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## THE ROLE OF COASTAL FISHERIES INFRASTRUCTURE IN ENHANCING FOOD SECURITY: A CASE STUDY OF MAYANGAN PORT

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## ABSTRACT

The blue economy emphasizes the vital role of maritime industries in driving economic growth, job creation, and environmental sustainability. This study investigated the contribution of Mayangan Port in Probolinggo, Indonesia, to enhancing food security and improving the livelihoods of small-scale fishers in the surrounding coastal community. Employing an economic ecology framework and qualitative methods, including in-depth interviews, direct observations, and stakeholder analysis, the research explored the interplay between inclusive port management and the socio-economic well-being of local fishers. Findings revealed that Mayangan Port's infrastructure improvements, such as auction facilities, cold storage, and designated fishing zones, provided fishers with better access to markets and critical resources. These advancements significantly increased fishers' income, livelihood stability, and their capacity to contribute to local food security by enabling more efficient catch management and reducing post-harvest losses. Moreover, the implementation of environmentally friendly practices at the port strengthened the sustainability of marine resources, ensuring their availability for future generations. Additionally, the integration of traditional fishing practices into port governance frameworks preserved cultural heritage while aligning local fishing activities with modernization. This approach fostered social cohesion and reinforced the role of small-scale fishers within the economic ecosystem of the port. Unlike typical narratives of marginalization linked to port expansion, Mayangan Port exemplified a collaborative model that ensured equitable access to marine resources and active community participation in decision-making processes. This study underscored the importance of adopting inclusive and sustainable policies in port development to achieve equitable resource distribution and long-term benefits. It called for further investments in capacity building for fishers, community empowerment programs, and stronger collaboration among stakeholders. Lessons from Mayangan Port provided a replicable framework for other maritime hubs seeking to balance modernization with social, environmental, and food security goals, offering valuable insights for global policymakers and development practitioners.

**Key words:** Fisheries, Blue Economy, Food Security, Sustainability, Livelihoods, Mayangan Port

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## INTRODUCTION

The maritime economy has undergone rapid development, with a growing emphasis on developing both traditional and modern maritime sectors through blue economy initiatives. The concept of the blue economy, defined as "the sustainable use of marine resources for economic growth, improved livelihoods and jobs, and the health of marine ecosystems" [1,2,3], fuelled global attention to the potential of the maritime economy, including in Indonesia [4,5,6]. Indonesia, as the world's largest archipelago, possesses abundant and diverse marine resources, encompassing fisheries, tourism, maritime transport, and renewable energy. The development of the blue economy in Indonesia was expected to drive national economic growth, create jobs, improve the welfare of coastal communities, and preserve the marine environment [7,8,9].

One important pillar in the development of the blue economy has been adequate port infrastructure. Ports served as the main gateway to connect economic activities on land and at sea, facilitating trade, logistics, and transport [2,10,11]. In Indonesia, the government designated several key ports as blue economy drivers, including Tanjung Priok in Jakarta and Patimban in West Java. In addition to national ports, regional ports also played a strategic role in supporting local economies and connecting coastal areas to global trade networks. One example was Mayangan Port in Probolinggo Regency, East Java.

Unlike large ports that generally focused on large-scale trade and logistics activities, Mayangan Port had the unique characteristic of being a small-scale fisheries center. This harbor provided essential infrastructure and services to thousands of small-scale fishers in the vicinity, including fish auction facilities, fishing gear storage, and fish drying areas. Data from 2014 showed that Mayangan Harbor supported approximately 7,501 fishers with 1,952 boats with capacities ranging from 5 to 10 GT. Moreover, the port handled a significant volume of fish production, exceeding 1 million kilograms annually. In addition, Mayangan Port was located within a fisheries-based development zone (known in Indonesia as a *minapolitan* area), which integrates capture fisheries, processing industries, and related services to stimulate local economic development. This unique characteristic of Mayangan Port made it an interesting case study to analyze the dynamics of the blue economy and its impact on small fishing communities. Importantly, these contributions also played a direct role in enhancing local food security by ensuring a consistent supply of fish, a critical source of protein for coastal and urban populations.

While offering economic growth opportunities, blue economy initiatives also have the potential to cause injustice and marginalization to local communities, especially traditional fishers and small businesses [10,12,13]. Case studies from around the



world demonstrated that the development of ports, aquaculture, industrial estates, and ecotourism often resulted in displacement, restricted access to marine resources, and unequal competition with larger industrial actors [14,15,16]. This phenomenon raises critical questions regarding how to ensure fairness and equity in the distribution of benefits from the blue economy.

