Small island, big impact: socio-economic analysis of landscape services in Pasaran island, Bandar Lampung

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Abstract. Managing landscape services on small islands requires special attention due to resource constraints impacting socio-economic dynamics. This study identifies landscape services on Pasaran Island, Bandar Lampung City, considering ecological, social, and economic factors, and examines the importance and performance of these services from residents' perspectives. Using the Importance-Performance Analysis Matrix (IPMA) in SPSS, 100 local residents who have lived on the island for at least five years were surveyed to understand the community's socioeconomic background. Drone mapping facilitated by DroneDeploy, Agisoft Photoscan Pro, and QGIS revealed diverse land use in Pulau Pasaran. The research highlighted that 37% of the population monthly incomes ranging from 300,000 to 1,000,000 IDR, influenced by natural resource availability. IPMA analysis categorized findings into quadrants: Quadrant I stressed enhanced community and government involvement in landscape service management. Quadrant II reflected community concerns about risks from landscape service use. Quadrant III underscored the necessity for greater transparency in government funding. Quadrant IV indicated community to engage in landscape service planning. The IPMA results for Pasaran Island identified significant gaps in community management: transparency (-0.09), labor assistance (-0.06), and cleanliness (-0.03). Conversely, positive gaps were found in financial assistance (+0.09) and community desire to reduce damage (+0.02). In conclusion, community needs is essential for effective landscape service management.

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1 Introduction

Small islands play a crucial role for sustainability across ecology, social, and economy dimensions [1]. However, the landscapes of small islands have a significant challenges such as climate change, environmental degradation, and substantial socio-economic pressures. Exploring the ecological, social, and economic conditions of small islands is essential to understand the interactions dynamics [2]. Important variables to consider include landscape heterogeneity, elevation, slope, landscape connectivity, and population [3].

Research on ecosystem services must underlying socio-ecological drivers to enhance understanding for potential future management [4]. Small islands are home to diverse ecosystems and require special attention and protection. Managing biodiversity and safeguarding fragile habitats are vital for maintaining ecological balance [5]. In this context, several small islands around the world are actively implementing sustainable practices [6]. These practices include zoning regulations, low-carbon initiatives, and the establishment of protected areas, all aimed at limiting habitat degradation [5]. Developing countries with small islands rely heavily on the ecosystem services provided by these islands. Sustainability and inclusivity are fundamental for the management of these areas, promoting social justice in their utilization [7]. conditions aims to identify challenges and opportunities for management by local communities. Therefore, a holistic exploratory approach aims to understand management perspectives on Pasaran Island.

The interaction between ecology, social, and economy factors can support the sustainability of the landscape. Exploring ecological conditions is crucial to understanding land use and the environmental factors influencing it with understanding social and economic, Exploring the ecological, social, and economic conditions is one way to assess the ecosystem services on small islands [8]. This research aims to dsiscuss the importance of ecological, social, and economic factors in shaping ecosystem services to manage natural resources efficiently and enhance human well-being [9].

One of the small islands located in Bandar Lampung, Indonesia, holds significant potential for the utilization of ecosystem services. The island is known as a center for the fishing industry and anchovy farming, which serve as the primary source of livelihood for the local community. However, to date, the utilization of ecosystem services on Pasaran Island has not been maximized sustainably, leading to various environmental and socio-economic challenges. Community activities in fisheries and land-use changes on Pasaran Island have resulted in several land-use issues and environmental degradation. This situation necessitates an in-depth study of ecosystem service utilization to identify existing potentials and challenges. The study of ecosystem service utilization on Pasaran Island is also crucial for formulating better and more sustainable management strategies. This aligns with the principles of sustainable development, which emphasize a balance between ecology, social, and economy factors.

Sustainable of ecosystem services on Pasaran Island has not been fully optimized, leading to various environmental and socio-economic challenges. Community activities in fisheries and land-use changes have caused land-use issues and environmental degradation, necessitating an in-depth study of ecosystem service to identify potentials and challenges. This study is crucial for formulating better and more sustainable management strategies, aligning with the principles of sustainable development that emphasize balancing economic, social, and environmental factors. The ultimate goal is to provide a comprehensive view that supports the formulation of sustainable management strategies, balancing ecology, economy, and social. The research objectives in this study are to identify the landscape services from ecology, social, and economy factors on Pasaran

Island, Bandar Lampung City and understand the importance and performance perspectives based on the viewpoints of the residents of Pasaran Island, Bandar Lampung City.

2 Method

2.1 Data collection technique

This research focuses on Pulau Pasaran, aiming to comprehensively analyze its ecological, social, and economic dimensions to inform sustainable management strategies. Pasaran Island is located in the city of Bandar Lampung, covering an area of approximately 10 hectares and housing around 300 residents. Its location, directly facing the strait, as a result, this island is directly affected by changes in sea level rise.

This study is structured in three phases, each employing different methodologies. Ecological Analysis, the first phase involves assessing biodiversity and land use to understand the ecological functions and ecosystem services utilized by the Pulau Pasaran community. This includes direct observation to identify organism diversity and mapping land use patterns. Social Analysis, second phase examines the social perspectives of the local community regarding the management of Pulau Pasaran. This involves administering questionnaires and conducting interviews to gather insights into community attitudes and perceptions. Economic analysis, The third phase investigates the economic background of the Pulau Pasaran community. This phase also utilizes questionnaires and interviews to understand the economic activities and challenges faced by the residents.

This research employs both primary and secondary data. Primary data are collected through two main techniques observation and questionnaires and interviews. Observations with field observations are conducted to directly monitor ecological parameters and land use. Questionnaires and interviews to structured questionnaires and open-ended interview guides are used to collect social and economic data from the community [10]. The requirement for respondent data fulfillment is 100 individuals, calculated based on the minimum conditions of Slovin's formula [11].

The criteria for selecting the 100 respondents used a purposive sampling technique, determined by specific considerations [12]. In this study, respondents were chosen who have lived on Pasaran Island for at least five years. The questionnaires are pre-tested for validity and reliability to ensure the accuracy of the data. Secondary data are gathered through a literature review, which includes studying relevant research, previous studies, and other pertinent documents.

