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DESIGNING RESILIENT COASTAL TOURISM FACILITIES BASED ON LANDSCAPE CHARACTERISTICS AND LOCAL WISDOM

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Abstract

Landscape characteristics in coastal areas greatly influence the resilience of tourism facilities for the economy of local people and government. On the other hand, the coastal areas are the first zone hit if a natural disaster such as a tsunami occurs. It is also vulnerable to abrasion as the impact of climate change. The topography of the coastal landscape is considered a factor in planning tourism facilities. Thus, to what extent does landscape design influence designing resilient coastal tourism facilities? The study area of this research is located in Lampuuk beach, Aceh Besar, Indonesia. The research aims to observe the landscape characteristics in coastal tourism areas as a preparedness strategy to confront natural disasters in resilient coastal areas. This research is conducted using a descriptive quantitative method by collecting data on landscape coastal characteristics and data records of coastal tourism growth. Next, all data are analysed based on the coastal tourism area that has developed tourism facilities. The final step is synthesizing collected data and the analysis result using a modelling approach. The research finds out that the landscape characteristics influence the design of facilities in the coastal tourism area, which requires different structures and materials. The local wisdom of Rumoh Aceh could mitigate and prevent the coastal tourism industry from rebuilding new facilities if the wave range reaches the land.

Keywords: resilient, coastal tourism, landscape design

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INTRODUCTION

Tourism facilities in coastal tourism are paramount for captivating visitors to come. Besides attraction, marketing materials for instance physical amenities and facilities are factors that contribute to the success of tourism industry development (Hall & Page, 2014; Makkonen, 2016). Biggs et al. (2015) assert that coastal and marine-orientated nature-based tourism plays an important socio-economic role and provides an incentive for conservation in many coastal regions. In the last decade, coastal tourism has experienced phenomenal growth since 2010, especially in vulnerable areas such as Lampuuk and Lhoknga beaches. This growth has led to the construction of tourism facilities such as gazebos, cottages, and restaurants. However, all of this construction has taken place in vulnerable areas in the wake of the Indian Tsunami in 2004. Therefore, it is threatened by the possibility of tsunami occurrence and the impact of climate change, for instance, rising sea levels causing shoreline movement closer to land and depth of the coastal area where it is forbidden to swim.

No empirical studies in Aceh, however, have been conducted to ascertain the impact of sea-level rise on tourism. Moreover, the local wisdom related to the prevention of natural disasters in the coastal area is hard to discover, so the efforts to provide resilient disaster management have not been reaching sustainability. Moreover, it is a known fact that local wisdom inherited from past generations who survived disasters would serve as precious knowledge with the potential to increase the capability of having a better and safer built environment. Thus, would it be appropriate to incorporate local wisdom into the landscape design concept in coastal tourism facilities?

In order to support tourism facilities, the government has dominant clout in implementing various tourism programs which have been proven complex and ineffective by previous researchers (Zulkefli, Jaafar, and Marzuki, 2021). Generally, programs that have been made by Aceh's government focus on the occurrence of a disaster. Moving the coastal tourism and the settlements to higher land would be improper to offer as the previously equal quality of life, and economic vitality for people and the industry might deteriorate. Therefore, preparedness in responding to disasters is required in order to mitigate the severity of the human and material damages. The study of designing a resilient coastal tourism landscape is critical, thus reinforcing the need to build sustainable disaster-responsive coastal tourism for tourists and the local community.

The research aims to observe the landscape characteristics in coastal tourism areas as a preparedness strategy to confront natural disasters in the resilient coastal area. Investigating the possibility to mitigate the impact of disaster is the main objective of the study. Therefore, the question at the heart of this research is: to what extent does landscape design influence the designing of resilient coastal tourism facilities?

LITERATURE REVIEW

Coastal tourism is considered a significantly growing segment of global tourism (Hall, 2011). As well as being significant in size, coastal tourism is considered to be one of the tourism segments that are most vulnerable to extreme weather events, most of which are driven by climate change. This is because they offer a wide array of activities that can be enjoyed by tourists, which in turn trigger the coastal economic development of many developed and developing countries across the world (Moreno & Becken, 2009; Scott et al., 2012). Coastal areas play a crucial role in the tourism sector as they remain yet renowned for being popular spots for tourism.

