Collective space on residential as a resilience measure to disaster mitigation earthquakes and liquefaction

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Abstract. Disasters have just hit Palu, Sigi, and Donggala, resulting in the fall of so many victims, not only humans but also city and village physicals (residential buildings, facilities, and infrastructure). Several villages hit by the disaster were hamlet 3 Vou, Langaleso village, Dolo sub-district, Jono Oge village, Biromaru sub-district, and Sigi district. The village's condition was damaged, but most of the buildings and plants were lost to the mud. Settlement neighborhoods that should be full of activity are nowhere to be seen, and people become apathetic. They just accept this situation and are always waiting for help. Huntara, a form of assistance provided by funders, temporarily occupy the settlers' land because the condition of the land or land needs to be cleared for the rebuilding process. The provision of inclusive spaces is one of the efforts to mitigate disasters in residential areas, namely public spaces that can be used by all settlers. These spaces must be safe and provide comfort, easy to reach, and become part of the residential environment. Village arrangement is one way that can be done to minimize the impact of a disaster. Arrangement of buildings, facilities, and environmental infrastructure are necessary not to create chaos in development. Also, aspects of environmentally friendly residential (village) spatial patterns, structural systems, and building construction that meet the requirements (SNI), the application of local and humane wisdom are no less important to consider in the process of procuring inclusive spaces in settlements, structuring villages, especially after a disaster.

Key Words: Space, Collective, Settlement, Resilience, Mitigation, Disaster.

1. Introduction
Hamlet 3 Vou Langaleso village and hamlet 3 Jono Oge Village are part of Dolo sub-district, Sigi regency which experienced the impact of the disaster/calamity on September 28, 2018. Each hamlet has a population of approximately 650 people or 130 households with farming (gardening) livelihoods, and raise livestock, so that it is known as a supplier of vegetables to the city of Palu and other areas around it. Land conditions are very fertile, in some parts of the hamlet there are water sources and irrigation channels flowing well. This is supported by the existence of the Gumbasa river water source which is part of the Sigi district. People live well, it can be seen from several permanent buildings surrounded by a large yard and garden with various types of plants. Coconut, banana, corn, lowland rice fields and various types of vegetables are found along the village roads. They have lived their lives in an atmosphere of harmony and simplicity for decades.
The disaster had devastated Langaleso village and Jono Oge village, the land that was originally fertile was cracked due to the earthquake and buried in mud due to liquefaction and brought all their belongings. The community is grieving, activities are totally paralyzed, all that is seen are the mountains of several roofs of buildings, piles of building materials that are still left behind, and their belongings that have also been destroyed without shape. Some others lost their families without any word of their whereabouts, so that the survivors had to struggle to continue their lives.

After the earthquake they did not have any shelter. Most of the settlers used evacuation tents, sometimes without food and drink, wearing volunteer clothes. Land for setting up tents only uses empty land around the settlement without paying attention to its suitability, both land conditions and health considerations, so it is often flooded when it rains heavily. Another problem arises because there are no available places for bathing, washing and toileting, resulting in various diseases due to the absence of medicines and medical personnel.

2. Research Method

This study uses a "qualitative-phenomenological" approach so that it will find patterns of residential space utilization [1];[2].

2.1. Research location : Sigi Biromaru sub-district

![Figure 1. Map of Jono Oge Village (left) and Langaleso Village, Sigi Regency (Source: Google Earth, March 2020)](image)

![Figure 2. Condition of Langaleso village (left) and Jono Oge village after the earthquake and liquefaction (Source: field data, October 2018)](image)
2.2 Research tools and materials

Research tools, namely researchers as the main instrument equipped with assistive tools, in the form of writing tools and drawing tools, portrait tools, tape recorders, measuring instruments, GPS, and basic settlement maps. The research material consisted of: settlements and the environment, namely residential units, community activities, and community behavior in settlement spaces.

2.3 Research design

The first step in conducting the research begins with preparing maps of the research location. Then make observations of the research area as a whole to determine the study case as the first "sample". The focus of the research is specific things, namely housing, settlement layout, settler activities, behavior towards the residential space. This specific environmental condition was taken as the first research sample. Through interviews and in-depth observation, information themes are obtained. Themes are emphasized on settlement units, in relation to social, cultural and historical aspects. Basically, the theme is not limited, but is still related to the focus of the study. Then identify the spatial pattern of residential land use, in order to obtain the most dominant spatial use pattern. The spatial pattern describes the 'settlement system' practiced by the people who live in the area (Sigi Biromaru and Dolo districts). Data analysis used the 'inductive' method through descriptions of cases as samples [3]. The cyclic iteration process was developed as the basis for a temporary research design, determining other cases (by purposive sampling) until they reached 'saturation' or to the extent agreed upon. Analysis by means of categorization, description and explanation is carried out at every observation and interview. These results are 'research findings', are provisional in nature, which are continuously tested through observation and interviews.

