



Ecotourism feasibility analysis for sustainable coastal management in a tropical island setting

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ABSTRACT

Background: Bungin Pinungan Beach on Towea Island, Muna Regency, Southeast Sulawesi, possesses high natural ecotourism potential, characterized by ± 3 km of sandy coastline, clear seawater, mangrove stands, and attractive coral reef ecosystems. Although the natural landscape is promising, its development is constrained by limited sea transportation, insufficient basic infrastructure, and a lack of accommodation facilities. This study evaluates the feasibility of developing Bungin Pinungan Beach as an ecotourism destination using the ADO-ODTWA criteria established by the Directorate General of PHKA (2003). **Methods:** The assessment covers seven indicators: attractiveness, accessibility, environmental conditions, facilities and infrastructure, accommodation, safety, and linkages with other tourist attractions. A descriptive qualitative method was used, supported by field observations, questionnaires for visitors and local residents, and visual documentation. The research population consisted of the Lakarama Village community and tourists visiting the site, with samples selected using purposive and accidental sampling techniques. Data were analyzed based on the seven indicators to determine the overall ecotourism feasibility index. **Findings:** The findings show that Bungin Pinungan Beach has a feasibility score of 69.03%, indicating that it is suitable for ecotourism development. High scores were recorded for accessibility (84.03%), environmental conditions (89.77%), and safety (82.43%), demonstrating strong natural and physical support for tourism activities. Meanwhile, the indicators for facilities and infrastructure (40%) and accommodation (41.67%) require major improvements. The attractiveness indicator achieved 77.8%, and linkages with surrounding tourist destinations scored 67.5%. **Conclusion:** Overall, the results indicate that development priorities should focus on enhancing basic facilities and increasing accommodation capacity while maintaining environmental quality and access. It is recommended that local governments, communities, and stakeholders strengthen collaborative management, improve supporting infrastructure, develop community-based homestay services, and promote integrated tourism networks with nearby attractions. **Novelty/Originality of this article:** This study applies the ADO-ODTWA framework to a small island ecotourism site, integrating quantitative feasibility scoring with community-based assessment to provide location-specific development priorities for sustainable coastal tourism planning.

KEYWORDS: accessibility; ADO-ODTWA; coral reef; ecotourism; environmental conditions.

1. Introduction

Tourism is a new type of industry that can generate rapid economic growth in terms of job creation. It increases the standard of living and stimulates other productive sectors (Takome et al., 2021). Tourism plays an important role in a country's economy. This sector can be a significant source of income through foreign exchange, investment, and taxes.

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Tourism also creates new jobs, improves the welfare of local communities, and encourages the growth of related sectors such as hospitality, transportation, and handicrafts. Tourism also plays a role in preserving culture and the environment, as well as promoting a positive image of a country in the eyes of the world. Tourism development is essentially an effort to develop and utilize tourist attractions and attractions that include diverse natural beauty, various types of flora and fauna, arts, culture, traditions, and historical relics. According to Papeo et al. (2024), the main elements that must be considered in tourism development planning include tourists, transportation, attractions/tourist sites, service and information facilities, and promotion. According to Alfianto (2017), the locational factors that influence the development of tourist attraction potential are physical conditions, accessibility, land ownership and use, obstacles and support, and other factors such as labor wages and political stability. Currently, tourist attractions have been introduced as tourist attractions since 2019.

Southeast Sulawesi is one of the provinces that has a variety of tourist attractions. The types of tourist attractions in the Southeast Sulawesi region are divided into four categories, namely heritage, culture, marine, and ecotourism. However, only a few tourist attractions are widely known due to the lack of available information about these tourist attractions, which is one of the factors causing tourist attractions in Southeast Sulawesi to be less known. Many methods have been used to promote the tourism industry, one of which is utilizing information technology to increase the tourism potential of an area (Ali et al., 2020). Southeast Sulawesi Province has various natural tourist attractions that are interesting to visit, one of which is Muna Regency. Muna Regency has several beautiful tourist attractions, including beautiful beaches, blue lakes surrounded by cliffs and small islands, and towering natural rock formations, one of which is Bungin Pinungan Beach, located in Towea District (Fitriyani, 2021).

