Important-performance analysis of capture fisheries development in Karimunjawa Islands

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Abstract. The Karimunjawa Islands is a strategic area in Indonesia that is prone to conflicts regarding conservation, fisheries and tourism. Conservation programs should also consider the improvement of community welfare in the area by conducting priority scale determination of strategy. The important-performance analysis (IPA) approach can be used in the priority scale determination of the capture fisheries development in Karimunjawa Islands. This study was performed to measure the priority of capture fisheries development in Karimunjawa Islands using the IPA. Local fishermen were involved in this study, (especially those who lived in Karimunjawa Island and Kemojan Island), where there were diverse ethnic groups that affected the culture of the local community. Based on the results of the IPA, the priority attributes must be improved including docking facilities, culinary centers and fishing ports. Meanwhile, development programs that need to be prioritized include the supervision of sustainable fishing practices, law enforcement on illegal, unreported and unregulated (IUU) fishing practices, development of public facilities (sea transportation, land transportation, electricity, and clean water), development of fish processing centers, development of culinary centers, as well as community empowerment programs (including capital strengthening, production equipment, cooperative institutions, and fishermen families and conservation).
Key Words: artisanal fisheries, IPA, Karimunjawa Island, Kemojan Island, strategy.

Introduction. Karimunjawa Islands is one of the protected marine areas in Indonesia (located at coordinates of 5°40'39" to 5°55'00" South Latitude and 110°05'57" to 110°31'15" East Longitude). This area has fairly high complex problems (Prihantono et al 2021; Putro et al 2016; Kennedy et al 2020; Zharif et al 2022). Most of local community mainly makes living as fishermen through generations. They had lived there before Karimunjawa Islands was designated as a conservation area by the Indonesian government in 1999 (Decree of the Minister of Forestry and Plantations No. 78/Kpts-II/1999). Karimunjawa Islands also offers the natural beauties of tropical forest, mangrove forests, beaches, clean waters and under the sea view (coral reef), making it favorite tourist destinations, both for domestic and international tourists. Consequently, the development of Karimunjawa Islands is prone to conflicts of interest between fisheries, conservation and tourism (Fafurida et al 2020; Wijayanto et al 2020; Wijaya et al 2021).

Conservation programs are considered failing if they cannot improve the community welfare. Fisheries, tourism and conservation in the Karimunjawa Islands need to be synergized (Yuliana et al 2016; Wijayanto et al 2022). Fishermen's perspective should be taken into consideration in the development of Karimunjawa Islands. Determining the priority of capture fisheries development in the Karimunjawa Islands can be done using important-performance analysis (IPA). This study was performed to measure the priority of capture fisheries development in the Karimunjawa Islands using an IPA by taking into account fishermen's perspectives.

Material and Method

Research location. This study was conducted from July to August 2022 and took place at Karimunjawa Islands, mainly on Karimunjawa Island and Kemojan Island (Figure 1)

which are the two largest islands in the Karimunjawa Islands where 82% of the total population of Karimunjawa Islands reside (Wijayanto et al 2022). Karimunjawa Island is also the center of government and economic in Karimunjawa Islands.

