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MANGROVE MANAGEMENT STRATEGY FOR SUSTAINABLE BUSINESS BASED ON INDONESIAN ECOLOGICAL PRODUCTS

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Abstract: Mangrove ecotourism provides ecological and economic benefits for the community. This study examines the sustainability of the ecotourism business with a 5-dimensional approach, namely: ecology, economy, social, technology, and infrastructure, as well as law and institutions. Therefore, this study aims to analyze the sustainability of the Banyuurip Mangrove Center (BMC) ecotourism business. The data analysis used quantitative with Multidimensional Scaling (MDS)-ecotourism analysis and SWOT analysis. The sustainability of the BMC ecotourism business multidimensionally resulted in a value of 52.36, so it can be said to be entirely sustainable. The government, managers, and related parties are expected to consider the variables that affect the sustainability of ecotourism, including mangrove rehabilitation, government budget, public awareness, environmentally friendly development, and local government commitment. Mangrove ecotourism management strategy is to carry out an aggressive strategy by increasing and developing the quality of human resources and facilities to improve the community's economy and sustainable mangrove ecosystems. Ecotourism provides many business opportunities for the community to maintain ecological sustainability if it provides economic value.

Key words: ecotourism, mangrove, MDS Rap-ecotourism, SWOT, business

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INTRODUCTION

Indonesia has many beautiful natural landscapes, there are still many unexplored and unexplored natural attractions (Ismail, 2021). Banyuurip Village has quite a considerable fishery potential in Indonesia. One of the potentials of Banyuurip Village is the mangrove forest located on the north coast of the village. This mangrove forest is a search area for residents, especially fishers looking for shells and crabs. Based on information from the village head and anglers, the mangrove forest area in Banyuurip Village was reduced because many were cut down and converted into ponds. In addition, the mangrove forest has also been damaged and lost due to abrasion from the Java Sea. Fortunately, the awareness and concern of several fishers to restore mangrove forests have been carried out since 2007. This effort was pioneered by a fisherman named Abdul Mughni, who felt that his crab catch was decreasing due to reducing mangrove forests (Sambah et al., 2019).

The Banyuurip Ujungpangkah mangrove is located about 35 kilometers from the city of Surabaya or about 23 kilometers from the city of Gresik to the north (Aliyah et al., 2019). Mangrove development into ecotourism is a sustainable tourism concept that aims to preserve nature and culture (Intyas et al., 2021a). Since 2013, the Banyuurip Village Government and the Banyuurip Mangrove and Environmental Conservation Group established an Ecotourism and Mangrove Conservation Area known as the Banyuurip Mangrove Center (BMC). Apart from being a place for mangrove nurseries and conservation, this ecotourism area which was opened in 2015, has various types of mangroves, with the dominant species being *Avicennia sp.* and *Rhizophora*. When mangrove fruit is abundant, residents around BMC sometimes use it as preparations such as syrup and *jenang* for their consumption (Rahman et al., 2019). The economic value of the BMC mangrove ecosystem using the individual travel cost (ICTM) method and the total consumer surplus per visit each frequency is IDR 459,635.61 with an average consumer surplus per individual visit of IDR 91,927.12. Therefore, the estimated economic value of BMC is IDR 1. 124,551,798.76 per year (Sakti and Fauzi, 2020). Fattah et al., 2020 research shows that good management of the Ecotourism Probolinggo will provide net benefit value for 30 years of Rp. 10,616,017,603 or Rp. 353,867,253/year. The area of BMC can be seen in Figure 1.

Several empowerment activities have been carried out in 2019 that is Universitas Brawijaya provide packaging and marketing training of mangrove processed products to BMC management to make mangrove flour that can be used as a base material for some food such as cendol, sticks, pudding, and peyek (Sambah et al., 2019) and Institut Teknologi Adhi Tama Surabaya given training how to use mangrove material for batik crafts, kind of food dodol, mangrove syrup, they also

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build of jogging tracks, gazebos and gave two boats for the tour (Aliyah et al., 2019). In 2010 – 2017, there was a decrease inland by 2.52 ha (61.91%) which is a heavy category (≥50%) The decrease in mangrove ecosystem land area was caused by the clearing of farmland of the community while according to Azizah, 2021 mangrove breeding business in the BMC area from 2014 - 2019 is calculated by R/C Ratio to get more than one every year which means this business is profitable with a relatively moderate payback period (3 years 2 months 24 days) (Hidayah and Muzayanah, 2018).

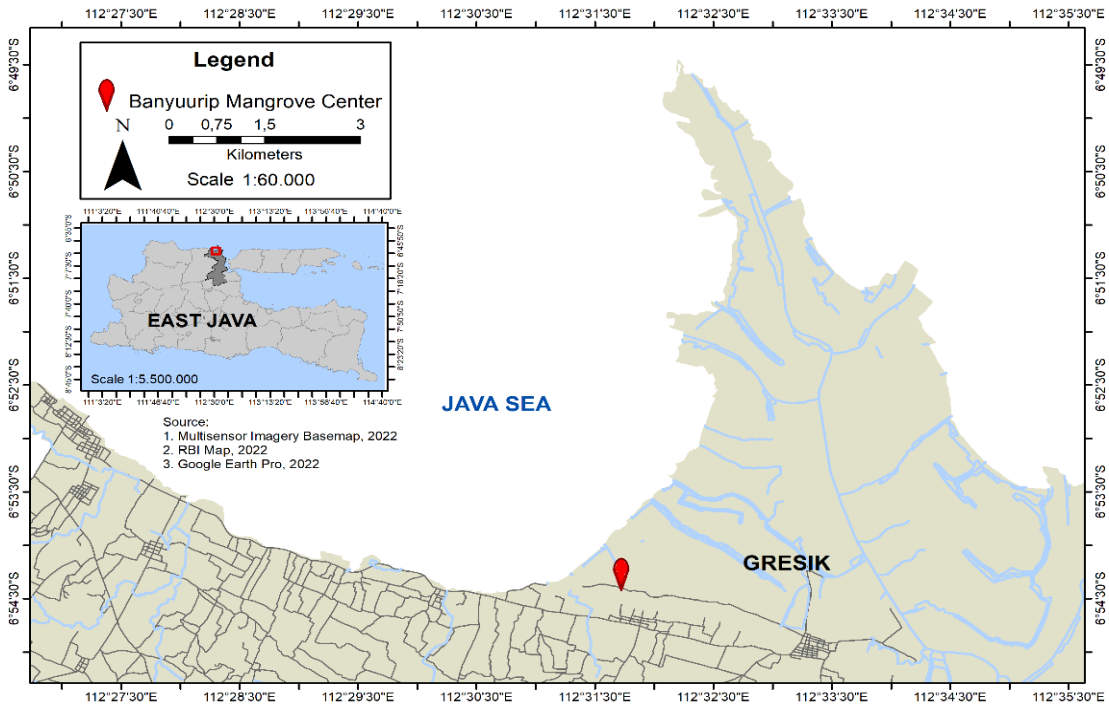

Figure 1. Banyu Urip Mangrove Center (BMC) Area

Based on the data, there is a gap between the number of mangrove areas that are decreasing while the increase in mangrove breeding shows an increase in area and how the effect of empowerment activities that have been given to BMC management and surrounding communities including fishermen around BMC.

