



Analyzing the development of Payangan Beach mangrove ecotourism in Indonesia

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Abstract. The development of ecotourism helps produce tourism responsible for preserving nature and local culture by considering the principles of ecotourism, namely: conservation, education, economy, participation, and tourism. This study aimed to analyze the development of mangrove ecotourism at Payangan Beach, Jember, Indonesia. The analysis in this study uses the Analytical Hierarchy Process and Ecotourism Suitability Analysis. The priority when developing the Payangan Beach ecotourism is to rehabilitate and conserve mangroves that have been damaged by abrasion and predators. The second stage utilizes local government support to provide permits or legalization in ecotourism management. After obtaining a permit, the manager can develop tourism products by utilizing endemic flora and fauna that consider ecological sustainability. Community participation in ecotourism development is needed to preserve or protect ecotourism areas and influence the income of involved people. The final stage in development is promotion because permits, tourism products, and community participation are already underway.

Key Words: conservation, community participation, rehabilitation, tourism products.

Introduction. The development of tourism in Indonesia is substantial and diverse. Thus, it can be developed further to be more attractive and become one of the leading destinations for world tourism. Currently, tourists prefer nature tourism combined with community participation in culture and society. Social interaction in the world of tourism is a need that must be met as part of tourism development (Ridlwani et al 2017). Tourism development has significant value and benefits for the progress of other sectors. However, developing tourism requires many activities that can harm the environment. Ecological or sustainable tourism development can be used to establish a tourism concept based on the region's uniqueness and condition to limit the risk or negative impact of tourism development (Susilawati 2008). The shift in the concept of world tourism to an ecotourism model is due to the saturation of tourists visiting artificial tourism objectives. Therefore, this opportunity should be utilized optimally to attract tourists to visit natural and cultural-based objectives of the local population (Abdoellah et al 2019).

Ecotourism is a combination of conservation and tourism, where income earned from tourism should be returned to areas that need protection and preservation of biodiversity and the socio-economic improvement of the surrounding community (Herman & Supriadi 2017), and aspects of learning and education (Pulungan 2013). The scope of tourism is limited as opposed to the concept of mass tourism. According to conservation principles in the ecotourism environment, this limited tourism scope can limit the number of visitors, visiting time, or access to resources (Purnomo 2020). Therefore, ecotourism deserves to be managed and developed so that its sustainability will continue to exist in the future. One of the ecotourism objectives that should be developed and managed is the mangrove forest, since the quality of mangrove forests is currently starting to be threatened. Therefore, well and wise handling and management are needed (Safuridar & Andiny 2020). Formerly, mangroves were limited to their ecological functions, but they have been widely developed in the tourism sector (Firawahyudi & Sofyan 2019).

The mangrove ecosystem is a unique and exciting coastal ecosystem that directly or indirectly contributes to people's lives and has high economic value. Mangrove forests have aesthetic value and offer tourism different from other natural attractions (Safuridar & Andiny 2020). Innovative efforts in utilizing all the potential of the mangrove ecosystem are carried out to improve the welfare of the local community while maintaining sustainability through the superior characteristics of its natural resources in ecotourism products (Nugroho et al 2019). Community-based ecotourism is very relevant to tourism development by involving the community directly and holding the key to its development (Asy'ari et al 2021).

