

Fish Value Chain Analysis in Abyan Governorates, Yemen

Conducted by

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**Within the framework of the "Resilient Livelihoods & Gender-
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Communities in Abyan and Abyan Governorates."**

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Executive summary

Yemen is experiencing one of the world's most severe humanitarian and economic crises, with coastal communities including Abyan Governorate suffering from the collapse of basic livelihoods and rising levels of food insecurity. In this context, the fisheries sector emerges not only as a pillar of national food security but also as a crucial lifeline for recovery, especially in rural coastal communities. The fisheries sector stands as one of the few remaining economic pillars that provide employment and food for the population, supporting an estimated 100,000 households nationwide. However, the full potential of this sector remains untapped due to a weak value chain, high post-harvest losses, and limited access to modern markets and technologies. This study was conducted to provide an evidence-based analysis of the fish value chain in the districts of Zinjibar and Khanfir in Abyan Governorate. It was carried out within the framework of the project "Resilient Livelihoods and Gender-Responsive Economic Opportunities for Women, Youth, and Communities," funded by Diakonie Katastrophenhilfe (DKH) and implemented by the Building Foundation for Development (BFD). The study aims to inform strategic programming, investment decisions, and policy-oriented interventions to enhance productivity, value addition, market performance, and inclusivity within the fisheries sector.

The study adopted a mixed-methods approach, combining quantitative and qualitative analysis based on the Food and Agriculture Organization (FAO) Sustainable Food Value Chain framework. This included:

1. Primary Data Collection: Through structured questionnaires administered to a sample of 108 respondents representing all nodes of the value chain (fishers, input suppliers, cooperative associations, traders, consumers). Random and purposive sampling ensured representation.
2. Secondary Data Collection: Review of previous reports covering the period 2015–2024.
3. Qualitative Tools: Focus Group Discussions (FGDs) and Key Informant Interviews (KIIs).
4. Data Analysis: Quantitative data were analyzed using SPSS, Excel, and Power BI, while qualitative data were transcribed, coded, and interpreted. Triangulation was applied to ensure validity and reliability.

The study aimed to achieve the overall objective of conducting a comprehensive analysis of the Fisheries Value Chain and assessing the roles, interactions, and challenges of its actors. This was broken down into six specific objectives:

1. Identify and map key value chain actors.
2. Assess infrastructure and post-harvest handling practices.
3. Analyze marketing channels and the "Dallal" (auctioneer) system.
4. Identify socio-economic, environmental constraints and opportunities.
5. Analyze cost structures, cash flows, and profit margins.
6. Explore entry points for women and youth in post-harvest activities.

Key Findings

The analysis revealed a fish value chain suffering from deep structural challenges, despite its significant economic and social importance. The most prominent findings can be summarized as follows:

1. **Male Dominance and Low Youth Participation:** Males completely dominate fishing activities, with a noticeable lack of youth participation (only 19% in the 18-30 age group), threatening the long-term sustainability of the profession. Family-inherited experience (62%) is the primary source of knowledge, indicating an absence of formal training.
2. **Low Educational Level:** The majority of fishermen have a low educational level (38% secondary, 33% preparatory, 5% illiterate), hindering the adoption of modern technologies and access to information.
3. **The chain consists of six stages:** Pre-fishing, Production, Collection, Distribution, Export, and Consumption. Mapping revealed critical logistical gaps; 100% of cooperative societies lack refrigeration facilities, and 95% of fishermen perform no processing, leading to immediate value loss after the catch.
4. **The current situation threatens food security and the livelihoods of thousands of families.** Market inefficiency and middleman monopolies lead to unfair profit distribution, harming both producers and consumers. Environmental sustainability is also at risk due to over-reliance on "Baghah" (Indian Mackerel) (47%), which may lead to the depletion of fish resources and ecological imbalance.
5. **Weak Logistics Infrastructure:** Cooperative associations (100%) and traders (95%) completely lack storage and refrigeration facilities or ice factories, leading to significant losses in fish quality and quantity after catch.
6. **Trader/Middleman Dominance and Fisher Exploitation:** Traders and middlemen control 95% of marketing channels, causing severe price volatility and capturing the largest share of value, while fishers suffer from weak bargaining power.
7. **Significant Financial and Technology Obstacles:** Despite the presence of microfinance institutions, 80% indicate that fishermen face difficulty in providing the necessary collateral for loans, hindering equipment modernization and business development, furthermore, 100% have received no formal training, and 90% use no modern fishing technologies.
8. **Lack of Market Information:** 95% of traders rely solely on local markets for information, with an absence of modern channels, making them vulnerable to price fluctuations and middleman monopolies.
9. **Absence of Value Addition:** The chain is limited to selling raw fish, with a near-total absence of primary processing or manufacturing operations, which limits economic returns.
10. **Consumer Suffering and Eroded Trust:** 100% of consumers report high fish prices, and 92% complain of poor quality, leading to reduced consumption and threatening local food security.

11. Inequitable Profit Distribution: While Restaurants achieve a reasonable profit margin (54%), most intermediary nodes (e.g., wholesalers and retailers) operate on thin margins (below 6%), indicating low efficiency and high operational costs that drain value from the chain.

5. Overall Recommendations

Transforming the fish value chain from its current fragile state into a thriving and sustainable sector requires multi-faceted and sustained policy intervention. Efforts should focus on the following points:

1. Urgent Investment in Logistics Infrastructure

- Developing the "Cold Chain": The establishment and equipping of refrigeration and storage units and ice factories in key landing areas and central markets must be a top priority. Governments and international organizations can provide the necessary funding, with the involvement of the private sector and cooperative associations in management and operation to ensure sustainability.
- Modernizing Landing Centers: A comprehensive upgrade of existing landing centers, including Al Khubar area, is required to provide adequate docks, modern unloading equipment, and sanitary facilities to ensure fish quality and reduce post-harvest losses.

2. Reforming Financing Mechanisms and Facilitating Access

- Designing Innovative Financial Products: The Central Bank and microfinance institutions, in cooperation with government agencies, should develop flexible credit products tailored to the nature of fishermen's work. These products could include group-guaranteed loans, loans secured by productive assets (such as boats and equipment), or government-backed loan guarantee programs.
- Supporting Essential Production Inputs: The government should consider direct or indirect support programs for key production inputs, such as fuel and modern fishing equipment, to reduce the high operating costs burdening fishermen.

3. Building Human and Institutional Capacities

- Comprehensive Training and Qualification Programs: Intensive training and qualification programs should be launched for fishermen and youth, focusing on sustainable fishing techniques, best practices for post-harvest fish handling, quality management, and small business management skills. This can be done in partnership with technical and vocational institutes and NGOs.
- Empowering Cooperative Associations: Strengthen the role of cooperative associations by building their administrative and technical capacities and providing them with the necessary support to offer services to their members, including storage, collective marketing, and access to finance.
- Attracting Youth to the Sector: Develop special programs and incentives to attract youth to the fishing profession, including providing vocational training, facilitating access to modern equipment, and connecting them with employment opportunities in value-added sectors.

4. Enhancing Value Addition and Market Transparency

- Promoting Small-Scale Processing Industries: Provide incentives for investment in small and medium-scale fish processing and manufacturing units (such as cleaning, cutting, salting, and packaging). This will contribute to increasing the market value of the product and creating new job opportunities.
- Maximizing Value Added: Transitioning from selling raw products to manufacturing (such as canning and luxury packaging) and investing in modern technology and infrastructure for processing fish waste into organic fertilizers. within specialized processing centers to increase sector income and open new markets
- Developing an Effective Digital Market Information System: Create a user-friendly digital platform (accessible via mobile phones) that provides updated information on fish prices in different markets, demand volume, and best marketing practices. This will increase market transparency, reduce middleman control, and enable fishermen to make better marketing decisions.

5. Regulatory and Oversight Framework

- Activating Health Control and Quality Standards: Relevant government agencies must tighten control over all stages of the value chain, from fishing to consumer sales, to ensure compliance with health and quality standards. This will help restore consumer confidence in local products and open export opportunities.
- Regulating Sustainable Fishing Practices: Establish and enforce strict regulations to control the fishing of overexploited species and encourage fishermen to diversify their catches and use environmentally friendly fishing gear to ensure the long-term sustainability of fish resources.