The increase in mangrove areas is influenced by the awareness and economic activities of the community from tourist visits. Business management based on ecological products requires the right strategy so that economic and ecological value can remain sustainable. Integration of ecological and business management can optimally manage ecotourism by considering the ecological carrying capacity and economic carrying capacity (Mulyadi et al., 2021; Liap and Ahmad, 2019). The construction of ecotourism facilities should consider ecology by using environmentally friendly materials and technologies (Fattah et al., 2021). In addition, the added value obtained from the development of mangrove ecotourism is a combination of environmentally friendly technology with modern technology to become a national and international tourist attraction (Intyas et al., 2020). Ecotourism provides opportunities for profit for the organizers, government, and local communities, through non-extractive activities, thereby increasing the local economy. An implementation that pays attention to ecotourism principles creates a sustainable economy (Valentina and Qulubi, 2020). Income is essential in ensuring that ecotourism results in environmental preservation (Purwanti et al., 2021). The increased unplanned tourism business and the construction of tourism activities that exceed carrying capacity have raised environmental concerns (UĞUZ et al., 2022). Based on this description, the purpose of this study is to analyze the management strategy of mangrove ecotourism for the sustainability of Indonesia's ecological products business.

MATERIALS AND METHODS

BMC Indonesia researched the sustainability of its ecotourism business with a total of 25 respondents from managers, agencies, and community leaders. MDS Rap-ecotourism data analysis refers to the Rap-fish technique (Rapid Appraisal for Fisheries), which attempts to evaluate the sustainability of fisheries in a multidisciplinary manner, with easy-to-assess and adjustable features (Alder et al., 2000; Pitcher and Preikshot, 2001; Kavanagh and Pitcher, 2004). Rap-fish is developed by using an ordination technique by placing something according to a sequence of attributes that have been measured using Multidimensional Scaling (MDS) (Alder et al., 2000). The analysis was adapted from Kavanagh and Pitcher, 2004 which consist of:

1. Multidimensional Scaling (MDS): The ordination technique is analyzed with MDS to determine the position of good and bad points.
2. Monte Carlo (MC): Monte Carlo analysis evaluates the effect of random errors performed to estimate the value of the ordinance used.
3. Leverage: Leverage analysis to determine the sensitive attributes of each dimension of sustainability in increasing the index value measured, namely natural, human, financial, social, and physical.

While the SWOT analysis continues the results from the MDS Rap-ecotourism with the following stages:

1. Identify strengths, weaknesses, opportunities, and threats from the MDS Rap-ecotourism analysis
2. Conversion of weights through leverage results from MDS Rap-ecotourism with the condition that the sum of S -W and O -T is a maximum of 1
3. Conduct a rating assessment based on the results of the MDS Rap-ecotourism assessment with a score of 1-3
4. Calculate the score by multiplying the weight with the rating
5. Performing the calculation of the grand strategy matrix to determine the quadrant position and compiling a SWOT matrix to produce a management strategy

Table 1. Attributes and Scale of Multi-Dimensional Scaling and SWOT

No	Attribute	Assessment Scale	MDS Dimensions	SWOT Variable
1	Diversity of mangrove species	1 = High (>5); 2 = Medium (3-5); 3 = Low (1-2)	Ecology	Strength (S1)
2	Biota diversity	1 = Fish and mollusks; 2 = Fish, Shrimp, Crab and mollusk 3 = Fish, Shrimp, Crab, Mollusk, Reptile and Bird	Ecology	Strength (S2)
3	Mangrove Ecotourism Cleanliness	1 = Dirty due to lack of trash cans (>1000m) 2 = Clean enough because there is a trash can but it is far apart (500-1000m) ; 3 = Clean because the distance between the trash bins is close (100-500m)	Ecology	Strength (S3)
4	Area Arrangement	1 = Unorganized; 2 = Moderately organized; 3 = Well organized	Ecology	Strength (S4)
5	Abrasion	1 = Severe; 2 = Medium; 3 = Not happening	Ecology	Threat (T1)
6	Tourist visit	1 = Low; 2 = Seasonal; 3 = High	Ecology	Opportunity (O1)
7	Mangrove Rehabilitation	1 = Never; 2 = Sometimes; 3 = Always		
8	Government Budget in Ecotourism Management	1 = None; 2 = Low; 3 = Adjusting to the needs	Economic	Opportunity (O2)
9	Employment	1 = Low; 2 = Seasonal; 3 = High	Economic	Opportunity (O3)
10	Tourism Market Potential	1 = Local market; 2 = Local and national market; 3 = Local, national and international market	Economic	Opportunity (O4)
11	Mangrove Area Accessibility	1 = Difficult; 2 = Medium;3 = Easy	Economic	Strength (S5)
12	Community Income After Ecotourism	1 = Low income and a high poverty rate 2 = Adequate income and the low poverty rate; 3 = High income and avoid the poverty line	Economic	Strength (S7)
13	Livelihoods Before Tourism and After Tourism	1 = Non-tourist work and not switching to tourism 2 = Non-tourism work that extends to tourism; 3 = Tourism workers who continue to develop their tourism business	Economic	Strength (S8)
14	Ability to use media/information technology for ecotourism promotion	1 = Incapable; 2 = Capable but less frequent in promotion 3 = Capable and consistent in promoting	Social	Weakness (W1)
15	Conflict level in the area used as an ecotourism site	1 = Lots of conflicts; 2 = Slight conflict; 3 = No conflict	Social	Threat (T2)
16	Community participation in ecotourism management	1 = Does not participate in management 2 = Participate but not active in management 3 = Participate and be active in management	Social	Strength (S9)
17	Community Knowledge About Mangroves	1 = Unacquainted with mangroves 2 = Being aware of sustainability but not taking anything to preserve it; 3 = Understanding and taking part in the preservation of the mangroves	Social	Threat (T3)
18	Tourists and community awareness towards sustainability	1 = Low;2 = Moderate;3 = High	Social	Opportunity (O6)
19	Eco-friendly tourist attraction	1 = lack diversity; 2 = Diverse, but the type of attraction affects the environment; 3 = Diverse and environmentally friendly	Technology and Infrastructure	Strength (S6)
20	Developing eco-friendly ecotourism facilities	1 = construction with concrete raw materials and changing the shape of the environment 2 = Construction uses concrete as raw materials but still considers the environment 3 = development using eco-friendly raw materials	Technology and Infrastructure	Strength (S10)
21	Availability and Access of Clean Water	1 = >2km; 2 = 1-2km; 3 = <1km	Technology and Infrastructure	Weakness (W2)
22	Public Facilities and Infrastructure	1 = No public infrastructure available 2 = Public infrastructure is available but not optimal 3 = availability of public infrastructure with good conditions	Technology and Infrastructure	Weakness (W3)
23	Modes of transportation	1 = High fares without knowing the pattern of travel does not help tourism development; 2 = Affordable rates but do not know the pattern of travel and can help tourism development; 3 = Affordable rates by knowing travel patterns and helping tourism development	Technology and Infrastructure	Opportunity (O7)
24	Telecommunication Infrastructure	1 = No communication signal transmitter yet 2 = There is a communication signal transmitter with a limited provider; 3 = There is a communication signal transmitter to access all providers	Technology and Infrastructure	Opportunity (O8)
25	Availability of Tour Services	1= Few or 1-25 tourism services 2 = Moderate or 26-50 tourism services 3 = Many or >50 tourism services	Technology and Infrastructure	Opportunity (O9)

