PROVISION OF A SUSTAINABLE PUBLIC SPACE: LEBIH COASTAL AREA IN THE AFTERMATH OF RAMPANT ABRASIONS

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Abstract. The study aims to examine sustainable uses of public spaces of Lebih's coastal line, in the aftermath of uncontrolled abrasion. It implements a qualitative research approach. Data was collected through a series of field observations, historical studies, and unstructured interviews. This study relates functions with spatial quality. While function is analysed based on social, economic and environmental roles accommodated by a public space, quality is assessed in terms of three conditions that a public space is expected to have, which are being responsive, democratic, and meaningful. Discussion over these two issues is based on the examination of both physical and non-physical attributes. The physical attribute is discussed in terms of spatial design and supporting facilities available to support the functions of Lebih as a public space, and the non-physical attribute is examined based on the capacity to be a responsive, democratic, and meaningful space to the public who uses it. This study alarmingly shows that abrasion has eroded Lebih coastal area to a level of 3.2% per year, which is equal to a 4m reduction annually. This condition directly influences the quality of Lebih Coast and consequently its capacity to accommodate the three inherent functions. The first two functions, to certain extents, remain well served, but the last one is feared to disappear along with the erosion of Lebih coast by continuous abrasion. This fear is especially underlined by the role of this coast as a buffer to protect the adjacent mainland and its associated ecosystem.

Keywords: abrasion, public space; public infrastructure, sustainability

1. Introduction

A public space often functions as a spatial unit dedicated for various communal interactions, social activities, and recreations. In acting on these roles, a well-planned public space, on the one hand, usually has a clear design as to how it is expected to be used by members of the public. An unplanned open space on the other hand, happens accidentally often on an unoccupied space or even on an unclearly defined space [1]. Many local governments refer to public space as an open space that is accessible to urban residents for free. Its provision is part of duties a city government has to fulfill as part of its public services, especially of those concerning to the maintenance of the public life as well as the associated social interactions. This public (open) space can take shape in many forms, such as parks, sport venues, children's playgrounds and so on.

Being classified as a public space, coastal area has its uniqueness. Its potential in attracting the public is built by untiring waves, sandy terrain, panoramic sunrises and sunsets, the scenic coming in and going out of ships, calming daily fishing and its associated activities, and many more inviting
sceneries. On top of these, the coast is a protected area for its natural resources and biota that are environmentally important as well as strategic to meet people's basic needs. The beach is a spatial unit that accommodates the daily living of fishermen as well as salt and seaweed farmers. In the case of Balinese tradition, many processions and rituals are carried out along the beach which supposedly aims at maintaining a balance between nature, human beings, and the belief system. Following this tradition, various rituals/ceremonies are performed along beaches, including melukat (cleansing ritual dedicated for individual), nganyut (to wash away body ashes as part of cremation ceremony), nyegara-gunung (sea to mountain ceremony, a demonstration of gratitude to all blessing) and melasti (cleansing rituals dedicated for deities).

Taking Lebih Beach of Gianyar Regency - Bali Province of the Indonesian State as its case study, the research documented in this article also observes that the aforementioned conditions are also found at this Beach. Lebih Beach has been well known being a recreational venue, mainly, for the surrounding communities. This is one of many destinations for culinary experiences available in Gianyar Regency. This position is preceded by its former role being the central venue for melasti ceremony in the Regency. This role however has been disappearing for years in the aftermath of a rampant abrasion that has continuously hit Lebih's waterfront for the last two decades. Another prominent development is the role of Lebih Beach as a destination for sport activities, including jogging, soccer, yoga and kite playing exercise. In lining its role in governing development activities within its spatial administration, Gianyar Local Government then assigns this waterfront as one of prime recreational zones in its Regency. This stamp has consequently placed more weight on the development and the use of Lebih waterfront and its surrounding areas. One can observe several villas start to sprout following this Local Government's Regulation.

