

DEVELOPMENT OF SUSTAINABLE TOURISM INSTRUMENTS FOR ECOLOGICAL RESILIENCE IN PARI ISLAND, DKI JAKARTA

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ABSTRACT

The research objective is to develop an instrument for assessing sustainable tourism in the context of ecological resilience in Pari Island, DKI Jakarta. This study uses research and development methods through the ADDIE model approach. The research sample includes potential and factual coral reef areas for tourism in Pari Island. The results of the study concluded that the validation of important instruments includes: (1) natural/biological criteria, namely unique and beautiful coral reefs, quite unique tidal phenomena, endemic flora and fauna such as seagrass and fish habitat, as well as other aquatic biota, ease of observing aquatic biota, opportunities for trekking, snorkeling, etc. as well as the support of comfortable temperature and humidity, normal rainfall conditions, as well as well-managed household industrial waste; and (2) Physical environmental criteria such as dominant beaches, controlled coastal land conversion rate and protected from pollution, ease of utilizing rocky beaches for friendly productive activities. The environment, such as maintaining fish, marine tourism, and others as well as the existence of a map of the distribution of coral reefs that accurately depicts local potential as well as information related to the low risk of natural disasters (landslides, floods, tsunamis).

Keywords: Sustainable; Tourism; Instruments; Pari Island

INTRODUCTION

The concept of resilience in ecology has been expanded into a framework for analyzing human-environmental dynamics where the extension of the notion of resilience to society has important limitations, especially the conceptualization of social change (A. J. Cote, M., & Nightingale, 2012).

Social change in the scope of climate change includes the character of capitalism as well as the relationship between nature and culture that drives the transformation of

society in response to climate change (Elizabeth Shove, 2010). In this aspect, the broad transformation eventually leads to a shift and movement of the low-carbon economy/society to the high-carbon one (John Urry, 2010). The economic activity of the community in Pari Island, Seribu Islands, DKI Jakarta, at least has experienced a shift and the movement of community economic activity is increasingly triggered by tourism developments. And therefore it is necessary



to carry out and analyze sustainable tourism assessment instruments in the context of the ecological resilience of the island and its tourism potential areas. The formulation of guidelines for the Pari Island Tourism Village in the Kepulauan Seribu, DKI Jakarta, should focus on creating sustainable tourism tools that are grounded in the ecological resilience of the environment, particularly the coral reefs. This is essential for promoting responsible environmental behavior among the residents of Pari Island and enhancing overall environmental stewardship. (Raymond Boudon, 1986) as well as

discipline a mindset that pays attention to environmental sustainability (W. Neil Adger, 2000).

The research question in this paper is: what is the right instrument for the development of the Pari Island Tourism Village, Seribu Islands DKI Jakarta based on environmental resilience and the socio-ecological system of coral reefs?

MATERIALS AND METHODS

This study uses research and development methods through the ADDIE model approach. The procedure of this model in **Figure 1**.

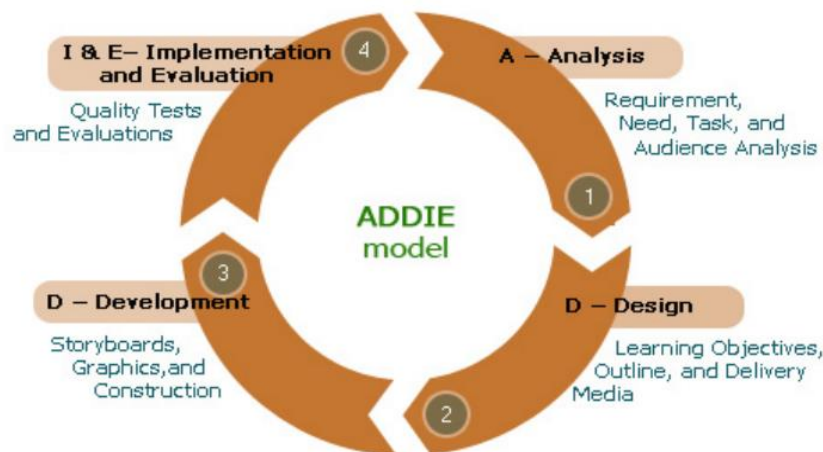


Figure 1. ADDIE Model

An environmental parameters of Pari Island and its waters studied are: (1) Unique and beautiful natural scenery (in this case coral reefs); (2) The presence of unique biological phenomena such as tidal areas; (3) There are endemic and unique plants, for example seagrass beds; (4) Ease of observing aquatic biota; (5) Availability of