2.2 Data analysis technique

Primary data collected through field observations, questionnaire surveys, and open-ended interviews. Respondents and informants are selected using purposive sampling, targeting community members who have lived on Pulau Pasaran for at least five years. This ensures that the data reflects the perspectives of long-term residents. Secondary data sourced from existing literature and documents relevant to the research topic. The collected data are analyzed using the Importance-Performance Matrix Analysis (IPMA) to identify critical areas for improvement and to develop strategic recommendations for sustainable ecosystem management on Pulau Pasaran [13].

The analysis used to understand ecological, social, and economic factors is conducted through descriptive elaboration to develop results from the obtained quantitative analysis. A quantitative questionnaire with a value range is supplemented with open-ended interview questions to gather comprehensive information about Pasaran Island. Descriptive analysis helps researchers understand the collected data, providing insights into data

distribution and characteristics that assist in decision-making [14]. Descriptive analysis is particularly useful in quantitative research as it helps summarize data, identify patterns, and provide a better understanding of the variables under investigation.

The ecological factor analysis involves observing vegetation and key species in the area. The output includes data on vegetation and animal distribution. Additionally, current land cover as of 2023 is analyzed. The ecological exploration involves analyzing land cover, classified to understand its impact on disaster threats, particularly tidal flooding. Classification is based on supervised classification of 2015 Landsat images.

Drone photo data in orthomosaic form is processed using ArcGIS software. Subsequently, training sampling subsets are used to focus images on the research location. Land cover classification in this study employs different land cover types using supervised classification. According to [15] supervised classification is necessary to transform multispectral image data into spatial feature classes. Image processing in land cover classification uses supervised classification analysis, with class grouping based on signature classes.

The analysis of social and economic aspects requires a questionnaire developed through a step-by-step process to ensure it is detailed and targeted. The initial step involves identifying relevant and important questions for the questionnaire. Defining the research objectives is the first step in designing the questionnaire. Next, the population and sample are identified to ensure the questions are appropriate for the characteristics of respondents from Pasaran Island [14].

Identifying the population and sample is the second stage in questionnaire development. The subsequent step is to determine the appropriate types of questions and compile a list of questions that align with the research objectives. The questions should be logically ordered to match the characteristics of the respondents. The next step involves piloting the questionnaire to ensure the questions are clear and relevant. The results from the pilot test are used to revise the questionnaire, improving its quality and accuracy. The final step is to distribute the questionnaire for direct implementation [16].

Analysis of socio-economic and cultural aspects from social economy background community, data will be collected through questionnaires and interviews with residents of Pasaran Island, focusing on areas prone to tidal flooding. Respondents will be selected using purposive sampling, considering factors such as position, role, mature age, and a minimum of five years of residence on Pasaran Island. The minimum sample size, calculated using the Solvin formula, is 100 respondents.

Importance-Performance Matrix Analysis (IPMA) superior to other tools due to its dual focus on importance and performance. This method ensures critical landscape elements are prioritized accurately, balancing aesthetic and functional values. The clear visual representation of IPMA aids in effective stakeholder communication, enhancing decision-making efficiency. Its adaptability across diverse projects, from urban planning to ecological restoration, underscores its versatility. Unlike single-dimensional tools, IPMA provides a comprehensive analysis, aligning project outcomes with strategic goals and stakeholder expectations [17].

The research objectives include assessing the ecological conditions and socio-economic status of Pasaran Island. For ecological conditions, data is sourced from UAV drone mapping, which surveys wildlife, vegetation, and land use, resulting in detailed maps of these elements. The socio-economic conditions are evaluated through questionnaires and interviews, with data analyzed using Importance-Performance Matrix Analysis (IPMA) and overall percentage calculations. This process yields insights into public perception regarding expectations and realities, as well as the economic background of the community and resource utilization. The outputs provide a comprehensive understanding of both ecological and socio-economic aspects of the island (Table 1.).

Table 1. Data analysis technique

No.	Research Objective	Data source	Data Processing Technique	Output
1.	Ecological conditions on Pasaran Island	Mapping through UAV drone	Survey of wildlife data, vegetation, and land use	Wildlife data, vegetation, and land use mapping.
2.	Social-economy conditions	Questionnaire and interview results	Analysis (IPMA) and Overall data percentage	Public perception of expectations and realities and Economic background of the community and resource utilization

3 Results

3.1 General Conditions

Pasaran Island is located in Kelurahan Kota Karang RT. 09 Lingkungan 2, Teluk Betung Barat District, Bandar Lampung City. The distance from Pasaran Island to Kecamatan Kota Karang is about 1 km, with a travel time of approximately 25 minutes. The current area of Pasaran Island is approximately 12 hectares. Historically, the initial area of the island was only 2 hectares. The island's area has increased due to the growing population. The entire land on Pasaran Island is used for various activities: 60 percent is used for drying anchovies, while the remaining 40 percent is used for housing, buildings, roads, cemeteries, educational facilities, places of worship, and fields (Figure 6). To reach Pasaran Island, the only accessible means is bridge circulation, with a travel time of about 15 minutes over approximately 200 meters.

Pasaran Island is located on a lowland with an average temperature of 37°C and an elevation of 2 meters above sea level. The soil type on Pasaran Island is sandy soil characterized by layers of white to reddish-white soil. The average humidity on Pasaran Island is 77.75%. This area is classified as having higher humidity due to its proximity to the ocean. Water vapor from the ocean can influence the humidity levels in the air, which in turn can affect cloud formation, rainfall, and other weather conditions. The recorded rainfall for Bandar Lampung City is 4.46 mm. Wind direction in this area is noted to have a maximum speed of 128.75 knots, with an average wind speed of 2.125 m/s. Coastal areas on Pasaran Island are often characterized by strong winds. Sea breezes and land breezes interact to form distinctive coastal winds, influencing temperature, humidity, and rainfall patterns in the coastal region[18].