Planning for creating a coastal landscape should be renewed and enhanced using adaptation to the risk of climate change and natural disasters to people and the tourism industry. Similarly, the distinctive topography of the landscape along the coast that differs from higher land should also be considered. Landscape planning provides information about the existing qualities of the landscape (i.e., landscape potentials), their value and sensitivity to the current, the objectives, and guidelines for the development of the landscape, upon which proposed measures and development plans can be appraised (E. Ü. Mander, Uuemaa E., 2015). One crucial element that connects human social relations with nature is the environment in which landscape becomes an integral part of both. This study refers to four main scope theories that include coastal landscape characteristics, coastal tourism, resilience in landscape design, and local wisdom.

Coastal Landscape Characteristics

This paper defines a coastal landscape as a strip of soil between the mainland and the sea, thus constantly formed by the actions of waves and tides, winds, and atmospheric agents. Four main characteristics of coast in a coastal landscape are rias coast, high coast featuring cliffs, low coast, and lagoons. Initially, rias coasts are formed when the sea invades old river valleys. Consequently, capes and peninsulas are created. Secondly, rocky and vertical slopes on the sea are featured on high coasts with cliffs. Third, low coasts are shaped because of the weak destructive action of the sea, allowing materials and debris in the river to settle. An outcome of low coasts is sandbanks and beaches. Lastly, an enclosed area is a lagoon leading to several kilometres of expansive, scenic sandy coasts and shallow waters.

Coastal Tourism

Coastal tourism pursues recreational activities as key in coastal areas, for instance, visiting beaches, swimming, surfing, and fishing (Gounden, R., et. Al., 2021). According to Hall (2011), the concept of coastal tourism takes place in the coastal zone embracing the full range of tourism, leisure, and recreationally

oriented activities. Therefore, coastal tourism is defined as tourism capacities in providing amenities such as restaurants, cottages, and shops based on recreational activities that are diverse in activities along with the coastal areas. Recapturing the coastal tourism during the Roman times when the Southern part of the Apennine peninsula was constructed with the first villa. Furthermore, in the mid-18th century, the therapeutic atmosphere of the sea and sun were considered a coastal tourism attraction. Consequently, this leads to the development of the mass coastal tourism industry in this century. The United Nations Environment Program accentuated that coastal tourism is based on a unique resource combination at the interface of land and sea in which it offers amenities such as water, beaches, scenic quality, rich terrestrial and marine biodiversity, diversified cultural and historical heritage, healthy food as well as good infrastructure (UNEP, 2009: 10).

Resilience in Landscape Design

Resilience in landscape design is to be responsive to the site condition in order to recover from the disadvantageous situation. Coping with dangerous events or disturbances along the coastal areas is defined as the adaptation and transformation of the capacity of social, economic, and environmental systems to maintain their function, identity, and structure (Pachauri et al., 2014). A powerful aid to considering landscape visibility is through a map, resulting in analysing development options and anticipating the future for territories facing a variety of challenges (Robert, S., 2018). Reductionist paradigms and mechanistic worldviews are still a foundation of landscape design to prevail in western society, thus attempting to dominate and control both nature and society for human benefit (Fischer, F., 2017).

Local Wisdom

Local wisdom is the identity of a crucial aspect of a society that enables them to survive and settle in a place, including their knowledge of various aspects of their surroundings to support their daily lives. The local community activities present an authentic cultural landscape that is part of the urban design (Rauzi & Dewi, 2017; Rauzi, 2018). Traditional settlement is crucial to be evolved because it shows the social behaviour pattern and local wisdom of an area. The original starting point of traditional settlement development is a traditional market where the space facilitates trading for primary daily needs, such as staple food and household needs (Rauzi, 2021). In particular, architectural heritage is an active agent providing resilience for survivors more than it is merely a passive victim needing to be rescued (Dewi & Rauzi, 2018). Therefore, recovery encompasses a mitigation plan and a preparation strategy to enhance the quality of life in long-term at-risk coastal areas.