2.3 Method of interpretation and theoretical dialogue

Meaning is carried out by interpreting and explaining the findings between substantive concepts in order to obtain the findings of 'local concepts', namely the values of local knowledge in the use of settlement spaces. The form of theoretical dialogue is to position local concepts on other concepts / theories. The next stage is the discussion of research findings, with the "explanatory" technique, namely explaining the findings and confirming the related theories, as well as other conditions in different areas. The results of the discussion are the conclusions of research which are 'local theories' or 'substantive theories', which are specific to the research area and are temporary.

3. Discussion

3.1 Settlements as shelter and places to carry out post-earthquake and liquifaction activities

The residential environment in both 3 Jono Oge and 3 Langaleso hamlets is a community settlement environment whose daily life carries out activities both as a vegetable garden farmer and raising chickens, goats and cows. Therefore, their settlement is not only a residential environment [4] but also surrounded by gardens and cattle sheds as a source of their livelihoods [5]. The two hamlets are known by the community as suppliers of vegetables and chickens for the city of Palu and its surroundings. The fertile land, climate and clean water sources really support their activities, so that their income is not only sufficient for their daily life, but also their economic condition can be said to be good (the economic level of the community is moderate) [6]. In several environmental units, several supporting facilities or facilities are found, be it for education, health, religious activities (a mosque in Langaleso village and a church in Jono Oge village), and other social activities [6].

The settlement conditions in the two hamlets changed after the earthquake and liquefaction. Most of the houses and settlement facilities were carried away by the mud, so that the settlers no longer had a place to take shelter, a place to carry out social activities or a place to earn a living, especially in the 3 Vou hamlet of Langaleso village. Unlike in hamlet 3, Jono Oge village, residential buildings and other social facilities were cracked to pieces, so that many settlers left their houses to move to other places and a small portion still occupied their homes. Shelters (temporary shelters) are built on vacant lands or residual lands in residential areas as well as supporting facilities, such as places of worship, schools, washing baths, and others. Their land is not fully cultivated due to limited sources of clean water that can flow through their gardens, as well as livestock sheds which require money to procure seeds and repair stables.
3.2 Settler behavior towards their settlement spaces

Living is living and living together, therefore the settlement is not only a place to live but also as a place to interact. Socio-cultural aspects greatly influence the formation of a place to live (space arrangement and placement) to suit their needs. Factors that are considered in establishing a place to live (occupancy) include religion, social relations, livelihoods and the natural environment [6]. Usually, people build their living quarters around places of worship, markets or shopping centers. As the smallest part of a village (ngata), settlements tend to be near the main neighborhood roads and a spreading pattern (not arranged in specific centers) and close to their livelihood places, namely gardens and livestock pens, making it easier for them to carry out activities.

Things like this did not change drastically after the earthquake, some settlers continued to build houses on their land, a small proportion received housing assistance from the government which was located far from the original settlement (landless settlers in the two hamlets). Likewise, land for gardens and livestock, settlers continue to work on their land to provide for their families, with some assistance provided by the private sector, including water sources (wells and pumps), so that they take turns using it to irrigate garden lands. Even though the results are still minimal, they remain and will not leave their hamlet. There are still very few supporting facilities for activities in the form of schools, places of worship, roads, places of interaction but they still do it in the remaining spaces or other empty land. Some settlers built a small garden in front of the house and made a shop to sell in the shelter space (huntara), while the small children played in the spaces between their shelters [2] [6].

![Figure 3. Settlers continue to build huntara and huntap on their respective lands as a process of adaptation to post-earthquake settlements and liquefaction (Source: Analysis based on field data, March and June 2020)](image)

The residential environment has local community values as local values and supports the cultural aspects of the people who live in the hamlet. Culture will be interrelated with cosmic entities or social strata, so that each will occupy these spaces. This can also be found in the two hamlets, land use, aid distribution, land ownership, coloring the life of the settlers and the formation of residential spaces [2] [3]