No	Attribute	Assessment Scale	MDS Dimensions	SWOT Variable
26	Availability of Management Regulations	1 = No management regulations 2 = management has regulations, but they are not optimal 3 = Management regulations are optimal and well-executed	Legal and Institutional	Weakness (W4)
27	Coordination between stakeholders	1 = There is no coordination between stakeholders 2 = There is no optimal coordination between stakeholders 3 = Good coordination between stakeholders	Legal and Institutional	Weakness (W5)
28	Work Safety and Security (WSS)	1 = There is no WSS implementation for workers and visitors 2 = There is already an implementation of WSS for workers and visitors, but it is not optimal 3 = There is already an implementation of WSS for workers and visitors with optimal conditions	Legal and Institutional	Weakness (W6)
29	Level of Community Compliance with regulations	1 = Low level of community compliance 2 = Medium level of community compliance 3 = High level of community compliance	Legal and Institutional	Threat (T4)
30	Local government commitment to managing ecotourism	1 = low; 2 = moderate; 3 = high	Legal and Institutional	Opportunity (O10)

Assessment of the sustainability of small-scale fishing households is based on five dimensions using a questionnaire. Each indicator of the five dimensions is given 0 (bad) to 10 (good). The higher the score showed that the fisherman's household is in good condition. The ordination technique in MDS is based on the Euclidean distance Pitcher and Preikshot, 2001 which is in dimensional space and can be written as:

$$d = \sqrt{(|x_1 - x_2|^2 + |y_1 - y_2|^2 + |z_1 - z_2|^2 + \cdots)}$$

The configuration or ordination of an object or point in the MDS is then approximated by regressing the Euclidean distance (d_{ij}) from point *i* to point *j*, with the origin (δ_{ij}) as the following equation (Pitcher and Preikshot, 2001):

$$d_{ij} = \alpha + \beta\delta_{ij} + \varepsilon$$

The technique used to regress these equations is the ALSCAL algorithm. The ALSCAL method optimizes the squared distance (squared distance = d_{ijk}) to the data square (starting point = o_{ijk}), which in three dimensions ($_{i,\ j,\ k}$) is written in the following formula called S-Stress (Alder et al., 2000): $S = \sqrt{\frac{1}{m}\sum_{k=1}^{m}\left|\frac{\sum_i\sum_j\left(d_{ijk}^2 - o_{ijk}^2\right)^2}{\sum_i\sum_j o_{ijk}^4}\right|}$

Where the squared distance is the Euclidean distance weighted or written as follows: $d_{ijk}^2 = \sum_{a=1}^{r} w_{ka}\left(x_{ia} - x_{ja}\right)^2$

The goodness of fit in the MDS analysis is measured by the value of S-stress, and the coefficient of determination (R^2), which can also be used to see if more attributes are needed, or the existing attributes reflect the accuracy of each dimension analyzed concerning the actual situation. A low S-stress value indicates a good fit, while a high S-stress value indicates the opposite (Fauzi dan Anna, 2005). The model is good or almost good if the results of the analysis produce an S-stress value less than 0.25 ($S < 0.25$), and R^2 is close to 1 (100%) (Pitcher et al., 2013). Furthermore, Rap-household analysis was carried out with the Rapfish software tool. The sustainability index value is used to determine the sustainability of fishers' households during a pandemic, as shown in Table 2. The sustainability status of fishers' households is grouped into four categories: unsustainable, less sustainable, moderately sustainable, and sustainable (Pitcher and Preikshot, 2001).

RESULTS AND DISCUSSION

Evaluation of Mangrove Ecotourism Business Sustainability

BMC is ecotourism with mangrove vegetation due to the hard work of conservation by fishers. Previously, the condition of the mangrove ecosystem was converted into proprietary land. The mangrove vegetation at that time became arid and became a dumping ground for illegal waste. This condition caused the environment to be unable to withstand the abrasion caused by the waves and eventually caused massive abrasion in 2007-2008. It causes fishers' income fields to decrease when they cannot go to sea. When the wave season comes, fishers usually use the mangrove ecosystem for hunting crabs as a fishing substitute. Those conditions gave rise to the idea of fishers forming a mangrove conservation community that aims to restore the mangrove ecosystem and create a clean and beautiful environment. The first activity carried out by mangrove conservationists to revive mangroves is to conduct mangrove nurseries, plant, care for, and maintain until the mangrove ecosystem recovers. On August 20, 2017, BMC was opened as ecotourism, and a tourism awareness group, "*Tirta Bahari*" was formed to manage ecotourism in Banyuurip Village. The opening of this ecotourism was inaugurated directly by the Regent of Gresik, namely Dr. Ir. H. Sambari Halim Radianto, S.T., M.Sc.