The flood hazard map of Bandar Lampung City is categorized as "moderate," indicating a level of flood risk between low and high. "Moderate" suggests a moderate likelihood of flooding in the Bandar Lampung area, particularly in East Teluk Betung as depicted on the map. In the flood hazard map, this area falls under the moderate-risk zone, indicating a potential for significant flooding impacts, though not as severe as high-risk zones. Therefore, while moderate flood risk still requires attention, the potential for damage or danger to residents and infrastructure is less compared to high-risk zones [18].

Fig. 1. Pasaran Island Conditions, fish drying sites (a), ship dock (b), Fish product store (c) , Bridge to the island (d), information island (e), fisherman boat (f).

Conditions on Pasaran Island in section (a) fish drying sites are prominently displayed, highlighting the island's fishing industry. Section (b) depicts the ship dock, essential for transportation and trade. The fish product store in section (c) is where locals sell their catch. The bridge to the island, shown in section (d), connects Pasaran Island to the mainland, facilitating access. The information center, seen in section (e), provides visitors with details about the island. Finally, section (f) features a fisherman boat, symbolizing the traditional livelihoods of the island's inhabitants (Figure 1).

The 2023 BNPB tsunami hazard map for Bandar Lampung, especially in East Teluk Betung, indicates a moderate level with areas at moderate tsunami risk. Areas with moderate tsunami risk have the potential for significant tsunami occurrences, though not as high as high-risk areas. Interpreting the moderate-level tsunami hazard map focuses on locations such as tsunami warning points and recommended evacuation routes. Understanding these areas have moderate tsunami risk enables targeted mitigation measures such as resilient tsunami infrastructure development, enhanced early warning systems, and evacuation planning [19].

According to the BNPB map, the status of extreme wave threat and coastal erosion on Pasaran Island is categorized as moderate. Although within Pasaran Island the classification is moderate, caution is still necessary for larger disasters if ecological changes occur in this area. Extreme waves can result from various factors such as tropical storms, strong winds, earthquakes, or continental plate movements on the seabed. These extreme waves carry substantial energy and can cause serious coastal damage, including beach erosion, floods, and infrastructure damage [20].

Pasaran Island has a diverse range of potential resources, including green mussels, grouper farming, simba fish, and white snapper [21]. Additionally, the island is known for its unique local culture, various fishing activities such as boat making, and the potential of its mangrove community, all of which can attract visitors to the island. Another unique feature of Pasaran Island is its proximity to the provincial capital, with easy access,

especially after the construction of a 200-meter bridge connecting Pasaran Island to Bandar Lampung City, making it easily accessible [22].

Considering the potential of Pasaran Island, the concept of marine tourism (minawisata) is highly relevant for its development. Minawisata is defined as a branch of tourism focusing on the utilization of the flora, fauna, culture, and maritime ambiance of a particular area [23] Establishing Pasaran Island as a marine tourism destination will enhance its appeal and boost the local community's income. Therefore, increasing community involvement in managing this tourism is essential. This approach is known as community-based marine tourism, which emphasizes the active role of local communities in managing tourism in their area. Developing a community-based minawisata concept can improve local welfare by creating various business opportunities associated with marine tourism [22].

3.2 Ecological Conditions

The ecological inventory conducted on Pulau Pasaran focuses on habitat and anthropogenic activities, including land use and biodiversity. Pulau Pasaran covers an area of 13 hectares and is home to 1,500 people. Most of the island's inhabitants work as fishermen and fish processors (Ministry of Tourism and Creative Economy, 2022). Vegetation is limited due to the prevalence of residential areas and fishing activities. Mangrove vegetation is only found on the outer parts not included in the Pulau Pasaran area. The dominant human activities are fishing and fish processing, which support the local economy. Land use is primarily for residential purposes and fish processing facilities.

Vegetation inventory on Pulau Pasaran reveals the presence of various species including *Cocos nucifera* (Coconut), *Ipomoea pes-caprae* (Beach Morning Glory), *Musa paradisiaca* (Banana), *Rhizophora marina* (Mangrove), *Thespesia populnea* (Pacific Rosewood), and *Pandanus fascicularis* (Screw Pine). The local ecosystem reflects a blend of residential and commercial land use, with minimal natural vegetation. Despite limited flora, the island sustains economically through its fishing and processing industries. The outer mangroves, although not extensive, play a crucial role in coastal protection. The presence of diverse plant species indicates resilience in a predominantly human-altered environment.

Land use on Pulau Pasaran is mapped as follows: commercial buildings, buildings for the fishing industry, fish processing facilities, residential buildings, and other facilities. The built-up area on Pulau Pasaran accounts for 70% of the total land (Figure 2). Most of the land is used for residential purposes and economic activities, with the majority of the population working as fishermen. Initially addressing freshwater fisheries, then extending to coastal and salmon fishing, knowledge expanded on spawning, migration patterns, age demographics, and other factors [24]. This growing understanding eventually fostered confidence that regulations targeting specific fish species could effectively conserve stocks and enhance catches. Today, regulatory frameworks rooted in biological principles are pervasive, particularly in offshore fishing. These regulations primarily involve gear restrictions, such as prohibiting the use of small-mesh nets, specific types of trawls, and large, powerful vessels. Another commonly employed strategy is the implementation of closed fishing seasons [25].

