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DETERMINING FACTORS IN OPTIMIZING THE UTILIZATION OF FISH RESOURCES IN THE COASTAL AREAS OF JEMBER REGENCY

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Abstract

The Jember Regency is directly adjacent to the Indian Ocean and boasts a coastline of about 170 km along the southern coast of East Java. The districts of Puger, Ambulu, Gumukmas, and Kencong have the most potential for marine fisheries in this area. The primary location for fishing operations, fish landings, and the distribution of marine goods is the Puger Coastal Fisheries Port (PPP). More than 80% of the total marine capture fisheries production in Jember Regency comes from lemuru (Sardinella lemuru), lisong tuna (Euthynnus affinis), and scad (Decapterus spp.). Finding the key elements for maximizing fish resources in Jember Regency's coastal regions is the aim of this study. The methodology employed is a descriptive exploratory approach with an expert system component. The analysis technique used is cognitive mapping analysis. This research concludes that: of the 17 factors identified, they can be classified as follows: (a) In order of priority, the following key factors directly and indirectly influence other factors that determine the direction of fish resource utilization: the income of fishermen, business groups, mutual cooperation and deliberation, the lack of large-scale industries processing captured fisheries products, the employment opportunities provided by fish processing SMEs in coastal areas, and landowners acting as leasing companies or loan sharks, (b) The income of fishermen, landowners acting as leasing companies or loan sharks, business groups, discussion and collaboration, the lack of large-scale industries processing captured fisheries products, fish processing SMEs as job opportunities in coastal areas, and landowners acting as leasing companies or loan sharks are the dominant factors that directly affect other factors, in order of priority.

Keywords: Determining Factors, Fish Resources, Coastal Area, Jember

INTRODUCTION

Coastal regions serve important social, economic, and ecological purposes and are strategically located. The southern coast of East Java is home to Jember Regency's Puger District, which has a wealth of local resource potential in the areas of fisheries, salt production, coastal agriculture, and ecotourism. However, this region is also susceptible to a number of issues, including economic disparity, environmental deterioration, climate change, disaster susceptibility, and the inadequate functioning of social institutions in coastal communities (Ulfa & Muhammad, 2023). The wealth of marine fisheries resources in Puger District, Jember Regency, is the foundation of coastal communities' livelihoods, especially for traditional fishermen. However, a number of intricate factors, such as the socioeconomic circumstances of fishermen and an inadequate fisheries resource management system, continue to contribute to Puger's suboptimal fish resource utilization. The fishing season, the type of gear used, and the availability of capital—which is frequently regulated by land bosses through a leasing system or loan sharks who charge exorbitant interest rates to fishermen—all have a significant impact on increases in fishermen's income in this region (Ulfa & Muhammad, 2023). For Indonesian coastal communities, coastal capture fisheries represent a vital economic sector. Fisheries are a major source of income, local food security, and indirect employment through supply chains and downstreaming (processing SMEs) in many coastal communities, such as the Puger District (Jember Regency). However, for a variety of technical, financial, institutional, and sociocultural reasons, the potential of fish resources is frequently underutilized. This phenomenon affects community economic stability, resource sustainability, and the income levels of fisher households (Evelinda & Suasih, 2023 : Putra & Budhi, 2025). The following factors must generally work together for the best use of fish resources: (1) the presence of post-harvest infrastructure (such as ice factories and cold-chain facilities); (2) equitable access to financing (lessening reliance on

loan sharks and landlords); (3) the presence of lucrative downstreaming and markets (strong processing industries and SMEs); (4) efficient local institutions (fishery business groups, discussions, and cooperation); and (5) sufficient income levels to allow fishermen to invest in sustainable technology and management practices (Mendoza & Prabhu, 2003 : Masudin et al., 2021). Lack of ice factories and cold-chain facilities at fish landing ports lowers the quality of fish when they reach the market and increases post-harvest losses, which lowers the fish's selling price and makes it more difficult to reach far-off markets (for example, exports or interregional marketing). The construction of cold-chain networks and ice factories is thought to be beneficial in lowering post-harvest losses and increasing shelf life, which opens up new markets and adds value (Hermawan et al., 2025; Kambu & Bisay, 2023).