However, the fear over the impact of the rampant and continuous abrasion on the beach as a form of important public space that is important to the public is more of a concern. At certain timing of the year, the waterfront is a dangerous place to be in. Members of the surrounding communities even anticipate that at not in far distance the abrasion will hit their communities and their homes. Several endeavors that were aimed at preventing further damages caused by this natural phenomenon have been put in place. These include the use of bamboo as a water breaker in 1992 and the construction of rock revetments in 2010. The latter has since been functioning as barrier that reinforces and therefore protects the shoreline from impacts brought by the strong waves and sea current. As a result many functions, that were used to be accommodated by Lebih as a public space, are disappearing. To date, many sporting activities can no longer take place. Place for social and cultural activities have been also vanishing. Lebih's fishermen who had used the coast to embark on their fishing activities also find it hard to maintain their job. Being grounded by circumstances mentioned above, this research aims at investigating the sustainability of Lebih public space and its uses in the aftermath of continuous abrasion.

2. Methods

This research implements a qualitative research. Discussions within focus on events, social activities, attitudes, beliefs, and perceptions of either individual/s or a group of people [2]. The research starts with an existing phenomenon pertaining to a deep concern over the impact of coastal abrasion on the quality and ability of Lebih Beach to accommodate activities that usually take place in it as a public space. The research then progresses with a demonstration of the overlapping utilization of Lebih public space in the aftermath of abrasion. This spatial utilization is discussed in three different categories embracing social, economic and environmental functions. This discussion will be followed with an analysis of the sustainable use of Lebih Public Space, again, in terms of these three groups of function. Data presented in this paper has been collected by conducting a series of interviews, physical observations and secondary data available at many government institutions and provided by previous studies relevant to the discussed topic.
3. Overview of the Location

Lebih Beach is located in the Banjar Lebih Beten Kelod, village of Lebih Gianyar. The boundaries of the research location are as follows, the northern part is Tohpati-Kusamba Bypass, the southern part is Lebih Beach, the eastern part is rice field, and the western part is rice field (Figure 1).

![Figure 1. Location of the case study](image)

Source: [3]

4. Lebih Beach as a Public Space

Lebih village is located on the coast of Lebih. The coastal area is a meeting area between land and sea, which in land direction covers parts of the land, both dry and submerged in water, and towards the sea covering parts of the sea that are still affected by natural processes. Public space that occurs in the coastal area is space that is used for the common interest, both in the form of social, economic, and environmental activities. Lebih Beach as a tourism area continues to run from year to year. According to an interview with one of the local fishermen, Mr. I Made Ana, as far as he concerns, Lebih Beach has been used as a place to carry out religious ceremonies, such as melasti activity, nangluk and nganyud activities. Like coastal tourism objects in general, Lebih Beach is also a recreational place for visitors who intend to enjoy the beautiful panorama of the beach and its exotic black sand.

Besides visited as a destination for recreational purposes, Lebih Beach also provides marine products, including fish caught by local fishermen, which are then processed by local warung (stall). The catches of the fishermen are served in various form of dishes including satay lilit (grounded fish,
wrapped around a skinny bamboo stick and then grilled), *pepes* (steamed fish wrapped in banana leaf), fish meatballs, and grilled fish. *Sate lilit*, first popularized in 1987 by a resident of Banjar Lebih Beten Kelod named Bapak Lodig. He works as a fisherman and the pioneer in processing fish into satay. Satay and fish dishes become a special icon of Lebih Beach up to now.

The existence of Lebih Beach is a publically shared place that accommodates public activities. The establishment of Lebih Beach as one of the tourism areas is set in accordance with Local Government Regulation number 16 year 2009 [4] concerning Bali Spatial Plan for Bali Province and Local Government Regulation Number 16 year 2012 [5] concerning Spatial Plan for Gianyar Regency. These policies stipulate Lebih Beach as a strategic region of Gianyar Regency. Subsequently, both of these laws increase number of visitors using Lebih as a public space. This position is intensified in line with the completion of another prominent public infrastructure of Tohpati-Kusamba Bypass.