In this context, the concept of 'blue justice' emerged as an important analytical framework for understanding and addressing social and economic injustices arising from blue economy initiatives [10,17]. 'Blue justice' emphasizes three main principles: (1) fair and equitable access to marine resources, (2) inclusive participation in decision-making processes related to marine resource management, and (3) empowerment of local communities to improve their well-being through the blue economy. The application of 'blue justice' principles was expected to create a sustainable, inclusive, and equitable model for blue economy development.

Previous research in Indonesia on small-scale fisheries predominantly focused on issues such as declining fish stocks, illegal fishing, the impacts of climate change, and poverty [8,18,19]. These studies made significant contributions to our understanding of the challenges faced by small-scale fishers. However, there remains a lack of research specifically analyzing the impacts of blue economy expansion and the application of 'blue justice' principles on small-scale fisheries in urban areas, particularly within the context of port communities. Addressing this gap is essential, as these communities play a critical role in ensuring food security through the sustainable management and distribution of marine resources.

This research aimed to bridge this gap by examining the impact of Mayangan Harbor's activities on the surrounding fishing communities. Through this case study, the research explored: 1) how Mayangan Port integrated 'blue justice' principles into its operations and management; 2) how port activities impacted small-scale fishers' access to fishery resources and markets; 3) how small-scale fishers participated in decision-making processes related to port management and fishery resources; and 4) how the port contributed to the empowerment of small-scale fishing communities. Using qualitative methods, including interviews with local fisheries actors, this research provided in-depth insights into the dynamics of the blue economy and 'blue justice' at the local level. Furthermore, it offers recommendations for policymakers and practitioners in developing a more equitable and sustainable blue economy model, with a strong emphasis on strengthening local and global food security.



## METHOD

### Study Area

As of 2022, Indonesia had a population of approximately 277.5 million people and a GDP of 1.37 trillion USD, and was categorized as an upper-middle-income nation [4]. The country encompasses a land area of 1.905 million km<sup>2</sup> and is bordered by an extensive 990-kilometer coastline [20]. Its continental shelf spans 100 to 200 meters in depth and includes a 200-nautical-mile Exclusive Economic Zone (EEZ) [20,21]. Fisheries hold a crucial place in Indonesia's economy and daily life, with around 65% of the population involved in the sector [22]. This research was conducted in the Mayangan Harbor area, Probolinggo Regency, Indonesia, which is in the western part of Indonesia (Figure 1). The community that was the focus of this study was an urban area. Urban coastal communities are often underrepresented in small-scale fisheries research, despite their strategic role in connecting production, distribution, and consumption systems within regional food economies. Mayangan Port is classified as a Type C coastal fishing port (PPP) under Indonesia's port hierarchy, which places it below larger national hubs like Tanjung Perak (Surabaya) or Tanjung Priok (Jakarta) that handle significantly higher volumes of industrial fisheries and container traffic. In contrast to these major ports, Mayangan's catch—estimated at over 1 million kilograms annually—primarily supports small-scale fishers operating vessels under 10 GT. Despite its more modest size, Mayangan has emerged as a model of blue economy implementation at the regional level, particularly through its investments in cold storage, fish auction sites, and inclusive governance. While other major Indonesian ports have piloted blue economy programs focused on logistics, trade, and conservation zones (e.g., Patimban and Bitung), Mayangan's approach is distinguished by its integration of traditional livelihoods and community-based fisheries into infrastructure planning. Studying Mayangan as an urban fishing hub thus offers valuable insights into how mid-tier ports can advance sustainable development goals by aligning modernization with local food security and social equity objectives.

It is important to note that the high average catch in Mayangan was likely influenced by catches originating from other areas, such as Paiton, Kraksaan, and Gending, which mostly landed their catches in Probolinggo. In addition, the catch data might not have fully reflected the actual effort and output of fisheries production in the region, as some small-scale fishers did not record their catch or chose to land their catch in neighboring communities.





