




Achieving Conservation Goals Through Sustainable Practices in Karimunjawa National Park



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ABSTRACT

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Karimunjawa National Park is tasked by the government with implementing a zoning system and sustainability principles to enhance marine conservation efforts. This study aims to evaluate assistance for achieving sustainability in Karimunjawa National Park. This research employed snowball sampling and conducted semi-structured interviews with 130 participants: 65 fishermen, 35 tourist stakeholders, and 30 aquaculture practitioners. This study employed a mixed-method approach, incorporating both descriptive statistical analysis and qualitative descriptive analysis. The findings of this research indicate that the community recognizes the zoning system for sustainability; nonetheless, the economic dimension is more predominant than the social and ecological elements. The dilemma between economic development and ecological preservation is an obstacle for the implementation of economic growth programs in Karimunjawa National Park.

1. INTRODUCTION

The ocean is a resource of considerable economic worth. Estimates indicate that the maritime sector provides about \$1.5 trillion per year to the global economy [1]. Moreover, it serves as a significant hub for human habitation, with over 40% of the global population residing in coastal regions within 150 kilometers of the shoreline [2]. Additionally, the ocean serves as a livelihood source for coastal populations by supplying food and jobs, while also significantly influencing local culture and history [3].

In alignment with global trends, Karimunjawa is leveraging its maritime resources for economic advancement. The Karimunjawa National Park encompasses over 98.65% of its aquatic territory, spanning a total area of 111,625 hectares [4].

The ocean's significance to human life has led to the establishment of a framework for sustainable marine resource management, commonly referred to as the blue economy. This concept has been articulated in numerous international accords as a reflection of humanity's commitment to the well-being of marine ecosystems, ensuring inclusivity and avoiding the marginalization of any community group. According to the World Bank in 2017 [5], the blue economy refers to 'the sustainable use of marine resources for economic growth, improved livelihoods, and employment, while maintaining the health of marine ecosystems. Germand-Duret et al. [6] in 2023 emphasize that this approach integrates the Sustainable Development Goals (SDGs) with economic growth objectives, ecological conservation, and community welfare. Similarly, United Nations in 2020 [7] defines the blue economy as a maritime economy that prioritizes improving human well-being and social equity while significantly reducing

environmental risks and ecological scarcity.

Some studies have reported that the implementation of the blue economy often deviates from established provisions [6, 8-11]. According to these studies, the term blue economy is sometimes merely used as a justification for maximizing economic benefits through the exploitation of marine and coastal resources. While the global concept of the blue economy emphasizes economic growth through marine resource utilization, this approach may overlook the specific social and environmental challenges faced by regions like Karimunjawa. The focus on economic exploitation, particularly in the tourism sector, can result in environmental degradation and unequal distribution of benefits, potentially exacerbating social inequality within local communities [12-15].

Ultimately, blue growth overlooks the unequal distribution of benefits and the potential for significant societal losses if adequate checks and balances are not in place. This leads to environmental and social injustices arising from marine-based development activities [6, 9]. In Karimunjawa, such issues are especially pertinent, given the heavy reliance on marine resources for economic activities, such as tourism and fishing [12, 14]. If not carefully managed, these economic drivers could compromise the sustainability of marine ecosystems and fail to provide equitable benefits to the local population [15].

In line with the mandate of Law Number 5 of 1990, the blue economy seeks to balance human and ecological interests. The diverse objectives of Marine Protected Areas (MPA) also reflect the three pillars of sustainable development: ecology, economy, and society [4, 16]. By emphasizing the growth of the tourism sector, the current driver of the Karimunjawa economy, this study aims to analyze local community support

for the blue economy and its role in advancing the three pillars of sustainability: economy, ecology, and social. It is essential to ensure that local development strategies align with sustainable principles, safeguarding both the environment and the well-being of the Karimunjawa community.

2. MATERIAL AND METHOD

The research was carried out at Karimunjawa National Park, namely at Karimunjawa Village and Kemujan Village. The data for this study were collected by direct observation and semi-structured interviews with respondents. This examination was carried out from June to July 2024, coinciding with the peak tourism season during summer holidays for both international and domestic tourists. This timeframe corroborates field observations concerning the effects of tourism growing.

