Mangrove potential and community characteristics for strengthening the utilization of environmental services based on ecotourism: A case study in Karangsong, Indramayu, West Java

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Abstract. Mangrove rehabilitation is often challenged by a lack of support from local communities. The success of mangrove rehabilitation can increase the chances of success by increasing the local economy, which will help increase public awareness. This study was conducted in the mangrove forest of Karangsong Village with the aim to identify the potential of mangroves and the characteristics of local communities as capital for the use of environmental services based on mangrove ecotourism. The interview method with semi-structured guidelines was applied to obtain social, economic and public perceptions data. Karangsong mangrove forest is dominated by three species of mangroves, namely Rhizophora mucronata, Rhizophora stylosa and Rhizophora apiculate. It has also become a habitat for various bird species such as javan pond heron, wandering whistling duck, lesser adjutant, imperial pied pigeon, and common sandpiper, which are potential ecotourism objects. The results showed that positive perceptions derived from the economic benefits obtained from mangroves, which have become feedback for mangrove conservation. The role of the driving group is also crucial to maintain the consistency of stakeholders' enthusiasm to conserve mangroves. Sustainable ecotourism development needs to involve local communities in its management.

1. Introduction
Indonesia, which has around 3 million hectares of mangrove forest [1], has experienced a decline in its mangrove forest due to unsustainable use. One of the threats to mangrove conservation was utilizing mangrove forests for economic purposes without considering ecological aspects and low public awareness [2]. The coastal area of Karangsong Village, Indramayu District, West Java Province, is one of the successful programs for rehabilitating mangrove forests. Damage to the mangrove forest in Karangsong began when there was an abrasion of 127.3 hectares of Karangsong coastal in 1983, which failed shrimp and fish farmings [3]. As stated by the head of Karangsong Village, other conditions, i.e., oil spill and water pollution from batik industries in Paoman Village, Western Indramayu, also contributed to environmental damage in Karangsong. To avoid abrasion and improve environmental conditions in the coastal area of Karangsong, a mangrove plantation covering 15 hectares surrounding the coastal area was conducted in 2008, and by 2016 a mangrove rehabilitation in Karangsong has been recorded as much as ±69.08 hectares [4].
The mangrove forest surrounding the coastal area of Karangsong nowadays has been allocated as a tourist attraction by the village government. Karangsong Village in Indramayu, as the largest area of revegetation [5], has enormous tourism potential due to its natural beaches, mangrove biodiversity, cultural, culinary and entertainment. However, several aspects should be considered for reliable and optimal successful ecotourism area, i.e., (1) maintaining environmental sustainability, (2) improving the welfare of people in the region, (3) ensuring visitor satisfaction, and (4) increasing integration and unity in community development in the surrounding area and the development zone [6, 7]. Mangrove ecotourism is one of the mangrove forest utilization for the proper economy [7]. If the management of mangrove forests with other businesses is well integrated, it would improve the management and accommodate the interest of other relevant stakeholders [8, 9].

Socio-economic conditions in the communities were primarily affected by the success of conservation and utilization of mangrove forests [10]. Perception, appreciation, aspirations and motivation of people around the mangrove forests may contribute to the success of developing mangrove forests in Karangsong Village in a sustainable way. Mangrove ecosystem conservation, which involves local communities, is able to restore mangrove function optimally, both ecological and economic roles [11]. The research was carried out in the coastal areas of Karangsong to determine the extent of effort related to preserving the coastal mangrove environment of Karangsong (plantation of mangrove forests and its ecology, biota biodiversity, and economic contribution and better future management). Mangrove rehabilitation and management in Karangsong could strengthen the potential use of ecotourism. The tourism potential can be reflected by well preserved and managed mangrove environment in Karangsong. The research was designed to identify the potential of nature and the characteristic of the local community around the Karangsong mangrove forest in the Indramayu district.

2. Materials and Methods

2.1. Study site

The study was conducted in Karangsong Village, Indramayu District, West Java Province, in August 2017 (Figure 1). Karangsong Village that was formed in 1982 and located at 06°18’45” and 06°19’45” S and 108°21’30” and 108°22’30” E, was surrounded by Pabean Udik Village in the North, Tambak Village in the South, the Java Sea in the East and Paoman Village in the West [4]. The village that was laid at 0.5 meters above sea level has a total area of about 341,027 hectares, in which 204 hectares have been used for fish farming [4, 12]. The rural population density in Karangsong is 1686 people km⁻². Including in coastal lowland areas [4].