opportunities for island trekking and snorkeling activities; (6) Comfortable temperature and humidity; (7) Normal rainfall; (8) There is household waste processing; (9) The condition of the physical environment is relatively unspoiled; (10) Having dominant natural beaches; (11) The rate of conversion of



coastal land is relatively controlled; (12) Coastal areas are relatively protected from pollution; (13) Utilization of environmentally friendly coastal areas by the local community.

By using an example of a measurement design from Hannum (Wallace Hannum, 2005) and modifying it according to the research objectives. The study spanned from February 2022, beginning with initial observations, and extended until June 2022.

It focused on researching both potential and actual areas of coral reef tourism sites on Pari Island, DKI Jakarta.

RESULTS AND DISCUSSION

The geographical location of Pari Island is at coordinates $5^{\circ}50'20'' - 5^{\circ}50'25''$ South Latitude and $106^{\circ}34'30'' - 106^{\circ}38'20''$ East Longitude. Pari Island is administratively located in Pari Island Urban Village, DKI Jakarta (**Figure 2**).

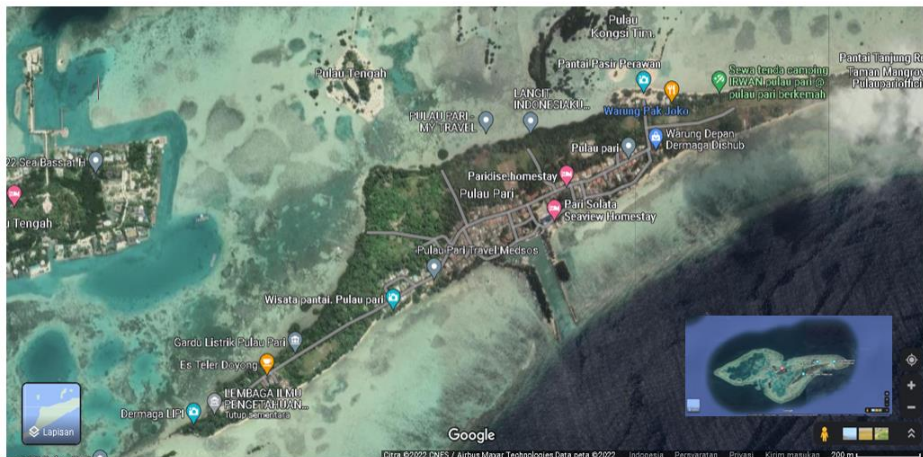


Figure 2. Pari Island, Thousand Islands DKI Jakarta

Pari Island, situated among the Thousand Islands, encompasses an area of 50.8 hectares, designated for various purposes such as settlement, tourism, dry land, unutilized land, education, and marine research. The land cover classification, reflecting the impact of human activities, reveals that coral reefs dominate the physical characteristics of the island. Coral reefs constitute the largest land cover in the Pari Islands, accounting for a total land area of 0.62 square kilometers or approximately

5% of the small islands. The remaining portion comprises coral reef ecosystems, including lagoons. These islands feature scrub, plantations, and open land, while settlements are exclusively present on Pari Island.

Pari Island boasts shallow waters and beaches characterized by a fine white sand substrate, accompanied by mangrove vegetation in the north and west, seagrass beds, and interconnected coral reefs, along with other biota within its ecosystem. With



a relatively extensive coastline, Pari Island's coral islands, as seen through satellite imagery, exhibit a distinctive stingray-like shape. The seabed configuration is predominantly flat, reaching depths of approximately 6 meters, with a slope that takes on a gradual incline. The condition of coral reefs in Pari Island and its surroundings shows a %-tase live coral cover of 32% to 50% (moderate to good condition). From various literatures, it is known that the optimization of coral reef growth in the tropics is strongly supported by an isotherm average surface temperature of 20 °C, and the most optimal is at a temperature of 23 °-25 °C, or able to tolerate up to a temperature range of 36°-40° C. The annual temperature must also have an average of never exceeding 18 °C.