The respondents represent Karimunjawa's tourism, capture fisheries, and aquaculture economies. A total of 130 respondents were sampled: 65 fishers, 35 tourists, and 30 marine cultivators. Snowball sampling was employed to determine this study's sample size. The technique allows study in unfamiliar areas by obtaining from a key respondent (a prominent individual in the subject field) for afterwards respondents until the data is homogeneous. Number of samples is adjusted to estimated population proportion in each economic actor. Snowballing sampling may not represent the population, but this study seeks to reach the statistically valid minimum sample size of 30 interviews per actor.

The research study used a mixed method, incorporating statistical descriptive analysis, including frequency and percentage, alongside qualitative descriptive analysis to provide comprehensive results [17]. The study seeks to identify and analyze based on the three pillars of sustainability as contained in his writings [18, 19]—social, economic, and ecological—structured into a positive statement to assess the sustainability level of blue growth in Karimunjawa. There are several tools to investigate the study: 1) using a questionnaire to find out whether or not zoning is known in Karimunjawa, 2) using mapping using GIS to create a map of the distribution of economic activities and zoning systems in Karimunjawa, 3) assessment the respondent using a scale from 1 to 10 (strongly disagree to strongly agree) with a standard format. Then calculation average, see Eq. (1).

$$\text{Average per Statement} = \frac{\text{The Sum of Values}}{n} \quad (1)$$

To complete the result also use each evaluation gathered from respondents is subsequently computed by assigning weights to each dimension (social, economic, ecological) through a weighted average score technique, encompassing the following stages:

Calculating formula:

Step 1: Calculate average score per dimension for each respondent. See Eq. (2).

$$\text{Score}_{e_{1,2,3}} = \frac{\sum_{j=1}^{k_{1,2,3}} R_{i,j}}{k_{1,2,3}} \quad (2)$$

Step 2: Calculate weighted score for each respondent. See Eq. (3).

$$\text{Total Score} = (w_1 * \text{Score}_1) + (w_2 * \text{Score}_2) + (w_3 * \text{Score}_3) \quad (3)$$

Step 3: Calculate total of overall average for all respondents. See Eq. (4).

$$\text{The Total Score} = \frac{\sum_{i=1}^n \text{Total Score Overall Respondent}}{n} \quad (4)$$

Notations used:

n : number of respondents (130)

k_1 : number of questions in the social dimension (5)

k_2 : number of questions in the economy dimension (6)

k_3 : number of questions in the ecology dimension (5)

w_1, w_2, w_3 : weight for each dimension (e.g., Social = 30%, economic = 30%, ecological = 40%)

Note: *Ecology weighs 10% more than social and economic dimensions because Karimunjawa National Park, a marine conservation area, must maintain the sustainability of marine and coastal ecosystems (ecology) per Law Number 5 of 1990.

$R_{i,j}$: score of respondent i for question j

The number of results based on calculation Eq. (1) until Eq. (4) obtained is classified based on five ranges in Table 1, as follows:

Table 1. Scoring scale

Scoring Scale	Categorize
0-2	Very Low
2-4	Low
4-6	Medium
6-8	High
8-10	Very High

Source: Study [20]

3. RESULT AND DISCUSSION

3.1 Sustainability practice in Karimunjawa National Park

Karimunjawa National Park has a zoning system as a strategy for nature conservation. The zoning system is established to achieve sustainability by harmonizing the area's ecological preservation with the welfare of the residents who inhabited Karimunjawa prior to its designation as a conservation area [16, 21]. This system is established in accordance with the interpretation of Law Number 5 of 1990 of the Republic of Indonesia. The zoning of Karimunjawa National Park was initially established in the Decree of the Director General of PHPA No. 127/Kpts/DJ-VI/1989, dated December 28, 1989, and is categorized into four zones: core, protection, utilization, and buffer. Following that, it was amended in 2005 by the Decree of the Director General of PHKA No. SK. 79/IV/Set-3/2005, establishing seven zones. Last amended in 2012 by the Decree of the Director General of PHKA No. SK. 28/IVSET/2012, it was modified to include nine zones: core, jungle, marine protection, land utilization, marine tourism utilization, marine cultivation, traditional fisheries and religious culture.

