Journal of Islamic Economics Lariba
(P-ISSN 2477-4839 E-ISSN 2528-3758)
2025, Vol. 11, No. 2, 693-716
https://doi.org/10.20885/jielariba.vol11.iss2.art2



# Designing an integrated Halal value chain model for sustainable fisheries: A case study from northern coastal of Java, Indonesia

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**ABSTRAK**

**Introduction**

The concept of the halal value chain has been widely applied in the food, logistics, and pharmaceutical sectors to ensure the halalness of products from upstream to downstream. However, the fisheries sector, particularly in the northern coastal region of Java, lacks an integrated halal value chain model that incorporates sustainability principles.

**Objectives**

This research aims to design a contextual halal value chain model that combines halal and sustainability aspects at each stage of the fisheries value chain.

**Method**

A case study-based qualitative approach is used with secondary data analysis from various official and academic sources. The analysis is conducted through content analysis, thematic synthesis, and mapping of halal critical points across five main stages: production, collection, processing, distribution, and consumption.

**Results**

The findings indicate that business actors do not fully comprehend halal standards, lack effective halal logistics, and have a weak certification and supervision system.

**Implications**

The proposed model emphasizes the importance of halal control, the integration of economic, social, environmental, and health sustainability, and the active participation of local communities. This model is expected to increase the added value of fishery products, expand access to the global halal market, and strengthen the sustainability of the coastal fisheries sector.

**JEL Classification:**
L66, M11, O13, Q22, Z12

**KAUJIE Classification:**
B6, F3, F6, F8, G2

**ARTICLE HISTORY:**

Submitted: May 19, 2025
Revised: June 21, 2025
Accepted: July 18, 2025
Published: August 3, 2025

**KEYWORDS:**

fisheries; halal certification; halal value chain; northern coastal of Java; sustainability



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**Originality/Novelty**

This research contributes to the development of the halal value chain theory in the context of the fisheries industry, providing applicable policy implications for strengthening the national halal economy.

**CITATION:** Takhim, M., Ayuningtyas, R. D., Fatchurrohman, M., & Az Zahro, F. A. (2025). Designing an integrated Halal value chain model for sustainable fisheries: A case study from northern coastal of Java, Indonesia. *Journal of Islamic Economics Lariba, 11*(2), 693-716. https://doi.org/10.20885/jielariba.vol11.iss2.art2

## INTRODUCTION

The concept of a halal value chain has shown significant developments in various industrial sectors, especially in the food, logistics, and pharmaceutical industries (Handayani et al., 2022; Rusydiana et al., 2023a). Implementing the halal value chain in the food sector aims not only to ensure the halal nature of products but also to establish a system that maintains the integrity of Sharia as a whole at all stages of production and distribution (Mustapha et al., 2024). Important aspects of this chain include the selection of halal raw materials, processing methods that adhere to Sharia regulations, and proper packaging and labeling (Ali et al., 2022). This system increases consumer trust in halal products in domestic and international markets. The success of the food sector has made it a pioneer in applying halal value chain principles, as well as providing a benchmark for other developing sectors (Tumiwa et al., 2023). This system also supports achieving efficiency and increased competitiveness in the global halal economy.

The implementation of halal value chains in the food industry focuses not only on Sharia compliance but also on aspects of product quality and acceptance, from upstream to downstream (Munawar & Mugiono, 2024). A good halal value chain emphasizes cleanliness, food safety, and ethical fulfillment in every process stage. The halal products produced are free from haram and unclean elements and meet the criteria of tayyib, which are good, clean, and suitable for consumption (Abdul Mokti et al., 2024). This practice encourages increased efficiency, transparency, and accountability in the production system. The impact is felt in increasing the competitiveness of halal products, especially in a global market that is increasingly demanding ethical and sustainable standards (Akbar et al., 2023). The integration of Sharia principles with sustainability values makes the concept of halal even more relevant in the global context.

The logistics sector has begun to adopt the principle of halal value chain to ensure that halal products are maintained intact until they reach the end consumer. The halal logistics chain encompasses the storage, transportation, and handling of goods that are free from non-halal elements contamination (S. Khan et al., 2023), including ensuring the safety of halal food products from microbial, chemical, and physical hazards. Studies have shown that microbial contamination, particularly from

Salmonella spp., Listeria monocytogenes, and Escherichia coli, can occur at various stages of the halal food chain if hygiene protocols are not strictly followed. Moreover, the presence of chemical residues such as antibiotics or heavy metals from aquaculture or storage processes also poses significant health risks. These contaminants not only endanger public health but may also compromise the halal integrity of the product when cross-contaminated with haram or unsafe substances (Vergis et al., 2021).

In this context, halal logistics certification is a crucial instrument that ensures the distribution process adheres to halal principles. The role of halal logistics is increasingly crucial as market demand for comprehensive and systematic halal assurance increases (Hidayat & Musari, 2022; Susanty et al., 2023). In addition to meeting the needs of the domestic market, halal logistics also strengthens Indonesia's position in the global halal industry supply chain. As part of the halal ecosystem, sharia-compliant logistics is an important link between industry players.

In the pharmaceutical sector, implementing the halal value chain occupies a very strategic position in ensuring the quality and halal of products from the earliest stage. Halal pharmaceutical products must undergo a rigorous verification process, from the source of active ingredients and additives to the extraction and formulation methods used (Dian Luthviati & Jenvitchuwong, 2021). Each production stage must be free from haram and unclean elements, and facilities that are not cross-contaminated must be used. Pharmaceutical companies must implement high standards in quality control and audit of manufacturing processes. This practice ensures compliance with Sharia principles and improves the accountability and transparency of the pharmaceutical industry as a whole (Herdiana et al., 2024). Strengthening consumer trust in halal pharmaceutical products is a direct result of this system.

