Post Landslides Recovery: Resilience of Community and Local Construction

Zakiah Hidayati*
Architecture Study Program, Department of Design, Politeknik Negeri Samarinda, Indonesia, zakitec@yahoo.co.id

Mafazah Noviana
Architecture Study Program, Department of Design, Politeknik Negeri Samarinda, Indonesia, mafazah79@gmail.com

*Correspondence author

Abstract The restricted availability of resources poses a significant barrier in the post-disaster recovery of landslides. Rehabilitation and reconstruction are integral components of the recovery process. The guidelines of BNPB (National Disaster Management Authority) in Indonesia served as the basis for it. This research conducted a case study to examine the resilience principle in the context of post-disaster recovery. The location of the locus was situated in Selili Hill, an urban community located in Samarinda, East Kalimantan, Indonesia. This area has had multiple instances of landslides, also known as land creeping, throughout the past two decades. The community and local construction engage in a conversation around the principle of resilience. The present study has identified that community resilience and local construction exert a substantial influence on the process of housing recovery. The level of community engagement was quite active in the aftermath of a disaster. They collaborated with the local government to furnish sustenance and urgent refuge to individuals requiring assistance. Consequently, the house restoration was highly effective, with a specific emphasis on improving both the social (income) and physical aspects. It is anticipated that the concept and demonstration of post-disaster rehabilitation will exhibit durability until the local administration undertakes the relocation of the settlement.

Keywords: recovery, landslide, resilience, community, construction


Kata Kunci: pemulihan, longsor, resiliensi, komunitas, konstruksi

Submitted: 2022-06-22 | Accepted: 2023-10-14 | DOI: 10.29080/eija.v0i1.1470 | Pages: 1-12
**Introduction**

According to the Mayor's Decree of 2015, the Selili village has been classified as a slum area by the Mayor of Samarinda. The local authorities will shift this settlement location from an uncontrolled green space to a safer region. The relocation issue of the community has been communicated by the government since the 1990s. Numerous conflicts of interest continue to impede the relocation process until the year 2021.

The village has been inhabited for over a century. At first, the towns were constructed directly alongside the river. After the linear communities had become overcrowded along the riverbed, the newcomers proceeded to extend the towns towards the hills. The local government of Samarinda City has identified the geographical positioning of communities as a region susceptible to landslides. Out of the over a thousand buildings, approximately 16.5% are located in the most susceptible zones.

The initial community originated from Banjar and constructed dwellings along the riverbed over a century ago. The community is connected through familial ties. Wooden stilt houses were constructed atop a body of water. Over time, an increasing number of individuals migrated to this region and constructed elevated dwellings along the Mahakam River. According to Hidayati and Noviana (2018), there was a growing heterogeneity within the community, leading to the emergence of an informal village in the upper region of the hill.

The landslip disaster in Selili village is characterised by a gradual movement of land, which intensifies with heavy rainfall. Landslides occur gradually over an extended period of time. The building becomes unstable due to the gradual movement of the ground. Intense precipitation increases the mass and lubricates strata, leading to a landslip. The occurrence of a landslip in Selili village had a significant impact on people of many ethnicities. Despite their longstanding tolerance for calamities, the community consistently experiences apprehension with heavy rainfall or strong winds. The occurrence of landslides poses challenges for the community, particularly in terms of repairing and reinforcing their houses.

To date, there has been a lack of involvement from Non-Governmental Organisations (NGOs) in the restoration of facilities and infrastructure. The government and the society typically offered quick assistance in the aftermath of a disaster, such as supplying sustenance and garments to the affected individuals. No non-governmental organisations (NGOs) were involved in the rehabilitation of destroyed facilities and infrastructures. The occurrences of landslides in the Selili settlement have persisted for several decades. The initial landslip that resulted in significant destruction to residential structures took place in 1999. The damages resulted in the occurrence of fractured concrete roads, inclined electric poles and trees, as well as water pipes experiencing leakage. Despite the gradual movement of the land, the potential harm and consequences of the damage might pose significant challenges to the ecosystem (Tohari & Soebowo, 2007).
Landslides, which result in mild to moderate destruction to residential properties and public infrastructure, transpire on an annual basis, particularly during periods of precipitation. According to BNPB’s disaster management approach, the implementation of both mitigation and recovery measures is conducted in a collaborative manner, involving several components of activities. During the recovery stage, the primary focus is on recovery. However, prevention and mitigation efforts also acknowledge the importance of anticipating future disasters (BNPB, 2020). The National Disaster Management Authority (BNPB), also known as the Badan Nasional Penanggulangan Bencana, serves as the governing body responsible for managing disasters in Indonesia.