In general, local wisdom emerges through internal processes and is passed down over generations over a long period of time, resulting in a significant interaction between humans and their environment. Moreover, it is a known fact that local wisdom inherited from past generations who survived disasters would serve as precious knowledge that potentially increases the aptitude of having a better and safer built environment. Thus, would it be appropriate to incorporate local wisdom into the landscape design concept in coastal tourism areas?

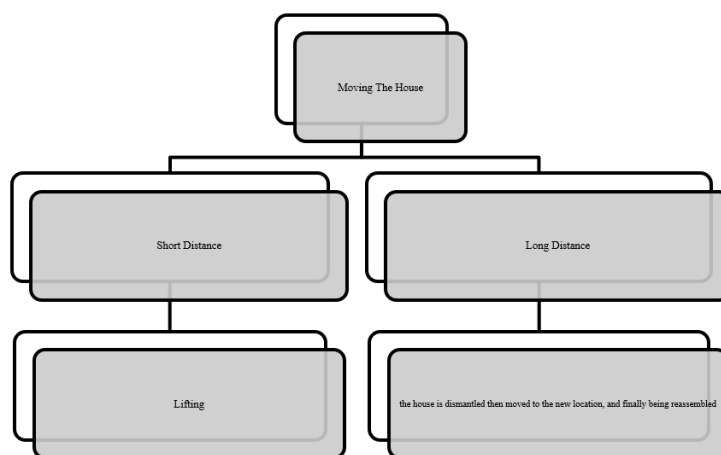


Figure 1: SEQ Figure * ARABIC 1 : Diagram of moving house method of Rumoh Aceh.
Source: Image Copyright, author (2021)

Rumoh Aceh's construction is one of inheritance knowledge known as local wisdom technique in building dwellings. The material of the structure is wood because it was available in their neighbourhood. Moreover, the stilt house construction aimed to keep livestock below and they living upstairs. Therefore, the local wisdom of Acehnese synergizes their daily norm with their traditional house structure. The main principle of Rumoh Aceh is constructed using wood from the bottom to the top of the building. It consists of columns and beams connected by *pasak* (its shape similarly looks like a nail yet is made from wood). Rumoh Aceh has no nails at all; however, it uses straps made in rattan as a replacement. There are two methods for moving Rumoh Aceh based on the distance of moving it (Figure 1). The first method is lifting Rumoh Aceh, which is carried out by the local community working together from the previous site to a new location within the neighbourhood. However, the second method required three steps: dismantling, transporting, and installation. All the processes involved are directed by Utoeh (an expert in building Rumoh Aceh). This method is applied if Rumoh Aceh is moved from its previous location (Meutia, E., et al.

2020). The tradition that follows the moving of the house go along with feast celebration during and after the process on-site (Figure 2).



Figure 2: SEQ Figure * ARABIC 2 : Illustration of moving house of Rumoh Aceh.
Source: Image Copyright, Amri Satria (2021)

RESEARCH METHODOLOGY

This research is conducted using a descriptive quantitative method to provide systematic information about spatial data from the study area to collect, analyse, and synthesize data. This study focus on disaster-responsive on Lampuuk beach, Aceh Besar, Indonesia (Figure 3) because it has unique coastal landscape characteristic and tourism facilities. The study begins by collecting data on landscape coastal characteristics and data records of coastal tourism growth using applications Google earth and photographs using a drone. Next, all data are analysed based on the area of coastal tourism that has been grown and developed. The final step is synthesising collected data and the result of analysis using a modelling approach.