5. Community and Lebih Beach as a Public Space

Community who uses Lebih coast areas can be grouped into 4 (four) categories. Details of each category group are explained as follows:

1. Food vendors who sell seafood based dishes in many culinary stalls exist at the surrounding areas of Lebih Beach. They usually start 7:00 am to 11:00 pm. There are 18 permanent culinary stalls in the research location. Each culinary stall is managed privately by the owners who are generally relatives of fishermen who supply them with various catches.

2. Fishermen who form Lebih coastal community. In 2017, there were 95 fishermen operating at the Lebih Beach.

3. Visitors who visit the beach. There is an average of 100 to 150 visitors visiting the beach daily. This figure however can reach three times as much (300 people) per day during public holidays.

6. Abrasion in Lebih Coastal Public Space

Abrasion is a process of eroding the coast by destructive ocean waves and currents [6]. Damage to the coastline due to abrasion is triggered by disruption of the natural balance of the coastal area. Based on interviews conducted in July 2017 with the Secretariat of Conservation and Environmental Rescue Workers (SKPPLH), I Made Mangku that the abrasion is caused by changes in currents due to physical development and the consequences of human activities namely sand and stone brush mining.

No one knows for sure when abrasion at Lebih Beach actually started. According to I Made Ana, chairman of fishermen in Lebih Village, in the 1980s the coastal was far from the present situation. According to him, more than 200 meters of coastline has been eroded. In the past, between Masceti Beach and Watu Klotok Beach was a straight line, there was no bay like now, moreover since the reclamation of Serangan Island in 1994 exacerbated the abrasion at Lebih Beaches. The same thing was also reaffirmed through a direct interview to Mr. I Wayan Weta (55 years) who is a food stall owner at Lebih Beach, he recalled that abrasion in Lebih Beach has occurred since 1985. But it did not take place as rampant as it is recently. This was reinforced by the Gianyar Regency Public Works Office. According to satellite imagery and Spatial Plan for Gianyar for the period of 2010-2017, there was a significant change in Lebih coastline within this period. The abrasion affects the physical existing of public spaces in the Lebih Coastal Area. The changes in the existing physical abrasion that occurred from 2010 to 2017 appear as follows:
Figure 2. The physical existing of public space in 2010
Source: Diah, 2017

The Spatial Plan for the year 2012 and 2010 satellite imagery show physical existing on the Lebih coast in which A is the western side distance from the public space which has a distance of 170 meters from the edge of Tohpati-Kusamba Bypass. then B is the middle side which is 155 meters from the edge Tohpati-Kusamba Bypass, and C is the east side with a distance of 170 meters. Overall the length of the coastal public space area reaches 323 meters. Conditions in 2010 showed that the street is one-lane road with a width of 7 meters. The coastal area in 2010 was 267,520 m² and the area used as a public space reached 9,700 m², with a percentage of the coast over public space reaching 3.6% (Figure 2).

In 2012 the physical condition (width) of public space decreased from the previous year. A (west side) decreased to 11.7%, then B (middle side) decrease by 13.5%, and C (east side) which is the eastern side the distance between the by-pass to the coast has decreased by 14%. In the same year, the Tohpati-Kusamba Bypass started to be constructed as a into two lanes road of ± 15 meter. The notation of E is the highest water mark in 2010. It can be seen how Lebih public space is narrowed down physically by the effect of abrasion. The with of notation A narrowed into 150m, B into 135m and C into 135m (Figure 3). The scale of public space available in the early 2010 reached 9,700 m² then in 2012 it was reduced into 8,500 m². It is a decrease of 12.37% (Figure 3).

Figure 3. The physical existing of public space in 2012
Source: Diah, 2017
In 2014 there were some constructions taking place including the making of revetment, jogging track, hall and shrine. In this year, the physical condition of public space again reduced to abrasion. The width of C (east side) reduced by 2.2%, then B (middle side) experienced a reduction of 2.98%, and A (west side) was reduced by 1.3% (Figure 4). The scale of public spaces in 2014 (Figure 4) was also reduced. For safety reason, government installed several forms of coastal security facilities. And to develop Lebih as a more friendly public space, several facilities to accommodate social uses were also built in this year. There were also culinary stalls and parking lot being built in area noted as C in the map, which used to be a paddy field. The physical percentage of Lebih public space over the total coastal area in 2014 reached 3.35%.