This study examines the process of disaster management recovery. Recovery is a process that involves adapting to the prevailing environmental conditions. This encompasses the processes of rehabilitation and/or reconstruction. This research examines the resilience of post-disaster house recovery in the Bukit Selli Settlement, Samarinda, from 2017 to 2021, with a specific focus on community and local construction factors. The study specifically examines the impact of landslides on low-income individuals. Recovery encompasses the processes of rehabilitation and/or reconstruction. Disaster rehabilitation involves the restoration of all public services that have been disrupted and have returned to their original state. The distinction lies in the fact that rehabilitation entails the process of enhancement, whereas reconstruction involves the creation of a novel entity with an equivalent purpose. Both the UNDRR and the Asian Disaster Preparedness Centre (ADPC) share the view that rehabilitation enhances an object by incorporating new components, hence restoring its functionality. Conversely, reconstruction involves substituting a damaged object with another object that serves the same purpose. The following illustration (UNISDRA, 2013) provides an explanation.

Figure 1, illustrates the distinction between reconstruction and rehabilitation (UNISDRA, 2021).

According to Shridar (2018), the distinction between reconstruction and rehabilitation lies in their respective types and durations. The reconstruction process is completed within a span of two years, whereas the rehabilitation phase is of a longer duration. Reconstruction measures encompass various aspects such as infrastructure development, sustainable technology implementation, building practices, and efficient management strategies. Rehabilitation is associated with the promotion of awareness, the creation of new economic prospects, and the restoration of individuals' livelihoods. Based on the viewpoints of BNBP and UNISDR, this study primarily emphasises the restoration of residential houses that have suffered minor to moderate damage and have been impacted by landslides. Resilience refers to the capacity of a system, group, or civilization to withstand and recover from the impact of a tragedy. In what manner can individuals effectively assimilate, adapt to, and recuperate from...
natural calamities by means of safeguarding and reinstating the Fundamental (UNISDR, 2009)? This word pertains to organisational structures and social groups. The concept of resilience encompasses a range of concepts that are relevant across all scales. These principles include addressing fundamental human needs, promoting diversity, simplicity, passivity, flexibility, local availability, and renewability (Resilient Design Institute, 2020).

The study places significant emphasis on the location features. The aforementioned factors encompass construction materials and local culture (Gautam, Prajapati, Paterno, Bhetwal, & Neupane, 2016), as well as the socio-economic circumstances of local populations, particularly those with low-income individuals, as they are disproportionately impacted by catastrophes (Nurdini, Yovita, & Negri, 2017). Local construction materials typically have minimal environmental impact and are more cost-effective, but global materials surpass technical capabilities. Nevertheless, it has been observed that local construction systems may necessitate additional exertion (Escamilla & Habert, 2015). According to Zulfadrim, Toyoda, and Kanegae (2019), there are instances where local construction is in accordance with scientific understanding.

Theories pertaining to 'community resilience', 'resilience in post-disaster', 'resilient recovery', 'resilient building', 'resilient structure', 'resilient construction', and 'resilient design' have emerged from study on the concepts of resilience and 'post-disaster recovery'. The interplay between the community and the physical elements, encompassing design, structure, and construction, is of paramount importance. The analysis will focus on two key components, namely community and local construction.

The involvement of the community and the establishment of public/private partnerships have played a crucial role in the process of recovery following a natural disaster that occurred in Greensburg, Kansas in 2007 (Dixson, 2016). The participation of the community influences various aspects in addressing the natural disaster. Numerous individuals who experience a sense of belonging to the community will remain and dedicate themselves to managing the aftermath of the natural calamity. Individuals who experienced a lack of connection would relocate to different regions or cities. Individuals within the community who are interested in enhancing and preserving their standard of living desire to actively participate in the process of recovery (Aldrich & Meyer, 2014).

