Local-Wisdom and Its Influence to Disaster Mitigation on the Spatial Configuration of Lakkang Waterfront Settlement

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Abstract. This paper discussed the concept of dwelling and its influence to the disaster-responsive mitigation on the spatial configuration of Lakkang waterfront settlement as settlement is formed by the local cultural. This research was conducted by using space syntax analysis techniques and supported by the disaster mitigation concept. The result of this study shows that dwelling concepts of Lakkang communities is developed from natural dwelling to collective dwelling. The spatial configuration of Lakkang settlement is developed by collective dwelling. Collective dwelling will form a more integrated space of the space which is formed by natural dwelling. Dwelling culture of the Lakkang people has formed an open space configuration so that the spaces are integrated with each other. The Lakkang settlement is adapted to the natural environment so that disaster can be minimized. The spatial configuration of Lakkang settlement is in accordance with the disaster mitigation concept. The layout of settlements and ecological carrying capacity are the determining factors for disaster response settlements. This paper could be a concept for the development of the waterfront settlements based on local wisdom.

1. Introduction

Lakkang village is a settlement which is located on the coast. This settlement grew up spontaneously along the river area and it was forming an unplanned settlement. Initially the settlement was formed by the local community, in this case the fishing communities. Lakkang settlement developed due to the concept of dwelling by societies which is related to the river. The dependence on the river causes the houses to form and the spatial order settlement described the social community conditions. Man dwells when he can orientate himself within and identify himself with an environment [1].

Lakkang settlements is inhabited by the majority of Makassar ethnic community, so that the activity of the society is still influenced by Makassar culture. Similarly, the concept of dwelling community is influenced by Makassar culture as well. In Makassar community, the concept of dwelling is influenced by values of solidarity which are known as sipakatau culture. Sipakatau culture is mutual respect and sense of togetherness. The sense of solidarity the Makassar community is considered influencing the formation of Lakkang settlement.

Although Lakkang settlement is surrounded by rivers, this settlement has never flooded. This is due to the settlement layout which is arranged in accordance with the dwelling culture of local communities. Therefore, this paper aims to describe the concept of dwelling Lakkang communities, and its influences on spatial configuration and disaster mitigation. This paper could be a concept for the development of the waterfront settlements based on local wisdom.
2. Literature Review

2.1. Cultural Living

Shelter and settlements as a product of human culture cannot be separated from those influences. Occupancy not just as a mere means of life, but rather a living process, namely the presence of humans as occupants in creating living spaces in homes and surrounding environments [2]. Shelter and settlement are the mediators between humans and the environment, the transformation from one to the other or form a relationship between them [3]. Culture of dwelling is a residence that has more meaning than just a form of buildings, but more than that is a very close relationship between occupancy and human, which includes all aspects of life for all residents: ideas, place and a physical expression of the activities carried out [4].

Dwelling by giving a three-part definition [1], first, dwelling means to meet others for exchange of products, ideas, and feelings, that is, to experience life as a multitude of possibilities. Second, it means to come to an agreement with others, that is, to accept a set of common values. Finally, it means to be oneself, in the sense of having a small chosen world of our own. Dwelling principles consist of natural, collective, public, and private dwelling [1].

- Natural dwelling
  This method begins with the arrival of humans on a place to stay and settle. This method is the beginning of the human form a place for living. In other words, the first place was formed by humans as called settlement, it is only establish a relationship with the surrounding environment. In this natural dwelling the occupants orient themselves in their environment and identify the environment as a place for living. The settlement as a naturally form.

- Collective dwelling
  This method begins with the arrival of humans together to forming someplace. Besides as a place for living, this place serves as a place to meet and gather. It is a place where human beings come together in diversity. This method of community oriented and identify the places by creating an identity. Space and buildings formation reflects the shared values that exist in society. In other words, collective dwelling describe the influence of social in the process of living and the space form.

- Public dwelling
  This method shows the harmony patterns that illustrate various of togetherness structures, and then implications for the values and rules in society. This way influenced by their common belief in society that formed the communal spaces. Space and buildings formed oriented values, rules and beliefs so that forming the identity of a place. Public dwelling describe the influence of culture in the process of living and the space form.

- Private dwelling
  This method is shown by the activities of the inhabitants are separated from each other. These activities form the residence and show personal identity.