3.3 Adaptation of settlers to the settlement environment

Culture must be able to be adaptive, that is, make adjustments to the social environment of its settlers. Some actions and ideas will develop in a social system, because culture as a result of actions and ideas will develop in a social system. Therefore actions and ideas always adjust to the development of the social environment [7]. This means that the culture owned by a certain community is used as an adaptation strategy in a certain environment so that the pollinators are still able to carry on their lives. This is also experienced by the settlers in the two hamlets, namely 3 Jono Oge hamlet and 3 Langaleso hamlet, the settlers are still trying to be able to adapt to their residential environment after the earthquake. The settlement that was previously comfortable, safe as a place to live, work and interact, is now just a stretch full of ruins of houses and buildings that can no longer be used by settlers.
In some lands, residential houses have started to be built but they do not use the space in the original area but use the remaining land in their yard. An atmosphere like this illustrates that they still feel part of an environment that previously provided a calm atmosphere and will still provide the same atmosphere even though the conditions are far different. The garden plots and stables remain in their original position without any desire to change them or move them. The adaptation process is also influenced by the settlers' perceptions and interpretations of objects and then refers to a categorization system in the form of a response to an environment both for residential buildings, access, building technology, building materials and other living activities [7]. Love for the house and its environment is a way to survive in the settlement which is influenced by the physical condition of the house, the environment, socio-culture, kinship, proximity to work, economy and psychologically to feel the living space [7] [8].

Figure 4. Farm land and livestock land as a source of livelihood they still do on their respective land, namely in hamlet 3 Langaleso village and hamlet 3 Jono Oge village (Source: Analysis based on field data, March and June 2020)

The structure is essentially a process of change, be it in the socio-cultural, economic and physical aspects. Even though the environmental conditions have changed, local or traditional values are still preserved, they still maintain kinship, religion, rural life and are not capital oriented [8], because the consequences of changes will manifest in norms, values, cultural adaptation, because of the existence of outside influence on their lives and will affect other elements in their lives. Settlers still survive to live and live, especially because this is where they were born and raised, so they feel the need to restore their village function as it should be, and it is arranged according to land conditions and its designation [9] and the safety factor against disasters (earthquakes and liquefaction) starting from structuring The area as a whole, occupancy and its environment, proper and disaster-friendly buildings according to standards (SNI) and based on local wisdom [10] [11] [12].

3.4 Collective space as a room for resilience and disaster mitigation

The settlement is a form of living space, an architectural work formed by the settlers who occupy it, consisting of a collection of houses, equipped with facilities and infrastructure to support the settlers' life [4]. Settlements have a spatial layout [5] as a living space including the behavior of the settlers and their social life [6]. Settlers will interact with each other in the residential spaces both in the micro and macro housing in the residential space. In addition to living, settlers also need work or business land, where the settlers try or work to support their families and meet other needs. Business spaces should also complement a settlement, such as in the two hamlets. The settlement consists of a collection of dwellings equipped with garden land and cattle sheds as a source of livelihood.

The procurement of collective space in settlements is a resilience space that should exist in every settlement that is prone to disasters, especially in Palu City and its surroundings and Central Sulawesi Province in general.
A settlement does not only consist of houses, equipped with facilities and infrastructure according to the needs of the settlers. Based on Indonesian national standards, a settlement should be equipped with public spaces, where humans can interact with fellow settlers for various activities [15] [17] [18]. These spaces consist of various facilities and are easily accessible (have adequate access) by the settlers from their residence. Facilities in the form of learning places, recreation areas, places of worship, shopping places, and various other activities, so that this public space is the center of a settlement. These spaces are very important for settlers because they are multi-functional and can be used by all settlers in a settlement as a common space [13] [14]. Procurement of public spaces known as inclusion spaces is tailored to the needs of each settlement, as well as in the villages of Jono Oge and Langaleso villages which were affected by the earthquake and liquefaction disaster [15] [16]. After the disaster, the settlers in the two villages still used the remaining spaces from their houses, empty land from the yard of their homes, or empty land from their settlements. Interaction has not been fully fulfilled because environmental conditions have not fully recovered.

Figure 5. Interaction spaces in the form of residential terraces and empty land in settlements (Source: Analysis based on field data, March and June 2020)

4. Conclusion

A. Settlers make use of the remaining space and empty spaces in the residential area as a place to live in the form of a shelter (temporary shelter) or a place to carry out daily activities.
B. Supporting activities (studying, praying, bathing and washing, etc.) use aid buildings both by the local government and private sector which are also built on the remaining land which is not used by the settlers as a place to live.
C. The land for gardens and livestock still occupies the original land, which the owners are working on to fulfill their daily needs.
D. The remaining space becomes a public space for activities that require a large enough area and meet the requirements for the implementation of these activities.
E. Therefore a collective space is needed in a settlement as a multi-functional space for disaster resilience, namely as a public open space equipped with adequate, humane, easily accessible, environmentally friendly facilities and infrastructure that pay attention to the local residents' activism to support their activities.
F. The arrangement and design of settlements should be habitable and sustainable and take into account the placement of Collective Space in a safe zone, according to its designation in the settlement.
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