Vulnerability is influenced by both the community and the physical environment. The probability of a disaster is increased when the population has limited social connections and resides in a hazardous area (Peek, 2016). The physical and social weaknesses of communities necessitate care. It is imperative to take into account the mitigation of the physical infrastructure in conjunction with the social infrastructure (Sutley, Lindt, & Peek, 2017). The bridge that connects the community and local construction is of interest. In the aftermath of the 2015 earthquake in Nepal, the local community actively engaged in the transfer of house construction technology from skilled individuals. The dwellings underwent a process of self-reconstruction in 2017, resulting in a stable and more durable state. The proficient community constructed residences in accordance with more secure criteria, employing indigenous resources and improving
conventional construction methods (World Bank Group, 2015). According to NBRO (2015), resilient building reduces the likelihood of houses being damaged following a disaster. According to Murtagh, Scott, and Fan (2020), resilient construction has the capacity to adjust the built environment in response to future changes. According to Gautam, Prajapati, Paterno, Bhetwal, and Neupane (2016), vernacular building structures in Nepal are characterised by their low-cost budget, use of local materials, and incorporation of local culture.

The aforementioned studies demonstrate the direct correlation between the community and local infrastructure in the process of recovering from disasters, regardless of the specific characteristics in each region or country.

It is a qualitative study employing a case study methodology. The vulnerability, financial, and policy aspects of Selili village were assessed through the use of primary and secondary data. An analysis is conducted on the resilience of the community and local construction to identify the notion of recovery and illustrate it using model building. This research employed a combination of semi-structured interviews, observations, and literature studies. The objectives of this study encompass various aspects, including community engagement, intercommunity interactions, conflicts with local government, community income, living conditions in risky environments, natural warning systems, local building materials, and local construction practices. Please refer to the image provided below.

Figure 2. Research Issues (Personal Analysis, 2021).

**Methods**

From November 2020 to August 2021, the study was carried out at Selili Village RT 16 and RT 17, situated in Samarinda. Rukun Tetangga (RT) refers to the process of dividing villages in Indonesia. Both RTs are located on the banks of the Mahakam river. The research site exhibits a high susceptibility to landslides.

![Figure 3: Research Locus](image)

The data was derived from the historical records of landslide occurrences spanning the years 2017 to 2020. In 2017, the landslides had a significant impact, however no victims were reported. Landslides transpired between 2018 and mid-2020, albeit with comparatively milder consequences. Landslides caused significant damage to houses in various regions, particularly in RT 15, 16, and 17. The focus of the research is situated on RT 17. Following the calamity in 2017, a total of seven residences sustained significant damage, resulting in a scarcity of remaining homes and necessitating the
evacuation of 10 residents. Between the years 2018 and 2021, the occurrence of landslides persisted, resulting in mild to major damage to residential structures.

A series of comprehensive interviews were carried out with 15 informants, including Selili people residing in multiple RTs (whose houses have experienced either minor or serious damage), RT heads (in two RTs that were particularly susceptible to landslides), as well as constructors and architects.

The interview questions focused on the landslides that occurred between 2017 and 2021. The subjects of inquiry encompassed community engagement in addressing landslides, the cultural aspect of Gotong Royong (cooperation), alterations in architectural structures, utility damage, understanding of cultural construction practices, external influences on building construction, residents' preferred architectural styles, and financial capacities. Primary data was obtained from local newspapers and other relevant literary sources.

The residence under consideration was a wooden dwelling situated in a region very susceptible to landslides. The house, situated on a precipitous incline of 40% in RT 17, was owned by individuals with middle to lower incomes and experienced moderate to minor damage. The accessibility of the location was facilitated by the ease of movement of building supplies.

Figure 4 displays a representative house.

