

Assessing Willingness-To-Pay for Coastal Defenses: A Case Study in Timbulsloko Village, Sayung, Demak, Indonesia

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7

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Assessing Willingness-To-Pay for Coastal Defenses: A Case Study in Timbulsloko Village, Sayung, Demak, Indonesia.

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Abstract. Marine and coastal ecosystems play an important role in the balance of the environment as they interrelate and interact dynamically. One of the main problems faced by coastal areas in Indonesia is the high level of coastal erosion or abrasion. This study aims to identify how far the damage of abrasion / erosion that has occurred in the village, steps precautions of abrasion / erosion that has been taken in the village, assessing respondents' willingness-to-pay in order to contribute in the program that has been launched. The method used is Contingent Valuation method to get Willingness-To-Pay of respondent with Close Ended question. The sampling technique used non-probability and purposive sampling method. The results showed that there is an abrasion from 2003 to 2016 and the government has been conducting coastal rehabilitation programs since 2000 such as mangrove planting and hybrid engineering. The community's desire to contribute on coastal rehabilitation programs in the village is relatively high, 47 percent of respondents want to contribute. It is necessary to improve the community awareness to mangrove ecosystem and to the role of breakwater in order to reduce risk disaster and to develop an ecotourism in the area.

1. Introduction

Indonesia is the country with the largest mangrove level in Asia (and in the world), contributing about half the regional level of the mangrove area. Other Asian countries with significant levels of mangroves are (in the order of mangroves) of Malaysia, Myanmar, Bangladesh and India, which, together with Indonesia, account for more than 80% of the total area of mangrove forests in Asia [1].

Mangrove forests are the main living ecosystems that are important in coastal areas. Mangrove forests have two important functions, namely as an ecological function and an economic function. Since the economic value of coastal forests and mangroves is very important, this area has become the object of various exploitative activities [2]. The direct use value of the mangrove ecosystem in



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Timbulsloko Village, Sayung, Demak with an area of 31.44 ha is Rp. 2,212,200,000/year or Rp. 70,362,595.42/ha/year. Direct benefits calculated from the fisheries sector, namely fisherman, fish pond farmers, *branjang* catchers, oyster catchers, trap makers, shop owner, grilled fish makers and shrimp chip makers. [3].

Mangrove forest is a typical tropical coastal vegetation community, grows and develops in tidal areas, especially in lagoons, river estuaries and beaches that are protected by substrate mud or sandy mud. The total area of mangrove / coastal forest planting activities carried out throughout Indonesia in 2009 to 2016 was 61,846 ha, in 2010 and 2014 there were no mangrove forest planting activities [4,5].

According to trend analyses of the available data, some 15.2 million hectares of mangroves are estimated to exist worldwide as of 2005, down from 18.8 million hectares in 1980. The most extensive mangrove area is found in Asia, followed by Africa and North and Central America. Five countries (Indonesia, Australia, Brazil, Nigeria and Mexico) together account for 48 percent of the total global area, and 65 percent of the total mangrove area is found in just ten countries. The remaining 35 percent is spread over 114 countries and areas, of which 60 have less than 10 000 ha of mangroves each [1].

In a growing number of countries, 50-80 percent of mangroves have been cleared in the last 40 decades. Less than 1 percent of the remaining mangrove forests are adequately protected. The impacts of climate change, particularly sea level rise, will make conditions even more precarious for mangroves and heighten the urgent need to improve their management and protection [6].

One of the main problems faced by coastal areas in Indonesia is the high level of coastal erosion or abrasion. The process of coastal erosion occurs due to an imbalance of sediment movement from and to the coast, where the amount of sediment on the coast eroded by waves and currents is higher than the amount of sediment carried by tides to the coast. This phenomenon is triggered by activities that cause changes in natural balance such as the opening of mangrove forests

Timbulsloko Village is a village located on the coast of Sayung Subdistrict, Demak Regency, Central Java Province. At first, the coastal area of Timbulsloko Village was an area with the spread of agricultural land and ponds and mangroves along the coast. However, in the 1980s there was a high conversion of agricultural land and mangroves due to the opening of ponds. In the 2000s, erosion began to occur on the coast of the village of Timbulsloko, and in 2013 the village had lost around 400 - 1300 meters of its coastal area. [7].

Timbulsloko is a dynamic area and vulnerable to the threat of environmental degradation. The high rate of abrasion/erosion, the conversion of mangrove ecosystem to farm land and the problem of sedimentation become the main factor changing the ecological and economic function of mangrove ecosystem in Timbulsloko.

This is interesting and requires a research on what makes the reasons people do not want to move and whether there is still an economic side to take from the region. The concept of resilience may be an example of a precise concept that disaster-prone areas will not fall or collapse as they can improve on their own and be helped with community awareness.

The aim of this research is to identify how far the damage of abrasion / erosion that has occurred in the village, steps precautions of abrasion / erosion that has been taken in the village, assessing respondents' willingness-to-pay in order to contribute in the program that has been launched.