Top Priority (2026): Stop the Bleeding and Build Trust

1. Immediate Investment in the Cold Chain: Fund and install cold storage units at key landing sites (e.g., Al Khubar, Al Ko'ud) and equip cooperative associations with portable ice boxes. This single measure could reduce waste by over 40% and immediately improve quality and prices.
2. Launch an Emergency Fishers' Finance Facility: Create a financing mechanism with flexible guarantees (e.g., group collateral, equipment liens) and repayment grace periods aligned with fishing seasons. It must specifically target youth to renew the workforce.
3. Regulate Markets and Break Middleman Monopolies: Support the establishment of a digital or physical centralized marketplace linking cooperatives directly to bulk buyers and restaurants, overseen by a local community committee to ensure pricing transparency.

Medium-Term Priority (2026-2027): Maximize Value and Build Capacity

1. Transform Cooperatives into Integrated Service Hubs: Support cooperatives to provide cold storage, training on primary processing (cleaning, cutting, packaging), and collective marketing. Empower women to lead these activities.
2. Launch a National Fishers' Training Program: A mandatory training curriculum covering: maritime safety, sustainable fishing, engine maintenance, and quality principles. It should be linked to small grants for purchasing essential equipment.

Strategic Priority (Post-2027): Integration and Sustainability

1. Issue a National Policy for Sustainable Artisanal Fisheries: Develop a legislative framework that protects fish stocks, regulates fishing gear, and ensures a fair share for local fishers. The policy must include incentives for transitioning to light processing (canning, smoking).
2. Integrate the Fish Value Chain into Economic Recovery Plans: Recognize the fisheries sector as strategic in reconstruction plans, allocating major investments for coastal infrastructure development (ports, roads, processing centers).

1. Introduction & Background

1.1 Introduction

Yemen remains gripped by one of the world's most protracted socio-economic crises, characterized by institutional fragmentation, widespread food insecurity, and the erosion of traditional livelihood systems. This fragile environment has severely diminished household resilience, particularly in coastal rural communities where the collapse of basic services and market disruptions have left vulnerable groups, including women and youth, with limited economic pathways. In this context, the Fisheries sector emerges not only as a pillar of national food security but as a critical lifeline for recovery. However, the sector is currently hampered by inefficient value chains, high post-harvest losses, and limited access to modern processing technologies. Within this framework, the “BFD–DKH Livelihoods and Early Recovery Project” seeks to bridge these gaps by fostering self-reliance and enhancing the income-generating capacities of small-scale fishers and coastal actors.

1.2 Description of the Study Area

The study focuses on Zinjibar & Khanfir (Abyan) districts. These areas are strategically significant due to their extensive coastlines along the Arabian Sea.

Abyan Governorate: Located 427 km southeast of Sana'a, Abyan is a cornerstone of Yemen's agricultural and marine production. With its capital, Zinjibar, and the major district of Khanfir, it boasts a diverse ecosystem where agriculture meets the sea. Fishing is a primary livelihood for its coastal residents, yet the potential of its rich waters remains underdeveloped due to the conflict's impact on infrastructure.

1.3 Description of the project

The project aims to revitalize the Fisheries Value Chain in targeted districts of Abyan Governorates. Funded by the DKH Foundation, the intervention provides technical and material support to small-scale fishers and coastal producers to enhance productivity, ensure quality compliance, and reduce post-harvest losses.

By focusing on the entire spectrum—from sustainable harvesting to processing and marketing—the project empowers women and youth to participate in value-added activities (such as drying, smoking, and packaging). This holistic approach is designed to improve the quality and safety of fish products, enabling access to high-end markets, increasing household profit margins, and ensuring long-term stability within the local fishing industry.

1.3 Background and context

One of the greatest obstacles to decision- and policymaking regarding small-scale fisheries is the lack of reliable data and information about various facets of the sector. Facilitating optimal conditions for small-scale fishers depends on access to good information upon which appropriate policies and management strategies can be based. This requires improved data collection, as well as further research, on small-scale fisheries to better understand the conditions, opportunities and constraints of this sector. In recent years there has been increased interest in the value chains of seafood products and in investigating the linkages and relationship between different actors and economic agents (individuals, companies, government) in the value chains. The value chain describes the full range of activities required to bring a product or service from conception, through the different phases of production (involving a combination of physical transformation and the input of various producer services), delivery to final consumers and final disposal after use.

Small-scale fisheries feed into diverse and spatially extensive networks of supply and trade that connect production with consumers, adding significant value and generating important levels of employment (the value chain). To some extent, this system can be used to provide an important mediation and buffering function to increasing variability in supply and source location, but direct impacts will also affect its ability to do so. This system can also be used to reduce vulnerability and increase adaptive capacities of fishers and fishing households. The value chain perspective is important because it offers insights that would not surface in studies focused on individual economic agents or fisheries policy or management frameworks. A value chain analysis can also uncover insights into the challenges that face the sector because of different drivers of change, such as weak governance and market access, including small firms' and fishers' competitiveness in changing markets. A value chain perspective of the small-scale fisheries sector can reveal response strategies that enhance the sustainability and competitiveness of the entire value chain and the economic agents that comprise it. Value chain analysis helps to effectively isolate the binding constraints that affect the sector in a systematic manner. The set of issues that emerge from such a detailed analysis at a sector level has implications for both the public and private sectors alike. Some of the issues are sector-specific, and others are relevant across an economy and apply to many sectors and firms in a country. It also provides an opportunity to find

policy and management positions that can be supported by the sector's different economic agents and important stakeholders.

The fisheries sector is a vital engine of Yemen's economy, supporting over 60% of the population in coastal regions. Yemen's strategic location along the Gulf of Aden and the Arabian Sea offers immense biological wealth; yet, the value chain faces systemic bottlenecks, including dilapidated cold-chain infrastructure, lack of fuel, and weak market linkages.

The fishery value chain in Abyan Governorate is a vital topic that requires in-depth study and detailed analysis, as the fishing sector is one of the important economic sectors that contributes to providing job opportunities and generating local income. Nonetheless, the sector faces numerous challenges that impact its sustainability and development. Understanding the value chain is essential to grasping the complex relationships among various stakeholders within this sector. This study aims to conduct a comprehensive analysis of the fishery value chain in Abyan Governorate, identifying both challenges and opportunities within the sector. By examining the value chain, we seek to determine how to enhance the sustainability and competitiveness of fisheries, as well-being of fisheries. This includes understanding the relationships among stakeholders such as fishermen, traders, and consumers, and analyzing the challenges each group faces. The study will provide a comprehensive analysis of the fishery value chain in Abyan Governorate, focusing on the different stages from fishing to the final consumer. By identifying the challenges and opportunities within the sector, we aim to propose practical recommendations that will contribute to improving the performance and sustainability of the fishery sector. Ultimately, this study analysis aims to serve as a valuable resource for both researchers and policymakers in the field, contributing to informed decision-making and sustainable development in the fisheries sector.

2. The Objectives of the Study:

The primary purpose of this study is to conduct a systemic analysis of the Fisheries Value Chain in the targeted districts, identifying bottlenecks and opportunities to enhance the livelihoods of small-scale fishers and coastal communities. :

2.1 The general objectives

To conduct a comprehensive analysis of the Fisheries Value Chain, evaluating the roles, interactions, and challenges of small-scale fishers, processors, and traders, while assessing fish handling practices, processing techniques, and marketing dynamics in the study area.

2.2 The Specific Objectives

1. Identify and Map Value Chain Actors: To identify the key actors within the fisheries value chain—from input suppliers and fishers to wholesalers and retailers—and examine their performance, roles, and levels of participation.
2. Assess Infrastructure and Post-Harvest Handling: To evaluate the efficiency of current fish handling practices, cold chain infrastructure (ice production and cold storage), and processing capacities to identify causes of post-harvest losses.
2. Analyze Marketing Channels: To describe the existing marketing channels, including the "Dallal" (auctioneer) system, and understand how fish products move from landing sites to local and regional markets.
4. Identify Constraints and Opportunities: To pinpoint the specific socio-economic and environmental barriers (e.g., fuel costs, climate change, lack of equipment) and identify opportunities for value addition, product diversification, and improved market access.
4. Evaluate Financial Dynamics: To analyze the cost structures, profit margins, and cash flows for different actors across the chain, providing a clear picture of the economic viability and income distribution within the sector.
5. Promote Gender and Youth Inclusion: To explore entry points for women and youth in post-harvest activities, such as fish processing, packaging, and marketing, ensuring equitable benefit-sharing within the value chain.