The area of mangrove ecotourism in Banyuurip Gresik is 32 Ha. Nine types of mangroves grow along the BMC jogging track, including *Sonneratia caseolaris, Avicennia officinalis, Avicennia alba, Avicennia marina, Rhizophora stylosa, Rhizophora mucronata, Rhizophora apiculata, Bruguiera clyndrica, Bruguiera gymnorrhiza*. Meanwhile, 18 types of mangroves have been successfully cultivated, namely: *Xylocarpus molucentis, Acanthus illcifolius, Excoecaria agallaocha, Aegiceras corniculatum, Ceriops tagal, Acrostichum aureum, Lummitzera racemosa, Brugueria cylindrical, Brugueria gymnorrhiza, Sonetaria casiolaris, Sonetaria alba, Avicennia marina, Avicennia officinalis, Avicennia alba, Avicennia lanata, Rhizophora apiculata, Rhizophora stylosa dan Rhizophora mucronata.* Mangroves form less than one percent of all tropical forests worldwide, it is highly valuable ecosystems, providing a variety of important goods and services which

make significant contribution to the livelihoods, well-being, and security of coastal communities (Ray and Sen, 2021). The existence of mangrove forests is very decisive and supports the social and economic development of the surrounding community. From an economic point of view, mangrove forests are a source of forest products with high economic value, such as wood, food sources, cosmetic ingredients, dyes, leather tanners, and sources of animal and bee feed (Safuridar and Andiny, 2020). The types of work at BMC are fishers, shop traders, tourism managers, and green mussel cultivators.

Well-developed infrastructure, effective adaptation, and application of innovations are essential for the creation of complex tour packages based on tourist attractions in the region and thus contribute to the development of the region (BENKŐ et al., 2022). Attempts to develop "tracking mangrove ecotourism" include ecotourism development in the form of a 500m tracking bridge, eleven gazebo units, seven boats, a floating wooden house, selfie spots, parking area, one toilet, and SME stalls on water and on land, Lembar Selatan Village, Lembar District Sheet, West Lombok (Rahmawati and Wahyu, 2017). Mangrove ecotourism supporting products that may have the potential to be developed around Bandar Bakau Dumai include: enjoying the natural and sea panoramas, seeing the activities of fishing communities and people's shipyards, culinary and souvenirs, cultural events, playgrounds, outbound or camping, jogging, and cycling. The supporting products for mangrove ecotourism can be developed in open space zones around mangrove forests, parking areas, roads, and beach accessibility (Mulyadi et al., 2021). Existing facilities in BMC ecotourism are a gazebo, parking lot, meeting hall, library, cafe, and toilet.The conflict in 2016 was the social jealousy of fishermen against BMC management. Fishers' concerns about the shift in the function of mangrove forests to ecotourism have resulted in fishers not being allowed to occupy the area to lean their boats and go to sea or look for crabs. Concerns from the mangrove conservation group towards the existence of ecotourism because it can damage the mangrove ecosystem, which the conservation group has attempted. So, in 2019 they discussed with the village chief intermediary which get the result that fishers get a special area to lean their boats (Figure 2) and built jogging tracks for tourist walk so the mangrove area protected.

Figure 2. Special Area In BMC For Fisherman To Lean Their Boats
(Source: Primary Data, 2021)

Table 2. Sustainability category

Index value	Category
0 – 25	unsustainable
>25 – 50	less sustainable
>50 – 75	moderately sustainable
>75 – 100	sustainable

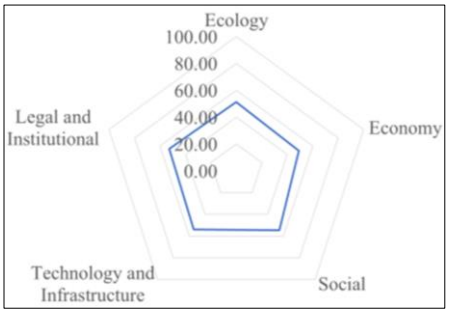

Figure 3. Multidimension of MDS Rap-ecotourism
(Source: Research Data Analysis, 2021)

In 2020, another conflict occurred about constructing a BMC kiosk without coordination between the BMC management and fishers. Fishers consider that all BMC development activities should involve fishers, such as permits, or ask for opinions after that all activities related to BMC should be discussed with the village chief intermediary and fishers.

The current management is confined to preventing the removal of mangrove trees, whereas excellent management results from continual planning, monitoring, and assessment process. Good management can only be achieved if complete and accurate information regarding the condition of mangrove ecosystems, such as vegetation conditions, potential, and socioeconomic activities, as well as institutional factors and stakeholders with interest in mangrove area management, is available (Rusdi et al., 2020). Prior to 2008, mangrove damage was caused by violations of the conversion of mangrove forest functions into ponds, excessive use of mangrove wood, and a lack of public knowledge of waste pollution in the mangrove region, which produced abrasion. Suppose the sustainability value is closer to 100. In that case, the sustainability status is improving, and vice versa. If it gets closer to 0, then the sustainability status will worsen. Based on the five dimensions used to measure the sustainability status of BMC's ecotourism business, the dimension that produces the highest value is the social capital of 54.60. In contrast, the capital that produces the lowest value is the economic dimension of 49.11. The multidimensional average of BMC's ecotourism business produces 52.36, which is moderately sustainable (Figure 3).

Leverage analysis determines the attribute that affects the sustainability status based on the highest Root Mean Square (RMS) value (Mahida and Handayani, 2019). The most sensitive attributes will contribute to sustainability (Sri Fitrianti et al., 2014). The number of fish specimens found in the BMC ecotourism area, Banyuurip Village, Ujung Pangkah District, Gresik Regency was 181 individuals from 11 species, ten families, and five orders. The number and composition of species, families, and fish orders differ between mangrove habitats, with the highest number in coastal mangrove habitats. Tilapia fish (*Oreochromis mossambicus*) dominates the estuary mangrove habitat, and *kuwe* fish (*Caranx sexfasciatus*) dominate the coastal mangrove habitat. There are variations in fish community structure between mangrove habitats. The