2. Research Methods

The method used in this research is Contingent Valuation method, which is a survey-based method frequently used for placing monetary values on environmental goods and services not bought and sold in the marketplace [8]. Contingent Valuation method has been used to get Willingness-To-Pay of respondent with Close Ended question. The sampling technique used non-probability and purposive sampling method.

Willingness-To-Pay is one of the two standard measures of economic value. It is the appropriate measure in the situation where an agent wants to acquire a good. Moreover, economic value as measuring the maximum amount a person wants to sacrifice goods and services to acquire

other goods and services [9]. The economic value of goods and services is measured by the sum of the will to pay (Willingness to Pay-WTP) of many individuals to the goods or services in question. Economic valuation is about measuring the preferences of the community. The result of the valuation is expressed in the value of money as a way of looking for confidential preferences.

3. Results and Discussion

The coastal area of Timbulsloko village is a region with distribution of agricultural land and ponds and mangroves along the coast. However, in the 1980's, there was a considerable conversion of farmland and mangroves due to the opening of the ponds. Starting from 2000, erosion began to occur in the coastal village of Timbulsloko and, in 2013, the village lost about 400 to 1,300 meters of coastline. The temporary suspicion of the cause of the high rate of erosion is due to increased tidal intensity, the use of wave backfills and the loss of the mangrove [7].

Analysis of satellite images in a row was conducted in 2003-2016, showing that since 2003 coastal villages in coastal areas due to erosion. The results of the research show that the beach of the village of Timbulsloko, Sayung, Demak, has been affected since 2003 by erosion.

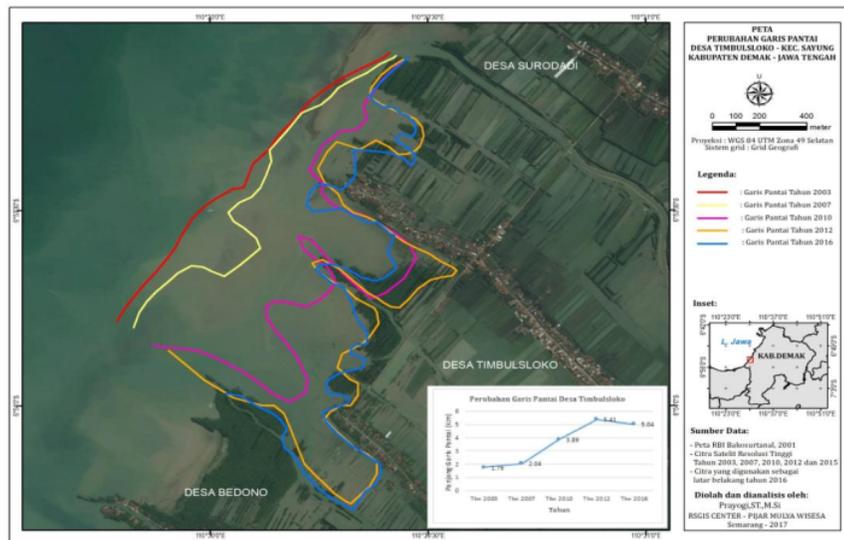


Figure 1. The decline of the Coastal Village of Timbulsloko, Sayung, Demak

The results show that the shoreline of Timbulsloko Village, Sayung, Demak since 2003 has decreased. This coastal retreat is caused by erosion of the coast due to conditions along the coast that does not have a coastal seal system. The conditions on the shores of Timbulsloko village, Sayung sub-district, and Demak district before the present state consisted of ponds and paddy fields. The state of the ponds and rice fields is the land that rests or make the flow of the sea more easily to irrigate the rice fields and ponds. The state of the earth does not give priority to the mangrove forest so that when there is a current / wave pattern change that continually strikes the beach with a coastal condition that is not resilient to receive a strong wave, it results in a phenomenon of erosion of the coast.

Based on 2003 high-resolution satellite image data, as shown in the figure above, the length of the Timbulsloko coastline is 1.76 km. This year there was no abrasion and the pond were still visible. In 2007, as shown in the photo above, abrasion began, the coastline retreated about 200 meters. This year's beach length will be 2.04 km. There are several areas of ponds which are starting to erode and sink.

In 2010, abrasion increased, and the coastline retreated 836 km from the coast in 2003. This year's coastline is 3.89 km. Almost all pond areas have been eroded and began to sink. In 2012, more severe abrasion eroded the pond area and entered the settlement community of the village of Timbulsloko. The coastline retreated 1.3 km. This year's beach length is 5.41 km. Almost all of the pool areas have been eroded and the pond began to sink, and there are also residential areas that are very affected by abrasion.

In 2016, coastal rehabilitation was carried out in many places, thanks to breakwaters, hybrid engineering, beach belts and mangrove planting, although there were still many abrasions. There are areas that recovered as far as 200 meters. The length of the coastline is 5.04 km.