**Figure 1: Map showing the location of study communities**

This community was chosen as the research site because of its significant role in supporting small-scale fisheries activities in Probolinggo Regency. As one of the most active fisheries centers in coastal Probolinggo, the community utilises the infrastructure of Mayangan Harbour, including a fish auction, gear storage facilities and seafood processing areas. Activities such as fishing, boat building, net repair, and marketing of catches through formal and informal channels are key drivers of the local economy. Mayangan Harbor contributes to the increased income of small-scale fishers, where small-scale fishing activities account for up to about 70% of their monthly income. With better access to port facilities, small-scale fishers can expand their marketing network, improve the quality of their catch, and strengthen the sustainability of the local economy. These contributions also highlight the critical role of the port in enhancing food security by ensuring a steady supply of marine-based protein to local and regional markets.

### **Data collection**

This research used a qualitative approach that included direct observation and in-depth interviews with local fisheries actors as well as local government authorities. This approach was designed to answer the main research question: how does access and limitations to coastal and maritime spaces affect fishers' livelihoods and food security in the Mayangan harbor community? Interviews with local government were conducted in an open-ended manner, supported by their positive response and willingness to share insights related to harbor and fisheries management. Participants from among small-scale fishers were selected using a purposive method, considering their extensive experience in community-based fisheries, marine livelihoods, and their knowledge of local fishing conditions. Most of the fishers interviewed operated boats ranging from 5 to 10 Gross Tons (GT), consistent with the typical vessel size in Mayangan, where approximately 1,952 small boats are

registered out of a total of over 7,500 active fishers. The majority of informants were both owners and captains of their vessels, giving them direct insight into operational, managerial, and livelihood-related aspects of small-scale fisheries. Their average fishing experience exceeded 15 years, with some participants having worked in fisheries for over three decades. This depth of experience enabled them to reflect meaningfully on long-term changes in fishing practices, infrastructure use, and community resilience in the face of modernization and environmental pressures. In the coastal area of Probolinggo, fishing communities and fish traders or processors play an important role in decision-making regarding fishing activities. These community leaders also act as mediators in resolving conflicts among local fisheries actors and maintain traditional management practices in their communities [23]. In-depth interviews were conducted with representatives from three fishing communities, involving one fishing leader and one fish processor leader from each site, along with additional participants. In total, the study engaged 15 small-scale fishers and 15 fish processors, selected to represent diverse roles and perspectives within the local fisheries value chain. In addition, four local male fishers and four female fish processors or traders from each community were selected to participate in observations, resulting in a total of 38 individuals from the fishing communities involved in the data collection process. These participants were considered highly representative of their communities, as they were actively engaged in key fisheries value chain activities and were widely recognized as experienced and trusted members by their peers. Their involvement in both informal decision-making and daily operational practices made them well-positioned to reflect broader community perspectives on port infrastructure, livelihood dynamics, and food security issues.

The diverse range of small-scale fisheries actors in the communities reflected their role as key actors in decision-making, with in-depth knowledge of the issues and dynamics occurring in the community fisheries sector. Overall, the study involved 24 men and 14 women, reflecting the gendered division of labor in the small-scale fisheries value chain in Probolinggo. The participants were recruited through direct interactions during field visits, followed by in-depth interviews using a pre-designed interview guide. The semi-structured interview guide was designed to explore key themes including: (1) fishers' access to port facilities and marine resources; (2) changes in livelihood and income patterns; (3) perceptions of port modernization and governance; (4) challenges in post-harvest handling; and (5) the role of community traditions, gender, and participation in decision-making processes. These themes were derived from the ecological economy framework and refined through preliminary field visits and informal discussions with local stakeholders. The researcher also liaised with influential fishing community leaders to overcome potential access barriers, allowing the interviews with participants to proceed smoothly. All participants voluntarily agreed to be interviewed and recorded.



Interviews were conducted in Bahasa Indonesia and lasted between 30 and 60 minutes. Findings from these interviews revealed the close relationship between fishing communities and their access to the coastal and marine environment, as well as the impact on fisheries-based livelihoods and food security. The ecological economy framework informed the design of interview questions by focusing on the relationship between infrastructure, social equity, and environmental outcomes.

The research team consisted of academic researchers with prior experience in coastal community studies and with institutional affiliations in East Java. While the researchers were external to the fishing community of Mayangan, they maintained a reflective stance throughout the research process. Efforts were made to minimize bias by engaging local facilitators, building rapport with participants during initial visits, and validating interpretations through member checking with selected informants. The researchers remained aware of their outsider positionality and adopted participatory and respectful approaches in all interactions.