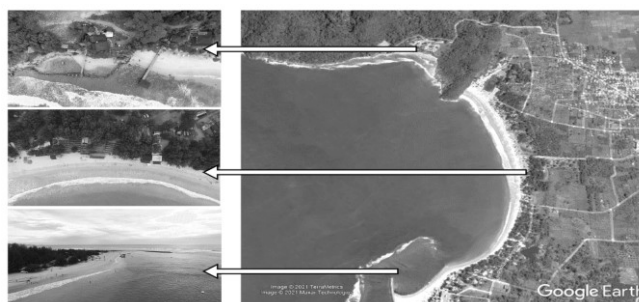


Figure 3: SEQ Figure * ARABIC 3 : Map of Lampuuk beach, Aceh Besar, Indonesia.

Source: Image Copyright, Chandra and GoogleMap (2021)

RESULT AND DISCUSSION

Data Collection

The topography of Lampuuk beach is categorised into two coastal landscape characteristics which are the high coast featuring cliffs and low coasts. The high coast with cliffs is located in the northern part, while the low coast is in the southern, as shown in Figure 4. The area is forbidden for swimming because the

seabed is very deep and has strong deep currents. However, it has tourism facilities such as cottages and restaurants. Visitors are welcome to enjoy food and stay at these cottages for the beautiful scenery across the beach.

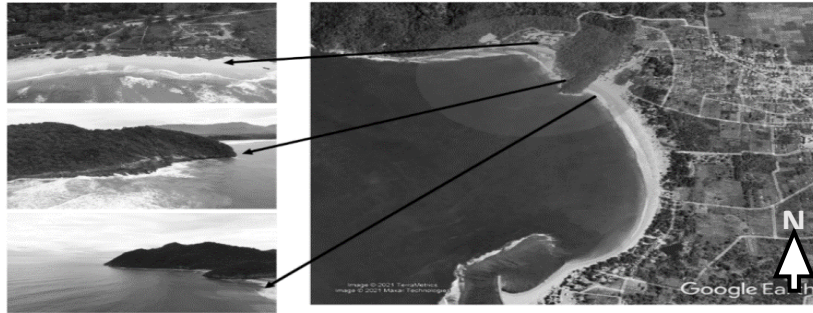


Figure 4: SEQ Figure * ARABIC 4 : Landscape characteristic of Lampuok beach.

Source: Image Copyright, Chandra and GoogleMap (2021).

Coastal tourism in Lampuok beach has been growing significantly since 2011 as it is illustrated in Figure 5. Firstly, there are three points of the tourism facilities built after the Tsunami disaster in 2004. Five years later, the area becomes more prominent, particularly at points 2 and 3 in 2016. Currently, the tourism facilities develop new sites at point 4, and both points 2 and 3 have become broader. The tourism facilities have increased along the coastal area and the type of the tourist facilities such as cottages, restaurants, and hut gazebos in the last decade.

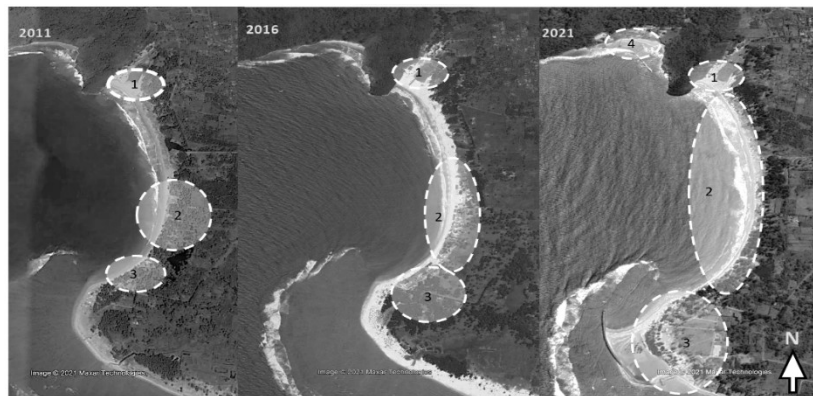


Figure 5: SEQ Figure * ARABIC 5 : Landscape characteristic of Lampuok beach
Source: Image Copyright, Google earth (2021)