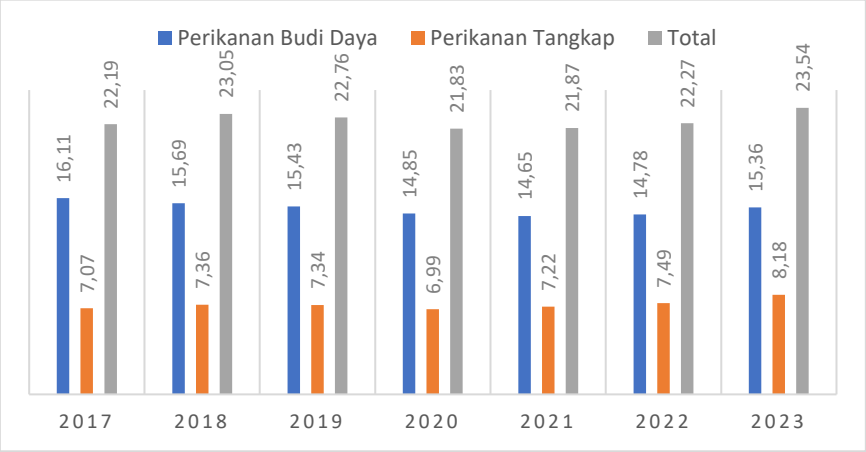
However, although the halal value chain has grown rapidly in various sectors, its implementation in the fisheries industry is still minimal (Kurniawati & Cakravastia, 2023; Rusydiana et al., 2023a). This sector has unique characteristics that have not been fully addressed by conventional halal approaches, particularly in terms of sustainability and sensitivity to the local context (Rejeb et al., 2021). Indonesia has the longest coastline in the world, making it a country with great potential to develop a competitive halal fisheries industry globally. In 2023, Indonesia's total fishery production will reach 23.54 million tons, consisting of 8.18 million tons of capture fishery products and 15.36 million tons of aquaculture products (Figure 1). In the same year, Indonesia's seafood exports contributed around 2.5 percent to the total national export value (Figure 2) (BPS, 2024). Unfortunately, the absence of an integrated halal model caused the implementation of halal principles in the fisheries sector to run partially and sporadically. This impacts the low consistency of halal certification and the weak guarantee of product integrity from the sea to the dinner table.

This issue is increasingly urgent as global demand for halal-certified seafood products is skyrocketing, driven by consumer awareness of religious compliance, food safety, and sustainability (Bux et al., 2022; DinarStandard, 2023). Several attempts have been made to introduce halal principles into aquaculture and coastal industries,

including the implementation of traceability systems for fish feed, segregation during processing, and halal certification in shrimp farming (Fernando et al., 2023; Himawan et al., 2023). However, these efforts are still limited in scope and often lack integration with broader sustainability frameworks.

**Figure 1**

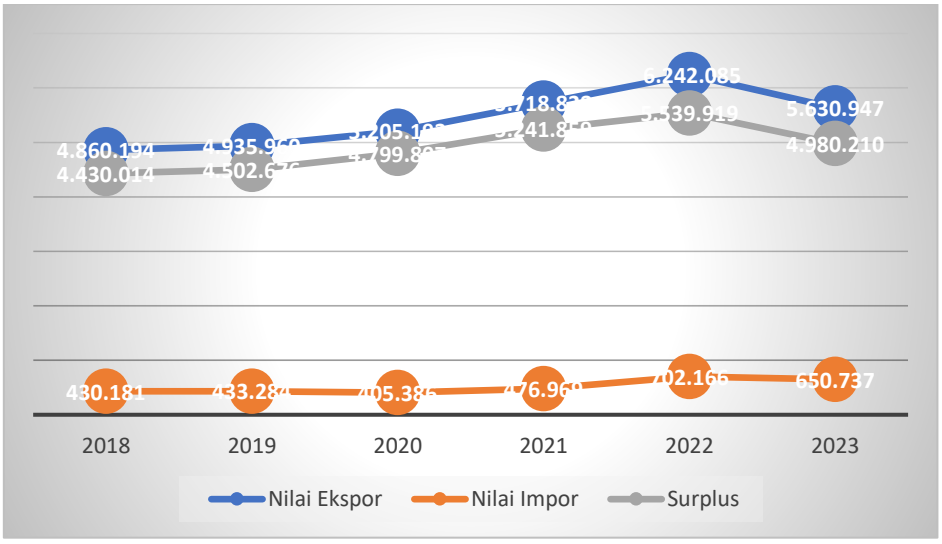
*Indonesia's Fisheries Production Volume, 2017-2023*




Source: Ministry of Marine Affairs and Fisheries (2024)

**Figure 2**

*International Trade Balance of Fishery Commodities, 2018–2023 (US$000)*




Source: Ministry of Marine Affairs and Fisheries (2024)

In addition to the absence of an integrated model, the development of halal value chains in the fisheries sector has also not seriously considered the sustainability dimension. The halal aspect is often only seen in sharia compliance, without paying attention to the sustainability of marine ecosystems and socio-economic impacts

(Rejeb et al., 2021). Sustainability is an important principle in the modern halal economy, emphasizing ethical values and long-term responsibility. In the context of fisheries, it includes the sustainable management of marine resources, the use of environmentally friendly technology, and the protection of the livelihoods of local fishermen. The integration of this sustainability aspect is an urgent need to strengthen the position of the fisheries industry in the global halal ecosystem.