Source: [12].

Figure 1. Map of Karangsong Village, Indramayu District.
2.2. Research materials and tools
The primary materials used in this study include questionnaires and work maps. The main tools used were a camera, recording devices, office stationery and laptop computer.

2.3. Methodology

2.3.1. Research stages. This research stage includes preparation and data retrieval in the field, including primary and secondary data, and then the obtained data is analyzed. Data retrieval in the field was the main activity in obtaining primary data, namely data from objects, secondary data obtained from literature and report data from related studied agencies that also related to research. Data identification of mangrove ecosystem potential was made by exploring the area, and potential socio-economic data of the community was conducted directly through the interview with selected respondents determined through purposive sampling following representation of the community conditions.

2.3.2. Data collection methods. A semi-structured and in-depth interview was applied to collect the social-economic data of the community. According to [13], the interview was a meeting of two people to exchange information and ideas through question and answer to construct meaning in a particular topic, both structured and semi-structured interviews. Semi-structured interviews aimed to find problems more openly, where the source person was asked for his or her opinions and ideas. Interview with semi-structured is a study based on the parameters of questions that have been determined [14]. Respondent parameters include characteristics of respondents (age, education, land ownership, livelihood) and economic income. In addition, the mangrove ecosystem potential data was collected by recording and identifying the potential diversity of flora and fauna.

2.3.3. Determination of the respondents’ numbers. Respondents were determined through purposive sampling. Purposive sampling is a sampling technique with certain considerations and everyone has the same opportunities as respondents [14]. Respondents are the most qualified or qualified resource persons to sample. The number of respondents in this study was 40, consisting of the head of families and people dependent on coastal areas the Karangsong. This is in accordance with the opinion of [14, 15] that the minimum number of samples that must be taken is 30 samples. According to (14) that sampling in purposive sampling can be homogeneous. This means that purposive sampling can be used for the homogeneous sample that focuses on one particular subgroup. Purposive sampling is a non-probability sampling method, which occurs when the element is selected to obtain a representative sample. The assessment must be precise and cost-effective (time and cost).

2.4. Data analysis
Data then were analyzed using a qualitative descriptive method. Qualitative analysis is a data analysis method that is done to obtain results obtained from interview results and questionnaire answers obtained [14].

3. Result and Discussion

3.1. Mangrove potentials
The size of the mangrove rehabilitation area in the coastal of Karangsong was ±69.08 hectares in 2016. Karangsong Village in Indramayu Subdistrict has the largest mangrove revegetation area. However, mangrove revegetation has also been implemented in other subdistricts, i.e., Balongan, Cantigi and Pasekan. There were nine species, consisting of six species of mangrove and three species of coastal vegetation trees. R. mucronata dominated the plantation (68.85%), followed by R. stylosa (18.33%) and R. apiculata (9.53%) [5].

An in-depth interview with respondents showed that most respondents (67.5%) indicated an increasing number of wildlife such as birds and reptiles compared to ten years ago. Bird species found in the area were Javan pond heron (Ardeola speciosa), wandering whistling duck (Dendrocygna arcuata), lesser adjutant (Leptoptilos javanicus), imperial pied pigeon (Ducula bicolor), common
sandpiper (*Actitis hypoleucos*) and barn swallow (*Hirundo rustica*). Meanwhile, reptiles such as monitor lizards (*Varanus* sp.), little filesnake (*Acrochordus granulatus*), Javan spitting cobra (*Naja sputatrix*), splendid poison frog (*Rana speciosa*), and giant mud crab (*Scylla serrata*) were also easily found.

The diversity of these wildlife has great potential that should be pursued in optimal utilization. However, such efforts should be well planned and managed so that utilizing the species diversity does not damage and affect its existence. One form of sustainable use is avian diversity-based tourism or well known as birdwatching [16]. Respondents stated that wildlife existence is more than in previous years as much as 80% because no hunting of wildlife, especially birds that contained in coastal mangrove forests of Karangsong.

### 3.2. Characteristics of the local community

#### 3.2.1. Age class of the respondents

Age, education and profession are essential factors that can affect the socio-economic conditions of the community [17]. The study showed that most respondents were in the productive class age category (35% in the age class of 30 to 40 years and 32.5% in 40 to 50 years (Figure 2). The productive age class was demonstrated by their profession who were active as fish farmers (50% at age class 40-50 years), fishers (42.86% at age 50-60 years), and traders (33.33% at age 30-40 years). These results are consistent with the opinion of [17, 18] that the productive age for workers ranges between 15-64 years.