Payangan Beach mangrove management is carried out by the Lumba-Lumba Joint Business Group (JBG). Efforts to rehabilitate mangroves at Payangan Beach, covering an area of 5 ha in 2015-2021, include planting 49000 trees. The rehabilitation was carried out because the mangroves were damaged and not appropriately managed, so the Lumba-Lumba JBG carried out reforestation and mangrove planting. The Payangan Beach Mangrove is useful for storing seawater and preventing flooding, it acts as a wave damper, and protects from storm winds, so that ships are not damaged when parked on the shore near Love Bay. In addition, the reason for rehabilitation is that mangrove forests produce economic value for fishermen, produce detritus from mangrove tree leaves and branches, are areas for foraging, and spawning areas for fish and another aquatic biota. Agencies that contribute to planting mangrove trees include Brawijaya University, SDI Mandala, Jember University, Jember Polytechnic, Bank Indonesia, PLN, Jember Pedal Community, and the Muhammadiyah University of Jember. The Payangan Beach mangrove management plan includes a bridge, a prayer room in the mangroves, trashcans, and an entrance ticket counter, built in an environmentally friendly manner. Masud et al (2020) stated that tourism suitability is essential to assess the development of mangrove tourism in using natural resources and the environment. The presence of tourists in ecotourism allows residents to earn alternative incomes by becoming tour guides, porters, opening homestays, ecotourism huts, stalls, and other businesses related to ecotourism to improve their welfare or improve the quality of life materially, spiritually, culturally, and intellectually (Kurniasari et al 2013). Based on the background, this study aims to analyze the development of mangrove ecotourism at Payangan Beach, Jember, Indonesia.

Material and Method. This research was conducted in the mangrove area of Payangan Beach, Jember Regency, Indonesia, from May to November 2021. Respondents in this study used purposive sampling, with a questionnaire, interviewing 25 people from mangrove managers, the Tourism Office, the Livestock, Fishery and Marine Service, Village Heads, and related stakeholders.

Biota data collection was conducted by using the visual method. Biota was observed directly at each observation station and captured using fishing aids. The captured biota was then identified using an identification book (Latupapua et al 2019). Species density is the number of individuals of species *i* in a unit area expressed by the formula:

$$K = \frac{n_i}{A}$$

The total density is the number of all individual mangroves in a unit area expressed in the formula:

$$KT = \frac{\sum n}{A}$$

Where: K - density *i*; KT - total density; A - total area of the sampling area (area of sample plot); n_i - total number of individuals of type *i*; n - total number of stands of all species.

The mangrove tourism category considers five parameters (Table 1) with two assessment classifications:

$$IKW = \sum \left(\frac{N_i}{N_{maks}} \right) \times 100\%$$

Where: IKW - mangrove tourism suitability index; N_i - the i parameter value (weight x score); N_{maks} - maximum value of a tourism category; the maximum value can be 39; if the index value is between 75–100%, then tourism can be considered suitable; if the index value is between 50-75%, the tourism can be considered conditionally suitable; if the value is less than 50%, tourism is not suitable.

Table 1

Parameters, weights, categories, and ecotourism suitability scores

No	Parameter	Weight	Category	Score
1	Mangrove thickness (m)	5	> 500	3
			> 200-500	2
			50-200	1
			< 50	0
2	Mangrove density (100 m ²)	3	> 15-20	3
			> 10-15	2
			5-10	1
			< 5	0
3	Mangrove species	3	> 5	3
			3-5	2
			1-2	1
			0	0
4	Tides (m)	1	0-1	3
			> 1-2	2
			> 2-5	1
			> 5	0
5	Objects (biota)	1	Fish, shrimp, crabs, mollusks, reptiles, birds	3
			Fish, shrimp, crab, mollusk	2
			Fish, mollusk	1
			the aquatic biota	0

Note: source - Yulius et al (2018).

Prioritizing the development of Payangan Beach mangrove ecotourism is made through the Process Hierarchy Analysis (AHP), through 11 stages, namely:

1. Determine the goals in the priority of ecotourism development.
2. Criteria and alternative policies for AHP use the theory of ecotourism development, which is then carried out by expert FGDs.
3. Arrange these criteria in the form of a paired matrix.
4. Sum the column matrix.
5. Calculate the value of the criteria column elements with the formula for each column element divided by the number of column matrices.
6. Calculate the priority value of the criteria with the formula for adding up the row matrix of the results of step 4 and the result of step 5 divided by the number of criteria.
7. Test the consistency of each paired matrix with the formula for each paired matrix element multiplied by the priority value of the criteria. The results of each row are added up. Each priority value of the criteria is as much as $\lambda_1, \lambda_2, \lambda_3, \dots, \lambda_n$. Calculate the maximum Lambda value with the formula:

$$\lambda_{max} = \frac{\sum \lambda}{n}$$

8. Calculate the consistency index (CI) with the formula:

$$CI = \frac{\lambda_{max} - n}{n - 1}$$

9. Calculating the Consistency Ratio (CR) with the formula:

$$CR = \frac{CI}{RI}$$

If $CR < 0.1$, then the pairwise comparison value in the given criteria matrix is consistent.