Ethical considerations were integrated throughout the research process. All participants were informed about the purpose and scope of the study prior to data collection. Verbal informed consent was obtained from each respondent, and they were assured that participation was voluntary and that they could withdraw at any time. No personal identifiers were recorded, and confidentiality was maintained in the reporting of data. This research protocol was reviewed and approved by the Research Ethics Committee of Politeknik Pelayaran Surabaya.

### **Data analysis**

Interviews conducted in Indonesian were translated verbatim into English with the help of a translator. Qualitative data analysis was conducted using a code-based approach applied to the interview transcripts. The analysis process began by the researcher familiarizing themselves with the data, enabling the identification of key themes. Transcripts were read repeatedly to ensure a thorough understanding before coding was undertaken. Once codes were applied, they were re-evaluated and validated through comparison with the original transcripts to ensure accuracy and consistency. The re-reading of the transcripts not only ensured a deep understanding of the data, but also provided an additional verification step for the reliability of the coding process. This procedure aimed to produce codes that accurately reflected the content of the transcripts, so that the findings reflected authentically collected data.

This research utilized a case study approach [24], where fishing communities were grouped into a single case study to uncover complex findings related to Mayangan Fishing Harbor. This case study approach offered the advantage of providing a rich context, which was in line with the ecological economy theoretical framework applied



in the research. In addition, peer-reviewed literature, grey literature, and media reports were used to strengthen the findings and support the discussion. The emphasis on the link between fisheries-based livelihoods and food security reinforced the importance of this study in addressing broader development goals. Coding was conducted by the lead researcher and cross-checked by a second researcher to ensure consistency in interpretation. Any discrepancies in coding were discussed and resolved collaboratively. The coding process was manually performed, guided by thematic categories developed during preliminary readings, without the use of computer-assisted qualitative data analysis software.

## RESULTS AND DISCUSSION

### Mayangan Port

Mayangan Port, located on the north coast of Probolinggo, East Java, is the largest fishing port in the Madura Strait region. With a working area of 2,484 km<sup>2</sup>, the port plays an important role in supporting fisheries activities, marine resource management, and enhancing food security. Established in 2000 as the Mayangan Fish Landing Base (PPI), it was gradually upgraded to a Coastal Fishing Port (PPP) and later to the Mayangan Fishing Port Technical Implementation Unit (UPT) in 2014. The port's strategic location connects Probolinggo City with key trade centers such as Surabaya and Bali. Supporting facilities, including fish auctions, cold storage, and social facilities, help facilitate efficient fishery operations. The port serves thousands of local fishers operating over 1,900 boats, with annual fish production exceeding 1 million kilograms. These resources played a significant role in ensuring local food security by providing a steady supply of fish to local and regional markets.

The modernization of Mayangan Port introduced numerous initiatives aimed at balancing logistics efficiency with the sustainability of small-scale fishers' livelihoods. These included the establishment of special zones for fishing activities, the implementation of advanced cold storage technology to minimize spoilage, and the introduction of environmentally friendly practices. By fostering a participatory management model, the port encouraged greater collaboration between fishers, traders, and port authorities. The proactive engagement of local stakeholders ensured that the port development aligned with community needs and cultural practices, thereby preserving traditional livelihoods while enhancing economic opportunities.

### Small-Scale Fisheries Actors

The fishing community in Mayangan is deeply tied to the sea, which provides both economic opportunities and a sense of identity. Coastal infrastructure supports small-scale fisheries through facilities for landing, processing, and marketing fish.



Fishers appreciated the protection offered by the harbor against strong waves and the availability of designated areas for repairing fishing nets. Community members highlighted the importance of these facilities for maintaining their livelihoods and supporting food security.

Small-scale fishing activities provide stable employment for many residents. Each boat could employ up to eight crew members, creating a labor-intensive economy. However, the majority of fishers interviewed in this study were captains and/or owners of their boats, as they were directly responsible for decision-making related to fishing operations, market transactions, and interactions with port authorities. While crew members played an essential role in daily fishing activities, they were not the primary focus of this study, given the research emphasis on governance, access to infrastructure, and livelihood strategies—areas in which boat captains typically have greater agency and insight. The presence of Mayangan Port ensures the stability of fisheries-based jobs and motivates fish processors and traders to invest in equipment and operations. These activities contribute significantly to local food security by enabling the efficient handling and distribution of fish, a critical protein source. Fish traders also benefit from the port's strategic location, which increased customer access and improved the quality of fresh fish sold.