3. Methods of the study

3.1 Scope of the Study

- **Geographical Scope:** The study focuses on key coastal districts and landing sites (Landing Centers) in the governorates of Abyan, known for their high marine productivity. These include:
 - Abyan - Zinjibar District: Al Sheikh Abudullah, Alkud-Ata'a
 - Abyan – Khanefer District: Al Khubar, Shuqrah, Muqattinm, Sirah, and Dufas
- **Temporal Scope:** The study utilizes secondary data from 2015–2024 to analyze trends, while primary data focusing on fish production, landing volumes, and market prices is collected for the 2025/2026 period.
- **Subjective Scope:** The analysis covers the entire Fisheries Value Chain (FVC), from input supply (boats, engines, fuel, nets) and harvesting to post-harvest handling, cold storage, processing (drying/smoking), and final consumption.

3.2 Methodology of the assessment

The study adopts the FAO Sustainable Food Value Chain (SFVC) framework, specifically adapted for the fisheries sector. This approach ensures a holistic analysis across three sustainability dimensions:

Economic: Analyzing profit margins, value-added at each node (e.g., from raw fish to dried/packaged fish), and cost structures (fuel, ice, labor

Social: Focused on the livelihoods of coastal communities, including the role of women and youth in post-harvest activities and the socio-economic status of small-scale fishers

Environmental: Assessing the sustainability of fishing practices, the impact of climate change on fish migration, and waste management at landing sites.

Institutional: Evaluating the role of Fishery Cooperative Associations (FCAs) and the General Authority for Marine Fisheries.

3.3 Types, Sources, and Methods of Data Collection

The study employs a Mixed-Methods Approach, triangulating primary and secondary data:

Secondary Data: A rigorous review of previous reports by the Ministry of Fish Wealth, FAO, and earlier BFD assessments to establish a baseline.

Primary Data: Collected through a combination of Random Sampling (for fishers and consumers) and Purposive Sampling (targeting specific actors like ice factory owners, "Middlemen" or auctioneers, and exporters).

3.3.1 Sampling Strategy

Stakeholders survey

The stakeholder's survey was conducted October 2025 and November 2025 (questionnaire Appendix). An interview schedule was used to interview the important stakeholders/key informants involve in Fish Value chain to obtain information about the challenges and opportunities of the Fish Value chain. A total of 108 respondents participated in the Fish Value chain assessment and were distributed across the chain to capture diverse perspectives:(Abyan), the details given in (Table 1).

Table 1: Distribution the sample of the fishing value chain across all actors.

GOV District /	Fishers (HH)	Input Suppliers	Microfinance Institutions	Cooperative Association	Wholesalers/ Exporters	Retailers/ Fishmongers	Consumers	Extension Services
Abyan / Khanefer	15	2	1	3	0	12	36	2
Abyan / Zanzibar	6	0	4	3	1	7	14	2
Total	21	2	5	6	1	19	50	4

3.4 Data Processing.

Data has been entered through online data entry platform called KoBo Toolbox. Supervisor has checked data at the field level by real time checking, spot checking and sudden checking mechanisms. On the other hand, the data management xxpert made sure real time checking at the central level. The data generated by FGDs and has been recorded through questionnaire after taking the verbal permission of the respondents.

3.5 Data Analysis

Quantitative data from questionnaires survey was analyzed using SPSS, excel and power BI programs by which measures of frequency, cross tabulation, mean etc. were done and graphical presentation were used. Qualitative data from FGDs were transcribed, coded and then interpreted in line with the ToR of the assessment. To ensure validity and allow for generalization, data were triangulated across all quantitative and

qualitative data collection tools to build consensus on the logical findings that were carried forward to formulate recommendations. Tables, graphs and charts will also be generated for analysis

3.6 Value Chain Performance Analysis

This section aims to evaluate the performance of the value chain from multiple

Economic Performance: Focuses on the "Catch per Unit Effort" (CPUE) and the price spread between the shore (landing site) and the final consumer.

Social Performance: Evaluates the inclusion of marginalized groups and the impact of the "Dallal" system on fisher income.

Environmental Performance: Investigates fuel efficiency and the use of eco-friendly gear.

Analyzing Value Chain Stages:

Input Supply: Availability of fuel, ice, boat spare parts, and fishing gear.

Production (Harvesting): Methods used, seasons, and challenges in the Gulf of Aden.

Landing & Primary Handling: Evaluation of auction practices and initial cooling.

Processing: Transformation into value-added products (e.g., dried shark, salted fish).

Distribution: Assessing the cold chain (refrigerated trucks) and market reach.

- Enabling Environment Analysis

Value chains do not operate in a vacuum; they are influenced by and impact a wide range of external factors that shape the "enabling environment." This section aims to analyze these factors and their impact on the performance and development of the fish value chain under study.

-Policies and Regulations: Government policies and regulations affecting the chain.

-Institutions and Their Roles: The role of institutions in supporting or hindering the chain.

-Physical Infrastructure: The impact of infrastructure on the efficiency and effectiveness of the chain.

- Support Services: The availability and quality of services such as finance, extension, and logistics.

3.6 challenges & Limitations

Seasonality: Data collection coincided with specific fishing seasons, which may affect volume estimates.

Accessibility: Some coastal areas in Abyan have security sensitivities.

Gender Gap: High male dominance in harvesting necessitated a targeted approach to reach women in the "processing and home-based activities" node of the chain to ensure gender representation.

4 .Fish Value chain analysis Findings.

Value chain analysis is an important tool for understanding how value is created in the supply chain and how it is distributed among the various stakeholders. In the context of the fishing sector, value chain analysis can help us understand how fish prices are determined and how profits are distributed among fishermen, traders, and consumers. It can also help us identify weaknesses in the value chain that can be improved to increase efficiency and sustainability in the sector. Through this analysis, we can gain a deeper understanding of how the fishing sector operates and how to improve its performance for the benefit of all stakeholders.

4.1 Overview of Socio-economic Fish Importance

The fisheries sector in Yemen is a vital component of the country's economy, playing a significant role in contributing to the national income, food security, and livelihoods of its people. With a coastline stretching over 1,900 kilometers along the Arabian Sea and the Gulf of Aden, Yemen has a rich marine resource base that supports a diverse range of fish species. The sector's importance is evident in its contribution to the national economy, where fish exports generate significant foreign currency earnings for the country. In addition to its economic importance, the fisheries sector is also a crucial source of food and nutrition for the Yemeni population. Fish and seafood are a vital part of the Yemeni diet, providing a rich source of protein and essential nutrients. The sector's role in ensuring food security is particularly important in a country where food imports are often necessary due to internal conflicts and agricultural challenges. The fisheries sector also supports the livelihoods of hundreds of thousands of people in Yemen, including fishermen, fish traders, and those working in fish processing and marketing. In many coastal communities, fishing is the primary source of income and sustenance, and the sector's performance has a direct impact on the well-being of these communities. At the level of Abyan Governorate, the economic and agricultural importance of the fisheries sector in Abyan Governorate is evident through its significant contribution to providing job opportunities and generating local income. The fisheries sector is one of the important economic sectors that contributes to providing food for the population through the production of various fish species. Abyan Governorate is distinguished by its unique geographical location along the Arabian Sea coast, which makes it rich in diverse fish resources. Fish contribute to achieving food security and providing animal protein to the population, as well as providing direct and indirect job opportunities for many individuals, including fishermen, port workers, and traders. Statistics indicate that fish production in Abyan Governorate reaches approximately 13,500 to 15,500 tons of fish annually and includes major fish species in the region such as large surface fish like tuna, and other marine fish like sheep head and grouper. There are also 12,000 to 15,000 people working in the fisheries sector, including fishermen, port workers, and traders. Statistics also indicate that there are approximately 40,000 people working in the fisheries sector indirectly, making this sector a significant source of income for many families in the region. Fish are exported from Abyan Governorate to many foreign markets, contributing to generating

significant financial revenues for the local and national economy. The fisheries sector also contributes to achieving food security and providing animal protein to the population, making it a vital sector in the Yemeni economy. The value of fish exports from Yemen reached approximately \$50 million in the last year, indicating the significant importance of this sector in the national economy. Despite the challenges facing the sector, such as lack of infrastructure, high production costs, pollution, and overfishing, there are still huge opportunities to enhance the fisheries sector in Abyan through investing in infrastructure, enhancing capabilities, and improving fishing practices, which can contribute to achieving sustainable and balanced growth for this vital sector. There are also opportunities to increase productivity and improve fish quality through applying sustainable fishing practices and providing training and capacity building for fishermen. Additionally, investing in the fisheries sector can contribute to enhancing the local economy and achieving sustainable development in the region.