10. Compile a row matrix between criteria whose contents result from the calculation processes in steps 4, step 5, and step 6.

11. The final result is a global priority, as the value used by decision-makers is based on the highest value.

Calculations of AHP with Expert Choice 11 software with hierarchy and variables are presented in Table 2.

Table 2

Hierarchy and variables in AHP analysis

No	Hierarchy	Variables
1	Goal	Developing Payangan Beach mangrove ecotourism
2	Criteria	Suitability of mangroves for ecotourism Mangrove ecotourism attraction
3	Alternative policy	Mangrove ecotourism facilities and infrastructure Improving mangrove conservation and rehabilitation Improving the participation and quality of groups and communities Utilizing financial and non-financial capital support from the city government, related agencies, other institutions, and universities Developing tourism products by utilizing the availability of existing flora and fauna vegetation as well as artificial tourist attractions Promoting through print and electronic media

Results and Discussion. Ecotourism development requires an assessment of the potential diversity of flora and fauna in mangrove ecosystems based on ecological suitability parameters to minimize the impact of ecotourism activities (Rodiana et al 2019). There must be good management of the potential to use the existing tourist attraction components as tourism support (Putra & Sunarta 2019). In addition, the way to increase the level of tourist visits is to build and improve tourism infrastructure through innovations that combine cultural elements with tourism infrastructure (Ghani 2017). Based on this theoretical study, the factors for developing Payangan mangrove ecotourism are ecological suitability, attractiveness, and infrastructure.

Payangan Beach mangrove ecotourism suitability. The highest thickness was found at station 1 at 510 m, while the lowest is at station 3 at 35 m. Thus, in station 1, according to the thickness value, the Payangan Beach mangrove area is very suitable for ecotourism (Table 3).

Table 3

The thickness of the *Payangan* beach mangrove

Observation station	Thickness (m)
1	510
2	165
3	35

Payangan Beach mangrove tourism has three species of mangroves (Table 4), namely: *Rhizophora apiculata*, *Rhizophora mucronata*, and *Sonneratia caseolaris*. They belong to the *Rhizophoraceae* and *Lythraceae* families. The most common mangrove species found and widespread in Payangan Beach are *R. apiculata* and *R. mucronata*.

Table 4

Distribution of mangrove species in Payangan Beach

Mangrove species	Station		
	1	2	3
<i>Rhizophora apiculata</i>	+++	+++	+++
<i>Rhizophora mucronata</i>	+++	++	+++
<i>Sonneratia caseolaris</i>	++	++	+++

Note: (-) - not found; (+) - scarce: 1-10 individuals; (++) - moderate: 11-20 individuals, (+++) - abundant; more than 20 individuals.

Mangrove ecosystems have different abundances of species (Table 5). The highest density at station 2 is 80 trees per 100 m⁻², and the lowest density was 30 trees per 100 m⁻² at station 3. Stations 2 and 3 are rehabilitated mangrove areas. Meanwhile, Station 1 is at the river's estuary, can be reached by boat, and is adjacent to the Love Bay beach, far from community activities. Station 3 is close to residential areas, like a parking lot for fishing boats, fishing net embroidery activities, and shrimp farming activities by Sabrang residents as well as near parking lots, close to cow and goat stables owned by residents, and near community residential houses.