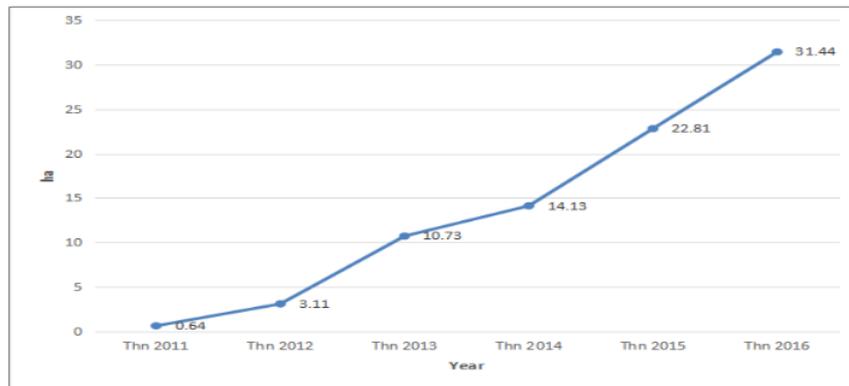


Figure 2. Increased Mangrove area in Timbul sloko village

With the extent of the damage caused by erosion, various aids have been put in place to rehabilitate the coast, for example by replanting mangroves. As shown in Figure 2 above; in 2011, the mangrove area in the village of Timbulsloko is only 0.64 ha. Thanks to this action, the mangroves increased the following year, for example in 2012, the mangrove zone of 3,11 ha. In 2013, the mangrove area is 10.73 ha. As if it did not stop to expand in 2014 and 2015, the mangrove area is 14.13 ha and 22.81 ha. In 2016, the mangrove area in the village Timbulsloko, Sayung, Demak is 31.44 ha.

The mangrove is intended to be a natural fortress for coastal areas. With the expanding mangrove forests, it is expected that the village area of Timbulsloko will be strengthened. Public awareness should also be reinforced by the importance of mangrove for coastal areas. It is not only useful as a natural fortress, but the mangrove also has benefits that can be felt directly by the community.

With the destruction of the coast, the public and the government began to realize that they had to deal with the impact of the disaster. The erosion until now has not been considered a disaster by the government, but the impact is clear to the people of Timbulsloko Village, Sayung, Demak. The residents who already have pool income (tambak) begin to lose their land due to erosion. Fish processing cannot function because the fish supply stops due to the loss of the pond. People who rice farmers lose their fields due to abrasion.

After the disaster, the government began to consider this problem for four (4) villages in Sayung District, Demak. Coastal rehabilitation programs, such as mangrove planting program, Hybrid Engineering - construction from bamboo to slow waves off the coast and to capture sedimentation have been installed offshore and green belts.

The contingent valuation method approach in this study was used to analyze the willingness to pay of respondents in the village of Timbulsloko, in a simulation used to rebuild hybrid engineering infrastructure if the structure is damaged in the future. The technique used to obtain transaction values

in this study was carried out using the Dichotomous Choice Single-Bounded approach, this approach was carried out by showing the value of the bid submitted to the respondent. The bid value is estimated based on the cost of making the structure divided by the population.

Tabel 1. Distribution of Willingness to Pay

No.	WTP	Person	Percent	WTP x Person	EWTP	WTP
1	Rp. 471.000	32	47	Rp. 15.072.000	Rp. 221.647	Rp. 799. 713.200
2	0	36	53	0		
Total		68	100	Rp. 15.072.000		

Based on the results of the above calculations, the average value of the respondent's WTP is Rp. 221,647.00 which is rounded up to Rp.221,650.00 / family / year is the value of the WTP multiplied by respondents who are willing to pay divided by 6 respondents. Based on the calculation results, the total WTP value is Rp. 799,713,200 / year. The total value of the WTP is the economic value of the maintenance costs and durability of Hybrid Engineering.

4. Conclusion

The abrasion / erosion that has occurred in the Timbulsloko Village, Sayung, Demak since 2003 has decreased. The coastline retreated 1.3 km based on high-resolution satellite image data from 2003 – 2012, but in 2016 there is 200-meter area that recovered, and the length of the coastline is 5.04 km. With the extent of the damage caused by erosion, various aids have been put in place to rehabilitate the coast, for example by replanting mangroves. In 2011, the mangrove zone is only 0,64 ha. but in 2016, the mangrove area in the village Timbulsloko, Sayung, Demak is 31.44 ha. The government of Indonesia is very concern with this problem of abrasion / erosion, various programs has been placed such as mangrove planting program, Hybrid Engineering - construction from bamboo to slow waves off the coast and to capture sedimentation have been installed offshore and green belts.

The contingent valuation method approach in this study was used to analyze the willingness to pay of respondents in the village of Timbulsloko, in a simulation used to rebuild hybrid engineering infrastructure if the structure is damaged in the future. Based on the calculations, the average value of the respondent's WTP is Rp. 221,647.00 which is rounded up to Rp.221,650.00 / family / year. The total value of the WTP is Rp. 799,713,200 / year. The total value of the WTP is the economic value of the maintenance costs and durability of Hybrid Engineering.

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