4.2 Socio-economic and demographic profile of Fishers.

The demographic and economic characteristics of fishermen and traders play a crucial role in shaping the dynamics of the fishing sector. Understanding these characteristics is essential for identifying the strengths and weaknesses of the sector, as well as for developing effective policies and interventions to support the livelihoods of those who depend on it. The characteristics of fishermen and traders, such as their age, education level, experience, and economic status, can influence their ability to access markets, adopt new technologies, and manage risks. Furthermore, these characteristics can also impact the sustainability of fishing practices and the overall performance of the sector. This section presents the results of an analysis of the demographic and economic characteristics of fishermen and traders in the fishing sector, providing insights into their socio-economic profile and shedding light on the opportunities and challenges they face, the data in figure 1 indicates male dominance in the fish activities in the study area, with male representing the majority at 100% (21 individuals). This highlights the significant role of male and youth in the Fish sector within the surveyed communities. This also indicates a relatively inclusive sector for male as asset owners only.

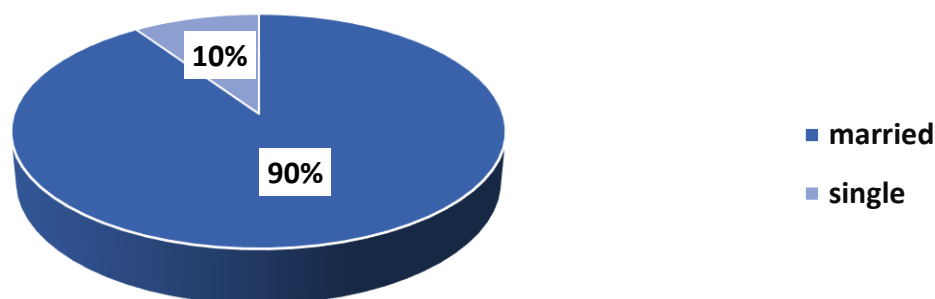
Figure 1: Distribution of fishermen in the fish value chain by gender



Regarding, the marital status of fishers, most fishers is married, accounting for 90% of the total. The remaining small percentages are single (10%). This strong correlation

suggests that fishers is predominantly a household-based and integral to family livelihoods and economic activity.

Figure 2: Distribution of fishermen in the fish value chain by Marital Status



The result in Figure 3 shows the distribution of Fishers by education level, the education profile of Fishers is relatively low, with the largest single group being secondary at 38%. This is matched by those with preparatory education (33%) and those with primary education (24%). While the illiterate was 5%. The data suggests a need for educational and technical training programs accessible to individuals with limited formal schooling. Also, this highlights a potential barrier to adopting modern techniques and accessing formal information.

Figure 3: Distribution of fishermen in the fishing value chain by Education Level

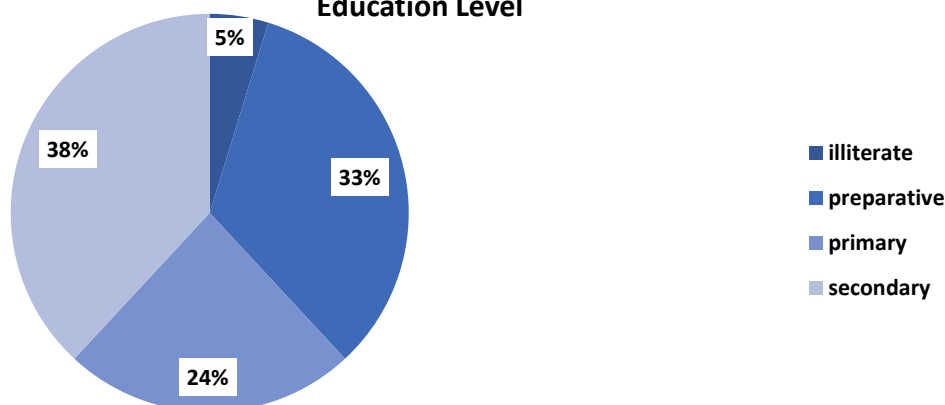


Figure 4 shows the distribution of Fishers by age, the data shows that Fishers is heavily dominated by older demographics, with 62% being over the age of 41. Specifically, the 41–60 and 31–40 age groups each hold an equal share of 14%. In contrast, young adults (aged 18–30) represent a significant minority at only 19%. The Fisheries sector currently relies on the experience and capital of older generations, highlighting a critical need for youth-targeted initiatives to ensure the future sustainability and renewal of the industry.

Figure 4: Distribution of fishermen in the fishing value chain by age

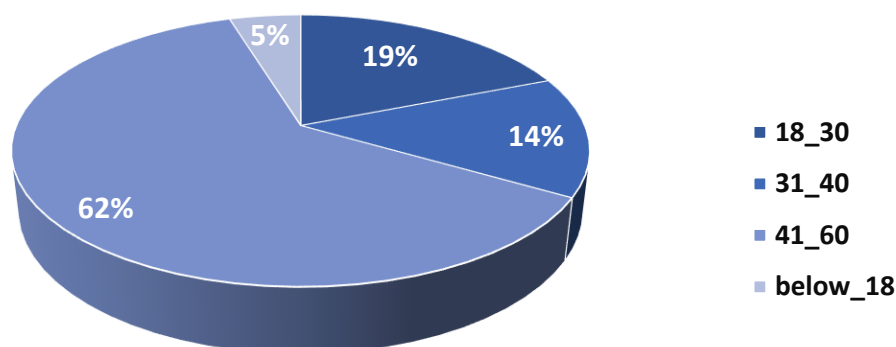
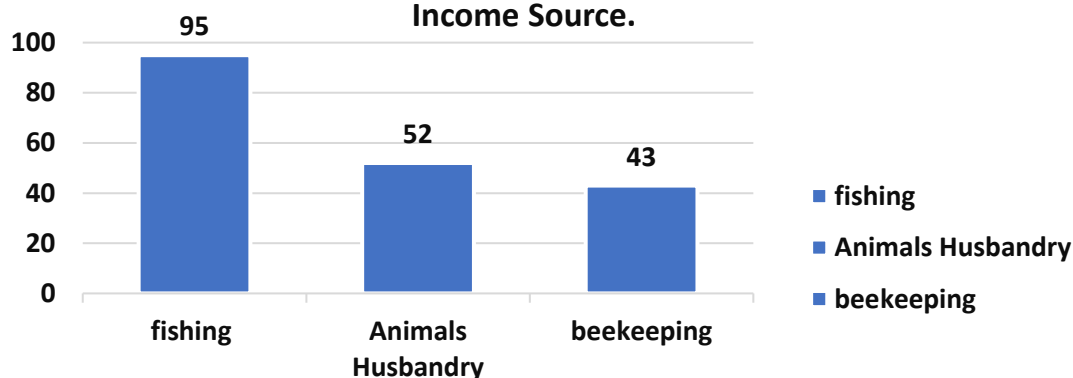


Figure 5 indicates that the primary source of income for fishers is fishing accounting for a dominant 95%. Animals' husbandry is the second most common source at 52%. Other sources beekeeping 42%. This indicates that animal's husbandry is the second activity for the most of fisher's households, and the fishing is primary source of their livelihood.

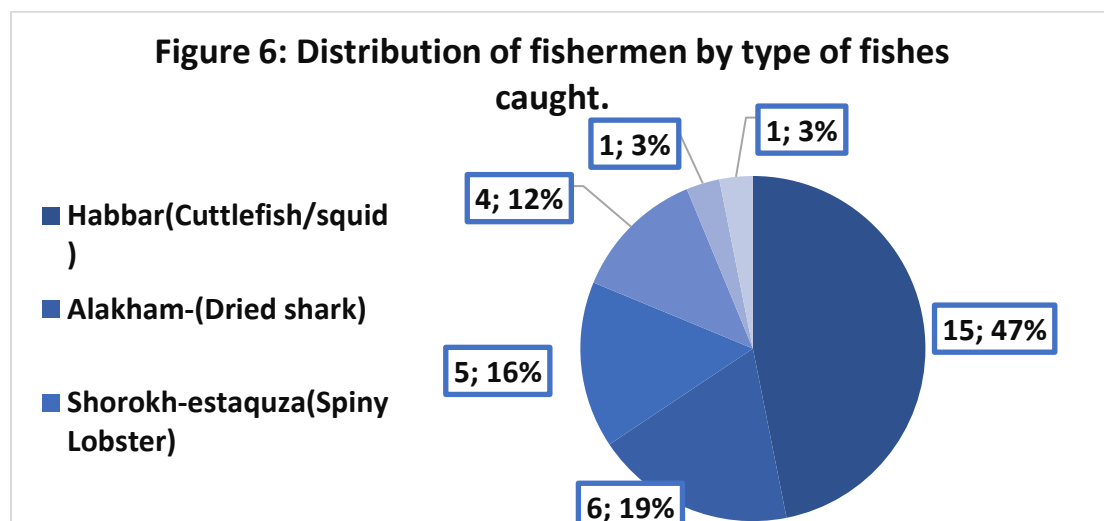
Figure 5: Distribution of fishers by primary and secondary Income Source.