Notes:
A. The western side of the selected coastal line - as a public space
B. The middle part of the selected coastal line - as a public space
C. The eastern side of the selected coastal line - as a public space
D. The Ida Bagus Mantra Road
E. The high water mark in 2010
F. The high water mark in 2012
G. The high water mark in 2014
H. The high water mark in 2016

Figure 4. The physical existing of public space in 2014
Source: Diah 2017

Figure 5. The physical existing of public space in 2016
Source: Diah, 2017
In 2016, the area of public space noted as C (east side) decreased by 3.78% from 2014, B (middle side) reduced by 2.3% and the area noted as A (west side) was also reduced by 4.05% compared to the 2014's data. Data also shows that there were more activities taking place at Lebih public space in 2016, accommodating more social, economic and environmental functions. However, the physical area of public spaces in 2016 decreased by 10.25% (Figure 5) compared with the same data recorded for 2014. Based on this data, abrasion had eroded the coast as much as 3.2% annually. The physical area of public space in 2016 reached 7,000m² (Figure 5).

In 2017 C (east side) decreased by 3.14% since 2016, B (middle side) decreased by 2% and A (west side) decreased by 2.8% since 2016 (Figure 6). In this year, the abrasions rate reached an annual average of 4-5 meters with an averaged percentage of 3.2%. In 2017 the area of public space reached 3.15% of the total coastal area available in the same year. The scale of area left for public space after abrasion in this year was 6,500m² (Figure 6).

7. Coastal Utilization as a Public Space Based on Social, Economic and Environmental Functions in a period of 2010-2017

The definition of spatial use according to Law No. 26 year 2007 [3] concerning spatial planning is an effort to realize the structure of spatial patterns in accordance with spatial plans. Within this regulation, the utilization of public space is expected to deliver three important attributes, including: it has meaning (meaningful), it has the capacity to accommodate the needs of the public (responsive), it accommodates public activities without discrimination (democratic) [7]. In this case public space is seen as a place for social interaction and communication conducted either by individuals or groups.
The use of a space is inseparable from the sustainable availability of the space. Sustainability in general means the ability to maintain the balance of a process or condition of a system, which is related to biological and guided systems. In the context of ecology, sustainability is understood as the ability of ecosystems to maintain processes, functions, productivity, and ecological diversity [8]. The use of space based on sustainability functions is related to economic, environmental and social sustainability.

The scale of Lebih public space used for social function in a period of 2010 to 2017 experienced several stages of change. In 2010 (Figure 7), the area available for this use was 9,700m². Then in 2012 (Figure 8) this figure decreased by 12.37% which again reduced by 8% in 2014 (from 2012's data). In 2016, the decrease was recorded as 5.8% (based on 2014 data). Then in 2017 (Figure 11) the decrease was 1.5%, based on the 2016 figure. These reductions are the immediate result of the narrowing scale of the public space due to abrasions. Every year the land is eroded by sea water and decreases by ± 4m, this has an impact on the narrowing of the social function area in Lebih coastal public spaces.

Utilization of Lebih public space to accommodate economic function, as a whole has also undergone an increase in changes from 2010 to 2017. In 2010 a number of culinary stalls are still located on the beach (south) adjacent to the sandy area of Pantai Lebih. Then in 2012 the shops were...
moved to the east of the two-wheeled parking area (eastern culinary stalls). And in 2014 the eastern culinary stalls experienced a rearrangement and an addition of several stalls. Then in the period of 2016-2017 the stall arrangement was further enhanced, in which the stalls’ front area which used to be a parking area, then made into a more organized area of the same use.

Environmental functions of Lebih public space in a period of 2010 to 2017 is explained as follows. In order to overcome the physical impact of the abrasion to the natural environment, Gianyar Local government decided to build coastal safeguards in the form of revetments in 2010. Then in 2012 the same government installed safety facilities along the coast and also the constructed jogging tracks. These all were aimed at maintaining the safety of the public members when they are using the area. Then in 2016 to 2017, there were constructions of buildings to further accommodate social functions, including the provision of public hall, padmasana (shrine) and several gazebos. Gazebos were placed along the coastline parallel to the coastal security facilities. Further detailed land utilization in the period of 2010 and 2017 is presented as follows.