Bungin Pinungan Beach has enormous potential to be developed as a tourist destination. In addition to being selected as the location for the 2017 film *Jembatan Pensil*, Bungin Pinungan Beach also has several other potentials, including natural beauty with clean white sand, clear sea water, relatively calm waves that allow for the development of water sports activities, unique local culture such as the Ma'dupa tradition in the Bajo tribe's funeral rituals, various other activities such as sunbathing, swimming, fishing, enjoying the scenery, and canoeing that can be enjoyed without disturbance from dangerous animals, and free from noise (Newsome et al., 2012). Issues that may affect its potential as a tourist destination include the lack of transportation to Bungin Pinungan Beach, damage to gazebos on the beach, damage to coral reefs due to human activities such as environmentally unfriendly fishing practices, a lack of environmental awareness, which may reduce its tourist appeal, the remote location of Bungin Pinungan Beach, which limits access, and the lack of facilities and infrastructure such as lodging, public toilets, rest areas, and tourist information centers, which can hinder tourist comfort (Cooper, 2005). Faced with these problems, it is important for the government, local communities, and related parties to work together to improve the condition of Bungin Pinungan Beach by increasing promotion through social media, improving infrastructure, raising environmental awareness through educational activities, and ensuring good coordination in the management of Bungin Pinungan Beach.

2. Methods

2.1 Research location, population, and sample

This research was conducted at Bungin Pinungan Beach, Towea Island, Towea District, Muna Regency, Southeast Sulawesi Province, which is geographically located at 4.500-4.360 LS and 122.41.-121.450 BT from April to July 2025. The population in this study was the entire community of Lakarama Village, Towea District, Muna Regency, totaling 1,284 people, and visitors who carried out activities at Bungin Pinungan Beach, totaling 74 visitors.

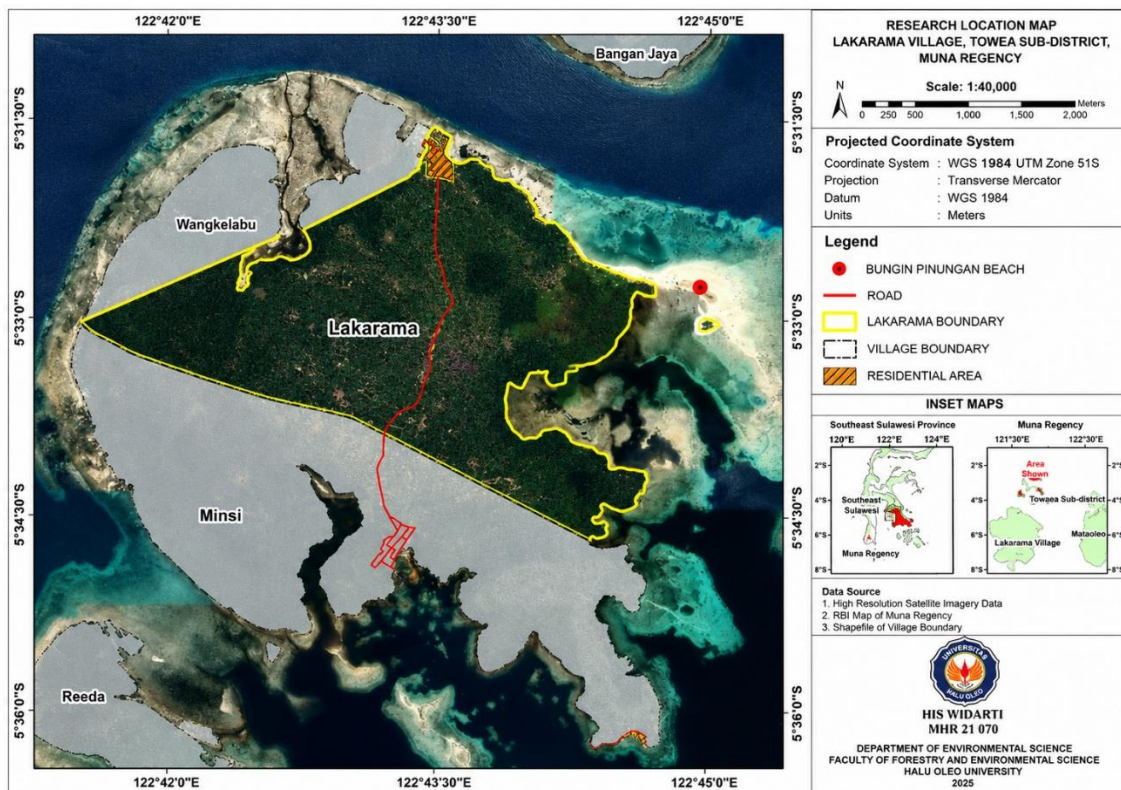


Fig. 1. Research location

The sample in this study consisted of the community in Lakarama Village, visitors, managers, and key persons. The method of determining the community sample was carried out using purposive sampling with the following criteria: a minimum age of 17 years and being a member of the local community. According to Arikunto (2006), if the number of subjects is less than 100, the sample consists of the population. However, if the number of subjects is more than 100, then 10-15%, 15-25%, or more than the population can be taken. Based on the number of people in Lakarama Village who met the criteria, which was 295 people, this study took a sample of 25% of the population of 74 people. The method used in sampling for visitors was accidental sampling, which was conducted at Bungin Pinungan Beach, with 74 respondents. Furthermore, the sample from key persons consisted of 1 traditional leader and 1 manager of Bungin Pinungan Beach Tourism. Singgalen & Prasadja (2025).