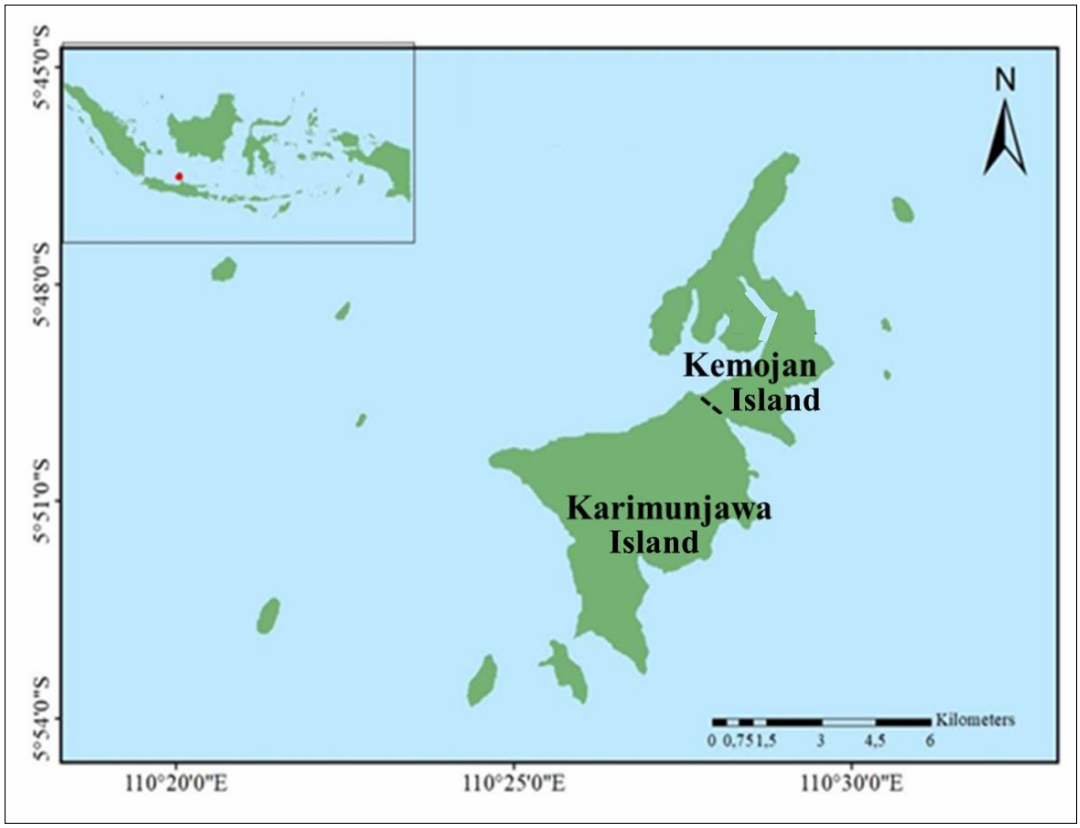

Figure 1. Karimunjawa Island and Kemojan Island.

Data collection. Data were collected through interviews with 440 fishermen living in Karimunjawa Island and Kemojan Island.

Data analysis. IPA was employed to identify the priority attributes that need to be developed related to capture fisheries development in Karimunjawa Islands. The IPA method was developed by Martilla & James (1977) which can be used to develop priority development strategies (Musa et al 2010; Lankia et al 2022). There are 4 quadrants of IPA that describe the relationship between importance and performance as illustrated in Figure 2.

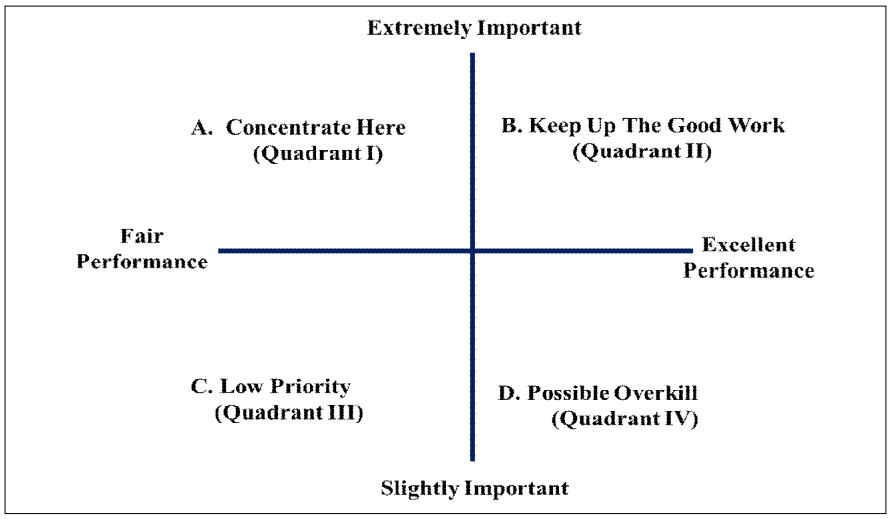

Figure 2. Important-performance grid (source: Martilla & James (1977)).