![Figure 2](image-url). Age categories of respondents in the Karangsong Village.

The fish farmers and fishers were different by their type of work. Fish farmers cultivate milkfish and shrimp on the coast [19], while fishers catch fish/other marine biotas at sea using vessels. The community has been trained in making ships weighing 30 to over 50 Gross Tonnage (GT) equipped with navigation technology. Ten workers built their fishing vessels and used raw timber material from *marbo* or *merbau* (*Intsia* spp.) purchased from Surabaya. The average working time spent on a vessel was about one year and the price of *merbau* wood was IDR 6.5 million meter$^3$.

#### 3.2.2. Education background

According to [12], the education level of the Karangsong Village people was low. The majority of people in Karangsong Village graduated from Elementary School (30.79%), ungraduated from Elementary School (28.15%) and only a few have high education such as Diploma or Bachelor-Doctoral degree (Table 1). The level of education positively influences the household income [17] and communities’ perception and participation in managing mangrove forests [20, 21]. The participation of the community affects the successful management of mangrove forests for residents who have a direct interest [22].

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7.5 35 32.5 17.5 5 2.5

| Ages (Year) | 20-30 | 30-40 | 40-50 | 50-60 | 60-70 | 70-80 |
|-------------|-------|-------|-------|-------|-------|-------|
| (%)         | 7.5   | 35    | 32.5  | 17.5  | 5     | 2.5   |
Table 1. Level of education in Karangsong Village.

| No. | Level of Education                              | Total (person) | Percentage (%) |
|-----|-------------------------------------------------|----------------|----------------|
| 1   | Pre-school                                      | 834            | 21.36          |
| 2   | Never have education at the age of 7-45 years   | 176            | 4.51           |
| 3   | Un-graduated from Elementary School            | 1099           | 28.15          |
| 4   | Elementary School and Equivalent               | 1202           | 30.79          |
| 5   | Junior High School and Equivalent              | 306            | 7.84           |
| 6   | Senior High School and Equivalent              | 256            | 6.56           |
| 7   | Diploma                                         | 23             | 0.59           |
| 8   | Bachelor-Doctoral                               | 8              | 0.21           |
|     | Total                                           | 3904           | 100.00         |

Source: [4] and [12]

3.2.3. Land ownership and pond cultivation. Ownership of land status highly corresponded to the work of the majority of respondents as fish farmers. The fish farmers who work on their own ponds was 60% with an average area of over 2.0 hectares household, rent the ponds was 35%, which covers about 1.5-2.0 hectares, and work as laborers were 5% with an area of 0.1-1.5 hectares (Figure 3). Therefore, the area for fish farming should consider the total area of mangrove forest, as stated by [23] and [24] that the vast pond in mangrove forest areas should not exceed 70% because it would disrupt the ecological function of mangrove forest ecosystems as providers of nutrients. Furthermore, it was said that the ratio between the area of mangrove forests and ponds is 65.35% and 34.65%. It means that mangrove forests should be wider than the pond area. Consequently, the total area of mangrove forests must be protected [25].

The land status owned by a native of Karangsong Village is inherited from parents' legacy for generations to be passed down from one generation to the next. While the landless typically rent other people's land [26, 27]. The rental price of land in the Indramayu Regency is about IDR 2.5-5.0 million ha$^{-1}$ year$^{-1}$.

Rental lands and workers' status indicated that respondents were not natives of Karangsong Village. However, based on the results of the village monograph, it was known that apart from the native of Karangsong Village, there were also migrants originating from Bugis/Makassar and Javanese who work as fishers and traders. In addition, there were also natives from Karangsong Village who preferred to rent a large area that closed to where they lived to be used as a pond.
The fish farmers of the Karangsong community who have less than 0.1 ha (40%) usually work as fishers, laborers, and traders (Table 2). However, some people have 2.0-21.0 hectares (25%) which were used as fish ponds. Extensive land ownership and land lease related to their capital, if they have a massive capital while the area of landholdings is small, they will rent land to increase the size of the ponds. According to [22], if the pond was cultivated wide enough, it tended to decrease fish production in the surrounding waters.