Factors to be taken into account when selecting the aforementioned house include its placement within the residential area of Selili Village (RT 17) that is highly susceptible to landslides. A limited number of antiquated dwellings persisted inside this locality; the house was constructed using a wooden framework; the residence was several decades old; the category of damage to houses encompasses both light and moderate forms of damage; the financial status of individuals from the medium to lowest socioeconomic classes who reside alone and proximity to local road access to assist the movement of materials and individuals.

The study employed a thematic analysis methodology. Subsequently, data pertaining to variables such as community resilience and local house construction was gathered. Subsequently, the data gathering was categorised into units that pertain to the process of post-disaster recovery. Subsequently, the classification of the units was examined in order to determine the outcome. Ultimately, the example house underwent a demonstration of house rehabilitation.

The Ministry of Law and Human Rights in Indonesia had copyright on the technical designs of the house rehabilitation. The owners granted authorization for the use of the house sample in the rehabilitation process.

Results and Discussion

The graphic presented in figure 5 provides a systematic depiction of essential variables and factors related to community resilience and the development of local houses. The objective of this study is to provide guidance for educated decision-making processes in the establishment and strengthening of resilient communities by examining elements such as community perception,
rehabilitation measures, and adherence to local government rules.

Figure 1. Result of data analysis

The Impact of Landslides on Community Perception

The settlement in question is a linear arrangement constructed by a familial group. The village was initially established by the community along the riverbank. Historians held varied viewpoints of the pioneer tribe. According to several communities, the initial settlers of the settlement originated from Banjar. This was demonstrated by a century-old Banjar house built in the vernacular style. According to other groups, the Bugis tribe was the initial group to arrive in Selili. The character of the Selli community closely resembled that of several rural communities in Indonesia. It is evident in those who demonstrate concern for one another and actively participate in their everyday activities. The Selli community offers a wide range of group activities. As an illustration, individuals engage in various activities like as community work, facilitating the marriage preparation of their neighbours, attending funeral ceremonies, reciting the Holy Qur’an, participating in dasawisma (small groups of women), and engaging in communal prayer at mosques and churches. The community enjoys engaging in social interactions during their gatherings. The data indicates a significant level of community engagement within the Selli community.

According to the firsthand accounts of long-term residents of Selli, the extensive landslide occurrences were documented on four occasions: in 1999, 2007, 2015, and 2017. If a significant number of dwellings sustained extensive damage, the community deemed it indicative of a substantial landslide occurrence. In the event of a landslide, the occurrence of modest damages in numerous residential homes would not be classified as a major landslide.

Multiple criteria exist to classify buildings into light/minor, moderate, and severe damage (see table 1). The minor structural impairments included of fractured domestic exhaust pipes, shattered glass, and loose tiles. On the other hand, the building sustained moderate damages in the form of damaged columns and roof rafters in multiple sections, while it remains structurally intact. If the house's structure was completely demolished and no longer standing, the damage would be severe. The standardisation of disaster data was established in accordance with Regulation 8 of 2011, issued by the Head of the National Disaster Management Agency.

Table 1. Category of house damage in locus of research

<table>
<thead>
<tr>
<th>Category of house damage</th>
<th>Criteria</th>
<th>Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Light /minor</td>
<td>Cracks in pipes.</td>
<td>A couple of times a year</td>
</tr>
<tr>
<td></td>
<td>Jammed window and door.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Loose roof tiles.</td>
<td></td>
</tr>
<tr>
<td>Moderate</td>
<td>Broken column (particular spot).</td>
<td>A couple of times a year</td>
</tr>
<tr>
<td></td>
<td>Broken roof rafters (in some particular parts).</td>
<td></td>
</tr>
<tr>
<td>Severe</td>
<td>Broken main structure and no longer standing</td>
<td>1999, 2007, 2015, 2017</td>
</tr>
<tr>
<td></td>
<td>Sand, gravel and stones flying and making noise on the metal roof</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Cracks</td>
<td></td>
</tr>
</tbody>
</table>
The public perception of the landslide category was not as detailed as the government's criteria. These four landslide events are stuck in the memory of the residents who have lived in this location for decades. Some people sometimes forget the exact year of the events, but they remember the moment. Living for decades in landslide-prone settlements did not make all Selili communities decide to move to another place. We analyzed various reasons why the Selili community does not move from Selili. Because the community houses' location is not in the most landslide zone, they feel at home in this village. Their workplace is near the living area, and they do not have sufficient financial capacity to move outside the settlement. The last statement is being the crucial reason for the community.

