Mangrove Forest Conservation-Based Tourism Industry Development in Indonesia

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Abstract: *The tourism industry has a significant impact on Indonesia's economic growth. Mangrove forests have unique characteristics that have the potential to become ecotourism-friendly. Mangrove forest conservation has a positive impact on improving the local community's welfare. The purpose of this study is to provide an overview of the successful development of a tourism industry based on mangrove forest conservation on Madura Island, Indonesia. Statistical methods are used in this study. A statistical method is a procedure or method used in processing data that includes data collection, data organization, data processing, and data presentation. The results of the study indicate that the keys to success for developing a tourism industry based on mangrove forest conservation on Madura Island are as follows: (i) community and community participation to improve the coastal environment; (ii) an educational-based mangrove forest tourism concept; (iii) mangrove conservation; and (iv) the concept of a mangrove educational park.*

Keywords: Tourism Industry; Mangrove Forest Conservation

1. INTRODUCTION

Industry plays a critical role in the Indonesian economy. The industrial sector is one of the nation's economic pillars. The industrial sector can (i) generate income through exports; (ii) absorb labor; (iii) build labor-intensive and asset-intensive enterprises; and (iv) boost productivity through advanced technology industries. As a result, the government continues to work to develop an environmentally friendly sector [1]. Tourism is a sector that contributes significantly to the growth of the national economy. The existence of large, small, and medium-sized entrepreneurs in the tourism industry also contributes to this. In the digital age, the tourism business is quickly expanding. The existing interaction among digital industry stakeholders will make it easier for travelers to obtain tourism information [2].

The tourism sector needs performance evaluation in order to continue to grow. Companies will be able to (i) identify their business strengths and weaknesses; (ii) meet consumer satisfaction; and (iii) improve the quality of products, services, and production processes as a result of performance measurement [3]. The development of digital economics has a substantial impact on long-term economic growth. Because of the rapid advancement of digital technology, the world has become more integrated, intelligent, dependable, and sustainable [4]. The tourism sector is expected to increase economic development. Natural tourism has experienced significant development. This is evidenced by the development of natural tourism towards ecological tourism (ecotourism) and special interest tourism (alternative tourism). Nature tourism plays a very important role in maintaining the existence and preservation of natural tourism objects in particular and forest areas in general [5].

The Indonesian government supports the development of mangrove ecosystems into ecotourism-based tourism destinations. The mangrove ecosystem has tourism potential that is of interest to the millennial generation. Mangrove ecosystems can also spur the growth of the creative economy sector. To beautify the mangrove ecosystem, several Instagrammable spots are made and promoted through social media (such as Tik Tok, Facebook, and Instagram) [6].

The development of ecotourism as an industry requires various efforts, including: (i) Consistency in preserving its natural resources. Mangrove forest as an ecosystem has the potential for natural beauty and the environment in the form of ecosystem constituent components consisting of vegetation, aquatic biota, wildlife, and the surrounding environment. For this reason, ecotourism visitors are taught to get to know the environment. This is an effort to increase awareness of the surrounding environment and (ii) Develop ecotourism principles to achieve sustainability. For this reason, it is necessary to involve administrators and the community. Through ecotourism-based principles, good relations can be bridged between managers and the community; and (iii) Involve the participation of local communities to contribute to ecotourism-based tourism activities [7].

The purpose of this study is to provide an overview of the successful development of a tourism industry based on mangrove forest conservation on Madura Island, Indonesia. Statistical methods are used in this study. The Indonesian government continues to strive to develop mangrove forest ecotourism as an environmentally friendly tourism industry. Mangrove forests that have been developed into natural tourism objects on Madura Island include: (i) the concept of education-based tourism in Lembung Village, Pamekasan Regency; (ii) a mangrove forest tourism village in Sreseh District, Sampang Regency; (iii) Kedatim mangrove conservation in Sumenep Regency; and (iv) a mangrove education park in Bangkalan Regency.