Based on the above explain, that concept of dwelling starts from the formation of a natural dwelling for orientation to the environment. This natural dwelling evolved forming the collective dwelling due to togetherness values in the community. Collective dwelling evolved into public dwelling because of the influence of the values and beliefs in society to form a communal space. Then, there are activities of the inhabitants of which requires it to separate in communities will be forming the private dwelling.

2.2. Spatial Pattern of Waterfront Settlement

The process of formation the waterfront area affected by aspects of environmental conditions, socio-cultural aspects, economic aspects, aspects of population and aspects of government policy. Aspects of most influence in the formation of the waterfront settlements are socio-cultural of society, so that culture of waters will be reflected on the settlement form. On the other side the dependence of community on the beach is an aspect that affects the coastal settlement patterns [5]. It describes that dependence of community on the beach influenced to the waterfront settlement patterns.

Spatial pattern of waterfront settlement is influenced by the physical aspects of the environmental and socio-cultural community. There are five types of the settlement patterns of coastal villages which are; inland water village, outward water village, parallel water village, water village and river mouth.
water village. [6]. The existence of coastal villages is very unique to typify their traditional urban settlements.

The spatial pattern of the coastal settlements has different forms according to the social cultural and ecological characteristics. Former research show that the spatial pattern of the coastal settlements generally formed elongated pattern, clustered pattern and scattered pattern [7, 8]. Figure 1 shows a sketch of spatial patterns of coastal settlement.

![Figure 1](image1.png)

Figure 1. The Spatial pattern of coastal settlement [7, 8]

Figure 1 explains that there are four essential elements that exist in coastal settlements, namely: buildings, activity centers, open space and water as elements forming environment. These four elements should be integrated in the spatial arrangement of environmental settlements that do not conflict with the social cultural community and coastal ecological.

2.3. Disaster Mitigation Concept
Disaster mitigation is defined as the efforts made to prevent or reduce the impact of disasters. Disaster mitigation is actually related to the disaster management cycle in the form of efforts to handle it before a disaster occurs [9]. On the other hand, mitigation is defined as the efforts and activities carried out to reduce and minimize the consequences caused by disasters which include preparedness and alertness [10].

The planning of land use based on disaster response includes:
- Designation of Dangerous Areas as a Function of Open Space
  Allocation of hazardous natural disaster areas to be used as agricultural areas, parks and recreation areas as a land use planning strategy [11]. This strategy is designed so that development in hazardous areas can be as minimal as possible.
- Population and Building Density
  Strict regulation of building types and land use permitted in hazard areas. Regional planning and allocation must use population density rules or very large land allocations (for example a minimum of 4 hectares) so that only low density residential functions may be in hazardous areas [12]. Only low density settlements are allowed in dangerous areas.

![Figure 2](image2.png)

Figure 2. Density and risk level in settlement areas [12]
Safe Zone Planning
The safe zone can be in the form of open space that functions as green land, such as fields, forests or public facilities that function as refugee shelters. To deal with extreme waves and tsunamis, it is necessary to build Escape Hill, an altitude area that can accommodate people in areas that can serve, accommodate when extreme waves occur. The location must be easily traversed and equipped with road facilities, and the altitude exceeds the extreme wave heights that have occurred. While the safe zone area must be able to accommodate the surrounding community. Besides that, it must consider the location of the distance, for example 10 to 20 minutes, the community has been able to reach the zone, so that the community can save themselves from disasters [13].

Utilization of Green Belts in Coastal Areas
There is a boundary between the water area and the housing area which can reduce the level of incoming sea water during extreme waves. The barrier can be in the form of hard plants or green belts that are built parallel to the waters with suitable vegetation types as barriers [11]. Recommended types of vegetation are those that have wide canopies that are planted on the city belt, district belt and neighborhood belt.

The study of local wisdom and disaster mitigation in traditional communities in Indonesia is seen in relation to natural resources and human resources. In traditional (local) societies, humans and nature are a unity because they are both the almighty creations. Nature and humans are believed to have the same spirit. Nature can be friendly if humans treat wisely and vice versa will be angry if we damage it. If nature becomes angry so that natural disasters occur in the form of floods, landslides, volcanic eruptions and so on, then traditional communities generally also have local knowledge and ecological wisdom in predicting and mitigating natural disasters in their areas [14].