This indicated that the income is diversified. While fishing is a primary source, many households also rely on animal husbandry and beekeeping, indicating vulnerability and a need for resilience-building in fishermen's' income.

Figure 6 presents a graphical distribution of fishermen by the type of fish caught, reflecting the diversity of targeted species in fishing activities and their economic importance for fishermen. The pie chart shows that 47% of fishermen catch Baghah (Indian Mackerel), making it the most common and exploited species in the region. Shorokh-estaquza (Spiny Lobster) follows with 19%, indicating the significance of this crustacean in fishing practices. Meanwhile, 16% of fishermen catch Habbar (Cuttlefish/squid), 12% catch Alakham (Dried shark), and only 3% catch other mentioned species.

These results reveals that the distribution of fishermen by fish type supports the study hypothesis that there is a preference for certain species based on their market value and ease of capture. This raises the question of whether the focus on Baghah reflects overexploitation or high market demand for this species. The findings also pose a question about the environmental impact of targeting less common species like Spiny Lobster on biodiversity. The data suggest that fishermen tend to target economically valuable species, which may affect marine ecosystem balance.



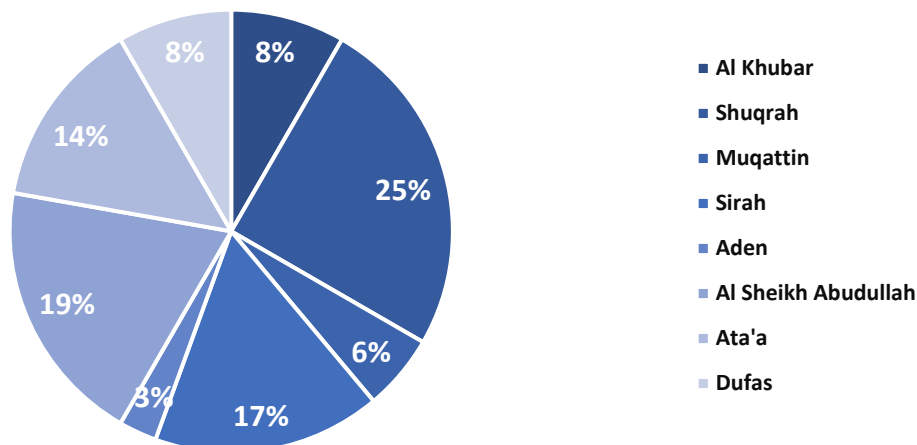
The distribution of fishermen by fish type is strongly linked to the economic value of the targeted species, and focusing on specific types may lead to ecological imbalances. Understanding these patterns helps guide policies for sustainable fisheries management.

Summary: The results of Figure 6 show that Baghah (Indian Mackerel) dominates fishermen's catches, with limited diversity in other species, highlighting the need for sustainable management of fish resources, so it is recommended to develop a fisheries management strategy that regulates the exploitation of heavily targeted species like Baghah and encourages diversification of catches to ensure sustainability of marine resources and ecological balance.

Figure 7 presents the distribution of key fishing grounds in the study area, illustrating the relative importance of various locations in terms of fishing activity percentages. The results indicate that Al Khubar is the most significant fishing ground, accounting for 25% of the total activity, suggesting a high concentration of fishing efforts or resources in this location. This prominence raises the research question of whether the physical or economic characteristics of Al Khubar make it a preferable site, thereby testing the hypothesis that geographic factors influence fishing ground selection. Aden follows with 19%, and Sirah with 17%, indicating these areas also play substantial roles in the fishing industry, which may relate to the study's inquiry into resource allocation efficiency within the value chain. Conversely, Al Sheikh Abdullah represents only 3% of the activity, implying marginal utilization or potential underdevelopment of this site, prompting an investigation into barriers that limit its exploitation and testing the assumption that all identified grounds have equal economic potential. The remaining locations—Shuqrah, Muqattin, Ata'a, and Dufas—

exhibit moderate percentages ranging from 6% to 14%, reflecting a diversified yet uneven distribution of fishing efforts across the study area.

Figure 7: The key fishing grounds in the study area



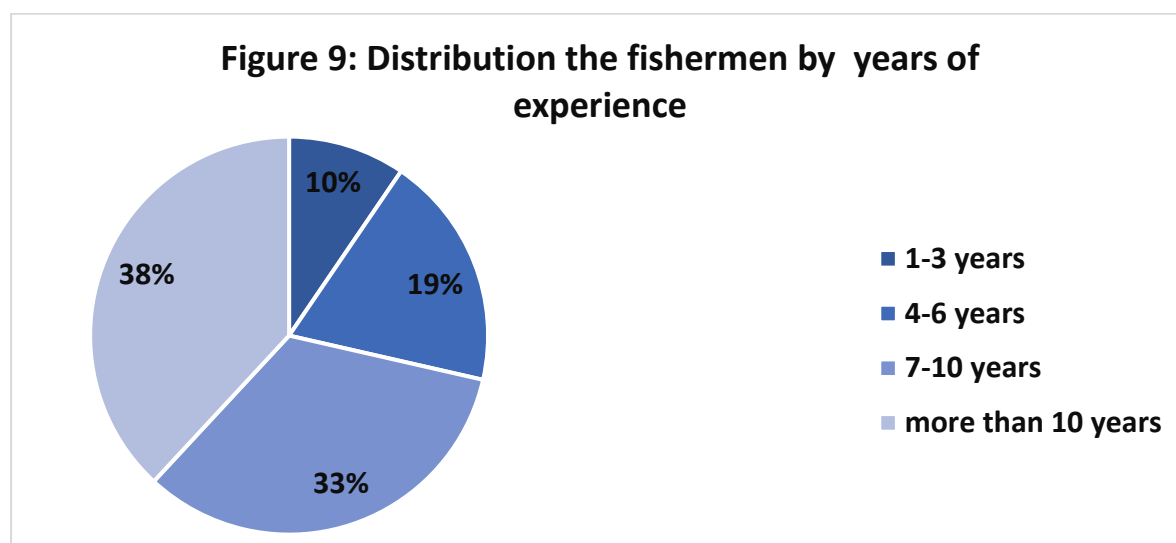
These finding suggests that fishing activities are unevenly distributed, with a few dominant grounds driving the majority of the output, which aligns with the study's objective to identify optimization opportunities in the fishing value chain. This unevenness implies that focusing development efforts on enhancing the productivity of secondary sites could balance resource use and improve sustainability. In conclusion, the analysis of fishing ground distribution highlights the necessity of targeted interventions to optimize utilization of underused sites and to manage the high-pressure areas effectively. It is necessary to conduct detailed feasibility studies for the underutilized fishing grounds such as Al Sheikh Abdullah to identify and mitigate limiting factors, while implementing management strategies in high-activity areas like Al Khubar to ensure sustainable exploitation and balance the overall value chain efficiency

Based on the result of sources of fishers 's experience in figure 8, the experience is overwhelmingly acquired through family, accounting for 62% (13 individuals). A small fraction is gained through friends (38%) (8 individuals), this data indicates that the fisher's reliance on traditional, family-based knowledge transfer highlights a potential gap in formal training and extension services.