Table 2. Total land ownership in rural Karangsong community.

| Land area   | Total | Percentage (%) |
|-------------|-------|----------------|
| <0.1 ha     | 16    | 40             |
| 0.1-0.5 ha  | 2     | 5              |
| 0.5-1.0 ha  | 3     | 7.5            |
| 1.0-1.5 ha  | 3     | 7.5            |
| 1.5-2.0 ha  | 6     | 15             |
| >2.0 ha     | 10    | 25             |
| Total       | 40    | 100            |

The area of cultivated ponds varied from 1.0 to 5.0 hectares. The cultivated ponds were 37.5% of milkfish, 17.5% of shrimp and 5% of seaweed. Most respondents possess milkfish ponds because easy to manage and have more stable prices than shrimp and seaweed.

3.2.4. Livelihood. The interview results with respondents showed that sources of livelihood for the people were 50% as fish farmers, 22.5% as traders, 17.5% as fishers and the remaining 10% as housewive, porters sewing nets, boat taxis, and maker of the boat (Figure 4). The research sites located in coastal areas have a high fishery potential, especially fish ponds. Aquaculture developed in Karangsong Village because milkfish's price and market share were relatively high and promising [28].

Most of the respondents who work as fish cultivators cultivate pond fish (37.5%), shrimp ponds (17.5%), sea bass (10%), and seaweed (5%). Meanwhile, the respondents who work as fishers usually leave the village for about two to nine months to catch fish near the border region of East Timor (Timor Leste) and Papua, whereas leaving for about two and three months, the fishers catch the fish surrounding Borneo Islands. According to interviews with the fishers, they found that fishing nets used were 50 feet in depth in the Borneo waters, while in the East Timor border, only 25 feet. Therefore, their activities caught a lot of fish. However, because East Timor borders the area, the fishers should be careful to avoid...

Figure 3. Ownership of land status.
illegal fishing. In addition, the more remote the location, the larger the fishing vessel required and the more workforce are needed.

![Figure 4. Occupation of respondents.](image)

3.2.5. **Income.** Income derived from the cultivation of fish, shrimp and grown seaweed increased with a combination of methods. Milkfish is harvested twice a year with revenue earned IDR 100 million year$^{-1}$. Fish farming can produce three to five tons of milkfish year$^{-1}$hectare$^{-1}$ at prices ranging from IDR 15-20 thousand kilogram$^{-1}$, depending on the quality of the milkfish. One kilogram of milkfish contains 3 or 4 tails (depending on the size of the fish). Shrimp are harvested three times a year with an income of IDR 15 million year$^{-1}$, where the price per kilogram was IDR 80,000. Seaweed can be harvested once every three months (3 to 4 times year$^{-1}$), with the price per kilogram IDR 1000 - IDR 1500 (wet weight of seaweed) and IDR 4500 (dry weight). The seaweed cultivated from the pond area sizing 1.5 hectares could reach four tons of dry seaweed in one harvest. In contrast, barramundi or seabass is challenging to reproduce [23, 28]; thus, cultivating it is challenging. Fish farmers, assisted by the village, plan to have a comparative study in the Kepulauan Seribu for seabass aquaculture training. However, some fish farmers have successfully cultivated sea bass, sold for IDR 30,000 to IDR 35,000 kilogram$^{-1}$.

Fishers with small boats of two or three people go for one day fishing around Indramayu from night to morning. They usually catch the fish between 5.0 to 10.0 kilograms per trip at sea with revenues approximately about IDR 100,000 to IDR 200,000 per person. The large fishing vessels usually use around 20 personnel on board in one trip and sail to the waters of Natuna or Borneo for two to three months which they can produce 80-90 tons, or about IDR 1.5-2.0 billions. On average, fishers with a small boat and fish around the Java sea only make money about IDR three million per month. Species of fish that were targeted by the fishers, namely tongkol (mackarel tuna), tenggiri (mackarel) and kakap (seabass), while the fish that are not targeted catch is hiu (shark) and pari (stingray) because both species of fish are prohibited from being captured. When the two types of nets have the alive fish, fishers will release them back to sea, but they will consume when the fish are already dead [22, 29]. Respondents who worked as a trader of 22.5%, including food stalls at home and tourist sites and fish or shrimp traders.

Even processing milkfish without spines (BATARI=Bandeng Tanpa Duri) is motivated by some fish farming in the Karangsong Village. The availability of milkfish raw materials could possibly vary the milkfish products. This is supported by the milkfish production in the Karangsong Village, with total production reaching 36,286 tonnes [12].