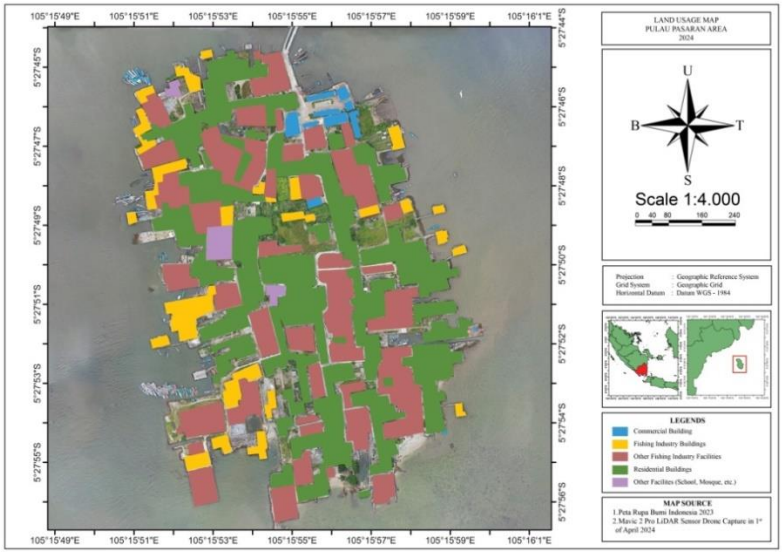

Fig. 2. Pasaran Island Land Use Conditions

Based on observations through drone and direct observation on Pasaran Island. The land use on Pulau Pasaran consists of vegetation, paved areas, and permanent built-up areas (Figure 3). Vegetation refers to the natural plants that still exist on this island, such as coastal character trees. Paving refers to areas that are paved or asphalted for roads, transportation access, or specific buildings that require a hard surface. Meanwhile, permanent built-up areas include fixed structures such as settlements, commercial buildings, fishery industry facilities, and other infrastructure that have been built and have become a permanent part of the island's landscape.

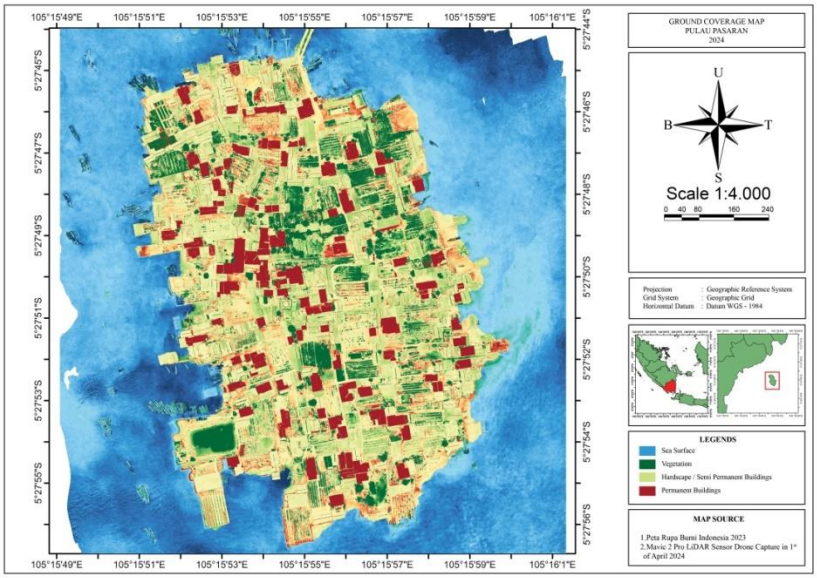

Fig. 3. Pasaran Island Land Cover Conditions

3.3 Background of social and economic community

Access to reach Pasaran Island has two alternatives: by land and by sea. The land route can be traversed by crossing a connecting bridge that spans 500 meters, linking Pasaran Island to the coast of Teluk Betung Timur District. However, this bridge, with a width of approximately 1.5 meterss, cannot accommodate large vehicles such as cars.

Electricity supply on Pasaran Island is distributed through electrical cables connected via poles installed in the sea and transmitted from underwater. The entire land area of Pasaran Island is utilized for various land uses: 60% of the land is used for drying anchovies, while the remaining 40% is allocated for social and economic facilities on the island. These include educational facilities such as one elementary school (SD), places of worship like one mosque and one prayer room (mushalla), health facilities including one Community Health Center (Puskesdes), burial grounds, a community hall, and a cooperative. Economic support facilities for processors on Pasaran Island include boats commonly used for buying and selling fresh fish in locations like fishing platforms situated in the middle of the sea.

The results from distributing the questionnaire, which was conducted in three field stages, obtained responses from 100 residents who have lived on Pasaran Island for more than 5 years. Thus, respondents are expected to interpret their knowledge of the Pasaran Island area. Based on the results, the gender distribution of respondents is 67% female and 33% male. This relates to the timing of data collection coinciding with activities undertaken by women residing in the area.

The total number of respondents, which is 100 individuals meeting the minimum criteria of residing on Pasaran Island for at least 1 year and being of productive age (minimum 17 years old), assumes emotional and psychological maturity to ensure that responses align with the research objectives. Respondents providing information consist of 33% male and 67% female. The 67% figure indicates that the majority of respondents are female, while males are a minority group in the sample (Figure 4a). This information provides an overview of the gender composition of respondents involved in the study.

Based on direct data collection at the research site, 33 males and 67 females were recorded (Figure 4). Data collection was conducted three times in the afternoon, specifically between 15:00 and 18:00 WIB. In research studies, it is important to collect accurate data. In this regard, it is essential to avoid generalizing or stereotyping based on gender when assessing someone's honesty. Each individual has uniqueness, and other factors such as personal values, education, culture, and life experiences also play crucial roles in behavior and the honesty of respondents when completing the research questionnaire. Gender equality and the empowerment of women have become global issues and topics discussed by world leaders. According to the United Nations report [26] (2015), the United Nations General Assembly on September 25, 2015, established the Sustainable Development Goals (SDGs) or Sustainable Development Agenda. In Indonesia, the image of women working in tourism shows a positive change, where women are increasingly employed in the tourism sector alongside the increase in tourism investment and the number of tourist visits [27].

Regarding the age of respondents whose information was gathered by researchers, they range from 17 to over 70 years old: 11% are aged 17-25 years, 26% are aged 26-36 years, 27% are aged 37-47 years, 26% are aged 30-40 years, 27% are aged 40-50 years, and 3% are over 70 years old (Figure 11 and Table 7). The total population of respondents residing on Pasaran Island includes those who have lived there for 1-10 years (9%), 10-20 years (14%), 20-30 years (30%), 40-50 years (22%), and over 60 years (5%) (Figure 4b until f).