Figure 8: The sources of fishermen's experience in fishery

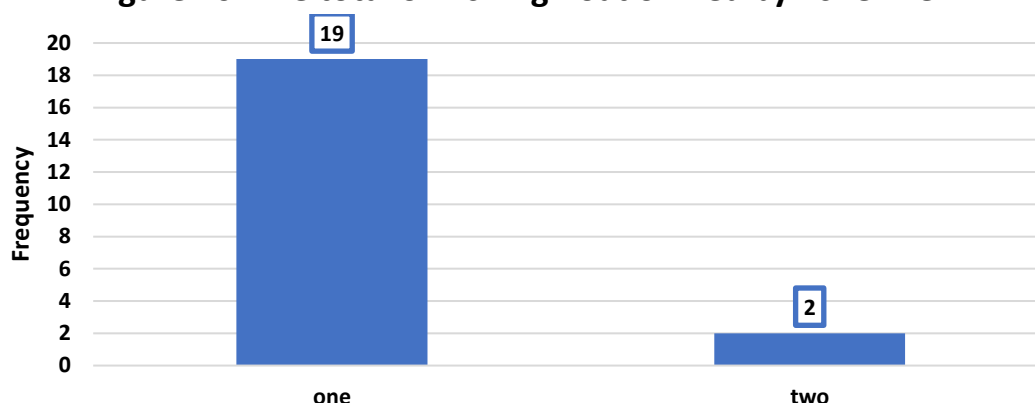


Figure 9 presents the distribution of Fishers according to their years of experience. The results are as follows: the majority of fishers (38%) have more than 10 years of experience, indicating that the profession attracts a significant number of individuals in the late stages of their fish career. The second-largest group (33%) consists of 4-6 years of experience and implying that this fishers in the activity beyond the intermediate stage. Meanwhile, 18% of fishers have 7 – 10 years of experience, 19% for 4- 6 years' experience reflecting a moderate level of seasoned practitioners. Only a small fraction (10%) has 1–10 years of experience. Fish experiences a high entry rate but also a noticeable dropout or transition after the initial years, leading to a shortage of experienced practitioners in the long term. The imbalance between novice and expert fishers may affect knowledge transfer and sustainable practice development



Invest in targeted training and mentorship programs that support fishers beyond their first three years, encouraging skill retention and experience accumulation to build a more balanced and experienced fishers' community. Figure 10 illustrates the distribution of fishing boat ownership among fishermen, providing insight into the asset ownership patterns within the fishing community. The results presented in Figure 10 indicate that the majority of fishermen (19 individuals) own one fishing boat, while a minority (2 individuals) own two fishing boats. This distribution suggests that boat ownership is concentrated among single-boat owners, implying that most fishermen operate with limited fishing capacity. The finding raises questions about the factors influencing boat ownership among fishermen and whether limited boat ownership affects fishing productivity or income levels. It also relates to the hypothesis that asset ownership (such as boat ownership) impacts the economic performance of fishermen in the fishery sector. The results imply that policies aimed at improving fishermen's access to capital or boat ownership could potentially enhance their fishing capacity and livelihoods.

Figure 10: The total of Fishing Boat owned by fishermen



These findings confirm that fishermen predominantly own a single boat, indicating limited asset accumulation and potential constraints on fishing operations.

In summary, the analysis of fishing boat ownership reveals that most fishermen own only one boat, highlighting limitations in asset ownership and potential economic constraints within the fishing community, according to these results it should be develop financial or incentive programs to enhance fishermen's access to boat ownership or improve their fishing assets, thereby potentially increasing their productivity and economic well-being in the fishery sector.

The results in table (Table 2) presents the fishing methods and technology adopted by fishermen in Abyan governorate, providing valuable insights into their practices and equipment usage. The results are summarized and discussed as follows.

The data reveal that fishermen in Abyan employ various fishing methods, with traditional nets being the most common technique, used by 76% of the respondents (frequency = 16), followed by motorized boats with GPS, also reported by 76% of fishermen (frequency = 16). The use of hand rods is less frequent, with 38% of fishermen (frequency = 8) adopting this method, while motorized rods are used by 57.1% (frequency = 12). Regarding the adoption of innovative fishing practices, the majority (90.5%) of fishermen have not adopted innovations (frequency = 19), indicating a significant gap in the integration of new technologies, which raises the research question of whether the lack of innovative adoption affects fishing efficiency and sustainability.

Concerning fishing trips, 62% of fishermen conduct daily trips (frequency = 13), while 38% make weekly trips (frequency = 8), suggesting that most fishing activities are intensive and frequent. The boat ownership data show that 85.7% of fishermen own one boat (frequency = 18), with boat lengths most commonly around 8 meters (52.3%, frequency = 11). Fish handling practices indicate that all fishermen (100%) sell their catch immediately without storage, and none use cold storage, which reflects poor post-harvest management and may relate to the hypothesis that inadequate handling affects fish quality and market value. Additionally, all fishermen (100%) do not engage in pre-sale fish processing, and 90.5% do not sort fish, highlighting deficiencies in value-

added practices and linking to the research question of how processing and sorting influence profitability.

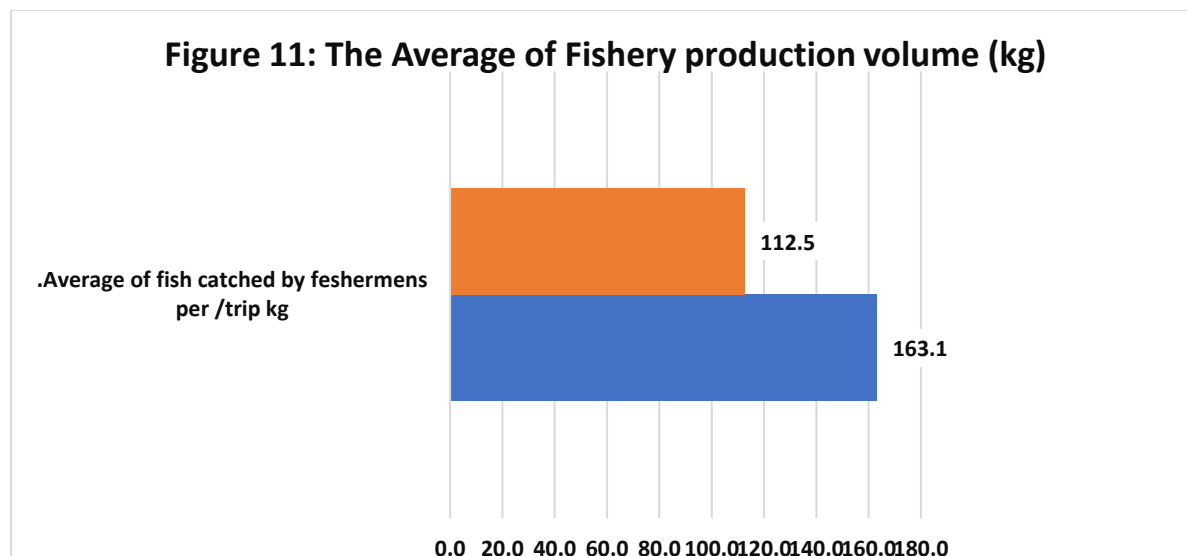
Table 2: Fishing methods and technology Adopted by Fishermen in Abyan governorate.			
Variables	Categories	Frequency	Percent %
Fishing methods	Hand rod	8	38
	Traditional nets	16	76
	Motorized rod	12	57.1
	Motorized boat with GPS	16	76
Adoption of innovative fishing	Yes	2	90.5
	No	19	9.5
Fishing trips count	daily	13	62
	weekly	8	38
Boat Number	One	18	85.7
	Two	3	14.3
Boat Length	11 – 15 m	4	19.1
	8 – 10 m	6	28.6
	8 m	11	52.3
Fish handling and storage	sell immediately	21	100
	Cold Store Fish	0	0
Pre-Sale fish processing	Yes	0	0
	No	21	100
Fish sorting	Yes	2	9.5
	No	19	90.5

In general, the results suggest that fishermen in Abyan rely heavily on traditional methods with limited adoption of modern technologies and practices, which may hinder productivity and sustainability. The findings imply that improving access to innovative fishing technologies and enhancing post-harvest handling could improve efficiency and income.

In conclusion, the study highlights the predominance of traditional fishing methods, limited technological adoption, and inadequate post-harvest practices among Abyan fishermen, which affect their operational efficiency and market outcomes. It is recommended to implement training programs and financial incentives to encourage the adoption of innovative fishing technologies and improved post-harvest handling practices, thereby enhancing productivity, sustainability, and income for fishermen in Abyan governorate.