The activity of removing milkfish spines has been conducted since 2012 as diversification with the marketing of products. PT. Pertamina Refinery Unit Balongan VI Indramayu assisted participants of the
nonmonetary program but in raw materials, freezer capacity of 1200 liters, packaging, and production houses. Moreover, assisting and monitoring are also regularly carried out by a technical assistant of CSR (Corporate Social Responsibility) PT. Pertamina. Capital and training were given to participants, as well as assistance in filing permits as Certification P-IRT for products of milkfish without spines, salted fish or BATARI of friction and BATARI fish crackers, as well as support the maintenance of halal certification for processed "BATARI" fish products. In addition to the mentoring process conducted by a technical assistant, experts monitor for at least three months.

Respondents of the "Pantai Lestari" group consisted of 12 females who contributed to the family income. The women have skills in milkfish fishbone. First, the fish was obtained from fish farming, then milkfish were checked for good quality, then cut and opened, washed and cleaned, removed spines using tweezers, covered and wrapped in plastic, and milkfish without spines (BATARI) were ready for the market. The price of BATARI was around IDR 38,000 to IDR 40,000 kilogram \(^1\) (1 kg contains four milkfish), or the price of one fish was ± IDR 10,000. The interview with the group's secretary of Pantai Lestari stated that the number of spines found in fresh milkfish (large or small) is as many as 146 pieces and many consumers prefer fresh milkfish without spines.

According to [12], 38% of the head of the family were located in Karangsong and categorized into poor households. Karangsong Village has a population of 3904 people. The number of families living in the Karangsong village of 1530 people, and 583 as the household is categorized as poor. It is closely linked to the level of public education because Karangsong Village primarily consisted of people who graduated from primary school or equivalent [17].

The highest level of respondent's revenue (27.5%) ranged from IDR 5 to 400 million. In detail, the highest level of income for fish farming was 40% (average year \(^1\) more than IDR 5 million), for traders were 44.44% (average per year less than IDR 500,000) and for fishers were 28.57 % (average income per year is IDR 500,000 to IDR 1,000,000) (Figure 5).

Income derived from the trader is from selling in food stalls, souvenirs, and fish or shrimp in the local market or around the house. Based on observations, food merchants earn relatively small compared to other types of merchants. This is because the sold goods are snacks, fried foods, instant noodles, and soft drinks. However, while food stalls such as restaurants serve fish (seafood) with significant turnover, their net income could reach over IDR 5 million month \(^1\).

![Figure 5. Income level of respondents at Karangsong Village.](image-url)
In Karangsong Village, generally traders of building materials, spare parts, and a seafood restaurant, their revenue could reach over IDR 5 million month\(^{-1}\). Compared to the income of fish farmers and fishers, the highest income of fishers on average was more than IDR 10 million month\(^{-1}\) and even the big vessel fishing. Therefore, the income could reach IDR 1.5 billion year\(^{-1}\). Milkfish farmers could harvest varied from IDR 10 to 50 million depending on the size of cultivated farms. In addition to income from milkfish ponds, fish farmers could earn from shrimp and seaweed harvests cultivated in the same areas.

Optimization of the Karangsong Mangrove Forest as an ecotourism destination needs to be supported by increasing the ability of local human resources, one of which is through training in the field of restaurants that make visitors comfortable. To increase income, food stalls around the coastal mangrove must-have business training, food selection, and trade place arrangement to be more comfortable and attract many consumers. Furthermore, increased revenue from food stalls could improve a positive opinion on the existence of mangrove forests with its ecotourism activities, as it will benefit directly from the mangroves and from tourist activities that have been running for about a year [30].

3.3. Community perception of mangrove ecotourism development
In respondents' perceptions of mangrove forests, the vast majority (77.5%) stated that the mangrove forest at the Karangsong positively impacts earnings directly and indirectly (Figure 6).

![Figure 6. Perceptions of respondents on economic benefits of mangrove forest.](image)

This evidence can be seen from the increasing income of food vendors around the mangrove forest due to many visitors coming to the mangrove forest to make ecotourism. However, a small portion of respondents (22.5%) stated that coastal mangrove forest in Karangsong has no benefit because these people are not involved in the group "Pantai Lestari," a group managing Karangsong coastal mangrove forests. Therefore, they do not economically benefit directly or indirectly. Furthermore, even though they were the original inhabitants of Karangsong, they needed to buy tickets to enter the territory of mangrove forests. Therefore, they considered that the welfare of the Karangsong community is not affected by the presence of mangrove forests. In general, however, this group of respondents recognizes the mangrove forest's positive value through better ecological impacts, although the economic benefit goes to only the board or the management group [31].