The optimal temperature is the temperature at which the metabolic processes of the reef can take place optimally, and the maximum temperature is the condition where the biota can still live in the highest/maximum temperature. Disarming, the salt content (salinity) in the waters is between 32-35 with a normal pH (acidity), relatively good currents, and hard waters. Based on filling in the list of basic data requirements at the research location in the form of local environmental parameters as described previously, it is necessary to have a guide for filling out the instrument as an observation material as well as the basis for developing an effective and efficient instrument as follows (**Table 1**).

Table 1. Instruments Content Phases for Observing Coral Reefs for Sustainable Tourism

Instruments Content Phases	Sample Tasks	Sample Output
Analysis determine the parameters of the study (coral reefs) of the island environment and the waters of Pari Island	– identification of local problems	– task analysis
Design the process of determining how the above environmental parameters can be studied and then developed into an instructional and functional instrument in the field and can help as an analytical tool	– Write objectives – Develop test items	– Measurable objectives
Development the process of writing and producing instrument materials by involving a lot of scientific literature and expert opinions	– Content creation – Making flowcharts	– Develop a flow of activities – Instrumental drafts – Limited instrument trials
Implementation internalizing instrument content into the real world context, namely the location of coral reefs	– Optimazing /instruments training – Tryout	– Student comments, and data



Instruments Content Phases	Sample Tasks	Sample Output
Evaluation a very detailed and focused process to determine the adequacy of the instructional instruments	<ul style="list-style-type: none"> – Record time data – Interpret test results – Survey and impact analysis – Revise activities – Revise instruments 	<ul style="list-style-type: none"> – Recommendations – Package report – Revised prototype

And based on the table above, an in-depth study was carried out on the content of the instrument to be developed and of course it must also refer to the local environmental parameters of the study area. We call these parameters the basic instrument, namely:

Criterion 1: nature/biological

- a. There is a unique and beautiful natural landscape (coral reefs).
- b. There are unique biological phenomena (eg tidal areas)
- c. There are endemic and unique flora / plants (eg seagrass / seagrass beds)
- d. There are endemic and unique fauna/animals (such as fish habitat, habitat for other aquatic biota)
- e. It's easy to observe aquatic biota
- f. There are opportunities for hiking (trekking, snorkeling, etc.)
- g. Comfortable air temperature and humidity
- h. Normal rainfall
- i. Small industrial/household waste is well managed

Criterion 2: physical environment

- a. The physical environment is relatively unspoiled
- b. Has a naturally dominant coast
- c. The rate of conversion of coastal-coastal land is relatively controlled
- d. The coastal area is relatively protected from pollution
- e. There are people who use the rocky beaches for environmentally friendly productive activities, such as maintaining water fish (cages), marine tourism, and others.
- f. There is a coral reef distribution map that accurately describes local potential
- g. Low risk of natural disasters (landslides, floods, tsunamis)

Analysis

Basic instrumental analysis for sustainable coral reef observation

Based on criteria 1 and criteria 2 above, measurements and validations are carried out in the field according to factual conditions. So the results shown in **Table 2** were obtained.



Table 2. Fill in the criteria for observing coral reefs for sustainable tourism

No.	Criteria	Survey Results	
		Yes	No
A	Nature /Biological		
1	There is a unique and beautiful natural landscape (coral reefs).	1	0
2	There are unique biological phenomena (eg tidal areas)	1	0
3	There are endemic and unique flora / plants (eg seagrass / seagrass beds)	1	0
4	There are endemic and unique fauna/animals	1	0
5	It's easy to observe aquatic biota	1	0
6	There are opportunities for hiking (trekking, snorkeling, etc.)	1	0
7	Comfortable air temperature and humidity	1	0
8	Normal rainfall	1	0
9	Small industrial/household waste is well managed	1	0
B	Physical Environment		
1	The physical environment is relatively unspoiled	1	0
2	Has a naturally dominant coast	1	0
3	The rate of conversion of coastal-coastal land is relatively controlled	1	0
4	The coastal area is relatively protected from pollution	1	0
5	There are people who use the rocky beaches for environmentally friendly productive activities, such as maintaining water fish (cages), marine tourism, and others.	1	0
6	There is a coral reef distribution map that accurately describes local potential	1	0
7	Low risk of natural disasters (landslides, floods, tsunamis)	1	0

Validation is important to review the maximum score of field data and observations obtained directly from coral reefs. Then **Table 3** describes the

validation results of the factual conditions along with the results of the validation assessment.