Figure 11 presents the average fishery production volume, measured in kilograms, highlighting the average catch of fish per trip achieved by fishermen. The results reveal that the average fishery production volume (112.5 kg) is notably lower than the average catch per trip (163.1 kg), suggesting a gap between expected production targets and actual fishing performance. This disparity raises questions pertinent to the study's hypotheses, such as whether fishing practices are optimized to meet production goals and what factors contribute to the difference between planned and realized yields. The analysis implies that fishermen are exceeding the anticipated production levels, which may indicate efficient fishing

techniques or overexploitation of resources, prompting further investigation into sustainability and management practices

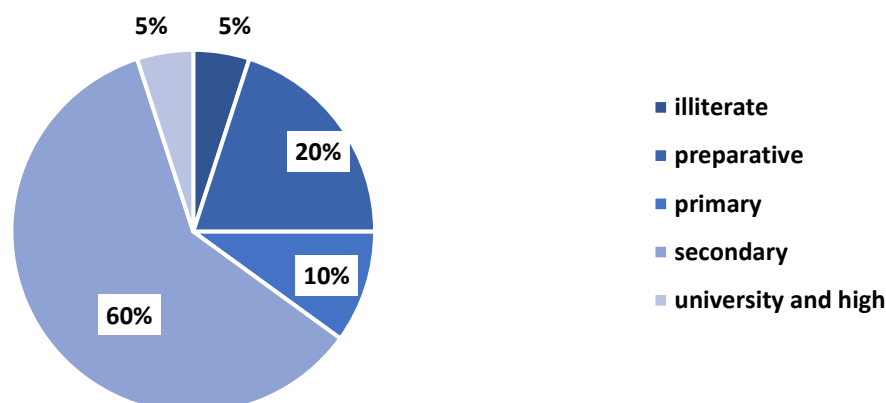


The general outcome of this analysis is that actual fishery yields surpass the average production estimates, signaling a need to reassess production benchmarks or to monitor fishing intensity to ensure resource sustainability.

In conclusion, the study underscores the importance of aligning production expectations with real fishing capabilities and encourages sustainable management to balance productivity and resource conservation. It is recommended to revise fishery production targets to reflect actual catch capacities while implementing monitoring measures that ensure sustainable exploitation and maintain long-term fishery productivity.

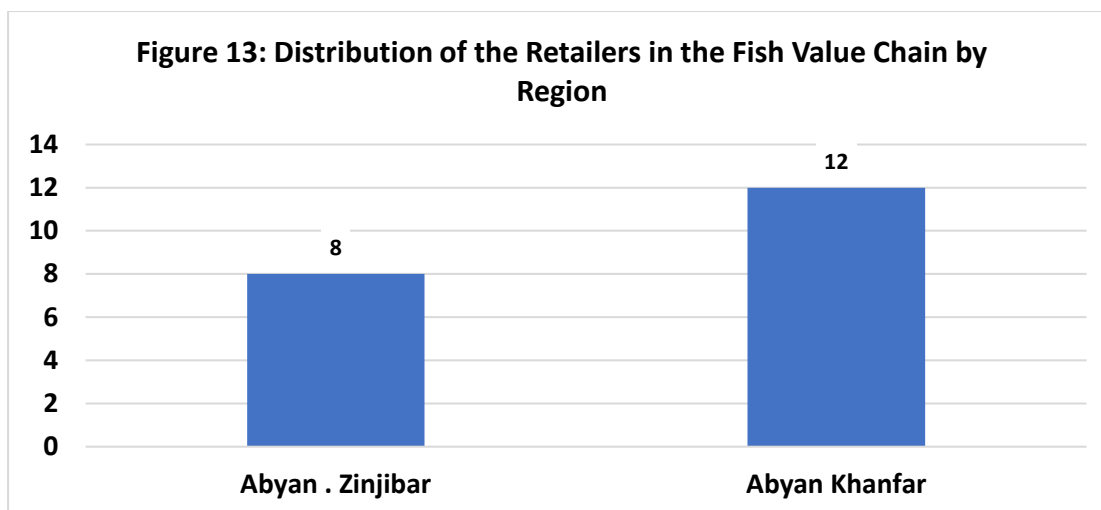
Regarding the socio-economic and demographic characteristics of retailers in Fish Value chain, they have been addressed in (Figures 11, 12, 13 and 14). Figure 12 presents the distribution of retailers in the fishery value chain according to their education level, providing insight into the educational profile of actors involved in the retail segment of the fishery sector. The pie chart illustrates that most retailers (60%) have a primary education, indicating that the retail segment of the fishery value chain is predominantly composed of individuals with basic schooling. Additionally, 20% of retailers are illiterate, highlighting a significant proportion of the workforce with limited formal education. A smaller segment (10%) has attained secondary education, while 5% have preparative education and another 5% have university or higher education. This distribution suggests that the fishery retail sector relies heavily on individuals with low educational attainment, which may affect business practices, market access, and adoption of sustainable practices. The data here addresses the inquiry about the characteristics of actors in the fishery value chain, specifically exploring how education influences participation in the retail sector. It also relates to the hypothesis that educational level impacts efficiency and sustainability in fisheries management, implying that limited education among retailers could constrain value chain development and innovation.

Figure 12: Distribution of the Retailers in the Fishe Value Chain by Education Level



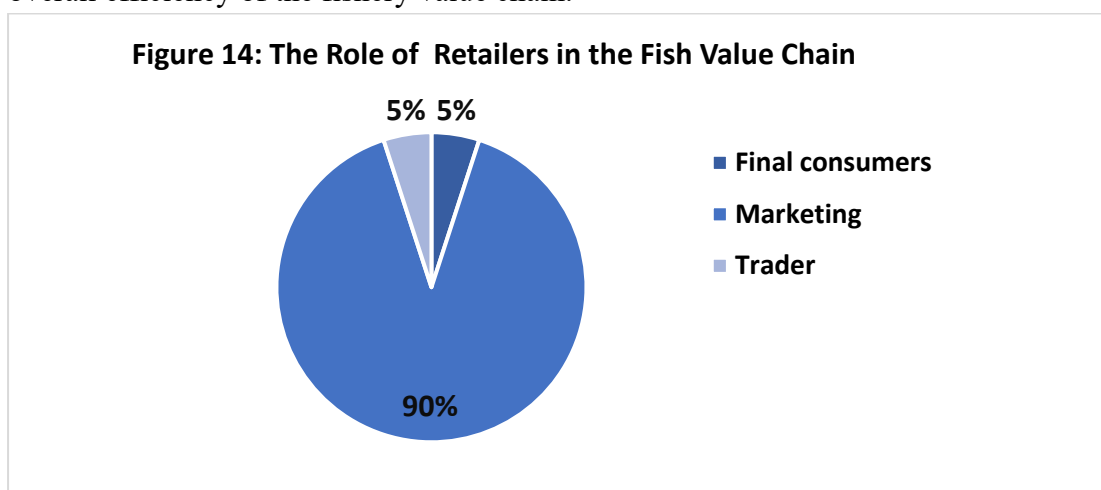
The result indicates that enhancing educational opportunities for retailers could improve their performance and contribute to a more efficient and sustainable fishery value chain. The analysis of retailer education levels reveals a workforce with predominantly low educational backgrounds, which may limit the sector's development and sustainability. It is recommended to implement targeted educational and training programs for fishery retailers to improve their skills, enhance value chain efficiency, and promote sustainable practices within the sector.

The data in Figure 13 illustrates the distribution of retailers in the fishery value chain by region, providing insight into the spatial allocation of market participants within the studied area. The results depicted in the bar chart reveal that the region of Abyan Khanefer hosts 12 retailers, while Abyan Zinjibar accommodates 8 retailers in the fishery value chain. This distribution indicates a notable disparity in the concentration of retail activities between the two regions, with Abyan Khanefer exhibiting a higher number of retailers compared to Abyan Zinjibar. the structure and efficiency of the fishery value chain, this finding suggests that regional factors may influence market participation and value chain dynamics. The hypothesis that regional characteristics affect the distribution of economic actors in the fishery sector appears to be supported by the observed difference in retailer numbers between Abyan Khanefer and Abyan Zinjibar. The variation implies potential implications for market accessibility, resource allocation, and economic development within the fishery sector of the two regions.



The overall result indicates that regional disparities exist in the involvement of retailers in the fishery value chain, pointing to the need for targeted interventions to balance market distribution and enhance value chain efficiency. In conclusion, the analysis of retailer distribution highlights regional imbalances in the fishery value chain that may affect its overall performance and development. It is recommended that policymakers and stakeholders implement region-specific strategies to optimize retailer distribution and enhance the efficiency of the fishery value chain, thereby promoting balanced economic development in Abyan Zinjibar and Abyan Khanefer.