dominant index value of fish communities in estuary mangrove habitats is higher and is in the medium category, while it is in the low category in coastal mangrove habitats. On the other hand, the fish community diversity index value in the coastal mangrove habitat is in the high category and the low category in the estuary mangrove habitat (Rohmawati et al., 2021). The tendency to decrease the area of mangroves in Banyuurip Village, Ujungpangkah District, Gresik Regency is due to the clearing of pond land because ponds are the main livelihood of the people of Banyuurip Village. Based on the results of the analysis of google earth images in 2004, 2010, and 2017 there has been a significant decline. From 2000 to 2004 the land area decreased from 5.9 ha to 5.61 ha. It showed a decrease of 0.29 with a percentage of 7.13%. From 2004 to 2010, 5.61 ha of land area becomes 4.35 ha, there has been a decrease of 1.26 ha with a percentage of 30.96%. From 2010 to 2017, from 4.35 land area to 3.09, there has been a decline of 2.52 ha with a percentage of 61.91% (Hidayah and Muzayanah, 2018). The community was concerned about preserving mangrove forests in the BMC area from 2014 to 2021. They contributed to the rehabilitation of mangroves by planting 513,850 trees which comes from the institution of PGN SAKA, Pupuk Surabaya, Surabaya Educational Institution, Jatim Provincial DKP, Banyuurip Village, Gresik Fisheries Service, SDN Meganti, UNISLA Student, PT. Barata, KLHK, NGO Nurul Hayat, and MAN Gresik. PGN SAKA is an agency that routinely conducts rehabilitation every year, but KLHK provides the largest contribution about 62.2% of the total (Figure 4).

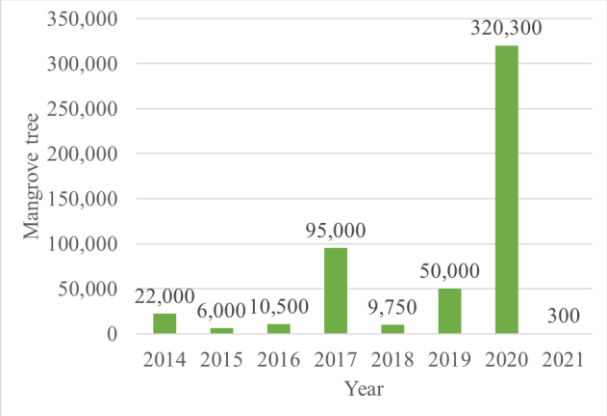

Figure 4. Number of Rehabilitation of Mangrove Trees in 2014-2021 (Source: BMC Management, 2021)

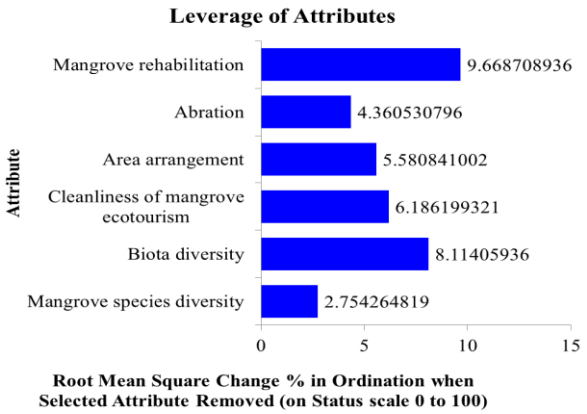

Figure 5. Ecology Leverage (Source: Research Data Analysis, 2021)

The ecological variable that most influences the sustainability of BMC's ecotourism business is mangrove rehabilitation. Conservation, rehabilitation, and restoration of mangroves to halt deforestation and degradation of coastal ecosystems and biodiversity (Masagca and Trinidad, 2021). Conservation policies and the establishment of nature reserves in China have made significant gains in mangrove conservation and restoration (Wei et al., 2021). Ecological restoration focuses on improving mangrove ecosystems that bring benefits to livelihood-oriented models and creating mangrove belts to protect beaches for adaptation to the negative effects caused by climate change and sea-level rise (Phong and Luom, 2021). Yona et al., 2018 suggested that mangrove rehabilitation could be done by rejuvenating mangrove areas or reforestation. Mangrove regeneration can be done by natural or artificial means. Rejuvenation naturally occurs when the fruit falls and grows by itself on the substrate. Artificial regeneration can be conducted by nurseries and replanting the seeds grown in their natural habitat. This mangrove forest is a rehabilitation forest where replanting is carried out by fishers who feel they have lost their livelihood due to reduced biota, such as crabs and shellfish previously found in mangrove forests. This condition was due to the destruction of mangrove forests caused by coastal abrasion since 2004 (Figure 5).

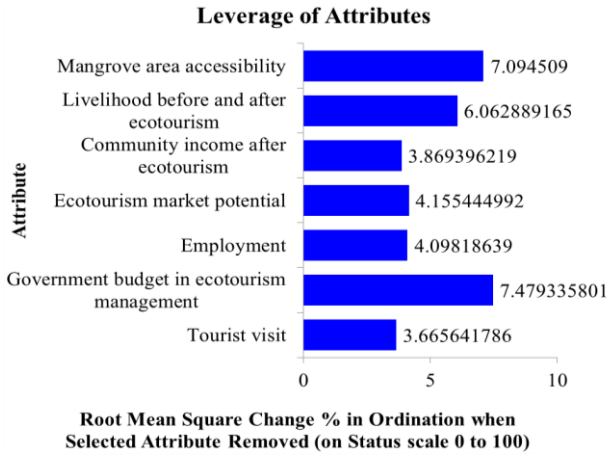

Figure 6. Economic Leverage (Source: Research Data Analysis, 2021)

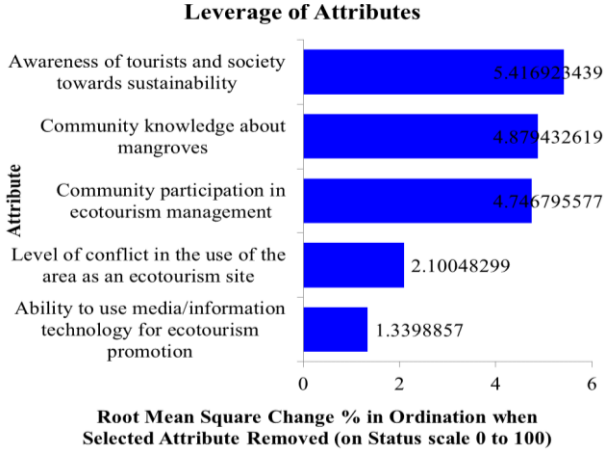

Figure 7. Social Leverage (Source: Research Data Analysis, 2021)

The government in developing and managing ecotourism Banyuurip has spent Rp. 2,005,081,000. The entrance ticket price is IDR 5,000, and for the people of Banyuurip Village, there is no entrance fee. Researchers or students doing KKN

or PKM are charged a one-time entrance fee at the beginning of their arrival to ecotourism. Meanwhile, the ticket price for the ferry boat attraction is IDR 5,000 (Figure 6). The economic variable that most influences the sustainability of BMC's ecotourism business is the government budget in ecotourism management. Nawawi et al., 2017 delineates that the role of the government is essential to make and implement mangrove management policies.