In many fishing communities, informal financing mechanisms—often referred to as the role of landowners or loan sharks/middlemen—are a structural reality. Fishing operations are made easier by moneylenders' quick access to capital, but financing packages frequently include high interest rates and unfavorable profit-sharing arrangements that keep fishermen stuck in a debt cycle. The best use of resources is hampered by these circumstances, which limit fishermen's capacity to save and invest (Lucas et al., 2024 : Syafrini, 2014). It has been demonstrated that social capital (cooperation) and local institutions (fishery business groups, cooperatives, and deliberation forums) increase the collective capacity of a community. Business associations can help with better price negotiations, joint marketing, joint ice and fuel purchases, and collective access to capital. Practices of cooperation and discussion improve local laws and the collective management of fisheries resources, which can lessen disputes over use. The degree to which technical interventions are actually adopted and sustained is frequently determined by this institutional strengthening (Paramita et al., 2023 : Wicaksana et al., 2022). Fish processing SMEs play two crucial roles: (a) absorbing catches that are unfit for fresh sale (reducing waste) and (b) generating local added value, which creates job opportunities, particularly for local workers and women. However, market constraints, processing technology, sanitation regulations, and financing availability frequently restrict SMEs' ability. SMEs' ability to maximize the use of fish resources will be constrained in the absence of input support (training, capital access, and market facilitation) (Mendoza & Prabhu, 2003; Paramita et al., 2023).

Many small landing ports in coastal areas lack medium- to large-scale downstream processing (processing industries). The majority of added value passes through the trader/intermediary level in short value chains as a result of this absence. Fishermen's income stability can be improved, the catch absorption capacity can be increased, and the product absorption season can be extended by investing in processing industries (Mendoza & Prabhu, 2003 : Purnomo et al., 2024). Lastly, to capture causal relationships and interrelationships between factors (technical, economic, and social) within a single evaluation framework, integrated analysis is advised by conceptual and methodological studies on criteria and indicator analysis (such as multi-criteria and cross-indicator interaction approaches). Mapping dominant indicators, their interactions, and setting priorities for local interventions can all be accomplished with a qualitative multi-criteria approach (Mendoza & Prabhu, 2003). By performing an integrated analysis of the key factors influencing the use of fish resources in Puger District, this study seeks to close this gap.

In order to improve resource management effectiveness and fortify fishermen's negotiating position, Puger's fisheries business groups serve as a platform for collaboration among fishermen. Low human resource capacity and members' lack of active participation in business groups, however, continue to limit this role (WRI Indonesia, 2022). A social interaction pattern known as "deliberation and cooperation" supports sustainability and more structured resource management by facilitating group decision-making in fish resource management (Rhomadani, 2023). he Puger region's dearth of large-scale fish processing industries is another major barrier that restricts the added value of fisheries products and the growth of jobs in this industry. Small-scale SMEs continue to process fish, which reduces efficiency and may lower the welfare of coastal communities (Djamali et al., 2021). Nonetheless, in addition to providing economic value to the catch, these fish processing SMEs continue to be a significant alternative source of employment for the Puger coastal community (Ulfa & Muhammad, 2023). Finding the key elements affecting the best use of fish resources in the coastal regions of Puger District, Jember Regency, is made possible by this study. It is anticipated that the findings will offer tactical suggestions for enhancing fishing communities' well-being and promoting more sustainable resource management.