Community knowledge of zoning regulations is required for the effective implementation of sustainability initiatives. Table 2 presents the investigation of zoning knowledge data among economic actors, including fishermen, marine farmers,

and tourism stakeholders. The zone questions directed at respondents concentrated solely on five of the nine relevant zones: the core zone, jungle zone, catch fisheries zone, cultivation zone, and tourism zone. The five zones were selected as not all zones directly influence the interaction between local residents and conservation areas. Only these five zones are particular to economic activities and carrying out of nature protection. The other zone such as religious-cultural zones, may be more synergistic with community, but less interaction with economic and marine resources.

Table 2 shows core zones and marine protection zones are important because they safeguard coral reefs, fish, and other ecologically sustainable biota. Nearly 90% of economic players, including maritime workers, fishermen, and tourism actors, know the core zone, according to Table 2. According to 30% of economic actors, maritime conservation zones are unknown. The public knows about the core zone because it has strict law enforcement, both preventatively with physical signs and surveillance patrols and repressively with warnings, arrests, and fines [22, 23]. Marine protection zones enable human activities, including research, teaching, and restricted tourism, with law enforcement is lax [12]. So it's understandable if the public knows less about marine protection zones than core or industrial zones. Tourism actors (74%) and fisherman (63%) who use the tourism zone are knowledgeable about it. Only 43% of marine farmers were

unaware of tourism special zones. Tourism zone is known to more than 50% of economic actors who use it, but agricultural zone is only known to 50% of cultivators. Considering they use the fishing zone most, 17% of fisherman know about it, which is surprising. Meanwhile, 51% of tourism players know the fishing zone better than fishermen. One factor is the stringent regulations for establishing tourism businesses Fafurida et al. [24] in 2020, coupled with the interest of those involved in tourism in the beauty of marine and coastal ecosystems, which are the primary attractions for tourist. as discovered by Setiyanto et al. [23] in 2024, tourism entrepreneurs are inclined to possess greater knowledge areas as prerequisites for comprehension and actions aimed at preserving marine ecosystem.

The subsequent result involves the investigation of mapped regions of economic activity—capture fisheries, aquaculture, and tourism— with the zoning area delineated by the Karimunjawa National Park Office in compliance with regulation No. SK. 28/IVSET/2012. This evaluation is depicted in Figure 1 for the investigation of the Karimunjawa Islands and in Figure 2 for the analysis of Karimunjawa Island and Kemujan Island, which are the islands with the biggest population and the epicenter of Karimunjawa's economic activity. Table 3 delineates the zoning violations detected by the analysis of tourism economic activity points inside the designated zoning area, as depicted in Figures 1 and 2.

Table 2. Zoning knowledge

Zoning Knowledge	Marine Cultivators (n=30)		Economic Actors Fishermen (n=65)		Tourism Actors (n=35)	
	Freq.	%	Freq.	%	Freq.	%
Know Core Zone	28	93.33	57	87.69	28	80.00
Know the Marine Protection Zone	2	6.67	7	10.76	10	28.57
Know the Marine Cultivation Zone	15	50.00	2	3.08	17	48.57
Know the Marine Tourism Zone	13	43.33	41	63.08	26	74.29
Know the Traditional Fisheries Zone	5	16.67	11	16.92	18	51.43

Note: The core zone is a protected area with no economic activity but limited research access. The Marine Protection Zone is an ecological preservation support zone with limited access to research, education, and tourism. Economic zones—marine cultivation, tourism, and traditional fisheries—support blue economic activity

Table 3. Violations zoning by economic activities in Karimunjawa National Park

Economic Activities		Ecology Zone	
Sectors	Business	Core Zone*	Marine Protection Zone**
Tourist	Snorkeling/Diving	-	V 4 points (1 point in Menjangan Kecil island, 1 point in Sintok island, 1 point in Tengah Island, 1 point in cemara besar island)
	Beach	V 2 points (2 points Tanjung Boma)	-
Traditional Capture Fisheries	Fisher	V 2 points (1 point in near Taka Malang, 1 points near Tanjung Boma)	V 3 points (2 points in Cemara Besar island, 1 in Sintok island)
	Aquaculture	Seaweed Cultivation	-
	Grouper Cultivation	-	-
	Shrimp Cultivation	-	-

Note: * Marine resource protection, research restrictions, and prohibition of economic activities; ** Protection of marine resources, research, education, and limited tourism activities

Figure 1 indicates that infractions by fishing and tourism activities within the core zone and marine protection were