2. MATERIALS AND METHODS

2.1 Definition, Benefits, and Classification of Ecotourism

Ecotourism is defined by the International Ecotourism Society as tourism activities that have a responsibility to nature, society, and the environment. Ecotourism is distinct from general nature tourism. Ecotourism is a place to learn about environmental preservation. Furthermore, ecotourism is a community-based environmental protection activity. Community involvement is required to preserve and develop biodiversity in tourist regions. Thus, ecotourism initiatives will require local community workers to protect and develop biodiversity's potential. In other words, ecotourism contributes to the economic empowerment of the local community [8]. There are five classifications of ecotourism activities as follows:

1. Landscape ecotourism, including natural objects (such as beaches and waterfalls) and flora (such as forests, fauna, and plantations).
2. Adventure ecotourism consists of outdoor activities such as mountain climbing, hiking, surfing, and so on.
3. Cultural and historical ecotourism of isolated or inland tribes (such as jungle people and Dayak tribes), batik handicrafts, carving crafts, and historical relics (such as temples, colonial forts, and others).
4. Ecotourism research, include species data collection, data on natural damage (such as deforested land and environmental pollution), as well as conservation activities (such as reforestation and localization of pollution).
5. Social ecotourism, conservation, and education, including: construction of health and communication facilities in areas near ecotourism; reforestation of deforested forests; development of flora and fauna whose sustainability is threatened with extinction; and providing education for communities around tourist areas (such as: teaching English; increasing reading interest; and so on [8].

2.2 Characteristics of Mangrove Forests

Mangrove forests have a variety of unique characteristics that make them potentially ecotourism-friendly. The unique characteristics are explained below. First, the mangrove ecosystem has natural resource components (such as landscapes, flora, fauna, and local communities) that interact with each other to form an ecosystem unit. Mangrove ecosystems also have three important functions (ecological, economic, and social) in developing coastal areas. Second, mangrove forest ecosystems are complex and dynamic. This characteristic can be seen in the great contribution of mangroves to producing organic detritus. The function of organic detritus is to support the food web in the ecosystem. Third, the wealth of mangrove natural resources consists of a variety of unique vegetation and animals, as well as the potential of mangrove ecosystems as tourism objects. In particular, ecotourism offers the concepts of education and conservation. Thus, ecotourism can be used as a means of tourism to promote environmental sustainability. Ecotourism has a program to improve the welfare of the local community and anticipate damage to the mangrove ecosystem. For this reason, ecotourism facilities and infrastructure must be adequate for tourists. The aesthetics of the coastal area (with millions of unique plants and animals) will bring out its potential for the development of the ecotourism concept. Thus, the development of ecotourism will bring enormous economic, ecological, and educational value to mangrove forest areas [9].

2.3 Functions and Benefits of Mangrove Forests

The existence of mangrove forests is very important for human life. The various functions and benefits of mangrove forests are as follows: (i) Mangroves are excellent locations for spawning fish, shrimp, and other aquatic biota; (ii) The preservation of the mangrove ecosystem will have an impact on increasing the productivity of aquatic biota; (iii) Mangroves function as a barrier to sea waves; (iv) The root system of mangrove plants can prevent seawater intrusion. This is very beneficial for maintaining the quality of groundwater; (v) Mangrove ecosystems provide products that can be used directly (for example, for wood, firewood, food crops, and medicines); (vi) Mangroves also function as CO2 absorbers and absorbers (as emission substances); (vii) The intrinsic value of mangrove forests can be utilized for the development of nature tourism; and (viii) Mangrove ecosystems are also habitats for unique fauna species [10].

2.4 Research Methodology

A research methodology flowchart is presented in Figure 1.