Community, response, and recovery

Disaster reaction refers to the prompt and quick actions undertaken in the aftermath of an event. Conversely, recovery refers to the process of recovering from a tragedy without any specific time constraints. These two activities have the potential to unveil the characteristics of the community in both the immediate and extended periods. Following the occurrence of the disaster and in the absence of the local administration, the community promptly and effectively responded to the landslide incident that impacted their surroundings. The local populace, who were not directly impacted by the calamity, promptly provided aid to their affected neighbours in accordance with their respective capacities. The community facilitated the evacuation of individuals with disabilities or advanced age to the closest public facility or a secure neighbour's residence, thereafter removing any damaged materials and establishing an emergency route. Each one made an effort to participate using their unique abilities. Upon necessity, the community promptly constructed emergency tents in a secure location and arranged an emergency kitchen to provide assistance to the victims. The community actively participated in the rescue operation. Following the arrival of BPBD (which operates under the supervision of BNPB), the community offered assistance based on their abilities, sharing information regarding the landslide. The landslide episodes, the extent of damage, and the immediate measures implemented were examined by BPBD. The community consistently engaged with BPBD in all instances of landslide occurrences. As an illustration, their efforts encompassed the construction of emergency tents, collaboration in the provision of emergency meals, and the removal of debris materials. The majority of individuals made modifications to their surroundings as a reaction. Following the occurrence of the calamity, a limited number of individuals remained in the village. Following the occurrence of the landslide, the community commenced the process of determining its further actions. Individuals whose residences were completely destroyed or extensively damaged (10 heads of families in RT 17) opted to remain in their families' residences, which are deemed to be a more secure location. The transfer of the community by the Samarinda City Government has encountered challenges and has not been executed seamlessly. The community actively participated in repairing the dilapidated buildings in their locality. The structural components of the residences and public infrastructure were restored. Difficulties arose when those affected by landslides lacked the financial
means to repair their residences and procure construction materials. Subsequently, home repair operations proceeded with imperfections. The government provided solely infrastructure and construction supplies for the purpose of repairing public facilities, such as damaged highways. The inhabitants who possessed residences with minor to moderate damage made the decision to remain in this particular settlement. They collaborated to restore their residences in their locality, offering recommendations for repairs or overseeing the process of house restorations.

**Local Construction**

The local wooden houses are built based on local knowledge and adjusted to the prevailing conditions. The resilience of local construction includes using materials from the local area, relatively low-cost prices, easy to obtain & can be done by the local community. The scope of rehabilitation works includes pre-construction, construction, and post-construction. Pre-construction work includes simple analysis related to work preparation, for example, the needs and distribution of building materials from the alley to the house. In the meantime, the post-construction activities include removing dust and unneeded materials.

The following figure 6 shows residential house construction that existed when the last landslide occurred. Its foundations were broken in some areas. When the wind pressure onto different parts of the house, the owner can feel parts of it wiggle a couple of times.

The most common types of houses there do not have any rain gutters. The rainfall infiltrates the soil when it rains and can cause slope failures. So all houses need gutters to collect water into a downspout, directed away from homes.

<table>
<thead>
<tr>
<th>No</th>
<th>Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Substructure</td>
<td>Foundation Part of the house foundation was broken</td>
</tr>
<tr>
<td>2</td>
<td>Middle structure</td>
<td>Walls The walls of the house shook when the wind was blowing hard.</td>
</tr>
<tr>
<td>3</td>
<td>Superstructure</td>
<td>Roof frame Fragile roof frame Rain gutters No rain gutters yet</td>
</tr>
<tr>
<td>4</td>
<td>Plumbing</td>
<td>Clean water pipe Broken Grey water pipe Broken</td>
</tr>
</tbody>
</table>

Source: Author, 2021

Some demonstrations of construction rehabilitation applied to sample houses. Here are some construction works we have finished.