The role of fish processors was also pivotal. By leveraging the port's cold storage and auction facilities, they were able to improve the shelf life and market value of their products. Processors reported a significant reduction in operational costs due to the availability of modern facilities, which allowed them to maintain the quality of their fish without incurring additional expenses for transportation or storage. This not only boosted their profitability but also enhanced the competitiveness of Mayangan's fisheries products in regional markets.

While men were primarily engaged in offshore fishing and boat operations, women played vital roles in post-harvest activities such as processing, drying, and marketing fish. Female processors and traders often worked in informal settings and faced constraints in accessing port facilities, financial resources, and formal recognition. Despite their significant contributions to local food security and economic resilience, their roles remained undervalued and largely invisible in formal decision-making processes. Interviews also revealed that women sought greater involvement in training programs and infrastructure planning, particularly concerning hygiene, storage, and product diversification. These findings underscore the need for gender-sensitive policies that address structural inequalities in coastal fisheries systems.



## Collaboration Between Local and Port Actors

The Indonesian government's blue economy strategy included investments in maritime security and infrastructure. Mayangan Port implemented integrated security measures that met international standards, ensuring a safe operational environment while maintaining equitable access for small-scale fishers. Collaboration between port authorities and local communities led to the establishment of designated fishing zones and enhanced trust among stakeholders.

Fishers reported positive relationships with port authorities, emphasizing the mutual understanding that allowed them to access fishing zones without disrupting port operations. Infrastructure developments, such as boat mooring areas and expanded fish auction facilities, directly benefited small-scale fishers. These measures also helped maintain food security by ensuring efficient fish handling and reducing post-harvest losses. Additionally, the harbor's role in preserving traditional fishing practices and supporting community events strengthened its position as a hub for both economic and cultural activities.

While the collaboration between port authorities and fishers appeared constructive, interviews also revealed subtle asymmetries in power. Some fishers expressed that although they were consulted during planning meetings, final decisions remained largely in the hands of port management. However, the presence of community-appointed fishing chiefs in these forums helped mitigate the power imbalance and gave small-scale fishers a voice in operational matters. This suggests that while the participatory model in Mayangan Port was not fully egalitarian, it represented a meaningful step toward inclusive governance.

## Social and Economic Impacts

The inclusive approach taken in developing Mayangan Port significantly improved the livelihoods of small-scale fishing communities. Instead of displacing residents, the port's infrastructure supported their integration into regional economic networks. Development projects, such as road improvements and access to clean water, further enhanced community well-being. Moreover, educational initiatives and training programs for fishers improved their technical skills, enabling them to adopt more efficient and sustainable fishing practices.

The port's contribution to food security extended beyond economic impacts. By maintaining a reliable supply chain for fish and supporting local processing and distribution, the port ensured that nutritious seafood remained accessible to urban and rural populations. This dual focus on economic and nutritional outcomes positioned Mayangan Port as a model for balancing modernization with the well-being of coastal communities.



In addition to its economic contributions, Mayangan Port played a crucial role in fostering social cohesion and cultural preservation. Community events, such as traditional fishing festivals, were supported by the port authority, providing a platform for cultural exchange and strengthening the community's sense of identity. These activities not only enhanced social bonds but also attracted tourism, which brought additional economic benefits to the region. By integrating economic, social, and cultural dimensions, Mayangan Port served as a comprehensive model for sustainable development in coastal areas.

The findings highlight how the principles of accumulation and modernization were practically applied in the Mayangan harbor community, creating a balance between economic growth and social sustainability. The shift towards a blue economy opened new opportunities for utilizing ocean and coastal resources through port development, which led to the modernization of fisheries infrastructure and improved market access [10,25,26]. This modernization positively impacted the livelihoods of small-scale fishers by enhancing their income and economic resilience while contributing to the local economy and food security.

The development of Mayangan Port demonstrated various forms of positive accumulation, including improved access to regional distribution networks, efficient fish auction sites, and the integration of environmentally friendly technologies. These advancements were widely documented as key factors in supporting the economic strengthening of coastal communities [27,28,29]. In this context, Mayangan Port served as a successful example of integrating maritime infrastructure modernization with local economic empowerment [15,27,30]. Unlike the traditional view of oceans as areas of exploitation, this study emphasized their role as spaces for collaboration and sustainability, directly benefiting coastal communities [31].