The condition of fisheries on the northern coast of Java, which is the focus of this study, reflects the complexity and urgency of implementing a contextual halal value chain model. This area is known as one of the national fisheries production centers but does not have an integrated halal governance system (Ekosafitri et al., 2017; Roberts et al., 2022). Traditional fishery practices are still being carried out, and there is a limited understanding of halal standards and sustainability principles. On the other hand, the pressure on marine resources and the quality of the coastal environment continues to increase due to overexploitation and a lack of effective regulation. Many fisheries business actors in this region do not have access to adequate information, training, and halal certification facilities (Lonsdale et al., 2022). A local-specific approach is urgently needed to ensure that the proposed halal model can be effectively implemented on the ground. This approach must also reflect the social and economic realities of coastal communities that are major actors in the supply chain.

The halal value chain model designed for the fisheries sector needs to consider diverse local characteristics, ranging from business-scale cultural wisdom to the capacity of certification bodies. In the context of the northern coast of Java, fishery business actors are mostly small-scale fishermen and micro-processors who do not have adequate access to modern resources (Rahmat & Neilson, 2023). An inclusive, participatory, and adaptive approach is important to make the proposed model theoretical and applicable. Collaboration between the government, certification bodies, academics, and local communities is key to the sustainable implementation of the model. Model flexibility should also allow for integration at different levels of business, both traditional and modern. Within this framework, developing technical assistance instruments and incentive schemes for actors committed to halal and sustainability principles is also important.

The development of an integrated and contextual halal value chain model not only has an impact on sharia aspects, but also has the potential to strengthen economic, social, environmental, and public health dimensions in fisheries resource management " (M. I. Khan et al., 2022; Mishra et al., 2024). From an economic perspective, this model can encourage the added value of halal products and expand access to export markets that require halal and sustainability certification. This aligns with global trends that place ethics and environmental sustainability as key elements in consumer preferences (Rejeb et al., 2021). Socially, the involvement of coastal communities in the production and certification process will increase local communities' awareness, skills, and well-being. This aspect is important to create long-term sustainability based on strengthening the capacity and independence of local actors. From the environmental side, applying sustainability principles such as waste management, environmentally

friendly fishing methods, and marine ecosystem conservation will support resource sustainability. Meanwhile " public health is ensuring proper handling, hygiene, and the absence of hazardous substances throughout the value chain, the model also contributes to reducing foodborne illnesses and promoting consumer health, in line with the principles of *halalan thayyiban* (Tabel 1)

**Table 1**

*Pillars of Sustainability*

| Dimensions | Main Focus | Implementation Examples in Northern Coastal of Java Fisheries |
|---|---|---|
| Economics | Financial sustainability of business actors | Increase in the income of fishermen and business actors |
| Social | Coastal community welfare | Halal training and human resource capacity building |
| Environment | Conservation of marine resources and ecosystems | Waste management and sustainable capture |
| Health | Consumer and worker health safety | Hygiene in handling, reduction of foodborne illness risks, and control of chemical/microbial contamination |

Source: Authors' analysis.

The data in Table 1 confirms that the proposed halal model should include four main pillars of sustainability in a balanced manner. The four are interrelated and must be used as an evaluation framework in the model design and implementation process. The integration of these dimensions is expected to strengthen the legitimacy and effectiveness of the model in the long run. It also enables stakeholders to adopt it at both the local and national levels.

The urgency of this research becomes even clearer when one sees the absence of a framework that unites halal principles and operational sustainability in the fisheries sector. Without a systematic and contextual model, the opportunity for the development of the halal industry in this sector will be challenging to realize to the maximum. The geographical potential, marine biodiversity, and strength of coastal communities in Indonesia strongly support this initiative (Azizah, 2022; Nurhayati et al., 2023). The absence of a model that can answer these needs will continue to prolong system fragmentation and implementation gaps in the field.

The solution offered in this study is to design a halal value chain model that integrates halal and sustainability principles comprehensively. This model covers halal certification aspects and incorporates social, economic, and environmental elements in every value chain stage. That way, the existence of this model is expected to answer the needs of the industry that have not been accommodated in a single framework. This holistic approach allows industry players to be Sharia-compliant and contribute to sustainable development. This design will be adapted to local realities so that it is applicable and relevant to the context of the northern coastal region of Java.

This study examines the actual conditions in the northern coastal area of Java. The proposed model will be sharper and more contextual by analyzing existing practices,

challenges faced, and local potential. This goal also reflects a systematic effort to make the fisheries industry an important part of the national halal economy. The results are expected to be a scientific and practical contribution to developing a more competitive fisheries sector.

The relevance of this research is very high, especially in the context of increasing global demand for sustainable halal products (Bux et al., 2022; DinarStandard, 2023). Importing countries now demand guarantees not only against halalism but also against production ethics and environmental impact. In this case, this study provides new insights into how integration between halal and sustainability can be realized in real terms in the fisheries sector. Referring to current and valid data, the results of this study have a strong foundation to support policy recommendations. In addition, this research also enriches the academic literature that is still limited in this field, especially in Indonesia.

The implications of this study cover the policy, industry, and academic dimensions simultaneously. For policymakers, this model can be the basis for developing regulations and halal industry assistance programs in fisheries. This model provides practical guidance for business actors in building a competitive, halal, and sustainable value chain system. As for the academic world, this finding expands the scope of halal value chain studies to sectors that were previously less touched. This research answers theoretical challenges and provides applicable solutions for developing a more inclusive and competitive coastal fisheries sector.

## LITERATURE REVIEW

In discussing the Integrated Halal Value Chain, it is also crucial to consider the hazards and risks associated with food safety. According to FAO (1997), food supply chains face three significant types of hazards: biological (e.g., bacteria, viruses, parasites), chemical (e.g., pesticide residues, heavy metals), and physical (e.g., metal fragments, glass). In the context of halal food, these hazards can compromise the concept of halalan tayyiban if not managed appropriately. Improper handling, cross-contamination, or non-standard processing environments may cause halal products to become unsafe or even non-halal. Risk assessment and hazard control must be integrated into the halal supply chain design to ensure both religious compliance and food safety integrity.