In this study, respondents were asked to share their views on importance and performance using a Likert scale (5 scales). The median value is 2.5 for important (Y axis) and 2.5 for performance (X axis) as the central tendency.

Results. Karimunjawa Islands is administratively a District of Jepara Regency (Central Java). There are four villages, namely Karimunjawa Village (Karimunjawa Island and its surroundings), Kemojan Village (Kemojan Island and its surroundings), Nyamuk Village (Nyamuk Island and its surroundings) and Parang Village (Parang Island and its surroundings). The population was concentrated on Karimunjawa Islands and Kemojan Island (Wijayanto et al 2022).

The characteristics of fishermen. Fishermen in the Karimunjawa Islands are mostly artisanal fishermen who use hand line, traps, gill nets, spears and boat lift nets in capturing the fish (Table 1). The fishing gear is operated around Karimunjawa waters in one-day fishing. A small number of fishermen use troll line which are operated in Java Sea within 1 week. Some fishermen often use more than one tool (multi-gears).

Table 1

Fishing gear used by respondents

Type of fishing gears	*Karimunjawa*	*Kemojan*
Hand line	203	267
Troll line	2	2
Boat lift net	2	2
Gill net	2	4
Spear	32	12
Trap (‘Bubu’)	15	3

Hand line is the main fishing gear used by fishermen in the Karimunjawa Islands, both for catching demersal fish, pelagic fish and squid. Squid hand line is widely used by fishermen on Kemojan Island. Artisanal fishing is allowed in Karimunjawa Islands to prevent overfishing and to maintain the balance of the Karimunjawa water ecosystem.

The majority of respondents are Muslim and Javanese (Table 2). These religious and ethnic backgrounds influence the local wisdom in Karimunjawa Islands. Fishermen there possess relatively low educational backgrounds as most of them are primary school graduates, even many of them dropped out the primary school. Education background then affects their way of thinking. The number of respondents aged younger than 30 years is relatively small, indicating slow regeneration. The children of fishermen in Karimunjawa Islands pursue their education higher and they prefer working in the formal sector with minimum physical risks (Wijayanto et al 2022).

Table 2

Respondents’ ethnicity, religion, education and age

Characteristics	*Karimunjawa*	*Kemojan*
Ethnicity		
Javanese	90.5%	88.7%
Bugis	1.6%	10.3%
Banjarese	1.2%	0.5%
Madurese	0.5%	0.5%
Bajo	4.5%	
Betawi	0.4%	
Buton	0.8%	
Sumbawa	0.5%	
Religion		
Islam	99.6%	99.0%
Christian	0.4%	0.5%
Buddha		0.5%

Education		
Dropped out from primary school	27.5%	18.8%
Primary school	59.6%	50.0%
Junior high school	10.4%	29.2%
High school	2.5%	2.0%
Age		
Under 20 years old	0.0%	1.0%
20 to 29 years old	10.3%	6.9%
30 to 39 years old	21.4%	18.6%
40 to 49 years old	29.2%	36.7%
50 to 59 years old	30.9%	27.5%
60 years old and older	8.2%	9.3%

Priority for capture fisheries development. The results of the IPA can be seen in Table 3. There is a relatively similar trend between fishermen from Karimunjawa Island and Kemojan Island regarding the priority attributes that need to be considered in fisheries development. Fishermen believe that ship docking facilities and fish culinary centers need to be prioritized for development as the current conditions of those facilities are poor.