Table 5

Mangrove density at Payangan Beach

Mangrove species	Tree density (per station)		
	1	2	3
<i>Rhizophora apiculata</i>	21	60	8
<i>Rhizophora mucronata</i>	42	16	8
<i>Sonneratia caseolaris</i>	7	4	15
Total	70	80	31
Total per station (ind 100 m ⁻²)	23	27	10

Information on tidal conditions in the Payangan Beach mangrove ecotourism area obtained from the Geospatial Information Agency (GIA) illustrates that, in a day, there are two high tides and two low tides with different sea levels and periods (Figure 1). The results of the tidal analysis for August 2021 observed the first lowest ebb at 00:00–01:00, around 0.451–0.796 m. Meanwhile, the tide's peak is between 06:00–07:00 WIB with the water level between 0.108–0.266 m. The second-lowest low tide is between 12:00–13:00 WIB at around 0.347–0.782 m; then the water level rises again and between 18:00–19:00 WIB is the peak of high tide with a sea level around 0.569–0.964 m.

Mangrove fauna/biota includes mammals, birds, reptiles, amphibians, fish, crustaceans, mollusks, and other invertebrates that all live and associate in the mangrove ecosystem. Mangrove ecosystems provide food, shelter, spawning, and nursery grounds for this fauna (Nugroho et al 2019). The mangrove area in Payangan Beach, based on the results of field observations and interviews with the community, has

various types of fauna/biota consisting of aquatic biota and terrestrial fauna. The most common aquatic biota encountered at the research site were the mudskipper, mangrove crabs, and Trasi shrimps (Table 6).

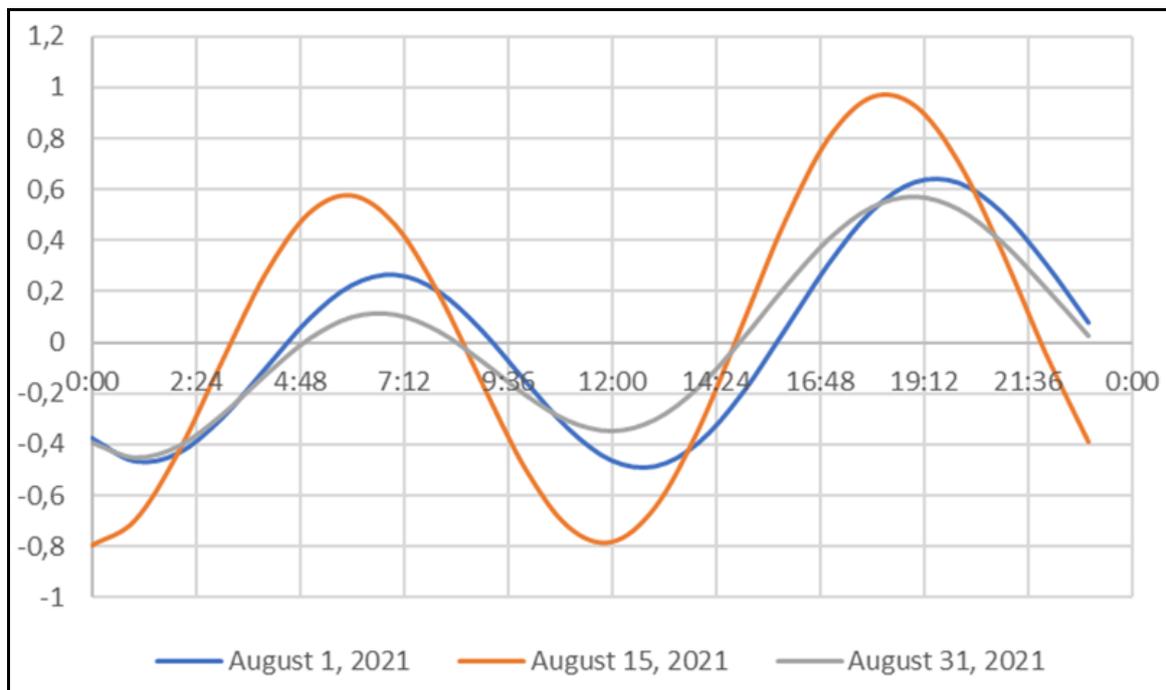


Figure 1. The tidal condition of Payangan Beach.