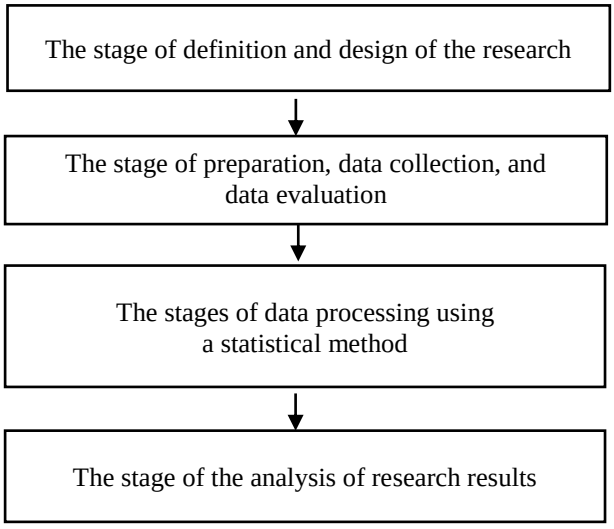

Fig. 1. Research methodology flowchart.

The four stages of the research methodology flowchart are described as follows:

1. The stage of definition and design of the research.
2. The stage of preparation, data collection, and data evaluation which include (a) mangrove area size, (b) mangrove forest type or classification, (c) distribution of mangrove forests by province, (d) condition of the mangrove ecosystem, and (e) information on the development of mangrove forest ecotourism on Madura Island.
3. The stages of data processing. The data on the size of the mangrove area is processed statistically. This is

done to obtain a percentage of the area, which is then plotted on a graph. Thus, data analysis will be simple.

4. The stage of the analysis of research results. This stage consists of (a) the potential of mangrove forests, (b) efforts to preserve mangrove forests, (c) improvement of mangrove ecosystems, and (d) development of mangrove forest ecotourism on Madura Island. The ecotourism development includes: (i) the concept of education-based tourism in Lembung Village, Pamekasan Regency; (ii) a mangrove forest tourism village in Sreseh District, Sampang Regency; (iii) Kedatim mangrove conservation in Sumenep Regency; and (iv) a mangrove education park in Bangkalan Regency.

3. RESULTS AND DISCUSSION

3.1 Condition of Mangrove Forests in Indonesia

Based on the National Mangrove Map, which was officially released by the Ministry of Environment and Forestry in 2021, it is known that the total area of Indonesian mangroves is 3,364,076 Ha. There are three classifications of mangrove forests: dense mangrove forests (DMF), medium mangrove forests (MMF), and sparse mangrove forests (SMF). Table 1 presents the percentage of canopy cover and mangrove forest area. Dense mangrove forests have the largest percentages of both crown cover (> 70%) and area (93%). The smallest percentage is sparse mangrove forest, which is < 30% and 2%, respectively. Mangrove forests are in the middle percentage, namely 30–70% and 5%.

Table 1. Classification of Mangrove Forests

No.	Class.	Heading Cov. (%)	Area (ha)	Area (%)
1	*DMF*	> 70	3,121,239	93
2	*MMF*	30 - 70	188,363	5
3	*SMF*	< 30	54,474	2

Table 2 presents the distribution of mangrove forests. The distribution of mangroves with the highest dense mangrove forest (HDMF) was in Papua Province (with a total area of 1,084,514 ha), and the lowest dense mangrove forest (LDMF) was in the Special Region of Yogyakarta (with an area of 8 ha). The distribution of mangroves with the highest medium mangrove forest (HMMF) was in the Province of North Kalimantan (covering an area of 41,615 ha), and the lowest distribution of medium mangrove forest (LMMF) was in the Special Region of Yogyakarta Province (covering an area of 3 ha). The distribution of mangroves with the highest sparse forest (HSMF) was in North Sumatra Province (with an area of 8,877 ha), and the lowest distribution of sparse mangrove forest (LSMF) was in Bali Province (with an area of 75 ha).