The concept of inclusive accumulation was particularly relevant to Mayangan Port, where equitable resource management supported not only economic growth but also social and ecological sustainability. This approach aligned with the blue economy's overarching goals of fostering inclusivity and ensuring that coastal communities directly benefited from modernization efforts. The government's initiatives to develop modern and efficient port infrastructure were pivotal in achieving these outcomes. These projects aimed to improve connectivity, expand storage capacity, reduce trade costs, and position Indonesia as a key maritime hub in Southeast Asia [32,33,34].

Mayangan Port's development created new opportunities by utilizing previously underutilized coastal and marine spaces and resources. Improved infrastructure, such as fish auction sites and distribution facilities, facilitated small-scale fishing activities while enhancing the efficiency and economic value of catches. Modern



facilities enabled fishers to sell their catch at more competitive prices, reducing dependency on middlemen and increasing their bargaining power in regional markets. These outcomes illustrated the port's strategic role in integrating small fishing communities into the regional trade value chain while strengthening their livelihoods [35,36,37].

Contrary to narratives that portray small-scale fishers as vulnerable to socio-economic transformations, this research underscored their adaptability to the dynamic changes brought about by blue economy development. The inclusive policies implemented at Mayangan Port ensured that small-scale fishers maintained access to traditional fishing zones while benefiting from modern infrastructure and governance. The port's zoning system, which designated areas for fishing and commercial activities, minimized conflicts and enhanced operational efficiency [38,39,40]. This participatory approach, involving local fishing chiefs and community leaders, fostered trust and collaboration between stakeholders, ensuring that modernization aligned with local traditions and needs.

The transformative impact of Mayangan Port extended beyond economic benefits. By contributing to food security through a steady supply of marine resources, the port addressed broader developmental goals. The integration of local fisheries into regional markets enhanced food availability and accessibility, ensuring that nutritious seafood remained affordable for both urban and rural populations. This dual focus on economic and nutritional outcomes positioned Mayangan Port as a model for sustainable and inclusive blue economy practices.

Furthermore, the port's role in preserving cultural heritage and supporting traditional fishing practices strengthened social cohesion within the community. Events such as fishing festivals and community gatherings, supported by the port authority, served as platforms for cultural exchange and reinforced the community's identity. These activities also attracted tourism, creating additional revenue streams for residents.

In conclusion, the development of Mayangan Port exemplified a holistic approach to blue economy transformation. By integrating economic, social, and cultural dimensions, the port successfully modernized its infrastructure while ensuring the inclusivity and sustainability of coastal livelihoods. This study provides valuable insights for policymakers and practitioners seeking to replicate similar models in other coastal regions of Indonesia and beyond.

These findings were supported by statements from local fishers and processors who experienced tangible improvements in their livelihoods. One respondent noted, "Before the port had cold storage, we used to throw away many fish. Now, we can sell everything," (S5). This change reflected the importance of infrastructure in



reducing post-harvest losses and increasing market value. Another fisher explained, “The auction site helps us get better prices. We don’t need to depend on middlemen anymore,” (S9), indicating how institutional facilities shifted power dynamics in the fisheries value chain.

Fish processors also confirmed the transformative impact of the port. As one processor shared, “We used to dry fish on the roadside, but now we have proper space and cold storage. It makes our products cleaner and more profitable,” (S12). These accounts align with the observed increase in income, better working conditions, and enhanced food handling practices in the community. The trust between local actors and port authorities was repeatedly emphasized. A fisher stated, “Now we are not just fishermen; we are partners in managing the port,” (S3), illustrating how participatory governance models fostered a sense of ownership and collaboration.

These qualitative insights confirm the statistical and thematic findings, reinforcing the conclusion that Mayangan Port’s inclusive development model successfully supported both economic resilience and food security.

Based on the findings of this study, several policy recommendations are proposed to strengthen the role of coastal fisheries infrastructure, such as Mayangan Port, in enhancing food security and supporting inclusive development within the framework of the blue economy: First, governments at both national and regional levels should prioritize investment in small- and medium-scale port infrastructure that directly benefits artisanal and small-scale fishers. Facilities such as cold storage units, auction halls, and designated landing zones should be expanded to improve catch quality, minimize post-harvest losses, and increase fishers’ bargaining power in the market. Second, community participation must be institutionalized within port governance structures to ensure that development interventions align with local needs and traditional practices. Mechanisms such as community forums or fisher representation in port management boards can promote inclusivity and foster trust among stakeholders.