2.2 Data types and data collection techniques

The type of data used in this study is descriptive qualitative, which describes the condition of the subject/object to be studied based on apparent facts or as they are. The data used consisted of primary and secondary data. Primary data in this study includes physical observations such as data on attractions, accessibility, accommodation, infrastructure, and security at Bungin Pinungan Beach, Lakarama Village, Towea District, Muna Regency. Secondary data in this study includes supporting data obtained from existing sources, such as in Lakarama Village, which shows that of the total population of 1,284, 641 are male and 643 are female. Based on the level of education, the majority of the population of Lakarama Village, 134 people, do not have an elementary school diploma. The number of residents with an SD/MI diploma reached 543, followed by 204 with an SMP diploma, and 320 with an SMA/MA diploma. Higher levels of education have a much smaller number of residents, such as Diploma I with 0 residents, Diploma II with 2 residents, Diploma III with 10 residents, Bachelor's degree with 69 residents, and Master's degree with 1 resident.

The data collection techniques used in this study are as follows, observation is a technique carried out by researchers by going directly to the field to carefully observe the conditions of the research location so that they can obtain relevant research data. Questionnaires are a data collection technique through face-to-face interviews and direct questions and answers between researchers and informants. This method is used to obtain relevant information. Documentation is a technique used to take photographs or pictures at the research location to obtain data on Bungin Pinungan Beach.

2.3 Variables, data analysis, and feasibility assessment method

The variables used in this study are attractiveness, accessibility, environmental conditions, safety, accommodation, visitor facilities and infrastructure, and relationships with other tourist attractions. The distribution of research variables related to the potential of Bungin Pinungan Beach as an alternative tourist destination is presented in Table 1.

Table 1. Breakdown of variables related to the potential of taipa beach as a tourist attraction

No	Variable	Weight	Indicator	Data Source			
1.	Attractiveness	6	Beautiful scenery on the way to tourist attractions Beautiful views from the tourist attraction to the surrounding area No public traffic to disturb you Cool air, Free from noise No dangerous water currents Free from plant interference Free from disturbing beliefs Free from dangerous animal disturbances, Free from human disturbances No impact from settlements No impact from factories No waste No siltation Clear No graffiti Boating Water skiing Swimming Education Fishing Enjoying the beauty Research Sports Free from unpleasant odors Clear water Cool water Cool air Noise-free	Observation			
	Beauty						
	Safety						
	Water cleanliness						
	Variation of activities						
	Cleanliness and comfort						
2.	Accessibility				5	Road conditions Distance from city Road type Travel time	Observations Documentation
3.	Accommodation				3	Number of accommodations Number of rooms	Observations Documentation
4.	Facilities and				3	Post office Telephone network Community health centers Electricity network Drinking water network	Observations Documentation

	Supporting infrastructure		Restaurants Shopping centers and markets Bank Souvenir and gift shops Public transportation	
5.	Security	5	No trespassing No theft No dangerous diseases No landslides No disturbing animals Clean and cool air No traffic disturbances	Observation Questionnaire
	Comfort		Good visitor services Facilities and infrastructure available No trash	
6.	Environmental conditions	4	Spatial layout of the object area Land status Education level Community attitudes Media exposure	Observation Questionnaire
7.	Relationship with other tourist attractions	1	Non-similar tourism Similar tourism	Observation Questionnaire

(Directorate General of Forest Protection and Nature Conservation, 2003)

Data analysis was conducted using the Tourism Area Feasibility Assessment method with assessment criteria according to the 2003 Ministry of Forestry Guidelines (ADO-ODTWA) in accordance with the predetermined values for each criterion. The objects and attractions that have been assessed are then analyzed according to the scoring criteria of the ADO-ODTWA Ministry of Forestry 2003. The weighting given to each criterion varies. The attraction criterion is given a weight of 6 because it is the main factor for someone to engage in tourism activities. Accessibility is given a weight of 5 because it is an important factor that supports tourists in engaging in tourism activities. Accommodation and facilities/infrastructure are given a weight of 3 because they are supporting factors in tourism activities. Safety and environmental conditions are given a weight of 5, and their relationship with other tourist attractions is given a weight of 1. The total score for one ODTWA assessment criterion can be calculated using the following formula:

$$S = N \times B \tag{Eq. 1}$$

Where *S* refers to the score or value of a criterion, *N* represents the total value of elements in the criteria, and *B* indicates the weight of the value.