Table 2. Distribution of Mangrove Forests

No.	Dist. Types	Province	Area (ha)
1	*HDMF*	Papua	1,084,514
2	*HMMF*	North Kalimantan	41,615
3	*HSMF*	North Sumatra	8,877
4	*LDMF*	Special Region of Yogyakarta	8
5	*LMMF*	Special Region of Yogyakarta	3
6	*HMMF*	North Kalimantan	41,615
7	*HSMF*	Bali	75

The classification of mangroves is based on their location, namely: mangroves within the forest area covering an area of 2,261,921 ha (79%) and mangroves outside the forest area covering an area of 702,798 ha (21%) (Figure 2).

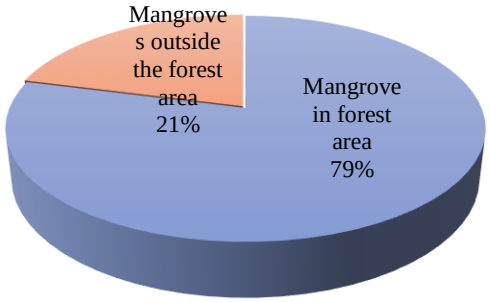

Fig. 2. Classification of mangroves based on location.

The condition of dense mangroves outside forest areas is 586,054 ha (84%), medium mangroves outside forest areas are 86,834 ha (12%), and sparse mangroves outside forest areas are 29,910 ha (4%) (Figure 3).

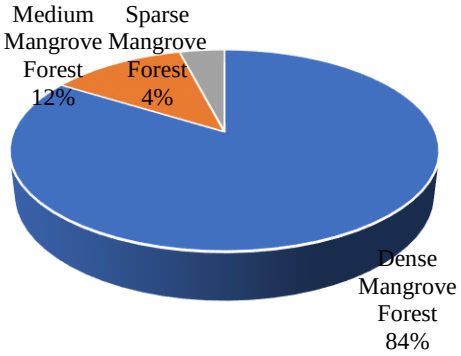

Fig. 3. Mangrove area outside forest area.

Based on the condition and distribution of mangroves outside the forest area, (i) mangroves with the highest dense cover are in East Kalimantan Province; (ii) the highest medium mangrove is in North Kalimantan Province; and (iii) the highest Sparse mangroves are in the Provinces of North Sumatra and Central Java [11].

3.2 Mangrove Forests' Potential

Mangrove forest is a type of forest that is in the tidal zone. Generally, mangrove forests develop well on protected beaches, river mouths, or lagoons. There are two functions of mangrove forests: ecological and economic. The ecological functions of mangrove forests include: (i) providing a habitat for marine animals to take shelter, find food, and breed; and (ii) protecting the coast from seawater abrasion. The economic function of mangrove forests includes: (i) the economic value of the tree wood and the living things in it. Usually, people use wood as fuel or charcoal material. Mangrove wood can also be used as material for making paper, and (ii)

mangrove forests are inhabited by various types of fauna that have economic value, for example shrimp and other fish species that breed well in the area.

Mangrove forests are scattered on the west coast of Sumatra Island; some parts are on the north coast of Java Island; along the coast of Kalimantan Island; along the coast of Sulawesi Island; along the south coast of Papua; and on several other small islands. The area of mangrove forests reaches around 3 million hectares (spread along the 95,000 km coast of Indonesia). The potential of Indonesia's Mangrove Forests is not evenly distributed. The largest area of mangrove forests is on the island of Papua, which covers 3.7 million ha. Next are Sumatra (417 thousand ha), Kalimantan (165 thousand ha), Sulawesi (53 thousand ha), Java (34.4 thousand ha), Bali, and Nusa Tenggara (3.7 ha) [12]. The Indonesia map is presented in Figure 4 [13].