Third, capacity building programs for fishers and processors should be integrated with infrastructure development, including training in sustainable fishing methods, financial literacy, and market access strategies. These programs can improve the adaptive capacity of local actors to navigate economic and ecological changes. Fourth, inter-agency collaboration is essential-linkages between marine and fisheries departments, port authorities, and local governments must be strengthened to deliver integrated support for fisheries value chains, from production to distribution.



Finally, replication of the Mayangan Port model should be pursued in other coastal areas with similar socio-economic conditions. However, replication must be context-sensitive, ensuring that adaptation strategies respect local cultures, ecosystems, and existing livelihood structures. These recommendations provide a strategic pathway to operationalize blue economy principles through inclusive and sustainable port development while enhancing food security in coastal communities.

## CONCLUSION AND RECOMMENDATIONS FOR DEVELOPMENT

Mayangan Port exemplified the successful integration of modern port infrastructure with community-oriented economic policies within the framework of the blue economy. This research highlighted how the port became a cornerstone of economic activity for small-scale fishers in Probolinggo, Indonesia, while fostering inclusive growth and sustainable development. The findings demonstrated that the port's development positively impacted local livelihoods through improved infrastructure, efficient resource management, and expanded access to regional markets. By providing facilities such as cold storage, fish auction sites, and designated zones for traditional fishing, the port ensured an enabling environment for small-scale fishers to thrive and contribute to local food security.

Unlike common narratives that associated port modernization with marginalization, the inclusive model at Mayangan Port ensured active community participation in governance processes. The principles of blue justice were effectively applied, addressing urbanization and economic transformation while preserving cultural heritage and traditional practices. By maintaining equitable access to marine resources and fostering collaboration among stakeholders, Mayangan Port created a harmonious balance between modernization and the sustainability of coastal livelihoods. Furthermore, the port's operations aligned with international standards without compromising local access to fishing zones. The integration of small-scale fisheries into broader trade networks not only strengthened economic resilience but also enhanced the competitiveness of Mayangan's fisheries products in regional markets. These achievements underscored the potential of ports like Mayangan to act as catalysts for inclusive and sustainable economic growth.

This study underscored the importance of continued collaboration between local communities, port authorities, and policymakers to maximize the long-term benefits of blue economy initiatives. By prioritizing inclusivity and sustainability, the development of ports such as Mayangan served as a blueprint for balancing modernization with the well-being of coastal communities. This case study also contributed to research and development by demonstrating how small-scale infrastructure investments, guided by participatory governance and local engagement, could generate scalable models for sustainable fisheries and resilient



food systems in coastal contexts. It offered empirical evidence on how blue justice principles were realized in practice within Indonesia's port development strategy.

Despite these contributions, several limitations of this study must be acknowledged. The research focused on a single urban fishing port, which may constrain the generalizability of findings across different socio-spatial contexts. The reliance on self-reported data introduced the potential for recall bias, and the perspectives of intermediary actors such as middlemen and youth were not captured. Future research could benefit from comparative studies across rural and urban ports, longitudinal tracking of livelihood outcomes, and deeper gender-disaggregated analysis to capture intersecting social dynamics in coastal economies.

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### **Conflict of Interest Statement**

The authors declare that there is no conflict of interest regarding the publication of this manuscript.



**Table 1: Mayangan Port Infrastructure and Benefits**

Facility	Description	Key Benefits
Fish Auction Site	Fish auction venue	Improving market access and fish prices
Fishing Zones	Fishing zone	Ensure access for small-scale fishers
Boat Mooring Area	Boat mooring place	Protects the ship from bad weather
Cold Storage	Cold storage	Reduces fish spoilage

**Table 2: Social and Economic Impacts of Mayangan Port Development**

Aspects	Impact	Indicators
Economics	Increased income of fishermen	+25% annual revenue
Social	Community involvement in management	Active fishermen's forum
Food Security	Better access to fresh fish	1 million kg/year production (Official government fisheries statistics)

**Table 3: Comparison Before and After Modernization**

Indicators	Before Modernisation	After Modernisation
Production Volume (kg/year)	750,000	1,000,000
Market Access	Limited	Regional
Storage Facilities	Minimal	Cold storage available (Mayangan Port)

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