Table 6

Payangan Beach mangrove area

Biota	Local name	Scientific name	Station		
			1	2	3
Fish	Gelodok/tembakul (mudskipper)	<i>Oxudercinae</i>	+	+	+
	Belanak (mullet)	<i>Moolgarda seheli</i>	+	+	+
	Kerong-kerong (Jarbua terapon)	<i>Terapon sp.</i>	+	-	-
	Puri (Anchovies)	<i>Stolephorus indicus</i>	+	+	-
	Bandeng (Milkfish)	<i>Chanos chanos</i>	+	+	-
Crustacea	Kepiting bakau (mangrove crab)	<i>Scylla tranquebarica</i>	+	+	-
	Kepiting biola (Fiddler crabs)	<i>Uca</i>	-	+	-
	Kompat atau ketam (mud crabs)	<i>Varuna litterata</i>	+	+	-
	Udang putih (White prawn)	<i>Penaeus merguensis</i>	+	+	+
	Udang rebon (Trasi shrimps)		+	+	-
Molusks	Tiram (Oyster)	<i>Crassostrea gigas</i>	+	-	-
	Kerang bakau (Mangrove scallops)	<i>Telescopium sp.</i>	+	+	+
	Kerang (Shell)	<i>Anadara sp.</i>	+	+	+

Note: (-) - not found; (+) - found.

Bird species that are commonly found are turtledoves (*Streptopelia chinensis*), milky stork (*Mycteria cinerea*), and finches (*Pycnonotus aurigaster*), Javan pond-heron (*Ardeola speciosa*), silver egret (*Egretta intermedia*). At the same time, a rare species is found in

the Srigunting crow (*Dicrurus annectans*). Reptiles and amphibians that are commonly found at the study site include water monitor lizards (*Varanus salvator*), mangrove lizards (*Emonia atrocostata*), lizards (*Eutropis multifasciata*), and various species of snakes such as mangrove snakes (*Boiga dendrophylla*) and water snakes (*Cerberua rynchopa*).

The thicker the mangrove forest, the more attractive it is. Mangroves that are too thick or too rare are not suitable for mangrove tourism. Mangroves with more diverse species will be more attractive to visitors. Not too high tidal conditions are safe for visitors to enjoy mangrove tourism. Mangroves with diverse biota have a better aesthetic value for visitors (Yulius et al 2018). The Tourism Suitability Index (TSI) of mangroves at the study site is presented in Table 7. Based on the TSI, station 1 is included in the appropriate category to be used as a mangrove ecotourism spot, while observations at stations 2 and 3 are in the conditionally appropriate category.

Table 7

The suitability results of the Payangan Beach mangrove tourism area

Parameter	Weight	Observation stations					
		1		2		3	
		Score	Value	Score	Value	Score	Value
Mangrove thickness	5	3	15	1	5	1	5
Mangrove density	3	3	9	3	9	2	6
Mangrove species	3	2	6	2	6	2	6
Tides	1	3	3	3	3	3	3
Biota objects	1	3	3	3	3	3	3
Ni			36		26		23
Value			92.3%		66.7%		58.97%
Category			Fits		Fits conditionally		Fits conditionally

Payangan Watu Ulo mangrove tracking is mangrove vegetation inventorying operation. However, because the Watu Ulo mangrove does not yet have an access bridge, it still has a dirt road with a length of 200-300 m and a width of 20-40 m. This area is suitable for camping to enjoy mangroves and black sand beach views.

Amenities are accommodations including facilities and infrastructure. They include commercial buildings such as hotels, homestays, villas, resorts, and others. However, near the Payangan Beach Mangrove, there are no hotels or villas. If visitors stay overnight, it is advisable to rent a tent for camping on the seafront.