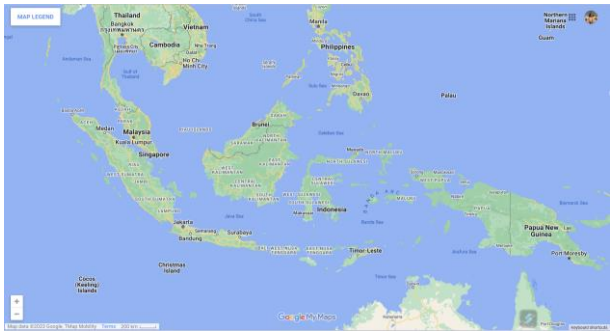

Fig. 4. Map of Indonesia.

3.3 Mangrove Forest Preservation Efforts

Table 3. Various Efforts to Preserve Mangrove Forests

No.	Explanation
1	Efforts to nurse mangrove land will accelerate the process of mangrove plant regeneration.
2	After the seeds are old enough, they can be planted in the mangrove forest area.
3	Restoration efforts depend entirely on nature and the ability of mangrove forests to return to their original state. The main obstacles faced are naturally longer restoration times and environmental conditions that support the restoration process.
4	Pollution in the mangrove forest environment can damage the mangrove forest ecosystem. One effort to overcome this is to improve environmental sustainability around the forest.
5	One of the causes of damage to mangrove forests is deforestation, which is used for commercial purposes. This damage causes the area of mangrove forests to continue to decrease. For this reason, it is necessary to expand the mangrove forest area. These activities can be carried out by improving regional governance (both tourist areas and mangrove forests) and reforestation.
6	Providing education about the importance of the function of mangrove forests in an effort to preserve their existence. This activity aims to raise public awareness about the need to preserve mangrove forests. Thus, the community can participate and play an active role in conservation efforts.

Mangrove forests play an important role in human survival. Various efforts to conserve mangrove forests have been carried out, including: (i) conducting mangrove nurseries; (ii) replanting mangrove forests; (iii) restoring mangrove forests; (iv) improving the environment around the forest; (v) spatial management for area expansion forests; and (vi) providing education on the importance of mangrove forests to the public. An explanation of each of these efforts is presented in Table 3 [14].

3.4 Mangrove Ecosystem Improvement

Mangrove ecosystem conservation requires intensity and community involvement. Damage to mangroves is related to community activities, so repairs must also involve them. There are three important aspects to carrying out conservation: ecological aspects, social aspects, and economic aspects.

1. Ecological aspects: Mangrove restoration needs to pay attention to the condition of the land and the types of mangrove plants. Thus, mangrove seedlings can grow quickly.
2. Social aspect: Mangrove rehabilitation requires the active role of the community. CSR activists (both companies and providers of mangrove rehabilitation actions) must involve local communities as subjects as well as partners to achieve common goals.
3. Economic aspects: The mangrove rehabilitation program can increase people's income (such as through aquaculture activities, ecotourism, and mangrove fruit management, which have become local specialties).

The key to successful mangrove rehabilitation lies in the accuracy of the program concept. The concept consists of planning, implementing, monitoring, and evaluating rehabilitation programs [15].

3.5 Mangrove Forest Ecotourism Development

Mangrove forest ecotourism is an educational tourism object that prioritizes natural beauty. The development of ecotourism will have various positive impacts, including (i) preserving the environment, (ii) increasing the economy of the surrounding community, and (iii) absorbing carbon emissions. Mangrove forests store 4 to 5 times more carbon than mainland tropical forests [16]. The Indonesian government continues to strive to develop mangrove forest ecotourism as an environmentally friendly tourism industry. Mangrove forests that have been developed into natural tourism objects on Madura Island include: (i) the concept of education-based tourism in Lembung Village, Pamekasan Regency; (ii) a mangrove forest tourism village in Sreseh District, Sampang Regency; (iii) Kedatim mangrove conservation in Sumenep Regency; and (iv) a mangrove education park in Bangkalan Regency.