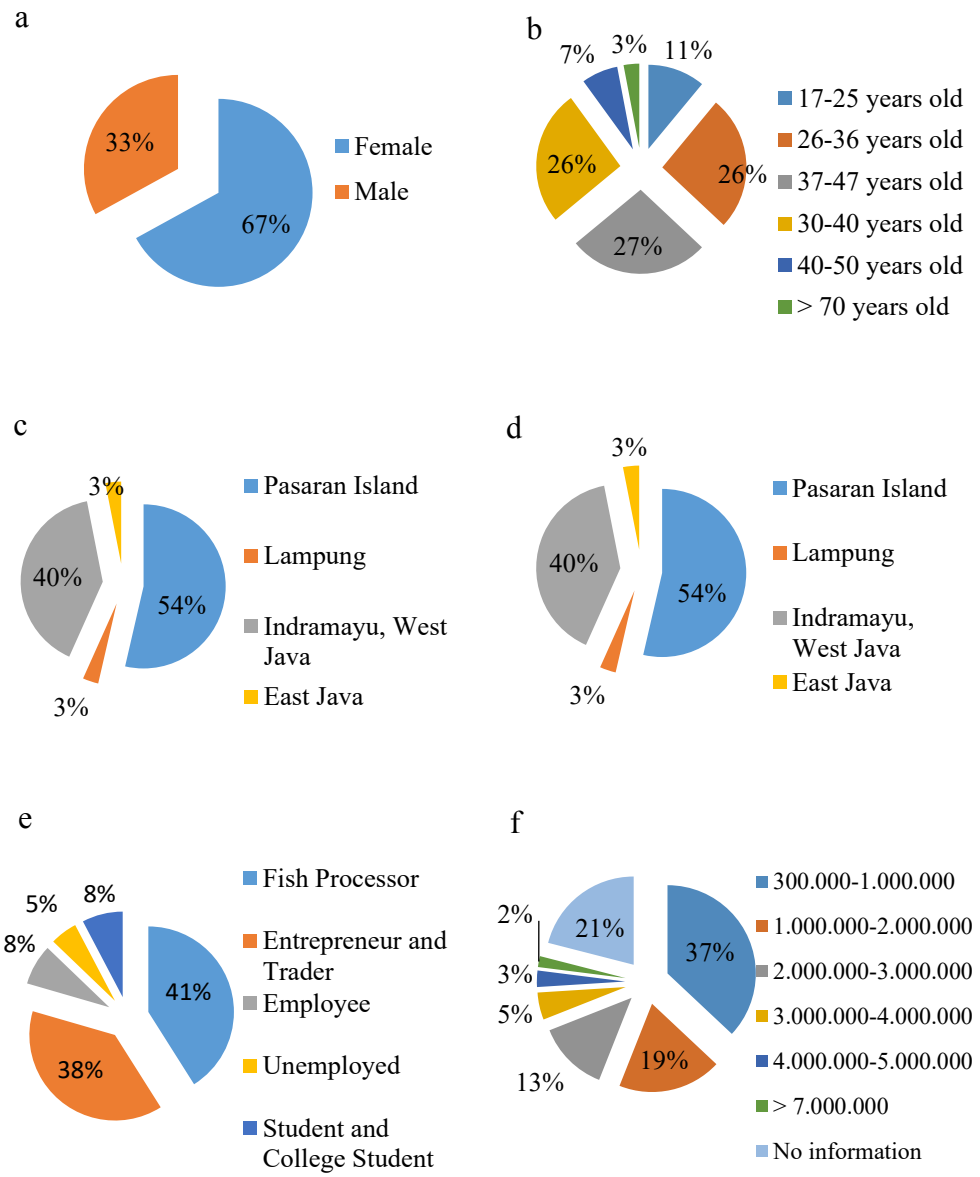

Fig 4. Background of social and economic respondents, gender respondents (a), age respondents (b), ethnic respondents (c), place origin respondents (d), occupation respondents (e), salary income respondents (f).

The residency status of the 100 respondents on Pasaran Island indicates that 53% are native residents and 47% are newcomers (Figure 4). Native residents are an ethnic group with historical, cultural, and identity ties to the area. They have inhabited the area for a long time, possess traditional knowledge, and have strong connections with natural resources on Pasaran Island. Newcomers are a group of people who have moved due to economic factors

or environmental changes. Newcomers influence cultural diversity and demographics on Pasaran Island.

The respondents' original area status records 52% native Pasaran Island residents, 3% Lampung residents, 39% newcomers from West Java, Indramayu, 3% newcomers from Central Java, and 3% newcomers from other areas (Figure 4). Local communities integrate natural phenomena and human response in disaster preparedness. These communities harness indigenous knowledge and ecological insights to predict natural disasters. Similarly, coastal communities rely on local wisdom. They interpret natural signs such as white clouds, navigate based on wind direction and understand sailing routes. Changes in seawater color also hold particular significance as indicators [28].

Thorough concept analyses have elucidated the importance of ecological wisdom in promoting sustainable landscape development. Concurrently, investigations have delved into traditional settlement areas and adaptations by local communities. Furthermore, empirical research has endeavored to uncover the ecological wisdom inherent in specific site cases, aimed at addressing modern landscape challenges. Lastly, a novel approach has been introduced for acquiring and applying ecological wisdom effectively [29].

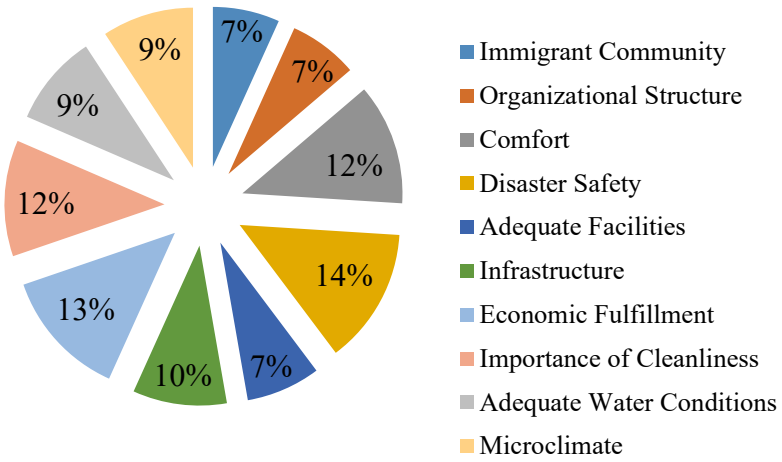

Fig 5. Percentage of Very Important Values from the Perspective of Society

Regarding the respondents' occupations, as recorded by the researchers, they include housewives (40%), fishermen (21%), fish processors (16%), entrepreneurs and traders (15%), private sector employees (3%), unemployed individuals (2%), and students or university students (3%) (Figure 12 and Table 8). In the research, it is important to understand the socio-economic status of the community. Data collection from respondents reveals that 37% have a monthly income of IDR 300,000-1,000,000, 19% have a monthly income of IDR 1,000,000-2,000,000, 13% have a monthly income of IDR 3,000,000-4,000,000, 3% have a monthly income of IDR 4,000,000-5,000,000, and 2% have a monthly income exceeding IDR 7,000,000. Furthermore, 21% of respondents did not provide information about their monthly income (Figure 5).

