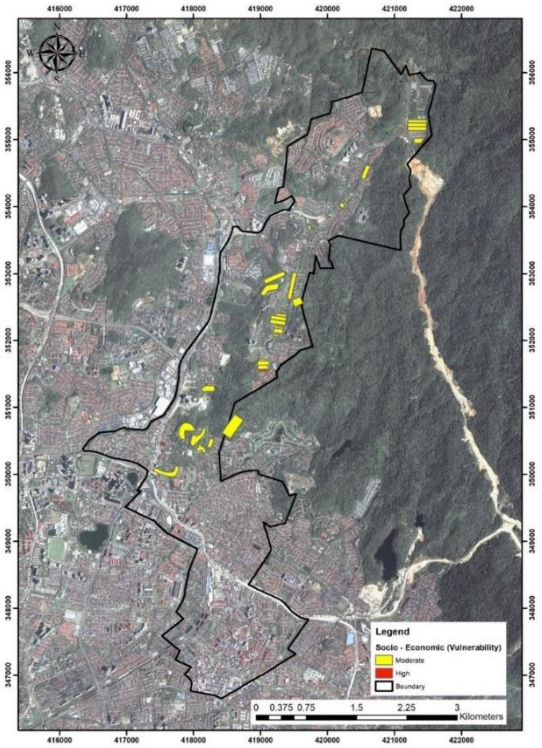

Figure 6. Overall socio-economics landslide vulnerability map for the study area – Bukit Antarabangsa

A total of 28 areas of socioeconomic in Bukit Antarabangsa are considered 'moderately' vulnerable to landslides (Figure 6). Meanwhile, only two areas of socio-economics are considered as 'highly' vulnerable. The vulnerability of socioeconomic aspect shows 'moderate' class that also indicates the preparedness and readiness of the local community towards landslide are at the moderate level. Perhaps some important points highlighted by respondents during FGDs and engagements can also be mentioned to support these findings:

1. Respondents show positive perceptions and important internal elements or factors that influence community resilience including good rapport and relationships among residents, strong community bonding, open-minded community, and ability to rely on their neighbors for help during disaster/emergency. Existing DRR activities are currently being carried out are self-initiated and self-implemented under the resident's association or individual local champions within communities

who report to the local councilor (Ahli Majlis), SlopeWatch and/or other community leaders. Beyond monitoring, there is no mechanism or structure for local planning and training.

2. Respondents' points out their concern on the lacking of training and exposure to DRR-related activities including training, awareness, an early warning system for monitoring, etc. Residents cite a lack of communication between the local authority and the communities as one of the reasons for lack of confidence. They demanded a joint problem-solving approach to slope safety in their areas. Some resident groups acknowledge the importance of a collaborative and constructive channel of communication with the local authority. They believe that a slope safety program, with clearly identified rules of engagement for communication and collaboration among all parties, maybe something that they would look forward to fruition.
3. Sub-indicators related to administration and governance also received a lower score value, indicating moderate resiliency (or maybe to some point, reflect respondents' lack of confidence for agencies to solve their problems related to landslide hazards and risk).

4. Conclusion

This paper explored a process of bringing back the SV dimension and discussions into the hazard assessment process which predominantly focuses on physical and infrastructure (including building, road, and slope) vulnerability assessment [4]. The process for SV inclusion into the study area in Bukit Antarabangsa as being discussed in this paper has involved a systematic approach starting from the determination of the common SV factors/indicators based on a review of the literature. Engagement with experts in the field of DRR and community resilience research has been carried out to further refined the list until the proposed of sub-indicators and their weightage score. The second part of the process involved strenuous activities in the field whereby a series of community engagement through FGD, crowd-sourcing and questionnaire-guided interviews were carried out to obtain feedback from respondents and local stakeholders. The process was completed with data analysis followed by the production of an overall socio-economics landslide vulnerability map for the study area – Bukit Antarabangsa. This study can be considered a meaningful exercise that could foster and encourage a wider application of SV factors into the overall research on community vulnerability in the future.

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