The score/value obtained is then compared to the maximum score for a criterion. The suitability index value of a tourist attraction can be calculated using the formula:

$$I = \frac{ST}{SM} \times 100 \tag{Eq. 2}$$

Where *I* represents the index value expressed in percentage form, *ST* is the total score obtained, and *SM* is the maximum possible score.

According to Singgalen & Prasadja (2025), after comparison, a feasibility index in percentage form is obtained. The feasibility index for a natural tourist area is categorized based on its value, where an index greater than 66.6% is considered feasible for development, an index between 33.3% and 66.6% is considered not yet feasible for development, and an index below 33.3% is considered not feasible for development.

3. Results and Discussion

3.1 Assessment of tourism object and attraction potential

Tourism attraction assessment criteria are an instrument for determining the feasibility of an object to be developed as an ecotourism area. The function of the criteria is as a basis for ecotourism development through the determination of criteria elements, weighting, calculation of each sub-element, and the sum of all criteria (Debut, 2003). The assessment criteria used to evaluate the potential and appeal of Bungin Pinungan Beach include appeal, accessibility, community environmental conditions, accommodation, supporting facilities and infrastructure, safety, and its relationship with other tourist attractions.

3.1.1 Attraction

Attractiveness is a factor that makes people want to visit and see firsthand the place that has this attractiveness. The assessment of this attractiveness component aims to determine the types of recreational activities that are in line with the attractiveness and available resources (Arafah & Plamin, 2012). The assessment for the tourism attraction criteria is 6 points. The assessment of the attraction component of Bungin Pinungan Beach, Towea District, Muna Regency, can be seen in Table 2.

Table 2. Assessment results for the attraction of Bungin Pinungan Beach, Towea District, Muna Regency

No (a)	Element/Sub-element (b)	Weight (c)	Score (d)	Total score (cxd)
1	Beauty	6	25	150
2	Comfort	6	23.33	139.38
3	Safety	6	25	150
4	Environmental Cleanliness	6	20.86	125.16
5	Variety of Activities	6	20.86	125.16
6	Environmental Characteristics	6	25	150
	Total Score		140.04	839.7

Table 2 shows that the attractiveness components of the Bungin Pinungan Beach tourist attraction on Towea Island, Towea District, Muna Regency, consist of beauty, comfort, safety, variety of activities, environmental cleanliness, and uniqueness, with a total score of 839.7. The highest scores were for beauty, safety, and uniqueness, each with a score of 25. while the lowest scores were for the elements of activity variety and environmental cleanliness, each at 20.86.

3.1.2 Accessibility

The accessibility studied includes road conditions, distance, road type, and travel time from the city center. Accessibility, such as roads, is very important for tourist attractions that will be visited by tourists. Road conditions, distance from provincial roads, and travel time from the provincial city center to the ecotourism site are also important factors in assessing accessibility (Akiriningsih et al., 2023). The assessment for the accessibility criteria is 5 points. The assessment of the accessibility of the Bungin Pinungan Towea Beach area, Towea Subdistrict, Muna Regency, can be seen in full in Table 3. The accessibility assessment of the Bungin Pinungan Beach tourist attraction received a total score of 503.65, with the highest score of 28.71 for travel time from the city center, where good road conditions will affect travel time and vice versa.

Table 3. Results of the assessment of accessibility in the Bungin Pinungan

No. (a)	Element/Sub-element (b)	Weight (c)	Score (d)	Total score (cxd)
1	Road conditions	5	26.3	131.5
2	Distance from the city	5	25.83	129.15
3	center	5	20	100
4	Road type	5	28.7	143.5
	Travel time from the capital city			
			100.83	503.15

3.1.3 Accommodation

Accommodation is something provided to meet the needs of tourist attractions, such as facilities for resting with food and beverage services or other services (Anugerah, 2024). The assessment elements for the accommodation aspect at the Bungin Pinungan Beach tourist attraction are presented in Table 4. It shows that in the assessment of the accommodation aspect in the Bungin Pinungan Beach tourist area, a total score of 75, with a score of 10 for the number of accommodations and 15 for the number of rooms.

Table 4. Assessment results for accommodation in the Bungin Pinungan Beach Tourism Area

No. (a)	Element/Sub-element (b)	Weight (c)	Score (d)	Total Score* (cxd)
1.	Number of accommodations	3	10	30
2.	Number of rooms	3	15	45
	Total		25	75

3.1.4 Facilities and infrastructure

The supporting facilities and infrastructure in the Bungin Pinungan tourist area, Towea District, Muna Regency, that were assessed are those located within a 75 km radius of the object, as shown in Table 5. It shows that the total score obtained for supporting facilities and infrastructure is 120, with a value of 20 for supporting facilities and infrastructure.