### *Halal Supply Chain and Value Chain Concepts*

The concept of the halal supply chain is rooted in the principle that the halal of a product depends not only on the raw materials but also on the entire process the product goes through. (M. I. Khan et al., 2022; Sarwar et al., 2021) This includes material selection, manufacturing processes, storage, transportation, and distribution to end consumers (Handayani et al., 2022). The risk of contamination with non-halal elements must be strictly eliminated in each stage. Therefore, the halal supply chain approach emphasizes the importance of a halal assurance system that can be applied comprehensively and standardized. This system involves documentation, verification, and periodic supervision to maintain the integrity of halal products (Tumiwa et al.,

2023). The existence of such a system not only fulfills the religious aspect but also strengthens transparency and consumer trust (Hosen et al., 2022). In the context of the fishing industry, this principle has become very relevant because of the characteristics of its production, which is still carried out traditionally and informally.

The concept of value chains introduced by Porter (2008) describes how every activity in the production chain contributes to creating economic value that can be transformed into a competitive advantage. Activities in the value chain, both primary (such as logistics, operations, and marketing) and supporting (such as technology and human resources), must be optimized to provide maximum value to consumers. When this concept is integrated with halal principles, then every element of the value chain is not only required to be efficient but also compliant with Sharia principles. This means the halal value chain focuses on religious compliance, effective management, and sustainable value creation (M. I. Khan et al., 2022). This approach has improved product reputation, strengthened customer loyalty, and expanded global market access in the food and pharmaceutical industries. With such integration, companies can turn halal compliance into a strategic value proposition (Ali et al., 2022). The same can be adopted to build the competitiveness of Indonesia's halal fisheries sector.

Combining the halal supply chain and value chain results in a strategic approach that ensures the halalness of products and optimizes economic and operational value in business processes (Kurniawati & Cakravastia, 2023). This integrative model allows for strict control mechanisms throughout the production process while providing an evaluative framework for the contribution of each activity to the final result. The value chain is a production line and an ethical oversight system that promotes transparency, fairness, and sustainability (Rahman et al., 2024). Studies by Abd Rahman (2023) and Haleem (2021) show that this approach can improve operational efficiency while strengthening the company's halal reputation in the eyes of stakeholders. Therefore, merging these two concepts is an important foundation for building an adaptive and highly competitive halal system. This convergence can be a tool for building realistic and contextual halal models in the fisheries industry, which has long and heterogeneous supply chains. Thus, the fishery's halal value chain design must consider integrating sharia values with modern management principles.

### Triple Bottom Line and Sustainability in the Halal Industry

The triple bottom line (TBL) sustainability concept, which includes economic, social, and environmental dimensions, is increasingly being expanded to incorporate health as a core concern, especially in the context of the One Health paradigm (Nogueira et al., 2023; Rejeb et al., 2021). The One Health approach recognizes the interconnectedness of human health, animal health, and environmental integrity. In the context of halal fisheries, integrating health aspects means not only ensuring hygienic handling and food safety but also considering the well-being of fishing communities and the risks of zoonotic diseases or contamination through marine ecosystems. Incorporating health into halal sustainability strengthens the alignment with halalan thayyiban principles

and addresses global calls for ethically and ecologically responsible food systems (WOAH, 2022).

This approach emphasizes that the success of an industry cannot be measured solely by financial gains but also by its impact on society and the environment. In the context of halal, TBL provides a strong ethical foundation to ensure that the halalness of the product is also accompanied by measurable sustainability value (Nogueira et al., 2022). A study by Aggerholm and Thomsen (2024) states that balanced sustainability between these three dimensions will strengthen the legitimacy and continuity of the business in the long run. The integration of TBL in the halal system creates a new narrative that halal is not just Sharia compliance but also a manifestation of collective responsibility towards humanity and the earth.

Implementing the triple-bottom-line approach is urgent in the fisheries sector, considering that the challenges are multidimensional (Garlock et al., 2022). From the economic side, fishermen and small business actors struggle with price fluctuations, high production costs, and limited market access. Socially, coastal communities often experience marginalization and limited access to education and technical training, including an understanding of halal (Ayilu et al., 2023). Meanwhile, from an environmental perspective, fishing practices that are not environmentally friendly have seriously threatened the sustainability of marine resources (Standal & Hersoug, 2022). In this context, integrating halal values with sustainability principles is strategic to ensure the fishing industry develops inclusively and ethically. Halal value chains based on TBL will not only create Sharia-compliant products but also improve resource governance and strengthen the competitiveness of local actors.

Empirical studies in the food and agriculture industries show that integrating TBL into the halal value chain can increase market confidence and consumer loyalty (Ali et al., 2022). Consumers now consider the halal aspects of their products and the production process's ethical, social, and sustainability background (Ahmad et al., 2020; Rahman et al., 2024). On the producer side, applying TBL principles encourages adopting environmentally friendly technology, fair work practices, and the involvement of local communities in the production process. The result is a system that is religiously viable and ethically and socially accountable (Shawl et al., 2023; Yip et al., 2023). This evidence suggests that a similar approach can be adopted in developing halal value chains for fisheries. The TBL-based model can improve the reputation of Indonesian fishery products in a global market that is increasingly aware of ethical and sustainability issues.