METHOD

Purposely, the research area was chosen to be the coastal region of Jember Regency's Puger District. An expert judgment/opinion approach was used in this study (Mendoza & Prabhu, 2002). The primary source for identifying issues, establishing criteria, assigning weight, or validating research findings in this approach is the evaluation, wisdom, and experience of specialists (fisheries/coastal practitioners). Direct interviewing (direct communication) and focus group discussions (FGD) with chosen experts and respondents using a semi-open

questionnaire were the methods used to collect the data. This study's analysis method, the Analysis of Indicator Linkages, is ideal for figuring out the causal relationships between indicators, ranking the most important indicators, and assisting in the development of strategies, policies, or system models. Differences in levels that rely on various data and understanding of how indicators interact can be analyzed using cross-indicator interaction. If enough data is available from each indicator used, this can be applied to quantitative dynamic system analysis (Mendoza & Prabhu, 2000a). Unlike traditional formal methodologies, which involve multiple types of analysis and typically yield general results, cognitive mapping is classified as a soft methodology. Soft approaches typically yield more accurate descriptions. Using arrow diagrams to organize and structure the components of a complex problem is a mapping technique known as cognitive mapping. The relationships and connections between the indicators are shown by the direction (Mendoza & Prabhu, 2000a, 2000b, 2002). Domain and centrality are the two primary cognitive mapping variables used in this study. Because it represents the density or number of indicators that are directly related to a specific indicator, regardless of direction, the domain is an important component of cognitive mapping. An indicator with a higher domain value has more indicators influencing or being influenced by it.

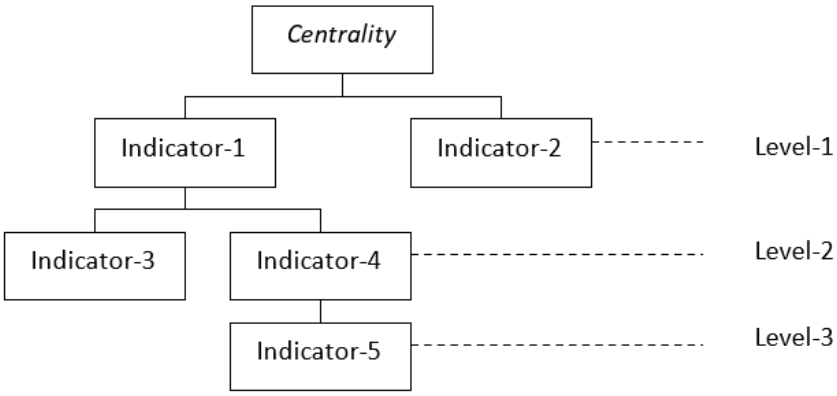

Figure 1. Concept of centrality indicator in cognitive mapping

Domain analysis counts the number of inputs and outputs that are directly related to a concept in the perceptual map; only direct relationships are taken into account. High domain concepts are thought to have a lot of direct interactions and are significant locally. By taking into account both direct and indirect links (broader implications), centrality analysis goes beyond domain analysis to gauge how "central" a concept is to the overall map structure. High centrality concepts are at the core of strategic issues because they are usually very influential and either support or are influenced by a large number of other concepts. According to Eden and Akerman (1998), domain and centrality are the two primary instruments used in the creation of cognitive mapping. Use the formula (Mendoza & Prabhu, 2000a, 2000b, 2002) to determine the centrality score.

$$C_j = \frac{S_m}{m} + \cdots + \frac{S_n}{n}, \quad j = 1, 2, 3 \ldots n$$

Cj: central score of the jth indicator at the mth level
Sj: number of indicators at the mth level

Because it accounts for both the total influence of indirect relationships with other indicators as well as the number of indicators that directly affect it, the central score can be used to determine the strategic value of an indicator or attribute.