Table 5. Assessment Results for facilities and infrastructure in the Bungin Pinungan Beach Area Bungin Pinungan

No. (a)	Element/Sub-element (b)	Weight (c)	Score (d)	Total score* (cxd)
1.	Facilities	3	20	60
2.	Infrastructure	3	20	60
	Total Score	6	40	120

3.1.5 Safety

The safety criteria in this assessment are weighted at 5. The assessment of the safety of the Bungin Pinungan Beach tourist area can be seen in Table 6. The assessment of the security component in the area consists of two elements, namely visitor safety with a score of 25 and comfort with a score of 24.45, resulting in a total score of 197.8 for the two elements.

Table 6. Assessment results for the safety of Bungin Pinungan Beach

No. (a)	Element/Sub-element (b)	Weight (c)	Score (d)	Total score* (cxd)
1	Security	4	25	100
2	Comfort	4	24.46	97.84
	Total score		49.46	197.84

3.1.6 Community environmental conditions

The assessment of the criteria for the community environmental conditions in the Bungin Pinungan Beach tourist area, Towea District, Muna Regency, is presented in Table 7. Table 7 shows that the highest value for the community environmental conditions criterion is spatial planning of the object area with a value of 30, while the lowest value is in the education level category with a value of 20. Thus, the overall value of all elements is a total score of 673.3.

Table 7. Assessment results of community environmental conditions in the Area Bungin Pinungan Beach Tourism Area

No. (a)	Element / Sub-element (b)	Weight (c)	Score (d)	Total score* (cxd)
1.	Spatial planning of the area	5	30	150
2.	Population livelihoods	5	24.66	123.3
3.	Level of education	5	20	100
4.	Community response	5	30	150
5.	Natural resources	5	30	150
	Total score		134.66	673.3

3.1.7 Relationship with other tourist attractions

The elements assessed in the criteria for relationship with other tourist attractions are based on the existence and number of other tourist attractions with a minimum attractiveness value of 100, within a radius of 75 km from the tourist attraction being assessed (Chaerunissa & Yuniningsih, 2020). The assessment of the criteria for relationship with other tourist attractions in the Bungin Pinungan Beach Tourism Area is presented in Table 8.

Table 8. Assessment results for relationship with other tourist attractions in Bungin Pinungan Beach Tourism Area

No	Name of other tourist attractions	Distance (km)	Value
	Similar		
1.	Indo Island Beach	35	40
2.	Melaura Beach	15	
	Not the same		
1.	Topa Bathing Area	40	95
	Total Score		135

Table 8 shows that the assessment of other tourist attractions in the Bungin Pinungan Beach tourist area includes two similar tourist attractions, namely Indo Island Beach and Melaura Beach, with a score of 45, while the non-similar tourist attraction is Topa Bathing Area with a score of 95, resulting in a total score of 135.

3.2 Feasibility analysis of tourist attractions and appeal of Bungin Pinungan Beach, Towea Subdistrict, Muna Regency

The feasibility of ecotourism potential is assessed based on the ADO-ODTWA guidelines with 7 criteria, namely attractiveness, accessibility, accommodation, visitor facilities and infrastructure, safety, environmental conditions, and relationships with other tourist attractions, which are obtained from direct observation of the research location and then analyzed to determine the feasibility of whether a tourist attraction is feasible, not yet feasible, or not feasible to be developed. The results of the research on these criteria can be seen in Table 9.

Table 9. Assessment results of attractions and appeal of the Pantai Bungin Pinungan area, Muna Regency

No	Research criteria	Weight	Score *	Total Score (B x N) **	Score Max ***	Index Value ****	Level feasibility
1	Attractiveness	6	140.04	840.24	1080	77.8	Suitable
2	Accessibility	5	100.83	504.15	600	84.03	Suitable
3	Accommodation	3	25	75	180	41.67	Not yet eligible
4	Facilities and infrastructure	3	40	120	300	40	Not yet eligible
5	Safety	5	49.46	247.3	300	82.43	Suitable
6	Environmental Environment	5	134.66	673.3	750	89.77	Suitable
7	Relationship with other tourist attractions	1	135	135	200	67.5	Suitable
Feasibility Level						69.03	Suitable

Description:

* Results of assessment of tourist attractions

**Results of the multiplication between weight and score for each criterion

***Highest score for each criterion

****Comparison between total score and highest score in percent

Based on Table 9, the assessment results for the objects and attractions of the Pantai Bungin Pinungan area in Muna Regency show that for each criterion, the environmental condition received the highest score with an index value of 89.77% and was categorized as suitable for development, while the lowest score was in the facilities and infrastructure category with a score of 40% and was also categorized as suitable for development.