The Concept of Education-Based Tourism in Lembung Village, Pamekasan Regency. The educational tourism being developed is in a mangrove forest conservation area of 46 hectares. The mangrove forest was pioneered by Sadra'i and Slaman (a father-son pair)

in 1986. The initial purpose of planting mangroves was to overcome abrasion. Before becoming an educational tourism, Lembung Village had several problems, including: (i) The ponds owned by residents were damaged as a result of seawater entering during the full moon night; (ii) The occurrence of abrasion because Lembung Village is an ocean area; and (iii) very hot weather. In 2010, the "Green Belt" community and coastal communities worked together to improve the coastal environment of Lembung village. Currently, Lembung village has become an educational tourism destination. Tourists carry out various environmental conservation activities, such as outdoor learning, implementing conservation, and planting mangrove seeds together. Preservation of mangrove forests has a positive impact on improving the economy of the Lembung village community. They innovate to process mangrove natural resources into a variety of food and beverage products, including coffee made from the Rhizophora Stylusa plant and syrup made from the Sonneratia plant [17]. Education-based tourism in Lembung Village, Pamekasan Regency, is presented in Figure 5 [18].

Fig. 5. Education-based tourism in Lembung Village, Pamekasan Regency.

Mangrove Forest Tourism Village in Sreseh District, Sampang Regency. Efforts to introduce the beauty of the village and the culture of the local community are built through the concept of educational tourism in mangrove forests. This concept was realized by establishing "Wisata Bakau Labuhan Manis". The objectives of establishing WBLM include: (i) Empowering the community to be tourism conscious; (ii) Creating an independent village; (iii) Improving the local community's economy; and (iii) Introducing the history, culture, and potential of the village to the public.


Fig. 6. Mangrove forest tourism village "Wisata Bakau Labuhan Manis" in Sreseh District, Sampang Regency.

The existence of educational tourism has had various positive impacts, including: (i) There is an opportunity to introduce village products and potential to the public; (ii) Tourists can understand the benefits of mangrove trees for the lives of coastal communities; (iii) Tourists understand the function of mangrove forests to hold sea water during high tide; and (iv) the formation of the concept of local living tourism. This concept separates tourism activities from the daily lives of local people. Mangrove forest tourism village "Wisata Bakau Labuhan Manis" in Sreseh District, Sampang Regency, is presented in Figure 6 [19].

Kedatim Mangrove Conservation in Sumenep Regency. The action of loving the environment by village youths has initiated the formation of the Kedatim mangrove tour. They planted mangroves on the coast that surrounds the village. When the mangrove forest began to grow thick, the idea arose to develop nature and educational tourism. In order to be professionally managed, the tourism business is managed by a Pasopati Village-Owned Enterprise. In 2021, the development of mangrove tourism has been supported by the construction of village access and facilities. Mangrove conservation has a positive impact on village progress, including: (i) improving the economy of the villagers; (ii) creating new jobs; and (iii) arousing local entrepreneurship. Kedatim mangrove conservation has built a synergy between environmental preservation and village economic growth. There are three objectives for village development through the conservation of the Kedatim mangroves, namely: (i) supporting the achievement of village Sustainable Development Goals (SDGs); (ii) realizing village economic growth evenly; and (iii) realizing a village that cares about the marine environment. The development of tourist villages is expected to increase the attractiveness and convenience of tourists. Thus, tourist visits will increase [20]. Gazebo tourism mangrove Kedatim Sumenep is presented in Figure 7 [21].


Fig. 7. Gazebo tourism mangrove Kedatim Sumenep.