### Vertical and Horizontal Integration in the Halal Value Chain

In the supply chain management literature, vertical and horizontal integration are important strategies for improving efficiency, quality consistency, and coordination between actors in the value chain (Jafari et al., 2024; Pishchulov et al., 2023). Vertical integration refers to the merger or partnership between stages of production, for example, between fishers, processors, and distributors in one integrated system. The goal is to create a controlled flow from upstream to downstream to make it easier to

standardize product quality and halal. On the other hand, horizontal integration involves collaboration between actors at the same level, such as between fishers or processors, to strengthen their collective capacity and bargaining power in the market. These two forms of integration improve operational efficiency and create space for innovation and cross-actor collaboration (Zhang et al., 2023). The integration allows for a more consistent application of halal standards because all actors in the value chain work within the same system framework.

Implementing the halal system requires strict supervision of critical points vulnerable to contamination or violating sharia principles (Haleem et al., 2021). In an unintegrated supply chain, monitoring these points becomes difficult due to information disconnection and low control over actors beyond direct control. Vertical integration can overcome this problem by providing a direct coordination path between production, processing, and distribution (Pishchulov et al., 2023). This makes implementing the halal procedure, internal audits, and traceability tracking easier. Similarly, horizontal integration through associations or cooperatives of business actors can be a forum for coaching, standardizing, and advocating for halal certification collectively. With an integrated system, business actors are better prepared to face formal requirements such as those from the Halal Product Assurance Agency (BPJPH) or Halal Inspection Agency (LPH).

In the fisheries sector, such as in the northern region of Java, vertical and horizontal integration is crucial, considering the business structure that is still scattered and informal (Wasik et al., 2024). Many fishermen operate individually without a direct connection to processing units or distributors, while small fish processors rarely have access to an adequate halal distribution system. This fragmentation causes difficulties in the consistency of quality and halal supervision, weakening local actors' bargaining position in the supply chain. By implementing vertical integration, business actors can form a joint business ecosystem that ensures the continuity of product flow and compliance with halal standards. Meanwhile, horizontal integration allows fishers or small processors to form cooperative networks to share resources, conduct collective certifications, and expand markets. A study by Fernando et al. (2023) shows that integration in the agro-halal sector has improved logistics efficiency and access to Sharia financing.

### Research Gaps and Contextual Relevance in the Fisheries Sector

A review of the literature shows that most studies on halal value chains are still focused on the processed food, agribusiness, and logistics sectors, with minimal attention to the fisheries industry (Handayani et al., 2022; Harsanto et al., 2025; Kurniawati & Cakravastia, 2023). These studies generally discuss certification, quality assurance, and halal distribution systems in the context of land-based food products. The fisheries sector has very different characteristics, such as dependence on natural catches, seasons, and social dynamics of coastal communities (Evans et al., 2023; Villasante et al., 2021). This complexity has not been studied in depth in the current halal value chain

literature. On the other hand, the fisheries sector contributes an important part of the national food system while having great potential in the global halal product market.

As the focus of this study, the northern coastal region of Java reflects the typical conditions of Indonesia's fishery sector, which is densely active but weak in halal systemization (Rahmat & Neilson, 2023). Fish production in this region is very high, but it is not yet fully integrated into a system that supports halal certification and supervision (Sagala et al., 2024). Supply chain digitalization is still low, and business actors are mostly micro and small-scale, operating informally. Existing regulations often do not reach field practice, resulting in a gap between policy and implementation. In addition, no operational model or guideline explicitly adapts halal principles to the local conditions of coastal communities. The available literature also discusses more technical issues of fisheries or sustainability in general, without relating to the halalness integrity of products. This emphasizes the need to develop a halal model that is not only normative, but also adaptive to local social, economic, and cultural realities.

Referring to these gaps in the literature and empirical conditions, it is clear that there is a need for a new approach that can integrate halal principles with sustainability in the local context of the fisheries sector. The model developed must not only be theoretical but also have the affordability of implementation at the level of the fishing community and small business actors. This approach must consider the capacity of human resources, infrastructure, and institutions in coastal areas to be adopted realistically. The local context is a key element in ensuring the successful implementation of the halal value chain in the fisheries sector because not all principles from other sectors can be directly applied without adjustment. By understanding local characteristics in-depth, the model built will be more accurate in answering real challenges and needs on the ground. The global literature supports the importance of contextual approaches in the design of inclusive and impactful halal systems.

### Research Gap and Justification

Although the halal value chain has grown rapidly in various sectors, its implementation in fisheries is still minimal (Kurniawati & Cakravastia, 2023; Rusydiana et al., 2023b). This sector has unique characteristics that conventional approaches have not fully answered, especially regarding sustainability and sensitivity to the local context (Rejeb et al., 2021; Rusydiana et al., 2023a).

Indonesia has the longest coastline in the world, making it a country with great potential to develop a competitive halal fisheries industry globally (Himawan et al., 2023). In 2023, Indonesia's total fishery production reached 23.54 million tons, consisting of 8.18 million tons of capture fishery products and 15.36 million tons of aquaculture products. In the same year, Indonesia's seafood exports contributed around 2.5 percent to the total national export value (BPS, 2024). Unfortunately, the absence of an integrated halal model caused the implementation of halal principles in the fisheries sector to run partially and sporadically. This impacts the low consistency of halal certification and the weak guarantee of product integrity from the sea to the dinner table.

### Contribution of This Study

This study contributes to designing the halal value chain model for the fisheries sector, which needs to consider diverse local characteristics, ranging from business scale cultural wisdom to the capacity of certification bodies. In the context of the northern coast of Java, fishery business actors are mostly small-scale fishermen and micro-processors who do not have adequate access to modern resources (Rahmat & Neilson, 2023). An inclusive, participatory, and adaptive approach is important to apply the proposed model. Collaboration between the government, certification bodies, academics, and local communities is key to the sustainable implementation of the model. Model flexibility should also allow for integration at different levels of business, both traditional and modern.