3.3 Discussion

Feasibility in tourism is necessary to measure the level of factors in a tourist destination using indicators such as physical conditions, attractiveness, accessibility, facilities, and socioeconomics. According to Suwinto Johan, a feasibility study is a comprehensive and in-depth study of the feasibility of a business. The feasibility of a business refers to the results of comparing all economic factors that will be allocated to a new business or venture with the results that will be obtained within a certain period of time (Nisa & Harjawati, 2019). The physical feasibility of a beach is an important indicator for determining the sustainability of beach tourism. A study of the physical feasibility of a beach can be used as a strategic reference to optimize the potential of Empu Rancak Beach as a beach tourism destination that can offer three attractions to entice tourists. The suitability analysis was conducted using the Tourism Suitability Index (IKW), which describes the physical suitability of Empu Rancak Beach from the perspective of implementing coastal ecotourism (Srimaharani et al., 2024).

In the results of research conducted in the Bungin Pinungan Beach tourist area, as a tourist area with ADO-ODTWA guidelines covering 15 indicators for assessing the potential of tourist attractions, only 7 indicators showed a feasibility score (high or moderate) from the field survey. The seven criteria used as benchmarks in the assessment included attractiveness, accessibility, accommodation, supporting facilities and infrastructure, safety, environmental conditions, and relationships with other tourist attractions. The overall index value for the Bungin Pinungan Beach tourist area indicates that the tourist area has the potential, with a score of 69.03%, to be developed as a tourist area. The community in the Bungin Pinungan Beach tourist area strongly supports the development of the tourist area and is willing to play an active role in its development, resulting in a diverse range of tourist products being offered.

3.3.1 Attraction

Based on the research results, the attraction criteria have a percentage value of 77.8, categorized as suitable for development. The prominent attractions of Bungin Pinungan Beach are its white sand along the coast and clear sea water, unique flora and fauna, and the beautiful scenery around the beach, which is a combination of the sea and mountains, as well as the calm coastal currents that are very suitable for tourists to swim and sail. In addition, Bungin Pinungan Beach is a comfortable place and far from the port. Tourism potential and attractions are among the main factors in tourism development. In general, tourism potential is defined as something that a tourist destination has that attracts many people to visit that place. A tourist attraction may have several potential areas that can be developed. The greater and more numerous the potentials in a tourist attraction, the greater the development opportunities (Gunn & Var, 2002).

The potential of natural tourist attractions and attractions described in the 2003 Directorate General of PHKA Guidelines for the Analysis of Natural Tourist Attractions and Attractions (ADO-ODTWA) are as follows, flora and fauna, namely the potential of flora and fauna in general, with an emphasis on information about unique flora and fauna and their distribution, which have natural tourism appeal. Natural phenomena, namely objects that can be utilized in nature tourism activities, including hot springs, waterfalls, caves, mountain peaks, craters, lakes, rivers, and others. Natural beauty, namely objects that possess natural beauty on land, at sea, and in lakes. Natural beauty can be seen from a panoramic view, a variety of views, the harmony of colors, and the view of the object's surroundings. Uniqueness of natural resources, which are objects that have distinctive natural characteristics in a location that are not found in other locations. Panoramas are objects that have natural scenery in an open and wide area that has natural tourist appeal. Historical relics, which are objects that have historical value, are sacred, and so on. Specific cultural attractions, namely customs and arts that have their own uniqueness and appeal (Senthilkumar, 2022).

3.3.2 Accessibility

Cooper & Emory (1995), as cited in a community service report, also used the aspects of attraction, accessibility, amenities, and ancillary services as a benchmark for the development of a tourist destination. The report applied this theory with a focus on optimizing accessibility (such as the installation of directional signs and identity gates) and amenities to support an ecotourism village. In the context of sustainable ecotourism, accessibility is also an important consideration in the feasibility study process. Research to determine the most suitable location for the development of a tourism village considers information layers such as distance to access roads as one of the key factors.

The assessment criteria for accessibility have a percentage value of 84.03, which is categorized as suitable for development. This assessment is based on several accessibility indicators, such as ease of access to tourist locations, types of transportation available, travel conditions, and travel time. Most respondents stated that even though Bungin Pinungan Beach is located on an island separated from the mainland, the trip to the location can still be reached in a relatively short time. The trip to Bungin Pinungan Beach must be done by sea. Tourists generally depart from Tampo Port to Towea Island, with a travel time of about 30 minutes by chartered boat. However, respondents also highlighted several obstacles, such as the lack of scheduled public transportation, limited chartered boats, and the absence of a dedicated tourist port at the destination. Therefore, although access to the location is considered adequate, the development of transportation facilities and supporting infrastructure is still very much needed to improve the comfort and suitability of the area as a tourist destination.