- The house roof was fixed in some parts because of some broken rafters.
- It kept 'ulìn' as the primary structural building material due to its endurance and establishment.
- The kalang sunduk foundations
were fixed with additional construction.
- The metal roof is still applied because it can produce some noise of sand and gravel that might become the natural signs of an upcoming landslide.
- The addition of rain gutters will keep the foundation from eroding.

In the case of rehabilitation of sample houses, the researcher, the homeowner, and several neighbors had discussed calculating building material and how the construction should be finished. We had some discussions about the efficiency of work during the rainy seasons. The neighbors looked enthusiastic in giving some suggestions that we categorized in the tables 2.

Table 2. The Community Involvement in House Rehabilitation

<table>
<thead>
<tr>
<th>Community characteristic</th>
<th>Tend to be actively involved with community activities in the neighborhood</th>
</tr>
</thead>
<tbody>
<tr>
<td>Construction work preparation</td>
<td>The community gave suggestions to the owner regarding construction work, for example, material supply and distribution. Provide temporary storage space for building materials, if needed.</td>
</tr>
<tr>
<td>Construction on progress</td>
<td>The supervision of house rehabilitation from neighbors. Some neighbors were directly involved in physical work.</td>
</tr>
<tr>
<td>Post Construction work</td>
<td>The community helped clean up the rest of the work. Provide suggestions for further improvements.</td>
</tr>
</tbody>
</table>

Source: Author, 2021

Conclusion

The post-disaster housing repair in Selili urban village was influenced by two key factors: community resilience and local house construction. Community engagement was highly proactive throughout a calamity and collaborated with the local administration to furnish sustenance, provisions, and emergency accommodations to individuals requiring assistance. The research reveals that community resilience plays a crucial role in the process of housing recovery, specifically in the context of rehabilitation.

The primary emphasis of house renovation was on addressing social and neighbourhood concerns. The societal concern pertained to the socio-economic

Figure 3. Rehabilitation Planning of Sample House (Author, 2021)

Figure 4. Demonstration of House Rehabilitation (Author, 2021)

Community and Local Construction on Rehabilitation Phase

The character of the Selili community tends to like to be actively involved with community activities in the surrounding neighborhood. When a neighbor's house is slightly and moderately damaged due to a landslide disaster, the community helps rehabilitate the damaged house construction according to their abilities, for example, by giving construction suggestions to the homeowner.

Post Landslides Recovery: Resilience of Community and Local Construction
© Hidayati & Noviana (2024) under license CC BY SA 10.29080/eija. V9 i1 . 1470
circumstances of the local populace. The economically disadvantaged population necessitated affordable and readily accessible construction supplies. Local concerns encompassed the utilisation of indigenous resources (like wood), which can be fabricated by local individuals and rely on local expertise. It is anticipated that the community will possess enduring durability for the purpose of post-disaster recovery prior to the relocation by the local administration. The aspects of resilience are highly varied and demanding. Additional research is advised to examine additional resilience elements in order to enhance the understanding of natural disasters.

**Author(s) Statement**

Authors with this declare that this research is free from conflicts of interest with any party, has never been published anywhere and has complied with the rules of publication ethics.

**Acknowledgements**

Thanks to all those who assisted in this research.

**References**


Author(s) contributions

Zakiah Hidayati devised the diagram's framework. She carefully picked relevant literature and research based on her knowledge of disaster management and community development. Her thorough research assisted in the integration of complex thoughts into a logical outline, which served as the foundation for the diagram's structure. Zakiah's understanding contributed to the content's refinement, which included community perspectives and local legislation. Her meticulous inspection and editing of the final edition demonstrated her commitment to a finished and polished work.

Mafazah Noviana brought architecture and construction expertise to the cooperation with Zakiah. She meticulously gathered information about local house construction techniques in the field. Mafazah's thorough analysis and assessment of the data yielded restoration solutions and optimum building materials. Her involvement with local government agencies provided practical insights into regulatory compliance for the diagram. Mafazah thoroughly planned the diagram's visual look to ensure clarity and communicating potency.