## METHOD

### Research Design

This study uses a qualitative approach with a case study method to explore the actual condition of the fishery value chain in the northern coastal area of Java. This approach is based on contextual complexity and the need to understand phenomena holistically in a natural environment. The study location is focused on the northern coastal area of Java, which is known as a fishery production center with dense economic activities but a lack of an integrated halal system (Kementerian Kelautan dan Perikanan, 2024; Rahardjo, 2021).

### Data Collection

The data used in this study are secondary and obtained from various official and trusted sources. Among them are sourced from government reports (for example, the Central Statistics Agency (BPS), the Ministry of Maritime Affairs and Fisheries, halal certification guidelines from the Halal Product Guarantee Agency (BPJPH), scientific publications, and related policy reports. These sources were chosen because they provide relevant information regarding the condition of the fisheries industry, halal regulations, and sustainability aspects. Data collection techniques were carried out through documentation and literature studies (within the last 5-7 years).

### Data Analysis

Data analysis is done through content analysis and thematic synthesis methods to identify key themes relevant to the research objectives. This technique allows for exploring patterns, relationships, and gaps in the literature and official documents analyzed. Furthermore, the fisheries' value chain from upstream to downstream is mapped, including production, processing, distribution, and consumption processes. The primary focus of this mapping is to identify critical halal control points that can potentially affect the halal integrity of products. In addition, the analysis is also directed at sustainability aspects at each stage of the value chain to ensure compliance with the triple bottom line principle. The results of this analysis are the basis for designing an integrated and contextual halal value chain model for the fisheries sector.

Thematic synthesis was conducted using manual coding and categorization based on recurring themes related to halal assurance, sustainability pillars, and value chain structure. While no specific software, such as NVivo, was used, the analysis followed the principles of content analysis—identifying patterns and cross-referencing between document types. Halal critical points were mapped based on content triangulation between regulatory texts, empirical case studies, and sector reports.

## Ethical Considerations

All data sources were publicly available and cited appropriately to ensure academic integrity.

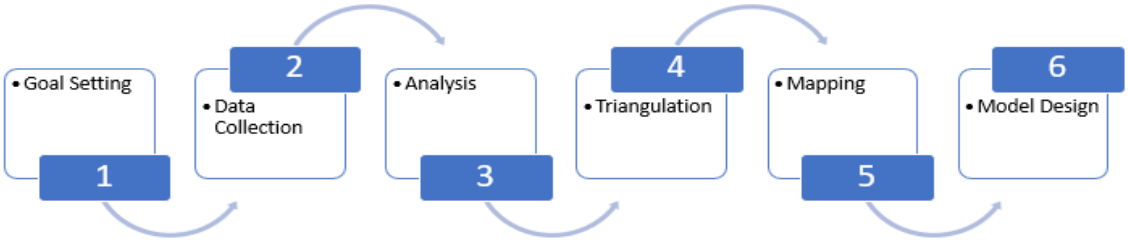
## Validity and Reliability

The data collection technique is done through documentation and literature review, ensuring validity through a triangulation process between sources. The selection criteria include up-to-date, institutional trustworthiness, and relevance to the research topic.

To ensure the reliability of halal critical point mapping, the study employed a triangulation strategy: comparing data across academic literature, policy documents, and statistical reports. The criteria for identifying halal control points were adapted from halal logistics and HACCP frameworks. A flow diagram of the research process has been provided below (Figure 3) to enhance methodological clarity and transparency.

**Figure 3**

*Research Process Flow Diagram*



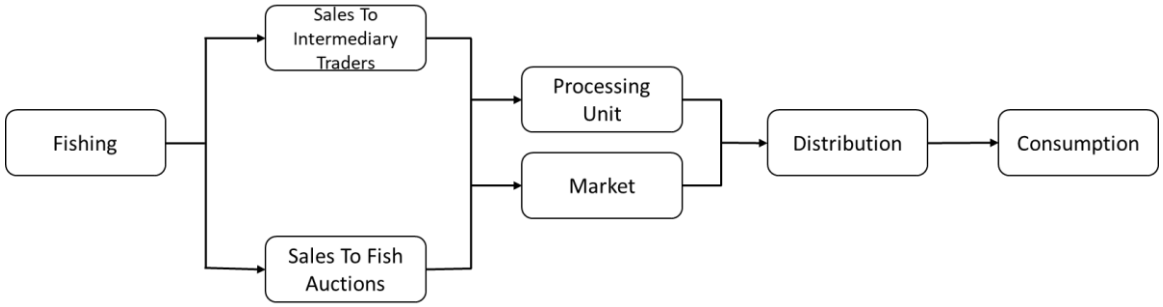

Source: Authors' analysis.

## RESULTS

The results of mapping the fishery value chain in the northern coastal region of Java show that the industrial structure is still traditional and fragmented. The production process starts from fishing activities by small-scale fishermen with limited facilities. The captured commodities are then sold to collectors or fish auction sites (Figure 4). After that, the product flows to the processing unit or directly to the market without the supervision of quality standards or halal. At the distribution stage, the supply chain often involves a third party without a halal logistics system. This pattern shows weak vertical integration and a lack of control over halal at every stage.

**Figure 4**

*Structure of the Traditional Fishing Industry in the Northern Coastal of Java*




Source: Primary data. Authors' analysis.

One of the important findings is the absence of halal control points formally implemented in the value chain. Most actors do not understand the importance of documentation of raw materials, the use of halal production equipment, and the separation of products from potential contamination. This ignorance makes it difficult for fishery products to qualify for halal certification, even though the raw materials are naturally halal. Processing practices such as adding preservatives, sauces, or other additives have also not been verified for halal. In addition, the processing facilities are still mixed and non-segregative (Table 2).