Based on the community perspective, various factors are rated in terms of their perceived importance. The Immigrant Community is considered very important by 27% of respondents, reflecting a moderate level of concern. Organizational Structure is slightly

more valued at 28%. Comfort holds significant importance for 49% of the community, indicating that almost half prioritize a comfortable living environment (Figure 5).

Disaster Safety is crucial for 55% of respondents, highlighting a strong emphasis on safety and preparedness. Adequate Facilities are important to 30% of the community, while Infrastructure is valued by 38%, suggesting that these physical and structural aspects are essential to a notable portion of the population (Figure 5).

Economic Fulfillment is a priority for 52% of the community, indicating that economic stability and opportunities are significant concerns. The Importance of Cleanliness is recognized by 47%, reflecting a substantial interest in maintaining clean living conditions. Adequate Water Conditions and Microclimate are each valued by 37%, emphasizing the importance of environmental factors in the community's daily life. Overall, these percentages indicate that while certain aspects like Disaster Safety and Economic Fulfillment are highly prioritized, other factors such as the Immigrant Community and Organizational Structure are also recognized but to a lesser extent. This distribution of values showcases the diverse priorities and concerns within the community [30].

3.4 IPA Diagram Based on Landscape Services from Natural Resources

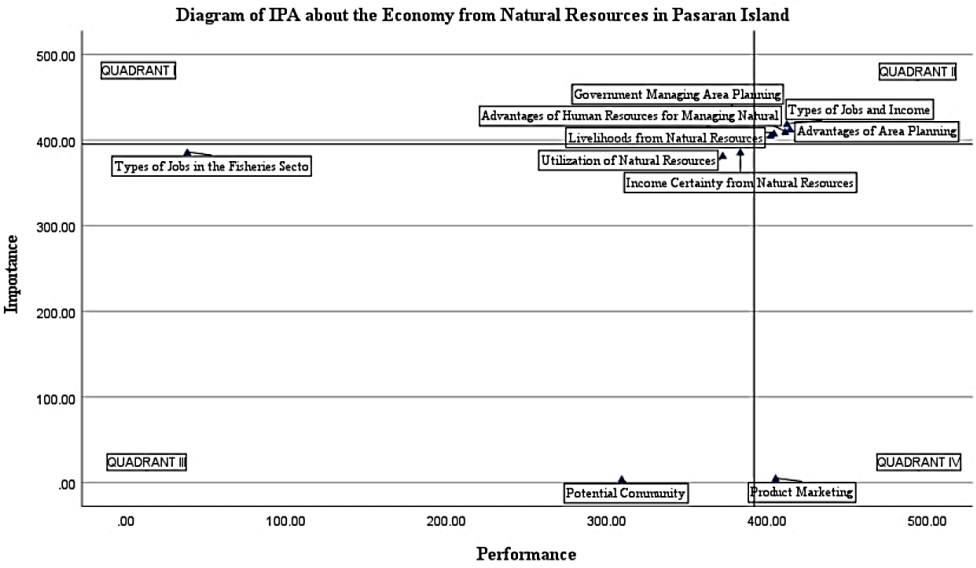

Fig 6. Diagram IPA about Economy from Natural Resources

The landscape services of natural resources is considered highly important by the community, with an importance value reaching 4.63. Performance in this regard is also quite high, scoring 4.53, resulting in a gap of 0.10. This indicates that although performance in natural resource utilization is nearly meeting expectations, there is still some room for improvement to fully satisfy community interests (Figure 6). Jobs in the fisheries sector are valued at 4.28, highlighting its significance to the community. Performance in providing employment in the fisheries sector is rated at 4.23, with a gap of 0.05.

This shows that performance in this field is close to meeting societal expectations, yet there remains slight room for enhancement to achieve closer alignment with existing interests (Figure 6). The fundamental economic principle revolves around satisfying

unlimited human needs with limited or scarce resources. Throughout history, natural resource management has sparked concerns, primarily focusing on resource depletion leading to economic uncertainties and environmental impacts. Economic development involves state-led efforts to enhance economic activities and the living standards of its populace, aiming to boost per capita income over the long term. The objectives of economic development include fostering national identity and increasing national output and individual incomes, influenced by a nation's worldview. Defines economic development as striving to elevate a nation's standard of living, gauged by heightened per capita income and enhanced productivity, thereby achieving broader societal prosperity [31].

Indirectly, marine fishing contributes to coastal community economies through trade, processing, and tourism, boosting employment and income. Analysis underscores marine fishing's pivotal role in these economies, necessitating efforts to enhance both catch quantity and quality. Strategies include upgrading fishing technology, sustainable resource management, and skill development among fishermen [32].