Table 3

IPA results

Attributes	*Karimunjawa*			*Kemojan*		
	I	*P*	*Q*	*I*	*P*	*Q*
Fish resource condition	4.99	3.36	2	4.98	3.53	2
Technical expertise	5.00	4.29	2	4.78	4.40	2
Fishery business managerial skills	3.77	3.72	2	4.00	3.99	2
Capital strength	4.98	3.05	2	4.97	3.39	2
Fish marketing network	4.37	4.02	2	4.44	4.10	2
Availability of crew members	4.03	3.50	2	4.29	3.48	2
Pier facilities	4.18	3.00	2	4.51	3.14	2
Ship docking facilities	3.32	1.31	1	3.49	1.63	1
Fish auction facilities	2.00	1.00	3	2.19	1.26	3
Fish market facilities	3.00	3.48	2	3.13	3.66	2
Public market facilities	4.05	4.02	2	4.12	4.08	2
Fish culinary center facilities	4.25	1.91	1	4.34	2.12	1
Fish processing facilities	3.87	3.00	2	3.93	3.13	2
Fuel station for fishermen	5.00	4.02	2	5.00	4.10	2
Ice factory	3.55	3.05	2	3.78	3.21	2
Fresh water supply	4.58	4.43	2	4.50	4.57	2
Electricity supply	4.98	4.43	2	4.96	4.58	2
Road and land transportation facilities	4.98	4.03	2	4.90	4.10	2
Public port facilities	4.95	3.70	2	4.92	3.96	2
Airport facilities	4.33	3.30	2	4.67	3.50	2
Fish price	5.00	3.83	2	5.00	3.88	2
Fishing equipment prices	4.49	4.03	2	4.62	4.11	2
Fish processing factory	4.27	3.40	2	4.36	3.36	2
Communication network and internet	4.78	3.78	2	4.66	3.83	2
Political support for fishermen	4.08	3.76	2	4.18	3.78	2
Regulations related to fishing business	4.08	3.87	2	4.18	3.94	2
Social environmental safety	4.69	4.78	2	4.88	4.77	2
Local wisdom of coastal communities	4.97	3.36	2	4.96	3.55	2
The existence of Karimunjawa National Park Office	4.19	4.07	2	4.04	4.15	2
The existence of Karimunjawa Coastal Fishing Port	3.14	2.84	1	3.29	3.19	2
The existence of a fishery cooperative	3.14	3.12	2	3.30	3.27	2
The existence of fishing groups	3.77	3.77	2	4.05	4.04	2
Fishery instructor services	3.77	3.75	2	4.03	4.01	2
Tourism progress in Karimunjawa	5.00	4.58	2	5.00	4.50	2
Development of fishing technology	4.49	4.07	2	4.65	4.16	2

Local market tastes to fish	4.08	4.07	2	4.16	4.15	2
Fish demand from tourists	4.79	4.38	2	4.76	4.28	2
The purchasing power of local people	4.08	4.06	2	4.17	4.14	2
National and regional fish demand	4.79	4.36	2	4.76	4.26	2
National economic conditions	4.05	3.17	2	4.13	3.34	2
Social environment conducive	3.17	4.27	2	3.35	4.31	2

Notes: I (important), P (performance), Q: quadrant, where quadrant 1 indicates high priority, quadrant 2 indicates the need for maintenance, quadrant 3 means less-priority, and quadrant 4 is considered less important.

Fishing ports are only located in Karimunjawa Island. Fishermen from Karimunjawa Island show greater enthusiasm in the development of Karimunjawa coastal fishing port. Therefore, fishermen in Karimunjawa Island consider that the development of coastal fishing port in Karimunjawa needs to be prioritized, while fishermen in Kemojan Island consider the development of coastal fishing port in Karimunjawa is not the major priority. On the other side, there is no fish auction service in Karimunjawa Island, yet there is one in Kemojan Island. However, fishermen from both Karimunjawa Island and Kemojan Island do not find the necessity to prioritize fish auction development.

The identification results of strategic priority recommendations from respondents are presented in Table 4. Viewing from respondents' perceptions, the strategies that are highly prioritized include the monitoring of eco-friendly fishing practices, law enforcement on illegal and non-environmentally friendly fishing practices, development of public facilities (sea transportation, land transportation, electricity, and clean water), development of fish processing centers, development of culinary centers, community empowerment programs (capital strengthening, production equipment, cooperative institutions, and fishing families, and conservation).