Awareness of tourists and the public towards sustainability is an essential element in the sustainability of ecotourism businesses. One of the simplest things is to maintain cleanliness when traveling. The management of ecotourism cleanliness does not have a specific schedule for each day. The managers, fishers, village government officials, youth organizations, PKK, and the surrounding community work together to clean up trash in ecotourism areas only on special occasions such as Cleaning on Friday, which is carried out twice or once a month. Institutional and community participation are essential aspects that are the main pillars in implementing mangrove rehabilitation. There are two types of trash cans at BMC tourist sites, especially at the jogging track: trash cans made of wood and plastic with four pieces each. Trash cans are not available along the jogging track but are only available along with the gazebo. The distance between the trash cans in the jogging track area is 5 and 15 meters long. Meanwhile, along the driveway after the BMC entrance gate, there are seven iron trash cans, three rubber tires, and one wooden trash can. The distance between the trash cans in this area is about 10 meters.

Active community participation is needed for sustainable mangrove management (Ounvichit and Yoddumnern-Attig, 2018). According to Figure 7, community participation and several stakeholder roles such as SKK Migas, PT Bharata, and Universities are essential. They are the main pillars and the key to success in mangrove forest conservation in Banyuurip Village, Ujungpangkah District, Gresik Regency, directed to the Banyuurip Mangrove Center (BMC). Community awareness and participation and the role of stakeholders in the proper management of mangrove conservation in Banyuurip Village is a form of positive participation (Trisbiantoro and Kusyairi, 2018). The BMC Instagram account, "bmcenter," and the Facebook account, "Banyuurip Mangrove Center," are intended to promote ecotourism. There is also a television station, RCTI, which broadcasted BMC ecotourism in 2018. The social component that has the most significant influence on the sustainability of BMC's ecotourism business is tourist and community awareness of sustainability. Juhadi et al., 2020 delineates that local communities' participation in the establishment and development of mangrove forest resources is inextricably linked to their awareness to manage mangrove forests sustainably. The presence of a mangrove forest that has been well-maintained by the community and supported by the local government attracts various people's attention and is being used as an edu-ecotourism destination. The BMC Tourism concept carries the theme of mangroves and green shells as tourism advantages. The areas that will be developed in BMC tourism are as follows: 1) BMC entrance gate, 2) large parking area, 3) beautiful and leafy entrance, 4) relaxing seating for visitors, 5) modern fish auction place, 6) decorative lights processed by green shells, 7) playground for children, 8) flower garden, 9) pine garden, 10) ticket sales, 11) jogging track, 12) souvenir shop typical of Banyu Urip Village, 13) seafood restaurant, 14) green mussel cultivation, 15) prayer room, 16) toilet, 17) lighthouse tower. Figure 9 shows the proposed design concept for the BMC Tourism area. The figure shows a bridge connecting BMC tourism with the northern boundary planned to be built by BEP (Banyuurip Education Park) (Setyaningrum et al., 2021). The construction of environmentally-friendly facilities is the technology and infrastructure variable that significantly impacts the sustainability of BMC's ecotourism business. Wahyuni et al., 2015 suggested that increasing efforts to conserve mangrove forests can be conducted by local governments and managers and coordinated with Nature Lovers activity units or student organizations from various universities. These various activities aim to develop sustainable ecotourism that is environmentally friendly. Intyas et al., 2021b examples of mangrove ecotourism in East Java that add attractions besides mangroves are Beejay Bakau Resort Ecotourism Probolinggo has modern artificial tours, Kampung Blekok Ecotourism Situbondo based on the conservation of mangroves and Blekok Birds also Pancer Cengkrong Trenggalek has pigeons feeding and crab cultivation.

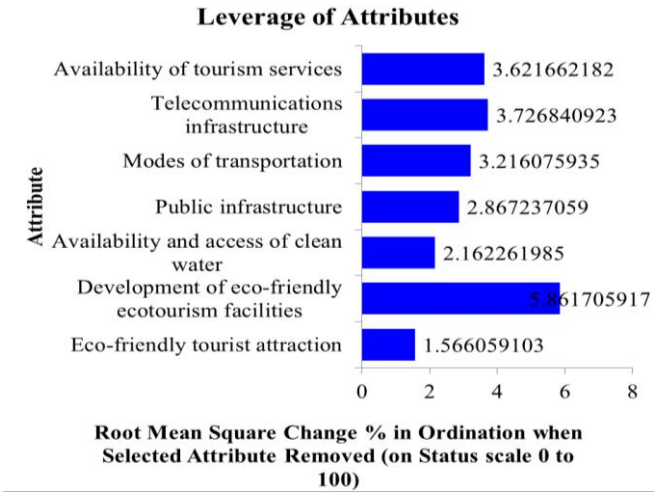

Figure 8. Leverage Technology and Infrastructure
(Source: Research Data Analysis, 2021)

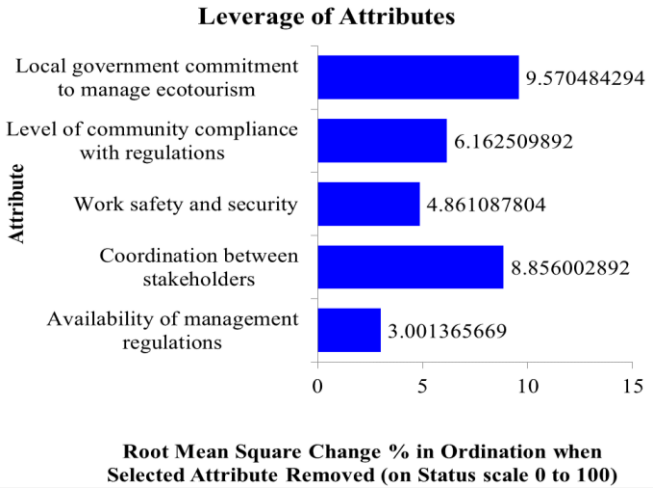

Figure 9. Legal and Institutional Leverage
(Source: Research Data Analysis, 2021)

Based on Figure 8, the management carries out the security system in ecotourism for visitor vehicles and acts as a counter guard because the parking lot and the ecotourism entrance counter are adjacent. Since the opening of ecotourism,

there has been no theft incident in the ecotourism area. It shows that the level of security is guaranteed. In addition, visitors are required to submit a parking ticket when returning to the counter guard to provide guarantees to visitors for the safety of their vehicle. Security for two-wheeled vehicles has provided an adequate parking space with an asbestos roof, while for 4-wheeled vehicles, it is still a field without a roof. For the level of safety at the mangrove fringing attraction, the manager has provided ten floats for passengers. However, this is still not going well because the manager does not require passengers to use it. On the other hand, the wet condition of some buoys makes passengers reluctant to use them, and the availability of several buoys is less than the number of boat passengers. Hence, the buoys provided are not enough. In addition, the boat used for cruising the mangroves is still new, and the boat driver is the manager of the BMC. so that it can be ensured safe for passengers. Regarding safety in the mangrove fringing, the driver also warned using a whistle for passengers sitting in the dangerous part of the boat to move to a safer place.