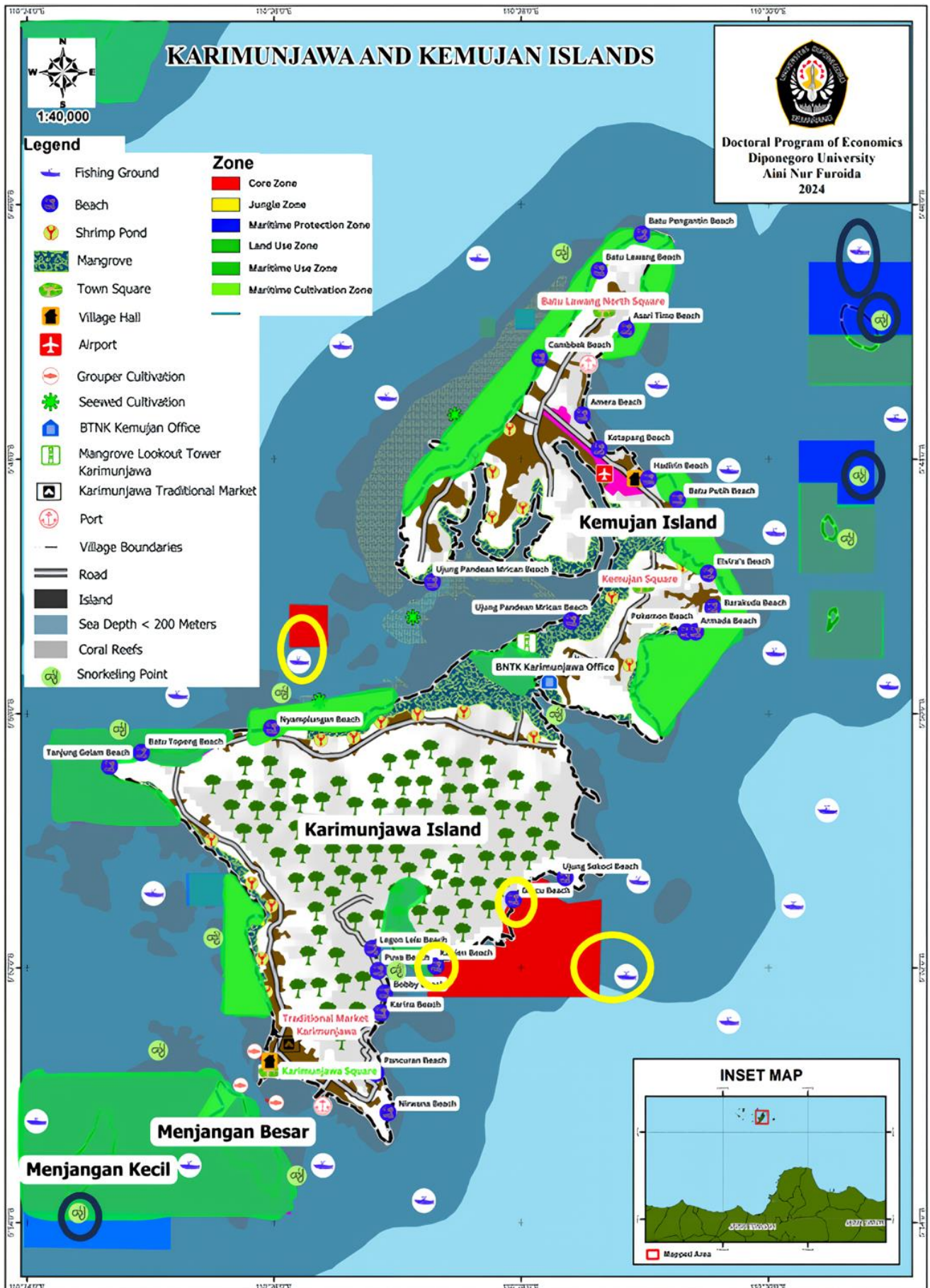


Figure 2. Map of economic activities and zoning in Karimunjawa Island and Kemujan Island
 Note: Black circle is activities not in accordance with their zone, yellow circle is activity near the core zone
 Source: WCS (2022) [4]; BTNK (2023) [25]; Google Maps (2024); Observation (2024), In-depth Interview (2024), processed