RESULTS AND DISCUSSION

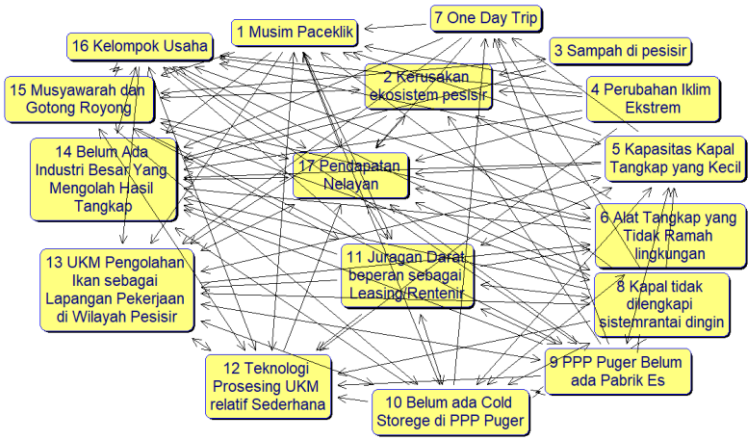

Figure 2. Cognitive Map of Determining Factors in Optimizing the Utilization of Fish Resources in the Coastal Area of Pugeer District, Jember Regency

Domain analysis demonstrates the degree to which a variable, factor, or attribute directly affects or is influenced by other variables, factors, or attributes. A variable, factor, or attribute's influence or dominance over other variables, factors, or attributes increases with the number of frequency currents flowing from and to it. Based on Figure 1's cognitive mapping findings. The data indicates that the six primary (dominant) determinants of fish resource utilization in the Puger coastal area are: the income of fishermen (Yulianto, 2018), landowners who serve as leasing/loan sharks (Paramita et al., 2023), business groups (WRI Indonesia, 2022), cooperation and deliberation (Purnomo et al., 2024), the lack of large industries that process captured fisheries products (Mendoza & Prabhu, 2003), and the employment opportunities provided by fish processing SMEs in coastal areas (Wasik & Handriana, 2023). These key elements, specifically:

1. *Fishermen's Income (Yulianto, 2018)*
   The primary determinant of the sustainability and well-being of fisheries resource use is. A higher income enables fishermen to upgrade their equipment, extend their fishing seasons, and raise the standard of living for their families. Nevertheless, despite having plenty of resources, low incomes can keep fishermen in debt to landowners, making it challenging to escape structural poverty. Traditional fishing gear, fishing seasons, and capital support all have a significant impact on fishermen's earnings. The Puger region's best use of its fisheries resources is impacted by fishermen's inability to grow their businesses due to unstable incomes.
2. *Landlord as Leasing/Moneylender (Paramita et al., 2023)*
   Operating capital (fuel, supplies, and equipment) is provided by landlords. Fishermen depend on landlords for funding, but they may be burdened by high interest rates and a strict profit-sharing scheme. Landlords have a beneficial effect of promoting the sustainability of fishing operations. However, the drawback of landlords is that they frequently oppress fishermen through high interest rates, unjust profit-sharing schemes, and long-term reliance. Because of this, fishermen continue to exploit fisheries resources, but the landlords, not the fishermen, reap the majority of the financial rewards. Hal ini berpengaruh negatif pada kesejahteraan dan skala pemanfaatan ikan karena nelayan terkadang terjebak dalam hutang.
3. *Business group (WRI Indonesia, 2022)*
   In Puger, Joint Business Groups (KUB) make it easier for fishermen to work together and access infrastructure. The efficient use of fish resources is still hampered by issues like low member engagement and a lack of human resources.
4. *Deliberation and Mutual Cooperation (Purnomo et al., 2024)*
   The Puger coastal community uses cooperation and discussion as social capital. They should encourage the use of resources collectively (e.g., local regulations for managing fishing grounds and sharing catches). By fostering solidarity among fishermen, mutual cooperation lessens the inequality brought on by boss dominance. In addition to economic orientation, this social component preserves balanced resource use. Decision-making among Puger's fishing communities is based on discussion and collaboration, which helps to settle disputes and promote unity. This promotes the sustainable and well-organized use of fish resources.
5. *There is no large-scale industry for processing catch results (Mendoza & Prabhu, 2003)*

The added value of catches processed conventionally and on a small scale is limited by the lack of a significant fish processing industry. Both the growth of product processing and the economic advancement of fishermen are hampered by this. Since fishermen only sell fresh fish, their incomes are stagnant and their bargaining power is limited. Fish resources are underutilized as a result of the unrealized potential for processing marine fisheries products into a range of products (surimi, canned fish, fish meal, and fillets). Because of this, there is a significant reliance on regional marketplaces and intermediaries.