Spatial Analysis

The purpose of spatial analysis is to obtain the shoreline movement from 2001 to 2021 (Figure 6). Shoreline extraction is conducted using Landsat 7 and 8 images on ArcGIS 10.4 software. This method study processes data from Landsat 7 satellite imagery acquired on August 15, 2001, and Landsat 8 on February 19, 2021. In Landsat 7 satellite imagery, data processing is carried out on raster composite bands 4, 5, and 3 to obtain images recognizing land and water bodies (Figure 6. A). Meanwhile, in Landsat 8, composite bands were performed at 5, 6, and 4 (Figure 6. B). After obtaining the images (A and B) seen in Figure 6, the coastline was extracted by digitizing where the visible colour differences formed a contrast to the coastline (Figure 6. C). The data present that the movement of the shoreline is not significant; however, the range of waves on the coastline reaches closer towards the land.

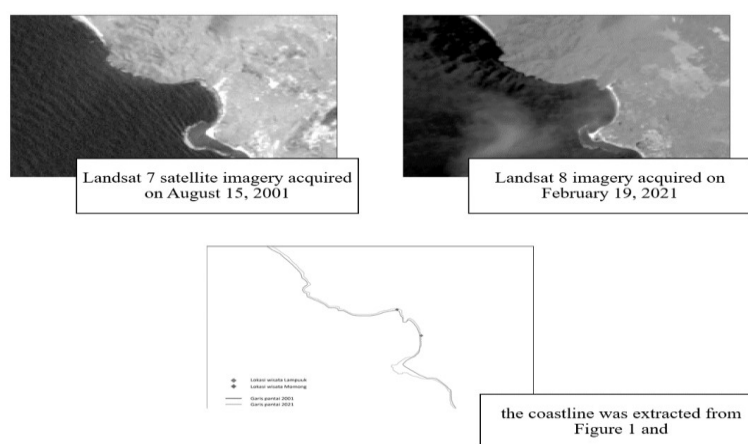


Figure 6: SEQ Figure * ARABIC 6 : Landsat 7 satellite imagery of shoreline of Lampuuk beach, Aceh Besar, Indonesia.

Source: Image Copyright, GIS (2021)

The topography condition of the coastal landscape category is divided into rocky and sandy areas. The rocky area lies around the cliff (Figure 7. at the top and in the below section), while a sandy area is located in the middle of the bay beach (Figure 7. in the middle). The analysis continues by identifying characteristics of some areas that are not allowed to swim (Figure 5, point 1). The site is located on high coasts featuring cliffs where the water depth is unpredictable because the topography of the shoreline is sandy. Even though the area is forbidden to swim, people still prefer to sit and enjoy the view. Moreover, the cliff is the most popular spot for taking pictures. In contrast, the opposite side of the cliffs is safe for swimming. In this area, cottages, and restaurants are available for tourists (Figure 5, point 4).

Tourism facilities located in the sandy area (Figure 7, in the middle) experience a high impact of wave range, although the shoreline lies in the same position for the last two decades. The development of tourism facilities is doubled since 2011 (Figure 5, point 2), thus resulting in it being observed getting closer to the land. This condition endangers tourism facilities because the building should be moved further back to prevent damages essentially for the structure which is constructed by wood. The distance between seawater from waves and gazebo has been getting narrower recently (Figure 8).



Figure 7: SEQ Figure * ARABIC 7 : Location of a sandy and a rock area in Lampuuk beach, Aceh Besar, Indonesia

Source: Image Copyright, Chandra and Google earth (2021)

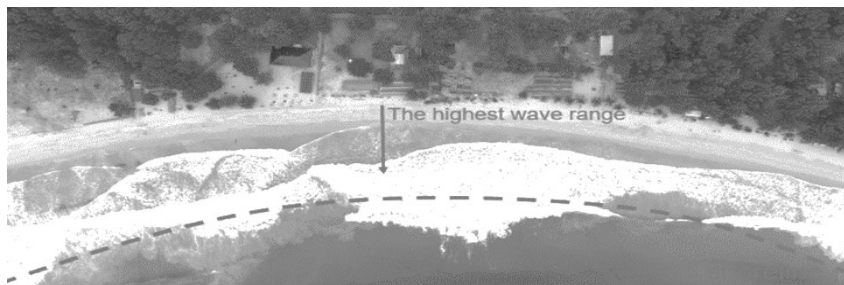


Figure 8: SEQ Figure * ARABIC 8 : Illustration of the highest wave range on a sandy area in Lampuuk beach, Aceh Besar, Indonesia.