The regulations for visiting the BMC are as follows: 1) it is forbidden to throw garbage in any place, 2) it is forbidden to sit on the fence of the mangrove tracking bridge, 3) it is forbidden to damage the mangrove plants and even cut down 4) it is forbidden to sell in the mangrove tracking area unless the owner/ land managers, 5) are prohibited from carrying firearms and sharp weapons, 6) are prohibited from carrying alcoholic beverages and illegal drugs, 7) are prohibited from committing lewd acts at mangrove tracking locations, and 8) if this regulation is violated, it will be subject to sanctions in the form of fines of RP 100,000 and will be handed over to the securities. The legal and institutional variables (Figure 9), that most influence the sustainability of the BMC ecotourism business are the government's commitment. Rodiyah and Agustina, 2018 reported that the Sidoarjo Regency Government has gained trustworthiness and goodwill, which must be followed by consistency following the creation of the ecotourism concept. The planting of mangrove seedlings is also a manifestation of the government's continued commitment to expanding ecotourism programs. The government engages the community by planting up to 200,000 mangrove seedlings on Sidoarjo's coast every year. The planting attempts to limit abrasion and avoid tidal flooding, affecting Sidoarjo's coastal area.

Monte Carlo analysis is used to evaluate the effect of random errors performed to estimate the value of the ordinance used. Monte Carlo analysis is also helpful for studying the effect of attribute scoring errors, data entry errors, or missing data (Kurniawan et al., 2016). The results of the Monte Carlo analysis (Table 3), show that the value of the sustainability status of the BMC ecotourism business is not significantly different from the MDS Rapfish result analysis. The Monte Carlo analysis in this study was carried out for 25 repetitions, showing a relatively small difference in results. It did not show a significant difference, so the determination of ordinance was able to overcome random errors due to errors in attribute scoring due to differences in assessments by different researchers or as a result of data entry errors. As a result, it can be concluded that the research on the sustainability of the BMC ecotourism business is based on an appropriate and valid model.

Table 3. Comparison of MDS with MC
(Source: Research Data Analysis, 2021)

Dimension	MDS	MC	Difference
Ecology	51.2842	50.9006	0.38363
Economy	49.1090	48.9971	0.11186
Social	54.5966	54.2925	0.30408
Technology and Infrastructure	53.9835	53.5571	0.42643
Legal and Institutional	52.8488	53.2765	0.42771

Table 4. Stress Value and RSQ
(Source: Research Data Analysis, 2021)

Dimension	Stress	RSQ
Ecology	0.146467	0.94590
Economy	0.145028	0.94739
Social	0.164493	0.93777
Technology and Infrastructure	0.149968	0.94589
Legal and Institutional	0.154705	0.94194

The accuracy of the Multidimensional Scaling Rap-ecotourism analysis is determined by the S-Stress value generated from the calculation of the S value. A low S-Stress value indicates high accuracy (goodness of fit), while a high S-Stress value indicates the opposite. In this Rap-beach tour, a good model (Table 4) is shown by the S-Stress value, which is smaller than 0.25 (<25%) with the coefficient of determination (R^2) approaching 1.0 or 100%, on the contrary, if the S-Stress value is higher than 0.25 or 25%, then the results of the Multidimensional Scaling (MDS) calculation have low accuracy (Suwarno et al., 2011). The S-stress value of the five sustainability dimensions shows a result of 0.25 with a squared correlation (RSQ) value close to 1.00 or in the interval 0.90 – 0.95. Thus, all of the attributes used to analyze the mangrove ecotourism business's sustainability adequately describe the five dimensions analyzed.

Sustainable Mangrove Ecotourism Business Management Strategy

The main strengths in the internal factors of mangrove ecotourism in Klong Kone, Thailand is the income associated with nature-supporting tourism, and the main weakness is the awareness and understanding of local stakeholders about ecological mechanisms while the main opportunities in the external factors are incurred from tourism policies also community relations and the main threats are from urban planning and pollution from nearby areas (Swangjang and Kornpiphat, 2021). Identification of internal and external factors in preparing management strategies are based on the Focus Group Discussion (FGD) to determine strengths, weaknesses, opportunities, and threats. The data and information obtained from the identification results are processed into the IFAS and EFAS matrix. The result of multiplying the relative weight with the rating produces a score. The score measures the influence level in the internal or external environment and between the external environment (Table 5). The calculation results between the internal and external environment resulted in the value of the internal environment being more influential than the external environment in managing mangrove ecotourism businesses. The x-coordinate is obtained from the difference between strengths and weaknesses. The y-coordinate is obtained from the difference between opportunities and threats. The two environments produced positive values so that the quadrant area was in Region I (one) with coordinates (1,157; 1,444) and demonstrated an aggressive strategy (Figure 10).