Numerous respondents noted that the community recognized their entry into the core zone, despite awareness of its prohibition on activities, attributed to the lack of rigorous enforcement. The findings suggest that the community lacks consciousness regarding the importance of the core zone in natural resource management. Their priorities are short-term economic rewards over long-term environmental benefits of core zone conservation [22, 26, 27]. The findings are corroborated by Lukman et al. [28] in 2022 found that Karimunjawa fishermen ignore zoning laws due to tourism-driven fish demand and fish in the core zone, which has more fish. Core zones are appealing fishing sites because of the substantial fish populations that they contain. This is because core zones serve as spawning grounds, nursery grounds, and feeding grounds for fish [29]. Despite the Marine Protection zone lacks stringent regulations, monitoring excessive exploitation within the zone may prove challenging. The use of natural resources in the area must be regulated and preserved, as this region serves as a buffer zone adjacent to the core zone. In the end, the delineation of zones and the allocation of economic activity centers have been largely beneficial; however, additional research is required about the community's pro-environmental initiatives.

3.2 Level of sustainability—social, economic, and ecological—in Karimunjawa

The notion of sustainability emerges from the optimal balance among societal, environmental, and economic needs [19]. The convergence of the three domains demonstrates that prudent decisions concerning sustainable resource management will yield sustainable economic growth and ensure wellbeing of community. Table 4 illustrates the degree

of sustainability as determined by public perception.

Table 4 presents the evaluation of respondents concerning the sustainability level of Karimunjawa, derived from the statements provided across the three dimensions. The economic dimension pertains to the facilitation of business development and a notable rise in income levels. Furthermore, there are initiatives aimed at fostering innovation within the realm of entrepreneurship. The social dimension is influenced by enhancing collaboration across sectors and ensuring equitable distribution of natural resource utilization. The ecological dimension provides a rationale for the use of environmentally sustainable marine and coastal ecosystems. The results indicate a high sustainability score for Karimunjawa at 6.34 point. This value is derived from the perceptions of each respondent, which are subsequently weighted with an economic proportion of 30%, social 30%, and ecology 40%. The increased emphasis on the ecological aspect aligns with the primary goal of the Karimunjawa National Park, which is to safeguard marine and coastal ecosystems as stipulated by Law Number 5 of 1990.

The assessment results presented in Table 4 indicate that the economic dimension's implementation is more pronounced compared to the social and ecological dimensions. The rapid economic growth of Karimunjawa can be attributed to the significant expansion of its tourism sector, which is not unexpected. The tourism sector has emerged as a dominant force, leading to the development of various derivative businesses, including resorts, lodging, cafes, and more. Furthermore, Karimunjawa has been identified as a National Priority Strategic Area, as outlined in Presidential Regulation of the Republic of Indonesia Number 88 of 2024. This presidential directive builds upon the framework established in Government Regulation Number 50 of 2011.

Table 4. The level of sustainability Karimunjawa

Dimensions	No.	Information	Average per Statement*	Weighted Score Each Respondent**
Social	1	Supporting agenda's government to develop economic	8.1	2.01
	2	Businesses can coexist with businesses in other sectors	7.85	
	3	Rapid economic growth encourages the formation of associations	9.02	
	4	The rapid economic growth is an opportunity to collaborate with businesses in other sectors	6.00	
	5	I am involved in the preparation of the development agenda's government	2.56	
Economy	1	The rapid growth in tourism impact increased income of household	8.74	2.65
	2	The rapid growth in tourism makes it easier for me to diversify my livelihood	7.96	
	3	The rapid growth in tourism inspired me to become an entrepreneur	9.80	
	4	The rapid growth in tourism has made it easier to get training new skills	8.90	
	5	The growth of the economy has encouraged infrastructure development in this region.	9.93	
	6	My business continues to operate successfully despite competition from other sectors.	7.83	
Environment	1	The businesses operated by others utilize environmentally friendly technology	7.22	1.63
	2	The business operated by others effectively manages their waste/garbage	5.76	
	3	Stringent sanctions must be enforced to mitigate environmental degradation.	4.73	
	4	The core zone must be expanded and added	1.40	
	5	Ecotourism is implemented by limiting the number of tourists	1.20	
Sustainability level				6.34 (High)***