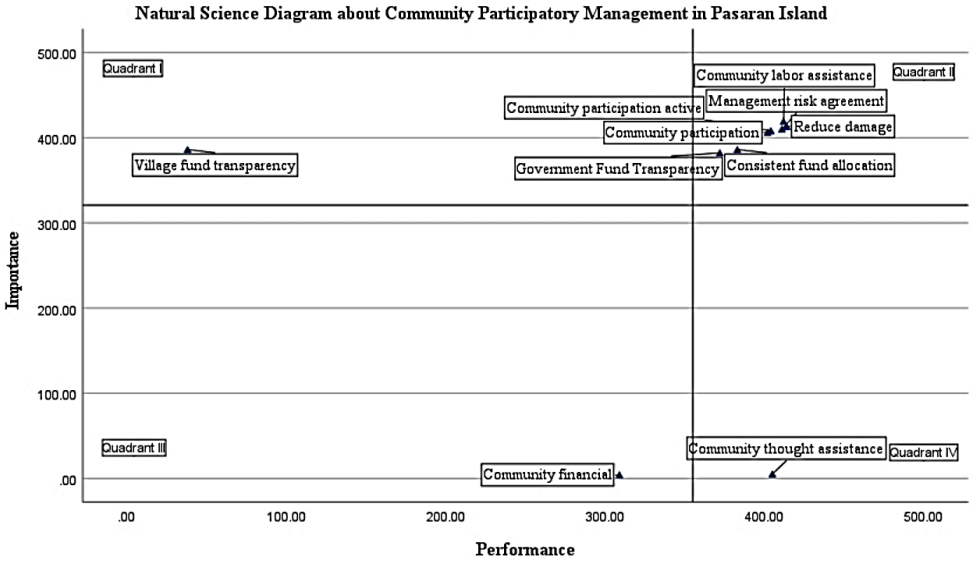

Fig 7. Diagram IPA about Community Participatory Management in Pasaran Island

This study examines ten key indicators in participatory community management on Pasaran Island using Importance-Performance Analysis (IPA). The data obtained includes importance values, performance ratings, and gaps for each indicator. The IPA analysis results indicate several high gap values that need attention. These gaps have notably high negative values, indicating the need for focused attention and solutions. In discussing the community perspective on participatory landscape management, transparency in local government management scores relatively low with an importance value of 3.81, a performance value of 3.72, and a gap of -0.09. Community labor assistance and active participation in maintaining cleanliness are also lacking (Figure 7).

Regarding community labor assistance analysis, the importance value is recorded at 4.18 and the performance value at 4.12, showing a gap of -0.06 that needs improvement. This indicates that community labor assistance is highly important (importance value of 4.18), yet current performance is slightly below expectations (performance value of 4.12), requiring further attention to bridge this gap (-0.06). Furthermore, active community participation in area cleanliness is considered highly important with an importance value of

4.07 and a performance value of 4.04, resulting in a small negative gap of -0.03. This suggests that active community participation almost meets expectations, although there is still some room for improvement (Figure 7).

Based on the analysis of community thinking assistance, the importance value is recorded at 4.00 and the performance value at 4.05, indicating a positive gap of +0.05. This shows that community thinking assistance is valued (importance value of 4.00) with performance exceeding expectations (performance value of 4.05), resulting in a positive gap (+0.05) indicating over-performance compared to expected importance (Figure 7).

In the analysis of community financial assistance, the importance value is recorded at 3.00 and the performance value at 3.09, indicating a positive gap of +0.09. This indicates that although community financial assistance is considered less important (importance value of 3.00), actual performance exceeds expectations (performance value of 3.09), resulting in a positive gap (+0.09). Furthermore, community desire to reduce damage has an importance value of 4.12 and a performance value of 4.14, showing a positive gap of +0.02. This indicates that the community's desire to reduce damage is highly important (importance value of 4.12) and performance is slightly better (performance value of 4.14), resulting in a positive gap (+0.02) (Figure 7). IPA also allows for evaluating how well these factors are currently implemented or realized [33]. By comparing the importance of a factor with its performance, we can see to what extent expectations have been met or even exceeded. In this analysis, it is evident that finding solutions to the cooperation between the government and the community is necessary [34].

4 Discussions

4.1 Ecological Aspect

The majority of the island's population engages in fishing and fish processing, vital components of the local economy (Ministry of Tourism and Creative Economy, 2022). Due to extensive residential areas and fishing activities, the vegetation is sparse. Mangrove vegetation is present only on the peripheries, which are not considered part of Pulau Pasaran itself. The dominant human activities include fishing and fish processing, which sustain the local economy. Land use is predominantly for residential purposes and fish processing facilities.

Land use on Pulau Pasaran is categorized into various types, including commercial buildings, fishing industry buildings, fish processing facilities, residential buildings, and other facilities. Built-up areas constitute 70% of the total land area. The primary land use is for residential purposes and economic activities, with the majority of the population working as fishermen. Achieving harmonious development of the “social-ecological” system is essential for global sustainable development goals. Landsenses ecology, an emerging concept, emphasizes sustainable land use planning. Islands, vulnerable ecosystems with significant human activity, are ideal for studying this concept [35].

4.2 Social and Economy Aspect

A questionnaire survey, conducted in three stages, gathered responses from 100 residents who have lived on Pasaran Island for over five years. The respondents comprised 67% females and 33% males, with data collection coinciding with activities predominantly involving women. Respondents, aged 17 to over 70 years, provided valuable insights into the island’s conditions. The survey results highlighted that most respondents had lived on the island for at least 1 year, ensuring emotional and psychological maturity to align with

the research objectives. The majority of respondents, 67%, were female, reflecting the gender composition of those actively participating in daily activities during the survey period.

The analysis of respondent occupations and socio-economic status on Pasaran Island provides valuable insights into the community's composition and priorities. The workforce is predominantly composed of housewives (40%), fishermen (21%), and fish processors (16%), with a smaller proportion engaged in entrepreneurship, private sector employment, or education. Monthly income levels vary, with 37% of respondents earning IDR 300,000-1,000,000, and a notable percentage earning more than IDR 1,000,000. The variability in income levels and occupations highlights the diverse economic landscape of the island.