6. *Fish Processing SMEs as Employment Opportunities (Wasik & Handriana, 2023)*
   Another source of catches is small-scale fish processors. It has been demonstrated that these SMEs generate more jobs, particularly for women living along the coast. To boost added value, they also process captured fisheries to produce shrimp paste, shredded fish, crackers, smoked fish, pindang fish, salted fish, fish meal, and more. SMEs are essential for diversifying the use of fish resources, despite their limited capacity. They can improve the use of fisheries resources and boost regional economies.

These six factors, which range from the economic aspects of fishermen to financing systems, social organizations, and catch processing, collectively have a significant impact on how fish resources are used in Puger. When evaluating their interactions, only 17 factors were considered. This is due to (a) limited information on the determinants, (b) limited knowledge about the determinants, (c) insufficient/limited meaning, or lack of clarity regarding the accuracy of the determinants' meaning, and (d) general limitations of the relationship in terms of qualitative indicator measurements. Furthermore, from the standpoint of a comprehensive assessment, centrality is a crucial concept. In reality, the term "centrality" refers to both the "central score" and the total number of influenced indicators. Because the central score captures both the total number of indirect relationships with other indicators as well as the number of indicators directly influenced, it can be used to determine an indicator's strategic value. Accordingly, the number of indicators that are directly related to the indicator and the number of indicators that are indirectly related at different levels or beyond the point of direct connection with the indicator make up the central score.

Because it indicates the degree of interconnectedness or interconnectedness of a factor, the influence of the number of indicators, as indicated in Table 1, shows how important the concept of centrality is. For instance, factor 1, "Famine Season," has 14 factors, which means that 14 of the 16 other determinants are affected, either directly or indirectly. The Fishermen's Income factor Yulianto (2018), has the highest Centrality score out of the 17 factors that were mapped. This demonstrates that the most important strategic determinant of fish resource utilization in the Puger coastal area is the income of fishermen. Where other factors have the ability to directly or indirectly influence this factor. It is increasingly clear that the orientation of the utilization of fish resources focuses on efforts to increase fishermen's income, which in turn greatly influences the welfare of coastal communities. One important determinant of fishermen's well-being is their income. The main source of income for fishing households comes from fishing-related activities. A higher income makes it easier to pay for necessities like food, clothing, housing, healthcare, and education. In actuality, a fishing community's well-being is influenced by a variety of factors, including working conditions (weather and sea), access to public facilities, and income stability. The welfare of fishermen's households is frequently at risk due to their erratic income, which is seasonal and contingent on weather and fish prices. Diversification of income sources (having side businesses outside of fishing), access to capital and technology, institutions, and fishermen's cooperatives are some of the factors that strengthen the link between income and fishermen's welfare. Additionally, the following factors had a centrality score of 14: ships with a cold chain system, lean season, There is currently no ice factory at the Puger Fisheries Landing Port (PPP), landlords serve as sharks for leasing and loans, small and medium-sized businesses that process fish provide jobs along the coast, no major industries process catches, and Fisheries Business Groups. Following the fishermen's income factor by Yulianto (2018), these seven factors also have the ability to directly or indirectly influence other factors. An explanation of the factors influencing Puger's fish resource utilization is provided below:

1. *Lean Season (Ulfa & Muhammad, 2023)*
   Westerly winds and large waves, which deter fishermen from going out to sea, cause the lean season, especially from December to May. As a result, there is a shortage of fish on the market, and fishermen's earnings sharply decrease. Fish resource utilization during the lean season significantly declines as a result of many fishermen opting to repair their boats and equipment during this time.
2. *Ships equipped with a cold chain system (Syafrini, 2014)*
   Vessels with a cold chain system help maintain the quality of fresh fish throughout the catch and into port, reducing damage and spoilage. Despite the limited supply of ice, this enhances the quality and selling prices of fish and boosts the efficiency of the Puger Fisheries Port supply chain.