**Table 2**

*Halal Control Points in the Fishery Product Value Chain*

| Characteristics | Status |
|---|---|
| Formal Halal Control Points, | None |
| Raw Material Documentation | Less |
| Halal Means of Production | Unverified |
| Product Segregation | Mixed |
| Halal Awareness | Low |
| Halal Verification of Additives | Unverified |

Source: Primary data. Authors' analysis.

In terms of logistics, no transportation and storage system meets halal standards. Fish products are often shipped alongside non-halal products without adequate labeling and separation. The cold chain has not run optimally, increasing the risk of quality damage and contamination. Product distribution tends to be cost-efficient-oriented without regard to halal integrity (Table 3). The lack of investment in halal logistics is a structural obstacle to developing a complete value chain.

**Table 3**

*Halal Logistics of Fish Products*

| Characteristics | Problem |
|---|---|
| Transportation | Hand In Hand with Non-Halal Products |
| Storage | No Facilities that Meet Halal Standards |

| Characteristics | Problem |
|---|---|
| Labeling | Often Missing or Inadequate |
| Cold Chain | Not Optimally Maintained |
| Distribution | Cost Oriented, Low Integrity |

Source: Primary data. Authors' analysis.

From a health perspective, the absence of proper halal control points and segregated processing facilities significantly increases the risk of foodborne illnesses. Without verified documentation, additives or preservatives used may include non-halal or even unsafe chemical substances. The mixed use of the equipment and lack of sanitation protocols can lead to microbial contamination, posing serious threats to consumer health (WHO, 2022). Furthermore, the failure to maintain cold chains during distribution may facilitate the growth of harmful bacteria, especially in fish products, which are highly perishable. These conditions highlight the urgent need to integrate food safety and hygiene standards into the halal assurance framework to support both Sharia compliance and public health protection.

Another finding is the absence of a comprehensive halal monitoring and audit system in this fisheries sector. Institutions such as BPJPH or LPH are still limited to the large industrial sector, while Micro, Small, and Medium Enterprises (MSME) actors have not been systematically reached. The absence of this system increases the risk of violating halal principles in the field. In addition, the halal certification process is felt to be complicated and expensive by small business actors, thus reducing the incentive to follow regulations. Developing a community-based or cooperative-based halal certification mechanism is necessary in this context. This mechanism can expand the scope of supervision and increase business actors' compliance with halal standards.

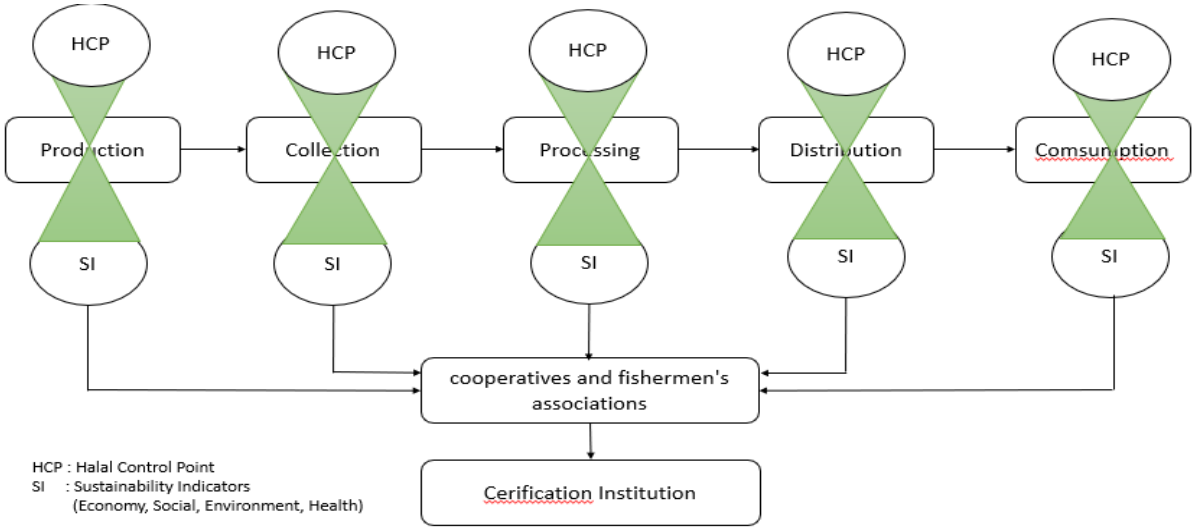
## DISCUSSION

The model proposed in this study integrates halal and sustainability principles through a locally-based value chain approach. The model design includes five main stages: production, collection, processing, distribution, and consumption. At each stage, halal control points and sustainability indicators are set as evaluation tools. Strengthening the role of cooperatives and fishermen's associations is also proposed as a liaison between local actors and certification bodies (figure 5). This model is flexible and adaptable based on the scale of the effort and local resources. This approach is expected to answer the challenges of the coastal fisheries sector in a contextual manner.

In line with the One Health perspective (FAO, 2021), the proposed model also contributes to health outcomes by addressing potential contamination and hygiene issues throughout the value chain. By integrating halal control points with sustainable handling practices, the model reduces risks of microbial contamination, chemical exposure, and spoilage, particularly in perishable fish products. Public health in coastal communities can also be strengthened through cleaner processing environments, improved worker hygiene awareness, and access to safe food.

**Figure 5**

*Sustainable Fisheries Halal Value Chain Model*




Source: Primary data. Authors' analysis.

In the production stage, the primary focus is on the fishing gear, the type of commodity, and the initial treatment of the catch. The use of ice cubes, cutting tools, and containers must be ensured to be free from contamination by feces or harmful materials. Strengthening fishermen's education on the principles of halalan tayyiban is the foundation of this stage. In addition, simple technologies such as halal special containers can be applied at a low cost. Traceability also needs to be started at this stage to support certification. Environmental aspects are considered when managing catches that do not damage the marine ecosystem.