3. Method
This study described the influence of dwelling culture to the disaster-responsive mitigation on the spatial configuration of Lakkang waterfront settlement. This study used the diachronic reading technique analysis and was supported by the space syntax method [15]. To explain the formation of the settlement spatial configuration, a diachronic reading technique analysis was used based on map, observations and interviews from several sources. The space syntax method was used to analyze and explain the influence of dwelling culture to the characteristics of the settlement spatial configuration.

The results are then used to interpret the spatial configuration settlement formed. Then, the spatial configuration settlement formed is analyzed based on the disaster mitigation concept. The results explain the influenced of spatial configuration settlement to the disaster mitigation aspects in the Lakkang waterfront settlement.

This study was conducted on Lakkang settlements in Makassar, South Sulawesi Province as growing settlements on the waterfront described in Figure 3.

![Figure 3. Research location [16]](image-url)
4. Result and Discussion
4.1. Dwelling Concept to Housing Layout
Lakkang settlement is beginning to be formed by community related on the river, in this case by the fishing communities. So that the layout of Lakkang settlement describes the dwelling culture conducted by the society. The formation of individual houses on the water describes the dwelling culture of society is related on the beach. It is influenced by the natural dwelling conducted by the society as part of the adaptation on the river. This natural dwelling caused the origin of Lakkang settlement is formed. In other words, the first place formed by Lakkang community because of human relationship with the around environment. In this natural dwelling Lakkang community is oriented and identified itself on its environment as a place for living. It can be said that initially the Lakkang settlement is formed naturally. The natural dwelling causes the formation of houses spreaded on the water, directly reaching the river or the work place.

The influence of natural dwelling to the Lakkang settlement is shown in Figure 4.

![Figure 4. The Natural dwelling on the Lakkang Settlement](image)

The influence of natural dwelling to house formation Lakkang settlement described in Table 1.

| House Form | Access Graph | Relative Asymmetry Calculation |
|------------|--------------|--------------------------------|
| Main depth value : MD = 21/(8-1) = 3.00 |
| Integrasi value : RA = 2 (3.0–1) / (8-2) = 0.667 |

The spatial configuration is non-distributed formed, because there is no route choice for moving from one space to another space. It is the closed settlement formed. The average settlement depth value of 3.00, it indicates that the settlement is relatively not easy to reach from outside the settlement. Spatial integration value of 0.667, it indicates residential spaces that are not integrated with each other.
In its development, the influence of kinship system of Makassar community is forming the collective dwelling. This occurs after a natural dwelling formed, then forming a collective dwelling in settlements. The togetherness tradition of Lakkang community for always wanted to stay close has been influencing natural dwelling formation. This method oriented on sense of similarly, so that it is forming the places identity. In other words, the collective dwelling for people Lakkang not only means a more meaningful place to stay but as a place collective that describes the influence of culture in the formation of space. Collective dwelling of Lakkang community have been forming the groups of homes in the settlements.

Lakkang settlement developments are influenced by collective dwelling of communities. It is occurred due to kinship of solidarity. Kinship solidarity has caused growing the family houses in one plot, so form the cluster-houses in the Lakkang settlement. The influence of collective dwelling to the Lakkang settlement forming is shown in Figure 5.

![Figure 5. The Collective dwelling on the Lakkang Settlement](image)

The influence of collective dwelling to house formation Lakkang settlement is described in Table 2.

### Table 2. Collective dwelling in house formation of Lakkang Settlement

| House Form | Access Graph | Relative Asymmetry Calculation |
|------------|--------------|--------------------------------|
| [Layout of house image] | [Graph image] | Main depth value : MD = 21/(12-1) = 1.91 |
| | | Integrasi value : RA = 2 (1.91–1) / (12-2) = 0.182 |

The spatial configuration is non-distributed formed, because there is no route choice for moving from one space to another space. It is the closed settlement formed. The average settlement depth value of 1.91, it indicates that the settlement is relatively easy to reach from outside the settlement. Spatial integration value of 0.182, it indicates residential spaces that are integrated with each other.
Based on the analysis above, the house formed by the natural dwelling has the integration value of 0.667, while the house formed by the collective dwelling has the integration value of 0.182. This is to indicate that the space formed by the collective dwelling will form more integrated spaces than the space formed by the natural dwelling. On the other side, elongated patterns are more integrated than scattered patterns.