Accessibility represents access to an area or a destination, including air, land, sea transportation, telephone, and internet networks. The access road to Watu Ulo hamlet is through small roads, located far from public transportation routes. In terms of road infrastructure, many access roads in the Watu Ulo hamlet are damaged. Most of the people in this hamlet use land transportation such as motorbikes or bicycles. For communication access, the people in Watu Ulo hamlet use cellular phones, and there is no wired telephone network available.

Ancillaries support tourism, such as management agencies, tourist information centers, travel agents, and stakeholders who play a role in tourism. The Payangan Beach mangrove tourism is managed by the Lumba-Lumba Joint Business Group (JBG) and the surrounding community under the head of the Watu Ulo hamlet, Sumberejo Village Ambulu District. However, visitors are free to access the Payangan Beach mangroves. The manager notifies visitors to pay directly for a small boat if they want to rent. The Minister of Tourism of the Republic of Indonesia regulates ecotourism facilities, and infrastructure standards must include the following elements (Table 8).

The entrance. Regulation of the Minister of Tourism of the Republic of Indonesia Number 3 of 2018 regulates the standard of entrances that must be provided with gates/markers and ease of accessibility for vehicles that want to pass through. The condition of the entrance to the Watu Ulo tourist attraction has a gate as a marker that can be accessed using vehicles such as motorbikes, cars, and buses, and the entrance has been paved.

However, the asphalt condition is not good because there are potholes, and the paving is not evenly distributed at some points.

Table 8

Availability of facilities and infrastructure according to tourism activity standards

No	Facilities and infrastructure	Availability	
		Yes	No
1	Entrance	V	
2	Transportation availability	V	
3	Road signs	V	
4	Communication network	V	
5	Clean water installation		V
6	Waste disposal system		V
7	Parking lot	V	
8	Souvenir shop		V
9	Seat		V
10	Toilet		V
11	Islamic prayer room		V
12	Ticket post		V
13	Clinic		V
14	Food stalls	V	V
15	Rubbish bin		V

Parking lot. Based on the Regulation of the Minister of Tourism and Creative Economy of the Republic of Indonesia Number 27 of 2014, there must be adequate, safe, clean, and well-maintained parking facilities in tourist places. The parking lot at the Watu Ulo hamlet tourist attraction has a reasonably large size. Unfortunately, the parking lot is not provided with shade to prevent the vehicle from hot or rainy weather.

The seats. Standard materials for gazebos or garden benches do not need to be luxurious, but rather focus on the value of beauty and comfort in a relaxed atmosphere (Pahlawan et al 2020). The seating conditions at the Payangan Mangrove tourism spot are comfortable and appropriate. Tourists can use the seats to rest and enjoy the surroundings.

The food stalls. The standard of the restaurant business is providing food and beverages with equipment and supplies for storage and serving in a fixed place (Regulation of the Minister of Tourism and Creative Economy of the Republic of Indonesia Number 12 of 2014). Watu Ulo tourist attraction has many food stalls in good condition. Each food stall offers different scenic spots. The majority of food stalls sell instant food and water catches such as smoked fish.

The road signs. Regulation of the Minister of Tourism of the Republic of Indonesia Number 3 of 2018 states that typical road signs should have an orange background with white fonts, and Gateway Signs and Advance Signs are placed near the entrance. The Payangan Beach Mangrove tourism object has road signs right near the entrance to the Watu Ulo hamlet to make it easier to find tourism attractions.

The transportation availability. Regulation of the Minister of Tourism and Creative Economy of the Republic of Indonesia Number 14 of 2014 also regulates the provision of transportation for tourism needs and activities. The public transportation facilities available at the Watu Ulo mangrove tourism spot are tourism buses, cars, and motorbikes. A homestay is provided as a resting place. However, the condition of the homestay is poor. It can be seen from the inadequate condition of the building.