Table 4

Strategic priorities

Priorities	*Karimunjawa*		*Priorities*	*Kemojan*	
	Type of strategies	*Values*		*Type of strategies*	*Values*
1, 2, 3, 4, 5	Supervision of environmentally friendly fishing practices.	5.000	1, 2	Supervision of environmentally friendly fishing practices.	5.000
	Law enforcement on illegal fishing and damaging fishing practices.	5.000		Law enforcement on illegal fishing and destructive fishing practices.	5.000
	Development of sea transportation facilities.	5.000	3	Development of electrical facilities.	4.980
	Development of electrical facilities.	5.000	4	Development of fish processing centers.	4.936
	Program to strengthen capital and production equipment.	5.000	5	Development and strengthening of cooperatives.	4.931
6, 7	Development of fresh water facilities.	4.992	6	Development of fish culinary center.	4.916
	Conservation program	4.992	7, 8	Development of fresh water facilities.	4.906
8	Empowerment of fishermen and fishermen's families.	4.988		Program to strengthen capital and production equipment.	4.906
9	Development of fish processing centers.	4.963	9	Empowerment of fishermen and fishermen's families.	4.838
10	Development of fish culinary center.	4.963	10	Development of land transportation facilities.	4.769

Discussion. The survey results show that docking facilities, culinary centers and fishing ports need to be prioritized for development for their current conditions are unsatisfactory. Some attributes are also considered highly important, including fuel station facilities, fish prices, tourism, fish resources, capital, road and land transportation facilities, electricity supply, local wisdom of coastal communities and public port facilities.

Fish resource preservation is considered very important, both by fishermen from Karimunjawa Island and Kemojan Island. The people of the Karimunjawa Islands mostly make living out of artisanal fishing, that they highly depend on the sustainability of fish resources. Therefore, the supervision of environmentally friendly fishing practices and the imposition of sanctions for illegal, unreported and unregulated (IUU) fishing actors should be prioritized. The results of the study by Zharif et al (2022) showed that fishermen families in Karimunjawa Islands are very dependent on fishing business, while the diversification of their business is low. Fluctuating amount of income from fishing can put fishermen in difficulties in fulfilling their daily necessities, especially when the weather is not safe for fishing. According to Fafurida et al (2020), the awareness of the environment preservation should be taught early on through formal education. Technological developments can be utilized in educating the public about the importance of clean, natural tourist destinations and back-to-nature lifestyle. Yuliana et al (2016) mentioned that most of Karimunjawa fishermen did not clearly understand the boundaries of water zoning in Karimunjawa marine protected area, including the boundaries of the core zone.

The aquatic resources in the Karimunjawa Islands are highly diverse with 412 species of fish, 205 species of anthozoa, 47 species of gastropods, 8 species of bivalves, 8 species of cephalopods, 5 species of arthropods, 31 species of echinoderms, and 35 species of sponges (Ministry of Environment and Forestry 2017). Kennedy et al (2020) suspected that destructive fishing practices could lead to a reduction in coral reef area. Coral reefs are also affected by the decline in water quality due to tourism and aquaculture activities.

Tourism has become a new economic sector in Karimunjawa Islands. The development of tourism in Karimunjawa encourages infrastructure improvements, including electricity, public sea-ports, airports, telecommunications, and land transportation. Some fishermen even work two jobs as fishermen and tourism service providers. Tourism in Karimunjawa also affects the demand and price of fish. The business diversification of local communities in the Karimunjawa Islands needed to be developed to improve the welfare of local communities and encourage conservation programs that include including fisheries, agriculture, seaweed cultivation and environmentally friendly tourism (Wijayanto et al 2020, 2021).

Furthermore, the waste management and clean water sources in Karimunjawa need to be prioritized. The increase in population and higher tourist visits lead to greater amount of waste that must be properly managed and they also increase the need for clean water. According to Wijaya et al (2021), the waste problem is one of the crucial problems that should be addressed since the major tourist attraction in Karimunjawa is its natural beauty. In a study, Prihantono et al (2021) showed that groundwater in Karimunjawa has experienced seawater intrusion, making it unsuitable for consumption as drinking water. Therefore, water desalination technology needs to be developed in the Karimunjawa Islands.