Table 3. Results of validation of coral reef observation criteria for sustainable tourism

No.	Criteria	Field Validation	
		Maximum Score	Observation Score
A	Nature/Biological		
1	There is a unique and beautiful natural landscape (coral reefs).	4	3
2	There are unique biological phenomena (eg tidal areas)	3	3
3	There are endemic and unique flora / plants (eg seagrass / seagrass beds)	3	3
4	There are endemic and unique fauna/animals	3	3
5	It's easy to observe aquatic biota	2	1
6	There are opportunities for hiking (trekking, snorkeling, etc.)	2	2
7	Comfortable air temperature and humidity	2	2
8	Normal rainfall	2	2
9	Small industrial/household waste is well managed	3	1
B	Physical Environment		
1	The physical environment is relatively unspoiled	3	2
2	Has a naturally dominant coast	2	1
3	The rate of conversion of coastal-coastal land is relatively controlled	3	1
4	The coastal area is relatively protected from pollution	2	1
5	There are people who use the rocky beaches for environmentally friendly productive activities, such as maintaining water fish (cages), marine tourism, and others.	2	1
6	There is a coral reef distribution map that accurately describes local potential	4	0
7	Low risk of natural disasters (landslides, floods, tsunamis)	3	3



In Pari Island, past COVID-19 pandemic showed that if humans destroy biodiversity, it will damage human life support systems (Göran Wall, 2002), the same as that expressed by Iosef I. Gitelsona and G. M. Lisovskya (2008) as well as by S. Samadi, S. Suhardjo, and Aris Munandar (2021). And efforts to minimize damage to the human life support system can be done, among others, by increasing social resilience as the ability of groups or communities to cope with various external environmental pressures and disturbances as a result of social, political and environmental changes (W. Neil Adger, 2000).

Based on the results of instrument validation, the instrumentation needed in the effort to develop a sustainable tourism assessment instrument in the context of ecological resilience in Pari Island, DKI Jakarta is determined, namely several criteria and main aspects, namely:

1. Natural /biological criteria

This criterion covers many aspects of the natural/biological environment that are important to be studied in the field related to mangrove ecosystems, namely the presence of a unique and beautiful natural landscape (coral reefs), the presence of unique biological phenomena (eg tidal areas), the presence of endemic flora/plants and the presence of endemic flora and

fauna. unique (eg seagrass / seagrass beds), endemic and unique fauna / animals (such as fish habitat, habitat for other aquatic biota), there is ease of observing aquatic biota, opportunities for cross-country (trekking, snorkeling, etc.), comfortable temperature and humidity conditions, normal rainfall conditions, and well-managed small/household industrial waste conditions.

2. Criteria for the physical environment

These criteria encompass elements such as the preservation of the natural environment in a relatively untouched state, the existence of a prominent and naturally preserved coastal stretch, controlled conversion rates of coastal land, a relative shield against pollution in the coastal area, the involvement of community members engaging in productive activities on rocky beaches, such as maintaining aquatic fish (in cages) and participating in marine tourism. Additionally, these criteria involve the availability of an accurate coral reef distribution map, providing insights into local potential, along with information indicating a low risk of natural disasters like landslides, floods, and tsunamis.

CONCLUSIONS

The results of the instrument validation determine the instrumentation needed in the effort to develop a sustainable tourism



assessment instrument in the context of ecological resilience in Pari Island (several criteria and main aspects; namely the importance of natural/biological criteria and physical environment criteria).

In the future, it is believed that this instrument can be used as a measuring tool that can be used to determine efforts to develop sustainable tourism assessment instruments in the context of ecological resilience, especially in small island areas.

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