Table 5. IFAS and EFAS Mangrove Ecotourism Business Management (Source: Research Data Analysis, 2021)

No	Strength	Weight	Rate	Score		No	Opportunity	Weight	Rate	Score
1	S1	0.037	2	0.074		1	O1	0.051	2	0.102
2	S2	0.108	3	0.325		2	O2	0.104	3	0.311
3	S3	0.083	3	0.248		3	O3	0.057	2	0.114
4	S4	0.074	2	0.149		4	O4	0.058	2	0.115
5	S5	0.095	3	0.284		5	O5	0.134	3	0.402
6	S6	0.021	2	0.042		6	O6	0.075	2	0.150
7	S7	0.052	2	0.103		7	O7	0.045	3	0.134
8	S8	0.081	3	0.243		8	O8	0.052	2	0.103
9	S9	0.063	3	0.190		9	O9	0.050	2	0.100
10	S10	0.078	3	0.235		10	O10	0.133	3	0.398
				1.892						1.930
No	Weakness	Weight	Rate	Score		No	Threat	Weight	Rate	Score
1	W1	0.018	2	0.036		1	T1	0.060	2	0.121
2	W2	0.029	2	0.058		2	T2	0.029	2	0.058
3	W3	0.038	2	0.077		3	T3	0.068	2	0.135
4	W4	0.040	2	0.080		4	T4	0.085	2	0.171
5	W5	0.118	3	0.355						0.485
6	W6	0.065	2	0.130						
				0.734						

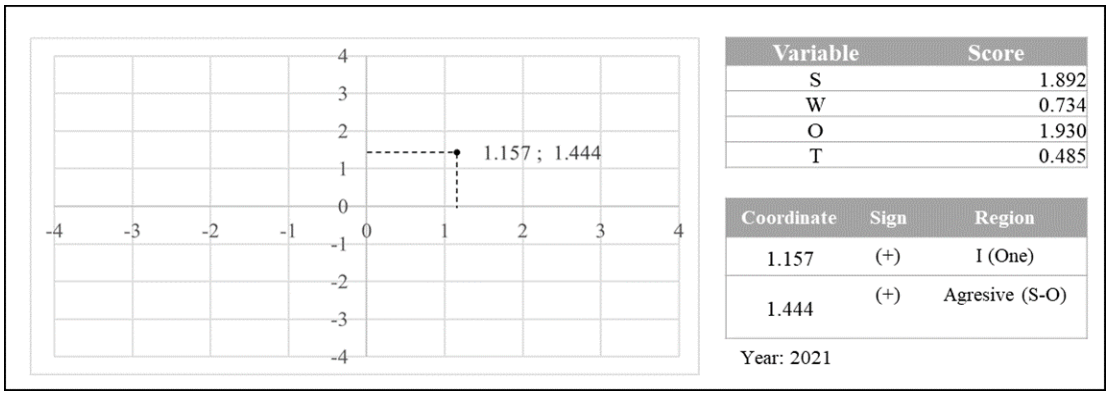

Figure 10. SWOT Analysis (Grand Strategy Matrix) (Source: Research Data Analysis, 2021)

The SWOT matrix in determining the strategy to be implemented was divided into four parts: S-O, W-O, S-T, and W-T. Based on the calculation results, the S-T strategy was selected and executed.

	S	W
O	S-O Strategy: Improving the quality of mangrove ecotourism products by utilizing local wisdom and ecological characteristics (S1, S2, S3, S4, S6, S10, O1, O3, O4, O5, O6) Improving the quality of human resources to manage and produce competitive ecotourism products (S7, S8, S9, O3, O4, O6) Improving and developing the main and supporting mangrove ecotourism facilities with environmentally friendly technology (S1, S3, S4, S5, S6, S10, O2, O4, O7, O8, O9, O10)	W-O Strategy: Coordinating with relevant stakeholders for mangrove ecotourism management (W5, O10) Utilizing information technology and holding a training organized by the government and non-government to develop the quality of human resources (S1, O8) Utilizing community involvement in managing mangrove ecotourism (S2, S3, S4, S6, O3, O5, O6)
T	S-T Strategy: Executing mangrove rehabilitation independently to minimize abrasion (S1, S4, T1) Diversifying ecotourism products so that trading can be distributed evenly and do not dominate in the same product to minimize conflict (S7, S8, O2) Conducting socialization and counseling regarding the functions and benefits of mangroves (S1, S2, S4, S9, T3, T4)	W-T Strategy: Optimizing the role of the community and the role of the government in managing mangrove ecotourism (W1, W5, T2, T3, T4) Utilizing local wisdom to manage mangrove ecotourism (W4, T2, T3, T4) Optimizing natural seeds to repair damaged mangroves (W6, O1)

Efforts to achieve a sustainable mangrove ecotourism management strategy with the S-O strategy include:

a. Improving the quality of mangrove ecotourism products by utilizing local wisdom and ecological characteristics, such as:

1. Implementing management based on ecotourism principles;
2. Regulating mangrove planting based on regional characteristics;
3. Setting the schedule and number of tourist visits;
4. Developing independent mangrove nurseries to produce quality mangrove seedlings;
5. Developing ecotourism attractions that utilize and maintain ecological sustainability and local culture;

6. Applying appropriate technology in developing and utilizing ecotourism to overcome the declining environmental carrying capacity;
7. Making use of spatial planning for mangrove planting sustainably so that the potential of the land can be optimized according to the carrying capacity of the environment.

b. Improving the quality of human resources to manage and produce competitive ecotourism products, including:

1. Training to improve the skills of promotion technology and environmentally friendly technology;
2. Increasing the number and quality of courses and training on mangrove ecotourism management;
3. Increasing counseling for technology mastery in ecotourism management to produce tourism products that can compete in regional, national, and international markets;
4. Implementing continuous monitoring of mangroves;
5. Increasing the number and quality of extension workers and state apparatus in ecotourism management;
6. Improving managers' skills, skills, and abilities to increase productivity;
7. Developing regulations that can improve the sustainability of mangrove ecotourism;
8. Synergizing between the community, government, and managers related to ecotourism management.

c. Improving and developing the main and supporting mangrove ecotourism facilities with environmentally friendly technology, including:

1. Procurement of main and supporting ecotourism facilities from local governments or private parties by implementing a profit-sharing system.
2. Building physical facilities by considering ecological sustainability and using environmentally friendly raw materials.
3. Developing ecotourism facilities that can increase community involvement, skills, and economy in souvenir shops, food shops, and other facilities.

CONCLUSION

The local government of the Gresik Regency is committed to managing and developing mangrove ecotourism by allocating a particular budget for BMC ecotourism. The role of the government, management, and stakeholders in the development of ecotourism is to develop environmentally-friendly tourist attractions and plant mangrove trees every year. Furthermore, mangroves must be protected by raising public awareness and refraining from damaging actions. Even though BMC ecotourism is moderately sustainable, it still needs perpetual management and development.

The long-term management strategy that can be carried out is improving and developing product quality, human resources, and mangrove ecotourism facilities while maintaining ecological sustainability. This research suggested that the government needs to commit to managing and developing BMC ecotourism sustainably. In the short-term, the management needs to develop mangrove tree nurseries, continue rehabilitating mangroves, then continue in the medium term that needs to promote tourist visits to BMC while adhering to ecotourism principles.

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