Source: Image Copyright, Chandra and Google earth (2021)

Synthesising

According to collected data and results of spatial analysis, there are four topography conditions that synchronise with the type of tourism facilities. The analysis shows that the topography condition influences the structure and material construction of tourism facilities. The tourism facilities are developed following massive requirements of tourist activities. Consequently, the number of tourism facilities has rapidly increased in the last five years. Therefore, a modelling approach is required to tackle the topography condition as a resilient design of tourism facilities in coastal areas.

Adaptation in the design of tourism facilities refers to the principle of resilient design in which “learns” from its environment. The results present how the existing buildings respond to weaknesses, dangers, hazards, and the impact of the immediate changes on topography conditions. Tourism facilities on shorelines illustrate that wood construction is suitable for abrasion because it is located on the coastline. On the other hand, tourism facilities in the rocky area are constructed using concrete structures in which the foundation of buildings is in the sea. The concrete structure could resist wind load and the wave crash because the column has space in between, so the water can flow easily.

Table 1: List of collected data and the result of analysis

Data		Analysis	Result	Images
Topo- graphy	Tourism Facilities			
The Rocky area	The type is Varied (floating hut gazebo; cottages; restaurants)	People fancy to go to the beach because the tourism facilities offer various services, therefore, the number of the facilities increases	The type of facilities are dominated by using a concrete structure	
The Sandy area	The type is similar (hut gazebo and restaurants)	The type of facilities following the topography characteristics	The variety of facilities is dominated by using wood structure	
The shore-line	The position of tourism facilities are located on the coastline	The characteristic of the coastal landscape influences the wave range reaching the land	The hut gazebo is constructed using wood materials that are vulnerable to the effect of waves and seawater such as abrasion	

Source: Author

The local wisdom of the wood structure of Rumoh Aceh is possible to be implemented for constructing tourism facilities in the sandy area which are impacted by the wave range (Figure 8). It is able to apply because the principle of structure is simple and easy to assemble; the material is affordable, and it is possible to move the building if seawater reaches out closer to the land.

The construction of the floating hut gazebo is appropriate for coastal tourism in the rocky area because the foundation is possible to erect on a steady, rocky seafloor. The type of foundation has sufficient stability to survive the wind loads. Therefore, the construction requires specific waterproof material preventing corrosion caused by seawater. Furthermore, the rigid structure should be strong enough to bear wind load as it has space for flawing wind through columns, and space between seawater level and the building's floor. (Figure 9).



Figure 9: SEQ Figure * ARABIC 9 : Illustration of modeling approach for coastal tourism facilities in Lampuuk beach, Aceh Besar, Indonesia.
Source: Image Copyright, Chandra, and Ferian (2021)

The tourism facilities in the sandy areas could use a similar structure system using rigid frame structures such as the stilt house construction of Rumoh Aceh. The building's foundation is not soaked in seawater. It will be submerged if a high tide occurs. Therefore, wood as the structure material is possible with peculiar treatments such as drying dan covering the wood with waterproof paint.

CONCLUSION

The landscape characteristics influence the design of facilities in the coastal tourism area. Every topography condition, both rocky and sandy area, require different structure and materials. The local wisdom of Rumoh Aceh could mitigate and prevent the coastal tourism industry from rebuilding new facilities if the wave range reaches their hut gazebo along the coastal area. The stilt house structure model can be implemented for the building structure's system of tourism facilities on Lampuuk beach. The difference is the material of the structure that concrete or reinforced concrete should be used in the rocky area, and wood with certain treatments is possible only in the sandy area. This research suggests the model of tourism facilities based on the local wisdom approach of the Acehnese norm and traditional house knowledge. The study demands further research related to the quality of the space and the element of the coastal landscape area to be resilient.

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