The boat to explore mangroves. Watu Ulo's mangrove tourism spot provides transportation facilities such as rafts or small boats, which are in good condition, to visit the mangroves and can accommodate 6-8 people. These facilities have met the standard of providing transportation for tourism needs and activities regulated in the Regulation of the Minister of Tourism and Creative Economy of the Republic of Indonesia Number 14 of 2014.

The priority of development according to the criteria for the suitability of mangrove ecotourism should be conservation and rehabilitation (0.394) as essential policies to be implemented. The sustainability of mangrove forests should also be increased, so that the criteria for density, thickness, mangrove species, tides, and biota diversity are suitable for ecotourism development (Figure 2). Latupapua et al (2019) explain that efforts need to be made to rehabilitate and reforestation mangroves in ecologically suitable locations. Thus, the suitability can be achieved by increasing the area of mangroves.



Figure 2. Development priority with ecotourism suitability criteria.

Since the priority of development is for tourism attraction, the most important policy is to carry out conservation and rehabilitation (0.3364) to increase sustainability, because mangrove forests are the main attraction for tourists (Figure 3).

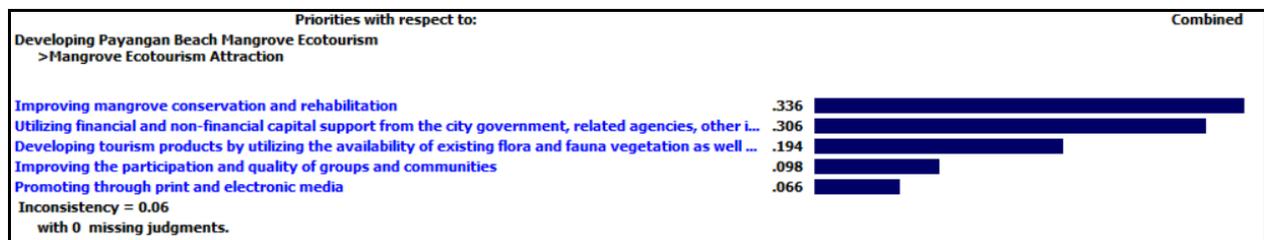


Figure 3. Development priorities with ecotourism attractiveness criteria.

Based on the priority of development through the criteria of ecotourism facilities and infrastructure, the most crucial policy implemented is the development of environmentally friendly tourism products (0.404) to attract tourists (Figure 4).

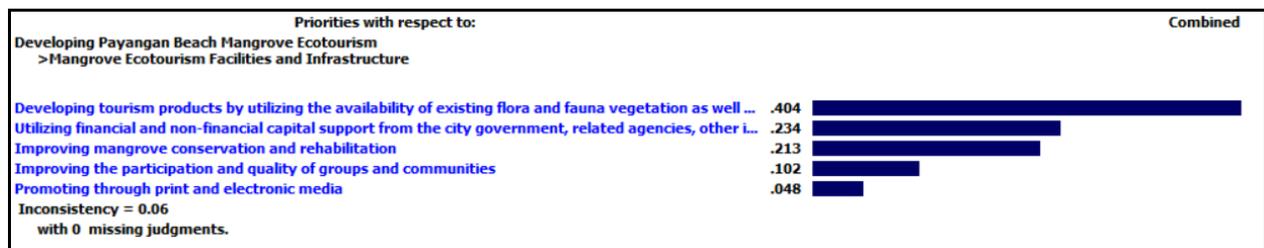


Figure 4. Development priorities with ecotourism attractiveness criteria.

The status of the mangrove is state-owned land, referring to Law Number 2 of 2012 on Land Acquisition in the Public Interest which states that if the area belongs to the Navy,

then there needs to be a negotiation process on the ecotourism design. Unfortunately, there has been no concrete step from the Regency Government to ratify and support the development of ecotourism areas. Institutionally, no one manages Payangan mangroves, and the legality is unclear. However, those who care for the mangrove area are community groups with the Lumba-Lumba JGB. Latupapua et al (2019) reported that government support and attention are substantial for developing facilities and infrastructure that can support mangrove ecotourism activities. Purnomo (2020) added that the government needs to involve the community and provide transparency in managing funds resulting from ecotourism development.