3.3.3 Accommodation

The results of the accommodation criteria study had a percentage value of 41.47, categorized as not yet suitable for development. This assessment shows that the majority of respondents considered that accommodation facilities were not yet available in the Bungin Pinungan Beach tourist area. Currently, there are no lodgings, hotels, homestays, or rental rooms around the beach. Tourists who come generally only make short visits (one-day trips) without staying overnight at the location. Some respondents also said that if they wanted to stay overnight, visitors had to find accommodation in other villages on Towea Island or return to the mainland, such as in the Tampo area. The lack of accommodation is one of the main obstacles in developing Bungin Pinungan Beach as a more professional tourist destination. Therefore, the provision of accommodation facilities such as homestays or simple lodgings is urgently needed to support tourist comfort and encourage longer stays.

The development of accommodation in ecotourism is not merely about providing lodging, but is a concrete application of the principles of sustainable tourism and ecotourism itself. Its theoretical foundation centers on the concept that accommodation facilities must be designed and operated to minimize negative impacts on the environment, preserve local cultural heritage, and provide direct economic benefits to the local community. The Principles of Ecotourism, as formulated by The International Ecotourism Society (TIES), emphasize responsible travel to natural areas that conserve the environment and improve the well-being of local people. In the context of accommodation, this translates to construction that avoids ecosystem destruction, uses local materials, and employs labor from the surrounding community (Weaver, 2001).

3.3.4 Infrastructure and facilities

The results of the research on infrastructure and facilities criteria have a percentage value of 40, categorized as inadequate after comparing the suitability index in percentages. The lack of facilities such as kiosks, restaurants, damaged gazebos, damaged toilets, and inadequate accessibility to Bungin Pinungan Beach, which requires boats to operate to the location, resulted in a low percentage score. Internet and telephone networks are not available at the tourist site. Facilities and infrastructure are supporting criteria that facilitate tourists' direct or indirect visits to tourist areas. In the feasibility analysis of ecotourism, the adequacy of infrastructure and facilities is a crucial pillar that determines operational sustainability and the environmental impact of the tourism activities themselves. Theoretically, infrastructure refers to basic support systems such as access roads, electricity grids, clean water supply, and waste management systems. Meanwhile, facilities are the elements directly used by tourists, such as information centers, homestays, nature interpretation trails, and sightseeing spots. The difference lies in their nature; infrastructure is the backbone that is often not directly visible to tourists, whereas facilities are the elements that interact directly with them.

The analysis of these two components not only looks at their availability but also at their compliance with the principles of ecotourism sustainability. A study analyzing supporting facilities and infrastructure in tourist destinations found that aspects such as accessibility, security facilities, health facilities, information centers, and layout often still require significant improvement to create an adequate tourist experience that is also environmentally conscious (Daeli & Saragih, 2024). This means that feasibility is not only measured by the presence or absence of facilities but also by their quality, distribution, and integration with the natural landscape. Furthermore, the technical approach in infrastructure planning must prioritize ecosystem conservation. For example, in planning drainage systems and access roads, it is important to consider water resource conservation by implementing regulations on the buffer zones of lakes or rivers as a form of environmental impact mitigation (Hatmoko et al., 2012; Water Resources Management Agency of Bogor City, 2008).

This aligns with the eco-settlement concept in ecotourism development, which emphasizes maintaining ecosystem balance through sustainable infrastructure design, including water and energy management systems and the use of environmentally friendly materials to reduce ecological footprints. The approach also integrates community involvement through local empowerment and environmental education, ensuring that ecotourism development supports both conservation and socio-economic sustainability (Sartohadi et al., 2023; Abdullah et al., 2021; El Moslem Badr, 2022). Therefore, to produce a comprehensive analysis, the feasibility study of ecotourism infrastructure and facilities should not be conducted in isolation. These theories need to be combined with strategic analytical frameworks such as SWOT Analysis (Santiani et al., 2025) to identify the strengths, weaknesses, opportunities, and threats of the existing conditions. Thus, the resulting development recommendations not only address functional needs but also ensure that the existence of such infrastructure and facilities strengthens the conservation and sustainability values that are the heart of ecotourism.