Mangrove Education Park in Bangkalan Regency. The Bangkalan Regency Government continues to strive to develop Bangkalan's tourism potential. Tourism development is very much needed to improve the community's economy and the regional income-spending budget. The district government is developing the potential for mangrove ecotourism in the coastal village of Labuhan, Sepulu sub-district. The ecotourism

development is based on the concept of the Mangrove Education Park (MEP). MEP is spread over 8 hectares of coastal land and is overgrown with more than 10,000 mangrove trees. The Labuhan mangrove forest area is a former pond area that has been converted into a mangrove conservation area. Henceforth, it was developed into MEP by the "Cemara Sejahtera Mangrove Farmers Group". The mangrove tourism destinations consist of mangrove parks, cypress trees, California papaya cultivation, etawa goat cultivation, soft-shell crab cultivation, evergreen mangrove nurseries, saung, and camping grounds. To go around the mangrove forest, MEP managers have built a 350-meter wooden bridge (tracking) that divides the mangrove forest. The deck will lead visitors to the beautiful panorama of the beach. Some of the benefits of having MEP in mangrove forests are as follows:

1. The existence of MEP mangrove forests can attract hundreds or even thousands of migratory birds from Alaska and Siberia, with the aim of Australia stopping in certain months.
2. MEP provides a lot of natural education for children, including how to make a herbarium, a sea cypress nursery, and an exploration of the mangrove forest to get to know flora and fauna. Apart from that, there are also fun games, coloring mangroves, learning farming (picking papayas), raising livestock around the mangrove forest, mangrove nurseries and planting, safari nights, and trekking tours.
3. The existence of MEP ecotourism as a vehicle for nature conservation has the potential to drive the community's economy and can reduce the unemployment rate in Labuhan village.

Mangrove ecotourism management continues to be encouraged for its development. This is in line with the vision and mission to realize the spatial planning of Bangkalan Regency as the gateway for Madura Island to become a city of industry, tourism, and services [22, 23]. Mangrove education park in the coastal village of Labuhan, Sepulu Sub-District, Bangkalan Regency, is presented in Figure 8 [24].

Fig. 8. Mangrove education park in the coastal village of Labuhan, Sepulu Sub-District, Bangkalan Regency.

4. CONCLUSION

Mangrove forests have a very important role for environmental sustainability. Therefore, it is necessary to make various efforts to preserve the existence of mangrove forests. The Indonesian government continues to strive to develop mangrove forest ecotourism as an environmentally friendly tourism industry. Mangrove forests that have been developed into natural tourism objects on Madura Island include: (i) the concept of education-based tourism in Lembung Village, Pamekasan Regency; (ii) a mangrove forest tourism village in Sreseh District, Sampang Regency; (iii) Kedatim mangrove conservation in Sumenep Regency; and (iv) a mangrove education park in Bangkalan Regency.

Preservation of mangrove forests has a positive impact on improving the economy of the community of Lembung Village, Pamekasan Regency. They innovate to process mangrove natural resources into a variety of food and beverage products, including coffee made from the Rhizophora Stylusa plant and syrup made from the Sonneratia plant. Efforts to introduce the beauty of the village and community culture in Sreseh District, Sampang Regency, were built through the concept of educational tourism in mangrove forests. This concept was realized by establishing "Wisata Bakau Labuhan Manis". The objectives of establishing WBLM include: (i) Empowering the community to be tourism conscious; (ii) Creating an independent village; (iii) Improving the local community's economy; and (iii) Introducing the history, culture, and potential of the village to the public.

Kedatim mangrove conservation in Sumenep Regency has a positive impact on village progress, including: (i) improving the economy of the villagers; (ii) creating new jobs; and (iii) arousing local entrepreneurship. Kedatim mangrove conservation has built a synergy between environmental preservation and village economic growth. The Bangkalan Regency Government is developing the potential for mangrove ecotourism in the coastal village of Labuhan, Sepulu sub-district. The ecotourism development is based on the concept of the Mangrove Education Park (MEP). MEP is spread over 8 hectares of coastal land and is overgrown with more than 10,000 mangrove trees. The Labuhan mangrove forest area is a former pond area that has been converted into a mangrove conservation area. Henceforth, it was developed into MEP by the "Cemara Sejahtera Mangrove Farmers Group".

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