The preservation of mangrove forests through conservation and rehabilitation (0.359) is a major consideration in ecotourism development because natural attraction is the primary consideration for tourists. Government support (0.208) is needed to develop tourism products and services that utilize endemic flora and fauna, namely mangroves and monkeys, by implementing ecotourism principles (0.175). In addition, community participation (0.167) in ecotourism management contributes to preserving the mangrove ecosystem with good awareness and understanding. Promotion (0.091) is carried out if the tourism products offered, the legalization of the use of ecotourism, and community participation have been implemented optimally (Figure 5).

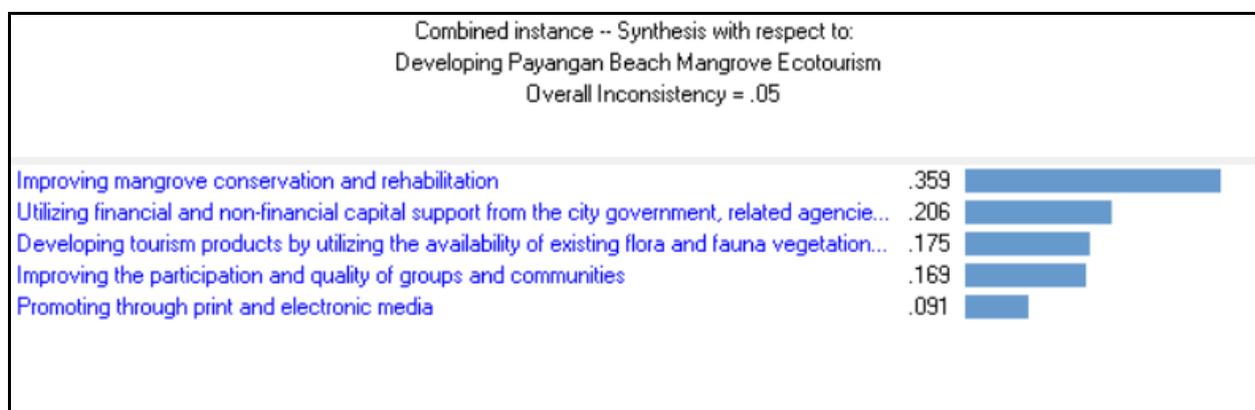


Figure 5. Policy priorities for overall ecotourism development.

The development of ecotourism products in the mangrove area is directed at a special interest in ecotourism, which has elements of mangrove conservation efforts in addition to tourist destinations. Special interest ecotourism activity programs that can be developed are bird watching, animal watching, enjoying the beauty of mangrove vegetation through a wooden bridge (board-walk), fishing, canoeing among mangrove vegetation, and taking photographs of the beauty and uniqueness of the mangrove vegetation and animals (Karlina 2015). In addition, mangrove ecotourism offers mangrove tree plantations or adoption, mangrove educational tours (Utari 2017), viewing towers, jogging tracks, selfie spots, bamboo piers, and suspension bridges (Trisbiantoro et al 2020).

Conclusions. If the mangrove habitat is protected and rehabilitated sustainably and receives legal and financial backing from the government, Payangan Beach mangroves have the potential and possibility to grow into ecotourism. Tourists are not interested in visiting these attractions because the tourism products are not up to par. Community engagement in mangrove ecotourism can help sustain mangroves since the community, both directly and indirectly, benefits from sustainable mangroves. Community-developed tourism products need to be promoted to attract more visitors and raise public awareness. The local government is expected to support the development of Payangan Beach mangrove ecotourism with the principle of sustainable development. It is also essential for the community to raise awareness about maintaining the mangrove ecosystem's cleanliness and refraining from introducing grazing livestock in the mangrove area.

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Conflict of Interest. The authors declare that there is no conflict of interest.

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