The positive perception of the Karangsong community towards mangrove forests is an important asset that will ensure the sustainability of the mangrove forest so that it becomes a source of environmental services and, in turn, will increase their welfare. Although mangrove rehabilitation and its use as an object of ecotourism are driven by a group of people named Pantai Lestari, this mangrove forests whole existence and sustainability are determined by all Karangsong communities with high awareness. Positive perceptions and awareness grow along with the benefits they get from the existence of mangrove forests. The most important thing is the benefits of mangrove ecotourism, which can drive the local economy.

Ecotourism is one form of promoting a distinctive environment that maintains authenticity and is a tourist visit area. Utilization of natural resource potential mangrove based on ecotourism is one of the
efforts to achieve conservation strategies to achieve ecological, economic and social sustainability [32]. Ecotourism is part of conservation achievements but cannot be without the community because conservation implementation is always side-by-side [33]. Ecotourism development should be supported by the biophysical potential of mangrove areas as one of the environmental support capacities in developing activities in the conservation area [34].

The potential of the mangrove ecosystem in Karangsong Village was very feasible to be developed as a mangrove ecotourism destination. It was the same as expressed by [35] that mangrove ecotourism activities based on its potential in the form of combining various activities in nature hiking, observing living things in their natural habitat, and others, but may include cultural activities were also important to be developed as tourist attractions. Ecotourism is an important educational component. It is an opportunity to learn to respect nature and local culture. For some people, it is an opportunity for self-reflection inspired by the beauty of the surrounding environment.

Most respondents gave suggestions for improving the ecotourism activities, such as by increasing or adding infrastructure (built gazebos, mosques, park benches and even larger space to trade) so that people will be more involved in mangrove forest tours. In addition, officials' mangrove forest managers expect training and comparative study to visit other mangrove forests to improve the coastal Karangsong management. However, according to respondents, socially, their tourism activities do not have a significant impact but only a limited contribution from the management.

Based on interviews with members or groups of Pantai Lestari, it was said that most of the revenue from ticket ratings (55%) used for the repair, maintenance, and development of road repairs line infrastructure such as in mangrove forests, repair and addition of toilets, the addition of mangrove planting area and all supporting more facilities. Ticket sales financial management was divided by the needs of mangrove forest area development with the composition of use, 45% is used as additional amenities and comfort for visitors, 10% for facilities and infrastructure, 30% for operational management, 10% contribution income and 5% social cost to the community.

3.4. Implication
Karangsong Village has mangrove forests which are the result of the rehabilitation of an abrasive beach. This mangrove forest is a natural potential that can be developed as a producer of ecotourism-based environmental services. This natural potential will generate optimum benefits if supported by all parties. One of the important parties was local people who live and depend on coastal areas.

Coastal communities, whose welfare is generally low, are often seen as a barrier to mangrove rehabilitation. They are often blamed for destroying mangrove forests. However, a different phenomenon occurs in the people of Karangsong village, where most people with high awareness are planting mangroves along the coast of their village. This mangrove forest has even been developed as an ecotourism object by a group of farmers called Pantai Lestari. Pantai Lestari groups have built facilities and infrastructure for ecotourism activities with the assistance of local governments and private companies.

The positive perception of the Karangsong community towards mangrove forests is an important asset that will ensure the sustainability of the mangrove forest so that it becomes a source of environmental services and, in turn, will increase their welfare. Although mangrove rehabilitation and its use as an object of ecotourism are driven by a group of people named Pantai Lestari, this mangrove forest's whole existence and sustainability are determined by all Karangsong communities who have high awareness. Positive perceptions and awareness grow along with the benefits they get from the existence of mangrove forests. The most important thing is the benefits of mangrove ecotourism, which can drive the local economy.

4. Conclusion
The mangrove forest, which is the result of coastal rehabilitation in Indramayu, and the characteristics of the Karangsong village community who have a positive perception and serious concern for mangrove conservation are the main assets for the successful use of ecotourism-based environmental services in
Indramayu. In the process of mangrove rehabilitation and ecotourism development, the role of the activist groups is critical to maintaining the consistency of enthusiasm of all parties. This research also learned that mangrove rehabilitation could be in line with improving the local economy. This is important because the low welfare of the people living in mangrove forests can trigger deforestation and conversion of mangrove forests.

The success of mangrove forests rehabilitation at the Karangsong coast and its use as a tourist attraction (ecotourism) can be used as a model to utilize mangrove forests. Sustainable management of mangrove forests needs to involve local communities so that people can get the benefits of the existence of mangrove forests. Community involvement can change negative perceptions of the mangrove forest existence into positive ones and impact their sustainability.

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