At the collection stage, the main risk lies in product contamination due to containers and transport used alternately. Products from various fishermen are mixed without halal labeling or adequate physical separation. Therefore, a standard operating procedure (SOP) that explains the procedures for halal collection is needed. Coordination between actors also needs to be improved through associations or cooperatives. In addition, a halal-based incentive system can encourage actors to comply with standards. From a sustainability perspective, waste reduction and transportation efficiency are also concerns.

The processing stage is a crucial point that determines the validity of the halalness of the product. Additives such as spices, sauces, or preservatives should be closely monitored. The separation of halal and non-halal production areas must be carried out firmly. In addition, training the processing workforce is essential to ensure their understanding of halal standards. Quality control and periodic audits need to be involved in this system. The social aspect is strengthened through the involvement of local workers with decent and fair work standards.

Distribution is a stage that is often neglected in halal control, even though it plays a significant role in maintaining product integrity. Halal products must be transported and stored in facilities that are not mixed with non-halal products. A system of labeling,

documentation, and physical segregation must be enforced. Collaboration with halal logistics companies or developing a locally-based community distribution system is needed. Adding halal cold chain facilities is also very important in maintaining the quality and halalness of products. In terms of sustainability, the use of energy-efficient vehicles and the reduction of carbon footprint can be part of the evaluation.

At the consumption stage, clarity of product information is key. Halal labels must be transparent, verifiable, and equipped with information on the source of the ingredients and the production process. Consumer education is important so that they can choose products that are not only halal but also tayyib. Public campaigns, digital labeling, and QR code-based certifications can be used to increase transparency. Consumers also play a role in driving demand for sustainable halal products.

This discussion reveals that an integrated halal model is not yet available in practice in the fisheries sector. The gap has been filled through a model design that considers halal and sustainability simultaneously. The model is adaptive to the local context and encourages the participation of various stakeholders. The findings of this study are consistent with previous literature but extend the scope to sectors that have not been widely studied. In addition, this model has the potential to be replicated in other coastal regions with similar characteristics.

## CONCLUSION

The integration of halal and sustainability principles in the fisheries sector has not yet been systematically realized, especially in the northern coastal areas of Java. The mapping results show various weaknesses in halal control, logistics systems, certification, and understanding of business actors. An integrated halal value chain model has been designed to address this by considering five main stages: production, collection, processing, distribution, and consumption. This model emphasizes the critical points of halal at each stage and combines economic, social, environmental, and health sustainability indicators. In addition to answering theoretical gaps, this model provides practical solutions based on local contexts.

The implications of this research extend to various dimensions. Theoretically, the developed model enriches the literature on halal value chains with a contextual and multidimensional approach. In terms of policy, these findings can be used as a reference in preparing regulations, training programs, and assistance for small and medium enterprises in the fisheries sector. For the industry, this model can potentially increase the competitiveness of halal products by strengthening added value and global market access. This study also opens up space for further research, primarily through trial model implementation in the field, as well as the development of sustainable halal performance indicators. Thus, the contribution of this research is not only academic but also directly impacts the strengthening of the national halal economy.

## Limitations of the Study

This study is limited by its reliance on secondary data, which may not fully reflect real-time practices and local stakeholder perspectives. The absence of primary data collection, such as interviews or field surveys, limits a deeper contextual understanding. Moreover, the proposed model has not yet been empirically tested in fisheries environments. These limitations position this research as a conceptual foundation that requires further validation through field-based implementation.

## Recommendations for Future Research

This study also opens up space for further research, primarily through trial model implementation in the field, as well as the development of sustainable halal performance indicators. Future studies should focus on piloting the proposed model in diverse fishery settings to assess its practical feasibility and adaptability. Stakeholder participation from small-scale actors will be essential in refining the model to suit local socio-economic and ecological conditions. Additionally, constructing a measurable framework of halal sustainability indicators will help evaluate and monitor the long-term effectiveness of the model.

## Author Contributions

| | | | |
|---|---|---|---|
| Conceptualization | M.T., R.D.A., M.F., & F.A.A.Z. | Resources | M.T., R.D.A., M.F., & F.A.A.Z. |
| Data curation | M.T., R.D.A., M.F., & F.A.A.Z. | Software | M.T., R.D.A., M.F., & F.A.A.Z. |
| Formal analysis | M.T., R.D.A., M.F., & F.A.A.Z. | Supervision | M.T., R.D.A., M.F., & F.A.A.Z. |
| Funding acquisition | M.T., R.D.A., M.F., & F.A.A.Z. | Validation | M.T., R.D.A., M.F., & F.A.A.Z. |
| Investigation | M.T., R.D.A., M.F., & F.A.A.Z. | Visualization | M.T., R.D.A., M.F., & F.A.A.Z. |
| Methodology | M.T., R.D.A., M.F., & F.A.A.Z. | Writing – original draft | M.T., R.D.A., M.F., & F.A.A.Z. |
| Project administration | M.T., R.D.A., M.F., & F.A.A.Z. | Writing – review & editing | M.T., R.D.A., M.F., & F.A.A.Z. |

All authors have read and agreed to the published version of the manuscript.

## Funding

This study received no direct funding from any institution.

## Institutional Review Board Statement

The study was approved by Program Studi Ekonomi Islam (S1), Universitas Wahid Hasyim, Kota Semarang, Indonesia.

## Informed Consent Statement

Informed consent was not required for this study.

## Data Availability Statement

The data presented in this study are available on request from the corresponding author.

## Acknowledgments

The authors thank Program Studi Ekonomi Islam (S1), Universitas Wahid Hasyim, Kota Semarang, Indonesia, for administrative support for the research on which this article was based.

## Conflicts of Interest

The authors declare no conflicts of interest.

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