The main source of electrical energy in Karimunjawa Island and Kemojan Island comes from Legon Bajak diesel power plant (located on Kemojan Island) with a capacity of 2 x 2.2 MW. The development of solar energy and wind energy can be an alternative energy resource for the community living in small islands. Dewandaru Airport has been developed with a runway of 1200 x 30 m. However, the Covid-19 pandemic affected the tourism in Karimunjawa due to the shutdown of tourism sea transportation (from Jepara regency to Karimunjawa) and flight from Semarang (Central Java Province capital) to Karimunjawa. Regarding sea transportation, some ships sail from Jepara to Karimunjawa and Semarang to Karimunjawa. There are 2 public ports in the Karimunjawa Islands, namely Karimunjawa public port in Karimunjawa Village and Legon Bajak public port in Kemojan Village (Wijayanto et al 2022).

People who live in the Karimunjawa Islands are multi-ethnic. Some of the dominant tribes living in the Karimunjawa Islands include the Javanese, Bugis, Butonese, Bajo, Mandar and Madurese. Mixed marriages between tribes living on Karimunjawa Island are also common. Indonesian and Javanese languages are the dominant languages in the community. Some younger generations from non-Javanese tribes living in the Karimunjawa Islands even no longer master their local language. Most of the population in Karimunjawa Island are Muslim, and their religion affects the culture that develops in the Karimunjawa community (Wijayanto et al 2022). The Karimunjawa community is a religious society. The local wisdom of Karimunjawa community can strengthen conservation programs in Karimunjawa. According to Murhaini & Achmadi (2021), nature conservation means preserving the life of the biota and the creatures that inhabit it, otherwise destroying nature will harm its inhabitants. Therefore, the management of community livelihood activities needs to be carried out by maintaining the values of local wisdom from generation to generation. Meanwhile, according to Hamid et al (2021), objections from local communities to marine conservation can be a major challenge for policy makers in carrying out conservation programs, especially in areas where local communities are highly dependent on marine resources for their livelihoods. Therefore, local wisdom should be used as an approach to the management of conservation programs. Putro et al (2016) found that efforts to improve the quality of human resources are more complicated to do in the poor community. Many people in Karimunjawa Islands are regarded poor and they lack of access to various resources. Therefore, efforts to eradicate poverty and improve human welfare through a pro-poor tourism (PPT) approach based on vocational tourism training need to be carried out in Karimunjawa Islands. Meanwhile, the results of a study by Richmond & Casali (2022) showed that social capital (including trust, involvement and leadership) can play a role in encouraging environmentally friendly and sustainable fishing practices. Social capital can be a key factor to the sustainability of fishing communities that can bridge relationships with other stakeholders, including the government.

Fishing ports (including fish auction facilities) are the main facilities that need to be developed to support the fishing business. A fishing port should be established on Kemojan Island to allow traditional fishermen on Kemojan Island carry out mooring and anchoring activities and sell fish more optimally. The construction of fish auction facilities needs to be accompanied by good governance for fair pricing of the fish. Fish auctions can increase the price of fish sold by fishermen to buyers. The fish auction is expected to bring together sellers and buyers in large numbers. The fish auction is also expected to reduce transaction costs borne by sellers and buyers. However, in the real practice, fish auctions are not always efficient (Sogn-Grundvåg et al 2019). Guillotreau & Jiménez-Toribio (2011) found fish auctions using electronic systems have been confirmed capable of increasing the selling price of fish. On the contrary, according to Fluvià et al (2012), fish auctions cannot optimally increase the fish prices. Fishermen who come to the fish auction earlier tend to get higher prices than fishermen who arrive later. Related to the research method, the validity of IPA as a managerial analysis tool has been questioned by several researchers, but by increasing the number of respondents, IPA is expected to reflect stakeholders' view on fishery activities (Bacon 2003; Musa et al 2010).

Conclusions. Fishermen in Karimunjawa Islands (especially on Karimunjawa Island and Kemojan Island) are diverse in terms of ethnicity which then affects the culture of the local community. Based on the results of the IPA, the development of docking facilities, culinary centers and fishing ports should be prioritized. Fishermen put more emphasis on the need for supervision of environmentally friendly fishing practices, law enforcement on illegal and environmentally unfriendly fishing practices, development of public facilities (sea transportation, land transportation, electricity, and clean water), development of fish processing centers, development of culinary centers, and community empowerment programs (capital strengthening, production equipment, cooperative institutions, and fishing families, and conservation).

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

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