

# Social Vulnerability of Landslide Hazard

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Landslides represent one of the world's most dangerous and widespread risks, annually causing thousands of deaths and billions of dollars worth of damage. Building on and around hilly areas in many regions has increased, and it poses a severe threat to the physical infrastructure and people living within such zones. Quantitative assessment of social vulnerability is worrying because it has been given less attention than hazard-related studies.

Keywords: social vulnerability assessment ; landslide ; social indicator ; disaster risk reduction ; Malaysia

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## 1. Introduction

In recent years, extreme events have increased in intensity and frequency globally, leading to rising economic losses and casualties. It is believed that these events will continue to accelerate in future climate scenarios. An accurate understanding of the physical and socioeconomic drivers of these extreme events is crucial and can ultimately enhance adaptive strategies. The frequency and intensity of geophysical events is increasing. This is the result of the interaction between humans and the environment. Climate change and increasingly aggressive human activities contribute to the vulnerability of catastrophic hazards to humans, their infrastructure, and the environment <sup>[1]</sup>. Faced with ever-increasing societal impacts arising from such events, a wealth of research and analysis has focused on understanding causal processes and outcomes <sup>[2]</sup>. Landslides are a type of geophysical event that plays a significant role in the evolution of a landscape <sup>[3]</sup>. However, landslides do pose a serious threat to local populations given that these events are being triggered increasingly by a changing climate and more unpredictable weather patterns. In recent years, it has become clear from previous research that the location, abundance, activity, frequency of landslides as well as the social and economic consequences are increasing over time and more people are exposed to the risks <sup>[4][5][6][7][8][9][10]</sup>. It was reported in <sup>[11]</sup> that geophysical disasters such as landslides are the deadliest. The presence of humans, infrastructure, and other forms of vulnerabilities in one location will make things worse.

Historically, efforts to reduce landslides are physically oriented resulting in a proliferation of technocratic approaches in the literature, while financial losses and social vulnerability from the geophysical events continue to increase. Over time, this gave rise to an alternative explanation that mounting losses are related less to the dynamics of the events but more to the vulnerability of exposed human populations <sup>[2]</sup>. Although assessing the magnitude and intensity of disasters is critical, the nature of population demographics and various socioeconomic contexts may also lead to a greater risk of disasters. Understanding the complexities of vulnerability to disasters, including those caused by geophysical events, is at the heart of disaster risk reduction. Efforts to reduce disaster risk involve various disciplines and should be viewed from numerous perspectives to provide long-term benefits. A comprehensive disaster risk reduction strategy that incorporates physical and socio-economic aspects is the key determinant of vulnerability.

## 2. Discussion

There are not many studies concerning the Social Vulnerability Index (SoVI) with reference to landslides. Based on the research undertaken, articles regarding landslide in the context of social vulnerability index usually consider other types of hazard or where landslides are bracketed with other natural disasters. Articles based only on social vulnerability and landslides are difficult to locate. Social vulnerability or the social vulnerability index has many types—not only SoVI but also referred to as SEVI or SVI. Even though the focus is only on SoVI in this paper, the researcher has taken note of other types of social vulnerability index.

There are 14 indicators that have been employed to measure social vulnerability in the context of landslide including (see [Table 5](#)): age, gender, ethnicity, built environment, income, family structure, education, employment, occupation, urban or rural, disability, migration, medical, and population. Based on the analysis, the researcher only focuses on five main

indicators that have been used by many scholars: age, ethnicity, education, special needs population, and health. These were chosen because they are very relevant to the more vulnerable in society, especially where inequalities and imperiled areas are very evident.

### **2.1. Education**

There are a few factors that affect social vulnerability including lack of access to: resources such as information, knowledge, and technology; social networks and connections with other individuals; social capital; and infrastructure <sup>[12]</sup>. In this study, education emerges as a major indicator employed in other studies regarding social vulnerability and landslides. Education is a bridge to success for many people, and it can refer to both formal and informal education. Education can also mean information, knowledge, and technology regarding the scope of discussion. The importance of education is to help people achieve more success and status in society, get a better job and understand the issues involved in a hazard or disaster. Furthermore, it helps individuals to be prepared for any circumstances. According to <sup>[13]</sup>, people who have better response mechanisms, always prepare and constantly recover from a disaster, and this is certainly the case for those individuals, households, and societies with better and more widespread higher education outcomes compared to others.

### **2.2. Age**

Indicators such as age can also mean susceptibility to social vulnerability. Older and very young people are more vulnerable to hazards and disasters than people in the middle. A higher proportion of senior citizens means that a society is at greater risk of disaster and the strategies needed to repair any given situation, simply because older people are more vulnerable to hazards than other age groups. Older people normally need a lot of physical and emotional care and support services. They can also be more disadvantaged compared to other age groups. The indicators that have been collected from previous studies do not represent the population or the place.

### **2.3. Ethnicity**

Racism or ethnic discord is one of the factors of disaster risk, and especially for minority groups such as migrants and/or non-residents in a given location <sup>[14]</sup>. They are also known as marginalised groups, considered to be inferior in terms of their economic status, health, social relationships, and environment. If this situation continues, it will result in lasting social, political, and economic losses <sup>[15]</sup>. Although a mixture of socio-spatial and biophysical influences forms people's susceptibility to environmental hazards, race/ethnicity, and class have been central to understanding social dynamics during hazard events <sup>[16]</sup>.