4.2. Spatial Configuration of Lakkang Settlement

Layout of Lakkang settlement is shown in Figure 6.

![Figure 6. Lakkang settlement layout](image)

| Table 3. Spatial configuration of Lakkang Settlement |
|-----------------------------------------------|
| **Layout Settlement Map** | **Access Graph** | **Relative Asymmetry Calculation** |
| Main depth value: | Integrasi value: |
| \( \text{MD} = \frac{57}{(19-1)} = 3.167 \) | \( \text{RA} = 2 \left( \frac{3.167-1}{19-2} \right) = 0.255 \) |

The settlement patterns are open because of the access around the settlements. The spatial configuration is distributed, so there is a route choice for moving from one place to another place.

The average settlement depth value of 3.167, it indicates that the settlement is relatively easy to reach from outside the settlement. Spatial integration value of 0.255, it indicates residential spaces that are integrated with each other.
Figure 6 explains that the Lakkang settlement is surrounded by waters and mangrove forests. Outdoor spatial configuration consists of fishponds and rice fields. Indoor spatial configuration consists of housing, open space and bamboo forests. This explains that the houses are located far from the water and are very protected by the fishpond and rice fields. The influence of cultural dwelling to the spatial configuration of Lakkang settlement described in Table 3.

Table 3 shows that the dwelling culture of the Lakkang people has formed an open space configuration so that the spaces are integrated with each other. This causes the Lakkang settlement to adapt to the natural environment so that disaster can be minimized.

4.3. The Influenced of Spatial Configuration on Disaster Mitigation

- Designation of Dangerous Areas as a Function of Open Space
  In hazardous areas used as ponds and rice fields. This indicates that the layout of the Lakkang settlement has minimized the area affected by the disaster.

- Population and Building Density
  The area of Lakkang village is around 1.65 km². The total population of 2018 is 925 consisting of 504 men and 448 women. Number of houses 261 units. The population of 925 and the number of buildings 261 in an area of 1.65 km² makes Lakkang village a low density (SNI Standards). On the other hand, houses that are formed in dangerous zones are only buildings that are related to livelihoods. This indicates that the Lakkang settlement density level is in accordance with the concept of disaster mitigation.

- Safe Zone Planning
  Placement of houses and facilities are placed in the middle of settlements that are far from the edge of the water and far from dangerous areas. Besides that, houses and settlement facilities are protected by bamboo forests. On the other hand, evacuation routes and safe gathering points are fields located in the center of settlements and in the highlands. This indicates that the layout of buildings and Lakkang settlement facilities have entered the safe zone area.

- Utilization of Green Belts in Coastal Areas
  Green belts in the Lakkang settlement are mangrove forests, rice fields and fish ponds, which function to reduce the level of tidal currents that enter during extreme waves. This indicates that the Lakkang settlement has a green belt that serves as disaster mitigation.

Based on the explanation above, the spatial configuration of Lakkang settlement is in accordance with the disaster mitigation concept.

5. Conclusion

The culture of Makassar community has changed the Lakkang settlement. Dwelling concepts of Lakkang communities is developed from natural dwelling to collective dwelling. The spatial configuration of Lakkang settlement is developed by collective dwelling. Collective dwelling will form a more integrated space of the space which is formed by natural dwelling. Therefore, kinship culture will form a more integrated space. On the other side, elongated patterns are more integrated than scattered patterns. Dwelling culture of the Lakkang people has formed an open space configuration so that the spaces are integrated with each other. This causes the Lakkang settlement adapts to the natural environment so that disaster can be minimized. This indicates that the spatial configuration of Lakkang settlement is in accordance with the disaster mitigation concept. Therefore, it is suggested that the arrangement of the waterfront settlements should pay more attention to local cultures. So it will emerge particularities or specificities of tradition and then disaster can be minimized.

Acknowledgements

This paper is part of a joint research with students of architecture department Hasanuddin University on the coastal and island settlements study in Lakkang village. The author thanks to students for their participation and assistance in surveying and collecting data. The author would like to express special thanks to the Lakkang District Head and Lakkang people are for the permission to survey in the location and the provision of data related to the Lakkang village, so that this research can be carried out.
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