Note: *See Eq. (1); ** See Eq. (2) until Eq. (4); *** See Table 1

The success of tourism in Karimunjawa plays a crucial role in fostering the development of attractions, enhancing accessibility, and improving amenities in the region [30, 31]. The number of tourist visits to Karimunjawa has exhibited a consistent upward trend since 2008, with an increase of 9,986 visitors. This growth became particularly pronounced in 2019, reaching a total of 148,283, predominantly comprised of domestic tourists, totalling 137,653. In 2020, there was a significant reduction in tourist numbers, dropping to 6,165, which was even less than the figures recorded in 2008, largely attributed to the impact of the COVID-19 pandemic. Following the transition into the post-local community have not directly developed Karimunjawa tourism. Low local community participation will lead to an uneven allocation of natural resource benefits, and only players with more investment and authority will limit people's rights to utilise natural resources [6, 32]. Environmental sustainability is needed to keep natural resource elements productive to meet human demands, although the ecological dimension has the lowest point [19]. People are reluctant to spend more on waste or rubbish management since it increases the economic burden. Due to money worries, they are also less willing to curtail tourist visits. This shows that the community wants more tourists, even if it could impair Karimunjawa's environmental carrying capacity [15, 33]. Karimunjawa is sustainable, yet tourism growth has unfairly involved indigenous people and ignored the ecological dimension. So need to transition injustice of blue growth to blue justice, alternatively through Collaboration with stakeholders is needed between local communities, local elites, entrepreneurs, managers, and the government to maintain ecological sustainability [34, 35]. In its development, adaptive co-management [36-38] can be an alternative that can be applied by focusing on the synergy of institutions, communities, and businesses based on scientific studies, knowledge and repeated learning opportunities indirectly based on the condition of marine ecosystems and social welfare.

4. CONCLUSION

The local community in Karimunjawa has shown a large amount of support for the growing blue growth. They have come to the realisation that the preservation of the maritime environment is critical to the continued economic well-being of the village. The zoning that has been adopted in Karimunjawa National Park is believed to be effective in separating ecosystems and economic activities. The majority of respondents agreed with the existence of the core zone and its size, as well as the significance of zoning in reducing the impact of environmental hazards. On the other hand, the community's understanding of utilisation zones, such as marine cultivation zones and traditional fisheries zones, is still quite poor, which indicates that additional education is required. In spite of this, the majority of respondents were in agreement that the natural beauty and health of the marine ecosystem had contributed to their well-being. This success has been achieved both directly through economic activities such as tourism and indirectly through the preservation of the environmental ecosystem. Due to the fact that there was a large increase in the number of tourists that visited prior to the pandemic, the tourism industry has become the primary economic driver of the local economy. In accordance with this, there are still obstacles to overcome in order to establish social

and biological ecosystems. One of the most important aspects of formulating a developing economy policy in Karimunjawa is having an awareness of the potential conflict that could arise between economic expansion and environmental longing. Support for this blue growth needs to be tempered with an approach that takes a holistic perspective, which places an emphasis on economic advantages and ensures that benefits are distributed fairly while also providing enough protection for the environment.

Equitable distribution of the benefits derived from tourism, as the main economic driver, is another critical aspect. Policymakers should prioritize initiatives that support local employment, implement profit-sharing mechanisms, and reinvest tourism revenues into community development and environmental preservation. This approach not only ensures fairness but also fosters a stronger commitment to sustainability within the community. The long-term success of blue growth in Karimunjawa ultimately requires a holistic and integrated approach that balances economic gains with environmental preservation. By fostering adaptive co-management, can achieve sustainable development that benefits both the local economy and its unique marine ecosystem. These recommendations provide a pathway for policymakers to address existing gaps and ensure the sustained prosperity and environmental integrity of Karimunjawa for future generation.

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NOMENCLATURE

GIS	Geographic Information System
BTNK	<i>Balai Taman Nasional Karimunjawa</i> (Karimunjawa National Park Office) <i>Departmen Perlindungan Hutan dan Pelestarian Alam</i> (Forest Protection and Nature Conservation Department, Ministry of Forest and Environment)
PHPA	<i>Perlindungan Hutan dan Konservasi Alam</i> (Forest Protection and Nature Conservation, Department, Ministry of Forest and Environment)
PHKA	<i>Perlindungan Hutan dan Konservasi Alam</i> (Forest Protection and Nature Conservation, Department, Ministry of Forest and Environment)