Community perspectives reveal that comfort is a primary concern for 49% of respondents, followed closely by disaster safety, which is crucial for 55% of the population. Economic fulfillment is prioritized by 52%, reflecting the importance of economic stability. Cleanliness, adequate water conditions, and microclimate are also significant, valued by 47% and 37% of respondents, respectively. While the immigrant community and organizational structure are recognized, they are less emphasized compared to other factors. This distribution illustrates the community's diverse priorities, with a strong focus on safety, economic well-being, and environmental quality, indicating areas where development efforts should be concentrated to address the most pressing needs of Pasaran Island’s residents. Social development relies on adapting water resource systems to droughts, floods, and anthropogenic changes, including climate change effects. Climate change impacts the water cycle by altering precipitation patterns, increasing glacier melting, and affecting river flows and sediment cycles, which in turn influences river basin, coastal, and marine ecosystems. The Source-to-Sea (S2S) approach offers an integrative perspective, viewing water as a continuous cycle from land to sea. It highlights the need to understand interactions within this cycle and recognizes the role of social, economic, and cultural factors. Thus, changes in one part of the cycle can affect the entire water system [36].

The IPA analysis of community participatory management on Pasaran Island reveals several critical insights. Key indicators, including transparency in local government management, community labor assistance, and active participation in cleanliness, show significant gaps between importance and performance. Transparency, with an importance value of 3.81 and a performance value of 3.72, has a negative gap of -0.09, indicating a need for improved transparency. Community assistance and cleanliness, while important, also show minor negative gaps, suggesting that current performance slightly lags behind community expectations.

Conversely, community thinking assistance and financial assistance display positive gaps. Community thinking assistance, with an importance value of 4.00 and a performance value of 4.05, has a positive gap of +0.05, indicating performance exceeds expectations. Similarly, community financial assistance, though considered less critical (importance value of 3.00), performs better than anticipated (performance value of 3.09), resulting in a positive gap of +0.09. The community's desire to reduce damage also shows a slight positive gap, highlighting a strong commitment to environmental preservation. Natural resources drive economic development by providing essential inputs for production and enabling the export of primary goods, thereby enhancing foreign revenues and comparative advantages. In underdeveloped countries, these resources stimulate financial development, improve governance, and bolster institutional quality. Effective use of natural resources requires sound financial practices, such as regulating credit and managing banking assets, alongside anti-corruption measures and political stability. While natural resources can spur economic growth, poor institutional performance and political instability may lead to the "resource curse," which hampers growth [37].

Ecosystem services in Pulau Pasaran refer to the direct and indirect benefits that ecosystems provide to human well-being. This suggests that human societies rely on healthy ecosystems, making their sustainable management and conservation vital [38]. The ecosystem services concept allows for a detailed examination of the intricate connections between ecosystem structures, ecological processes, and human well-being within 'socio-ecological systems'. These systems encompass ecological aspects, human dimensions, social practices, governance, institutional frameworks, technology, and the values humans assign to nature [39]. Consequently, the concept of ecosystem services offers a comprehensive framework for addressing complex issues related to sustainable resource use. It has the potential to be a valuable tool in policy-making and decision-making across various sectors and ecosystems.

Overall, the analysis underscores the need for focused improvements in transparency and active participation while acknowledging areas where current performance surpasses expectations. Addressing these gaps can enhance participatory management and foster more effective collaboration between the government and community. By applying this concept, management interventions can be designed to enhance human prosperity and biodiversity conservation, thereby achieving sustainable development goals [40].

5 Conclusions and Recommendation

5.1 Conclusions

1. Pasaran Island, situated in a coastal lowland, faces moderate environmental risks including floods, tsunamis, and coastal erosion. Despite its ecological challenges, the island supports a community dependent on fishing and marine activities. Sustainable land use planning is essential to mitigate risks and preserve biodiversity, particularly focusing on coastal resilience and adaptation strategies to safeguard both human settlements and natural habitats. Of the 100 respondents on Pasaran Island, 53% are native residents and 47% are newcomers. Native residents have deep cultural ties and traditional knowledge, while newcomers contribute to cultural diversity. Based on respondent data, housewives (40%), fishermen (21%), fish processors (16%), and entrepreneurs and traders (15%). Monthly income ranges: IDR 300,000-1,000,000 (37%), IDR 1,000,000-2,000,000 (19%), IDR 3,000,000-4,000,000 (13%), IDR 4,000,000-5,000,000 (3%), > IDR 7,000,000 (2%). Socio-economic management requires programs to stimulate community involvement. By enhancing community engagement, the aim is to foster socially responsible communities. This facilitates the management of programs aimed at improving community economics, such as resource-based ecotourism on Pasaran Island.
2. From an ecosystem services perspective, Pasaran Island exhibits The study reveals significant gaps in community management on Pasaran Island: transparency (-0.09), labor assistance (-0.06), and cleanliness (-0.03). Conversely, positive gaps are observed in financial assistance (+0.09) and damage reduction desire (+0.02). The community values these services highly, evident in their prioritization of economic fulfillment and disaster safety. However, gaps in community participatory management and infrastructure development highlight areas needing improvement. Sustainable strategies are imperative to enhance resource ecosystem services efficiency and community resilience against environmental hazards like floods and tsunamis, ensuring long-term socio-ecological sustainability and well-being. The solutions for Pasaran Island include enhancing transparency and

community participation, providing workforce training, conducting regular cleanliness activities, expanding financial assistance access, reducing disaster risks, and promoting sustainable ecotourism. These measures support ecosystem sustainability and community resilience against natural disasters.

5.2 Recommendation

Future research should prioritize detailed studies on adaptation strategies for enhancing Pasaran Island's coastal resilience against floods, tsunamis, and erosion. It's essential to assess the socio-economic impacts of sustainable land use planning on both native residents and newcomers, taking into account their cultural affiliations and economic activities. Understanding demographic shifts and income variations across different occupational groups will provide a comprehensive view of community dynamics. Emphasizing participatory approaches in infrastructure development and ecosystem management is critical for bolstering resilience and sustaining ecosystem services amidst environmental pressures. By focusing on these areas, future studies can contribute significantly to enhancing the adaptive capacity of Pasaran Island's communities, ensuring their long-term socio-ecological sustainability and well-being in the face of ongoing environmental challenges. The research limitations only involve observing the current social conditions of the community, without evaluating future ecosystem services or their socioeconomic conditions in the past. To obtain comprehensive results, it is necessary to analyze the socioeconomic conditions of the community from the past, present, and future projections.

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