3. *Puger Fisheries Landing Port (PPP) does not yet have an ice factory (Lucas et al., 2024)*
   Dependency on outside ice suppliers has resulted from the Puger PPP's lack of an ice factory. This has a detrimental effect on the market value and use of fish resources since it frequently leads to insufficient ice supplies and the possibility of fresh fish quality degradation.
4. *Landlords act as land leasing/loan sharks (Paramita et al., 2023)*
   Fishermen's financing is influenced by landlords, who also serve as loan sharks. They burden fishermen by offering profit-sharing schemes or lending money at exorbitant interest rates. In addition to affecting the less-than-ideal methods and scale of fish resource utilization, this situation can lower fishermen's earnings.
5. *SMEs that process fish as a source of jobs in coastal regions (Wasik & Handriana, 2023)*
   SMEs in Puger that process fish are essential to job creation and raising the value of fish catches. The economic use of marine resources is increased and coastal communities receive additional revenue from processed goods like shrimp paste, salted fish, fish meal, and fish crackers.
6. The catch is not processed by a large industry (Mendoza & Prabhu, 2003)
   The size and effectiveness of fish processing are constrained by the lack of large-scale industries. Due to limited and small-scale processing, this reduces the added value of marine products and the potential to enhance the well-being of fishing communities.
7. Business Groups for Fisheries (WRI Indonesia, 2022)
   Collaboration between fishermen and fisheries businesses is facilitated by fisheries business groups, which enhances resource management and coordination. These groups also play a role in training and capacity building, thereby encouraging more sustainable and organized utilization of fish resources.

In conclusion, these elements—which range from seasonal catches, product quality, and financing considerations to processing and organizing fishermen—have an impact on Puger's use of fish resources both directly and indirectly.

Tabel 1. Domain and centrality values

No.	Determining Factors	Domain	Skor Centrality	Number of Directly and Indirectly Related Attributes
1	Lean Season	15	14	16
2	Coastal Ecosystem Damage	12	13	16
3	Trash on the Coast	4	9	16
4	Extreme Climate Change	6	11	16
5	Small Fishing Vessel Capacity	15	13	16
6	Fishing gear that is not environmentally friendly	10	12	16
7	One Day Trip	8	12	16
8	Ships equipped with cold chain systems	17	14	16
9	PPP Puger does not have an ice factory yet	17	14	16
10	There is no Cold Storage at PPP Puger	18	13	16
11	Landlords act as land leasing/loan sharks	19	14	16
12	Simple SME processing technology	14	13	16
13	Fish processing SMEs as employment opportunities in coastal areas	18	14	16
14	There is no large industry that processes the catch	15	14	16
15	Deliberation and Mutual Cooperation	17	13	16
16	Fisheries Business Group	19	14	16
17	Fisheries Business Group	20	15	16

CONCLUSION

1. In order of priority, the following key factors directly and indirectly influence other factors that determine the direction of fish resource utilization: the income of fishermen, business groups, mutual cooperation and deliberation, the lack of large-scale industries processing captured fisheries products, the employment opportunities provided by fish processing SMEs in coastal areas, and landowners acting as leasing companies or loan sharks.
2. The income of fishermen, landowners acting as leasing companies or loan sharks, business groups, discussion and collaboration, the lack of large-scale industries processing captured fisheries products, fish processing SMEs as job opportunities in coastal areas, and landowners acting as leasing companies or loan sharks are the dominant factors that directly affect other factors, in order of priority

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