8. Utilization and Quality of Public Spaces

The quality of a public space can be viewed from two aspects, namely physical and non-physical aspects. Physical aspects include regional facilities, design, and conditions. Then the non-physical aspects are how responsive, democratic, meaningful and accessible a public space is [7]. The impact of abrasion has changed as to how public space of Lebih Beach of Gianyar is utilized. This is mainly due to the narrowing of the available spaces. The following section (Table 1) discusses how rampant abrasion has affected the quality of Lebih public space and its uses in accommodating social, economic and environmental functions.

| No | Year | Social | Economy | Environment | Remarks |
|----|------|--------|---------|-------------|---------|
| 1  | 2010 | Sports (soccer, volley, raw) | - Culinary stall | - Parking |
|    |      | - Religion (melasti, nangluk, nganyud, melukat) | - Stone craftsmen | |
|    |      | - Recreation | - Fishermen | |
|    |      | - Social service | | |
|    |      | - Metanem (sand therapy) | | |
| 2  | 2012 | Sports (Soccer, volley, raw, jogging) | - Culinary stall | - Parking |
|    |      | - Recreation | - Fishermen | Starts to reduce brush stone craftsmen to look for stones in the public space area |
|    |      | - Religion (melasti, nangluk, nganyud, melukat) | | |
|    |      | - Metanem | | |
|    |      | - Social service | | |
| 3  | 2014 | Sports (Soccer, volley, raw), jogging | - Culinary stall | - Parking |
|    |      | - Recreation | - Fishermen | The construction of coastal security/lifeguard |
|    |      | - Ritual (melasti, nangluk, nganyud, melukat) | - Beach lifeguard (revetment) | |
| 4  | 2016 | Sport (jogging) | - Culinary stall | - Parking |
|    |      | - Recreation | - Fishermen | Construction of monitoring towers |
|    |      | - Ritual (melasti, nangluk, nganyud, melukat) | - Beach lifeguard (revetment) | |
|    |      | | - Monitoring tower | |
| 5  | 2017 | sport (jogging) | - Culinary stall | - Parking |
|    |      | - Recreation | - Fishermen | Monitoring tower |
|    |      | - Ritual (melasti, nangluk, nganyud, melukat) | - Beach lifeguard (revetment) | |
9. Sustainability of Social, Economic and Environmental Functions of Public Spaces

Public space is interesting and never-ending topic to discuss. Government and urban planner in their effort to enhance the quality of its urban area have been trying to find ways in which the need for an adequate public space can be met. This attempt is always challenged with the fact, that there is a limited scale of land available to fulfill this objective. In some cases, this availability is even zero. In the case of Lebih coastal public space, the situation is worsened by the rampant abrasion that gets worse year by year. It does not only reduce the physical scale of this public space, it also affects the sustainability of the functions accommodated within (socially, economically, and environmentally) and the meanings imbedded within (meaningful, responsive, and democratic). As discussed, there are certain functions or activities that can no longer be contained by Lebih public space. However, we are challenged by the need to prolong both the existence and the use of this public space for future generation [9,10]. The following sections discuss further about this issue (Table 2).

Table 2. Utilization and Quality of Public Spaces

| No | Aspect          | Social Function | Economic Function | Environmental Function |
|----|-----------------|-----------------|-------------------|------------------------|
| 1  | Responsive      | -               | √                 | -                      |
| 2  | Democratic      | √               | √                 | -                      |
| 3  | Meaningful      | √               | -                 | -                      |
| 4  | Accessible      | -               | -                 | -                      |
| 5  | Area for facilities | -           | √                 | -                      |
| 6  | Design          | -               | √                 | -                      |
| 7  | Condition       | -               | -                 | √                      |

Note:

√ Exist
- Not exist

10. Sustainability of Social Functions

Based on the analysis grounded by the trend of how Lebih public space is used in accordance with its social functions, it is concluded that: (i) interactions that would no longer be possible to be contained in the future include activities pertain to sports (except jogging) and religious uses; (2) social interactions for recreational purposes would be prolonged. These remarks drawn here are based on interviews held to a group of respondents who visit Lebih Beach in a regular mode. Jogging will remain possible, especially after the installment of facilities that secure the safety of the people who use the beach as a public space. However, there will be no more football games, kites playing, and volleyball. People have their anxiety to be in Lebih Beach at certain timing of year, but overall the relaxing feeling and the rejuvenating impacts brought by being at the beach overtakes this anxiety. Most respondents to this study view, the meaning of Lebih Beach as a place for recreation will stay for much longer. Religious activities such as melasti, nganyud, nangluk and melukat may still be possible now and for the next few years. But in a long run, there will be no adequate space available to accommodate a large number of crowds, as is often required by these activities. However, ritual activities organized individually will be possible to be accommodated for a longer time, since they don't involve a large crowd.

11. Sustainability of Economic Functions

In terms of the sustainability of the economic functions, this study finds that it will go ahead for quite sometimes to come. This is inseparable from image of Lebih beach area as a destination for
culinary experience. Existence of food stalls and restaurants will be continuing since local government has installed safety measures as well as the construction of physical barrier to protect the beach from further impacts inflicted by the rampant abrasion. This study also believes that fishing activities will be thriving just that further investment will have to be put in by the fishermen. This includes investment to buy technology aided boats and investment to mediate the constructed revetment between the beach and the mainland. This analysis relates to earlier prediction stating that the seafood stalls located at the surrounding Lebih Beach will remain exist for some times to come. These premises will need catches provided by the fishermen. Therefore, as long as the demand is there the fishing community and their catches will subsequently be sustained.

12. Sustainability of Environmental Functions

In principal the sustainability of environment refers to the capacity of Lebih public space to maintain the existence and the quality of its biodiversity. Naturally at present, Pantai Lebih has no substantial biodiversity related resources to be protected. Instead, the beach has been a target of natural threats - abrasion. As has been explained, attempt to protect the coast has been done by revetments. This action is not merely aimed to protect the beach but also in consequence to protect the function of this zone from disappearing. The beach is a buffer to protect the mainland from erosion and the impact of abrasion. As a public space, Lebih Beach has been also used as a place to educate member of the public to enhance their environmental awareness. Many informal activities have been taking place to educate kids to properly dispose rubbish that they produce daily and to recycle them as much as possible. Action to free the beach from rubbish is also a routine activity held by groups of the community that involved many wider groups of different ages. This study finds that the use of Lebih beach being an environmentally friendly public space will be sustained. This is basically drawn from the fact that concern over the sustainability of our natural environment nowadays is a business of every single one of us, every single spatial unit, and every land development.

13. Conclusion

As one of important public spaces in Gianyar Regency, Lebih Beach has gone through a massive physical change. It is largely due to the impact of rampant abrasions. No one knows for sure when this natural phenomenon started but it has been estimated taking place for (at least) more than two decades now. Abrasions has significantly diminishes the physical scale of the Lebih Beach public space to a level that affect its capacity to act as a spatial unit, important for public uses. In discussing the sustainability of a Lebih public space and its roles, the social function has been the most that affected by the rampant abrasion, while economic and environmental related uses are thriving. Parts of Lebih beach that used to be utilized for numerous kinds of ritual procession are diminishing. This is due to the limited space left to accommodate a large number of people involved in each procession. The thriving of Lebih beach public space in accommodating economic and environmental related functions is due to the image of the place being a destination for seafood-based culinary experience and being part of Gianyar tourist zone. In this context, the creation of Lebih beach public space being an environmentally friendly tourist destination is promoted at all levels. This objective subsequently encourages the accommodation of activities that focus on sustaining our nature and its associated environment. Nevertheless, the impact of abrasion over Bali coastal zone has been a major concern right now. This is a natural phenomenon that will be going away, but it will continue to hit our waterfronts. By conducting this preliminary study, it is expected more researches will be carried out in this field in the near future.

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