3.3.5 Safety

Safety assessment criteria are crucial for tourist comfort when visiting tourist attractions. The score obtained from the assessment of Bungin Pinungan Beach is 82.43, categorized as suitable for development. The safety assessment of the Bungin Pinungan Beach ecotourism site shows that visitor safety is quite good, with no tree felling, theft, or other dangerous diseases, as well as comfort due to the clean and cool air in the tourist area. This is because the Bungin Pinungan Beach tourist area itself has no industries or factories that could disturb the comfort of tourists or the community around the tourist area; there is no traffic disturbance, no backlash, good community service to visitors, and the availability of adequate facilities and infrastructure. This aligns with the views of Arafah & Flamin (2012) that safety assessments in tourist locations are one of the factors that must be considered when traveling, as this relates to issues of comfort and satisfaction in enjoying the natural surroundings during the journey to the tourist area.

Based on available research, safety and security are a critical component in ecotourism feasibility analysis. It is assessed as a supporting factor that influences tourist experience and the viability of an area for development. In an ecotourism feasibility study, safety and security typically do not stand alone but serve as one indicator within a more comprehensive assessment framework. A study analyzing the feasibility of a Terrace Garden as an ecotourism site used an official guideline known as ADO-ODTWA (Analysis of Natural Tourism Attraction Operational Areas).

3.3.6 Environmental conditions

The results of the research on the environmental condition criteria of the community have a percentage value of 89.77, categorized as feasible for development. Environmental conditions have a significant influence on their involvement in the tourism area sector development. The assessment of the environmental condition component of the community's tourist attraction is categorized as feasible for development. There are five elements in the assessment of the environmental condition criteria for the Bungin Pinungan Beach tourist attraction, namely the spatial layout of the attraction, the livelihoods of the residents, the average education level of the Lakarama Village community (high school/vocational school equivalent), and the community's attitude, which is very supportive of the development of the tourist area.

The development of Bungin Pinungan Beach tourism actually needs to take into account the existence of other similar or dissimilar tourist attractions within a radius of 75 km, so that it can be packaged as a single tourism package that can support visitation rates. This is in line with the statement by Butler (2024) that a shift in the concept of tourism can occur due to tourist saturation. This situation can be an opportunity to introduce other tourist areas to tourists by introducing or promoting nearby tourist attractions.

3.3.7 Relationship with other tourist attractions

The relationship indicator with surrounding tourist attractions scored 67.5%, categorized as feasible for development. This value reflects the potential for tourists to extend their visits by exploring nearby destinations, such as the Topa Baths located about 40 km from Bungin Pinungan Beach. As a freshwater spring that flows into the sea, the Topa Baths offer a different type of attraction, making it complementary to the coastal ecotourism experience. In coastal ecotourism development, linkages between sites follow a broader theoretical framework on how tourism interacts with natural and social systems. Ecotourism is defined as sustainable, nature-based tourism that supports conservation and local benefits through interpretation and education.

The relationship between multiple tourist sites can also be understood through the Common-Pool Resource (CPR) Theory by Ostrom (1990), which highlights the need for collective governance to manage shared resources such as coastlines, coral reefs, and mangroves. Ecological pressure in coastal areas has increased due to the high intensity of tourism activities, leading to disturbances in wildlife, vegetation, and overall environmental quality. Excessive human use accelerates ecosystem degradation through pollution and waste, highlighting the need for coordinated coastal management and greater awareness among communities and visitors to ensure long-term ecosystem sustainability (Kesling, 2025; Truong et al., 2024).

4. Conclusions

This study concludes that the evaluated coastal ecotourism site demonstrates a strong potential for sustainable development, achieving an overall feasibility index of 69.03% under the ADO-ODTWA framework. The highest feasibility indicators were recorded for environmental conditions (89.77%), accessibility (84.03%), and safety (82.43%), reflecting the site's favorable biophysical quality, ease of access, and secure visitor environment. In contrast, low scores in accommodation (41.67%) and supporting infrastructure (40%) underline the need for targeted improvements in lodging facilities, sanitation, and public amenities. The findings highlight that successful coastal ecotourism development requires integrating environmental conservation, socio-economic inclusion, and institutional collaboration into a unified management strategy. Enhancing local participation and strengthening partnerships among government, community groups, and the private sector are essential to achieve both ecological resilience and economic diversification. Moreover, promoting sustainable design principles in infrastructure and community-based accommodation can ensure minimal environmental impact while maximizing local benefits. Overall, this research confirms that with appropriate planning, policy support, and investment in basic facilities, the studied area could serve as a replicable model for sustainable coastal ecotourism in tropical island regions, contributing to broader environmental and community development goals.

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Author Contribution

All authors contributed equally to the study, including research design, data collection, analysis, interpretation of results, and manuscript preparation, and approved the final version for publication.

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During the preparation of this work, the author(s) used Google translate to assist in improving grammar, clarity, and academic tone of the manuscript. After using this tool, the author(s) reviewed and edited the content as needed and took full responsibility for the content of the publication.

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