### **2.4. Special Needs Population**

Special needs populations such as people with a disability are the most-at-risk persons when a disaster occurs. Disability means that the person with a physical or mental condition has limited movements, senses, or ability to participate in activities. Characteristics that are considered to be a disability are deafness, blindness, diabetes, autism, epilepsy, depression, and HIV. According to <sup>[17]</sup>, disability emerges from the connection between people with health problems, such as cerebral palsy, Down syndrome, depression, as well as personal and environmental influences, including negative attitudes, limited transport facilities, public service facilities, and insufficient social support systems. They are generally the first victims of natural disasters. Indeed, early warning systems that alert the public may not actually reach the disabled individuals in time. The death toll from a disaster is two to four times larger than for those who are not disabled <sup>[18]</sup>.

### **2.5. Healthcare Accessibility**

Those with health problems are particularly vulnerable to landslides. They require constant attention and healthcare services to ensure their safety and good health. Therefore, access to health services such as hospitals, healthcare clinics, and pharmacies is an important need for this community. One of the principal components of emergency management is healthcare management to cope with disasters <sup>[19]</sup>. In disaster prevention activities, well targeted healthcare supply chain management can function effectively and efficiently. A substantial number of disaster casualties or even fatalities could be absorbed as long as healthcare services are up and running when a disaster occurs <sup>[20]</sup>.

All the variables are listed above give an essential role in determining the security of a community based on social indicators. However, the results of the author's study found that income indicators and social capital are less emphasised. Income indicators referring to those with low incomes and belonging to the group below 40% of Malaysia's income are very vulnerable to disasters. For example, the floods that occur every year have caused suffering because they cannot work, and the worst consequences, they will lose their jobs. The study <sup>[21]</sup> found that the income sub-domain is the largest contributor and gives high value to the index of endangered livelihoods of rural communities in Pahang in 2014. Low-income conditions will also affect the period for them to recover after a catastrophic event. The results of the author's

research found that there are no studies that explore social asset indicators. Social assets carry meaning as resources available to individuals and groups through membership in social networks. If the household has a higher position in a group or social institution, he or she will produce higher social strengths and resources [22]. Longer membership history as well as more participation in other social groups make it easier for access to information, business opportunities, social strength, and influence. The ability to access other assets is also simpler [23]. The evolution of social capital through the interaction of relationships between people and groups in community social networks [24][25]. Social networking means the interaction of an individual with other individuals, organisations, and groups to obtain information and assistance on something related to their livelihood [25][26]. The lack and absence of these elements within the social life environment of an individual will contribute to their vulnerability factors, as emphasised by [27][28]. Social capital influences, the sustainable life they possess significantly to strengthen the ability to develop a network of cooperation between groups both internally and externally and through enhancing the institutional capacity of community groups to improve the well-being of society.

State government agencies, local governments, and community leaders are the most familiar with the people in their communities. The social vulnerability index's importance is design to assist them in ensuring the security and well-being of their population. The SVI components can help the state and local people involved in all phases of the disaster sequence, in particular, landslides. Knowledge of locations and community information that is vulnerable to landslides can help planners in identifying target groups and accelerating assistance in efforts to reduce and impact property damage and loss of life, as well as prepare for disaster events. The stakeholders and management planners can setting the evacuation centre to places in secure condition to those are needs emergency assistances such as elderly people, single mothers with kids and infants, no transportations people and migrants whose are not influent in local language. In the recovery process, local governments may recognise communities that may require additional funding for human services or as a mitigation gauge to avoid a need for more costs due to the post support [29]. The slower to recover are those with the socioeconomically low-income community with hazardous areas of landslide occurrence. Therefore, the analysis results show that there are seven indicators as outlined that should be used as a social vulnerability index in measuring the level of susceptibility of landslides events. It consisted of education, age, ethnicity, special need population, healthcare accessibility, income, and social asset indicators. Future research will examine how SoVI can be used in the planning and mitigation processes to help target disaster management interventions as part of the system. Besides, the SoVI outcome can lead to geological mapping of disaster risk management in Malaysia's decision-making systems based on specific zones.

### **3. Conclusions**

In this study, we have reviewed a selection of socioeconomic vulnerability components. At the searching stage, 258 articles were found in key databases, and after inclusion and exclusion criteria using the PRISMA guideline, only nine articles were chosen as being valid to this research. Fourteen variables were listed, and five variables of social vulnerability, which were typically used by scholars, proved to be relevant to Malaysia. Not all places or locations have the same experiences of landslides, and so the level of social vulnerability will differ and how these are measured. Although people may experience the same hazard or disaster, it does not mean that all individuals go through the same processes of destruction, recovery, evaluation, etc., as others. There are individuals who experience much higher social vulnerability than others, and it depends on which indicators are employed. As a climatic condition and the landslides occurrences in Malaysian context, there are seven indicators underlined which are education, age, ethnicity, special needs population, health accessibility, income, and social capital. These are the important indicator to measure the social vulnerability index to the high-risk communities towards landslide hazard. The result of these indicator measurement should be useful to authorities to include it as a complementary data to their geological mapping of disaster risk management based on the location of the landslide events. Furthermore, that is why, this study is important for understanding the social vulnerability index in the context of landslides in Malaysia.

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