Figure 14 presents the role of retailers in the fishery value chain, highlighting the importance of retailers in linking fishery products to final consumers. The results shows that retailers control 90% of the fishery value chain, providing fishery products to final consumers. The remaining 5% is attributed to both final consumers and marketing, indicating that retailers play a crucial role in marketing and distributing fishery products. The role of retailers in enhancing the fishery value chain. These results raise questions about how retailers can improve their performance in the fishery value chain and enhance their ability to meet the needs of final consumers. It also posits the hypothesis that strengthening the role of retailers can lead to an improvement in the overall efficiency of the fishery value chain.



These findings confirm that retailers represent a key link in the fishery value chain, and enhancing their role can lead to an improvement in the overall performance of the value chain. In conclusion, the role of retailers in the fishery value chain is critical to the success of marketing and distributing fishery products, and their capabilities should be enhanced to improve the overall performance of the value chain. It is recommended to enhance the capabilities of retailers in the fishery value chain by providing necessary training and support to improve their performance in marketing and distributing fishery products, thereby contributing to the enhancement of the overall efficiency of the fishery value chain.

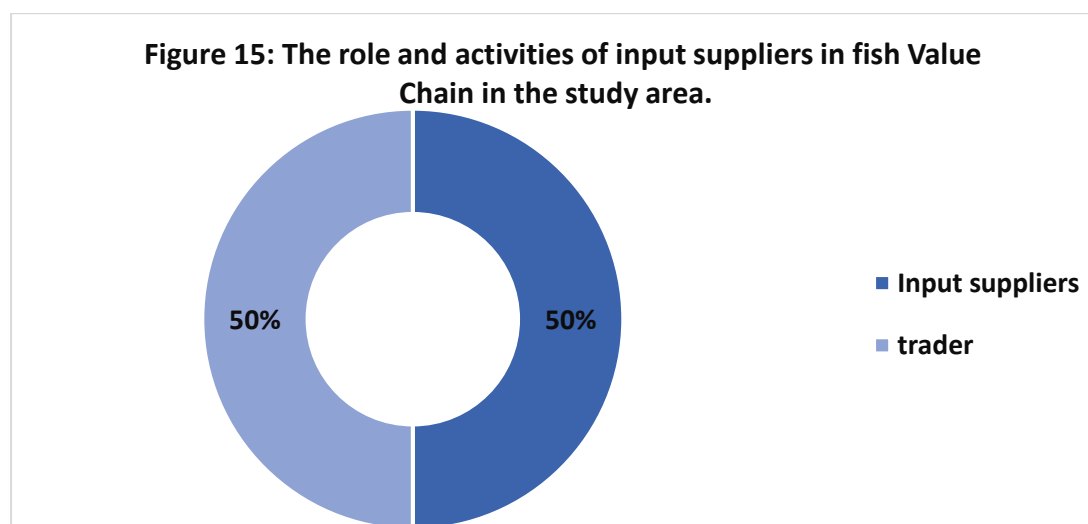
The analysis of the demographic and economic characteristics of fishermen and traders in the fishery sector reveals several key insights. The results show that the majority of fishermen have low levels of education, with a significant proportion being illiterate. In contrast, the education level of retailers is slightly higher, but still limited. The distribution of fishermen and retailers varies across regions, with some areas having a higher concentration of fishermen and others having more retailers. The average fish production volume per trip is substantial, indicating a significant level of fishing activity. The role of retailers in the fishery value chain is critical, with the majority of fish being sold to final consumers. These findings have implications for the development of the fishery sector, particularly in terms of improving education and training for fishermen and retailers and enhancing market access and infrastructure. Overall, the study highlights the importance of understanding the demographic and economic characteristics of fishermen and traders in the fishery sector, and the need for targeted interventions to support the development of the sector. By improving the education and skills of fishermen and retailers, and enhancing market access and infrastructure, it may be possible to increase the efficiency and sustainability of the fishery sector and improve the livelihoods of those who depend on it.

4.3 Enabling environment of Fish Value Chain.

To assess the enabling environment of the fish value chain, the following section presents a critical framework of policies, infrastructure, institutions, and support services that determines the efficiency and growth potential of the Fish Value chain. The data in this section offers a comprehensive look into the enabling environment of the fish value chain, highlighting significant gaps in the support systems available to fishers. A detailed analysis reveals critical areas where intervention is necessary to foster growth and sustainability in the sector.

4.3.1 Access to Input and equipment Supplies

Figure 15 presents a graphical representation of the role and activities of input suppliers in the fish value chain within the study area, illustrating the distribution of functions between input suppliers and traders. The analysis of these results reveals that the balanced participation of input suppliers and traders reflects the integrated nature of the value chain in the study area, where both entities play equally significant roles in facilitating production and marketing processes. This finding addresses the research hypothesis concerning the importance of intermediary actors in the fish value chain, confirming that input suppliers and traders are equally essential for the flow of goods and services. The equal distribution raises questions about the specific contributions of each group to value addition and whether their roles overlap or complement each other in enhancing the efficiency of the fishery sector.

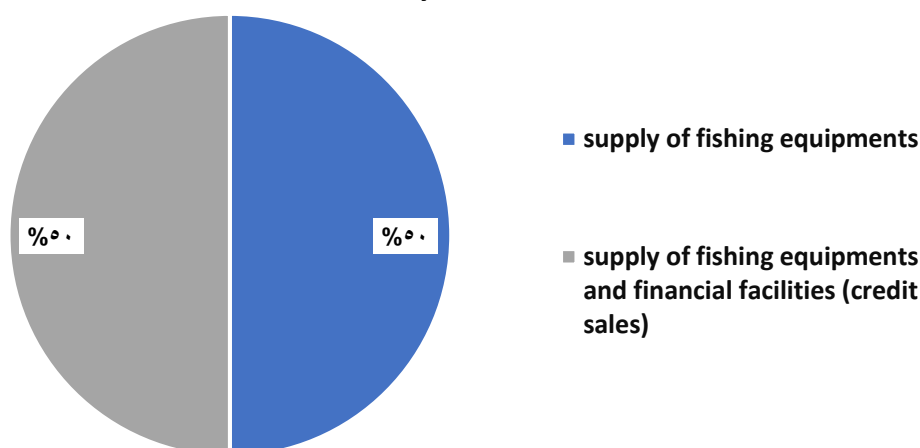


This analysis reflects that the fish value chain in the study area depends equally on input suppliers and traders, highlighting the necessity of balanced support for both to improve overall chain performance. This balance implies that policies should target both parties to ensure sustainable development of the fishery sector. The results of Figure 15 demonstrate an equal 50% involvement of input suppliers and traders in the fish value chain, emphasizing the shared responsibility and importance of both actors in the economic process, for that it should design development programs that equally

empower input suppliers and traders, fostering collaboration and optimizing their roles to enhance the efficiency and sustainability of the fish value chain in the study area.

The results in (Figure 16) illustrates the distribution of services provided by input suppliers to fishers in the study area, offering a clear depiction of the types of support that influence fishing operations and livelihoods. The results indicate that input suppliers divide their services equally between two categories, each representing 50% of the total provision. The first category involves the supply of fishing equipment alone, suggesting that half of the suppliers focus exclusively on providing physical gear necessary for fishing activities. The second category encompasses the supply of fishing equipment combined with financial facilities (credit sales), implying that the remaining half of suppliers offer a more comprehensive package that includes both material inputs and financial assistance, enabling fishers to acquire equipment on credit. This balanced split highlights the dual nature of support systems in the fishing sector, where material provision is sometimes augmented with financial services to enhance accessibility and affordability for fishers, it becomes evident that the provision of combined equipment and financial services may reflect an effort to improve fisher resilience and productivity, addressing both technical and economic constraints. The study likely hypothesized that input suppliers play a pivotal role in shaping fishing efficiency and income levels, and the results support the notion that financial flexibility is as important as equipment availability. The equal distribution suggests that the market recognizes the necessity of addressing both physical and financial needs to sustain fishing livelihoods, thereby influencing the overall performance of the fishing industry in the study area.

Figure 16 : Services offered by input suppliers to Fishermen in the study area.



The input suppliers adopt a bifurcated strategy, offering either basic equipment or bundled equipment-financial packages, with an even emphasis on each approach. This duality indicates that policymakers and development programs should consider supporting both types of services to meet diverse fisher needs effectively.

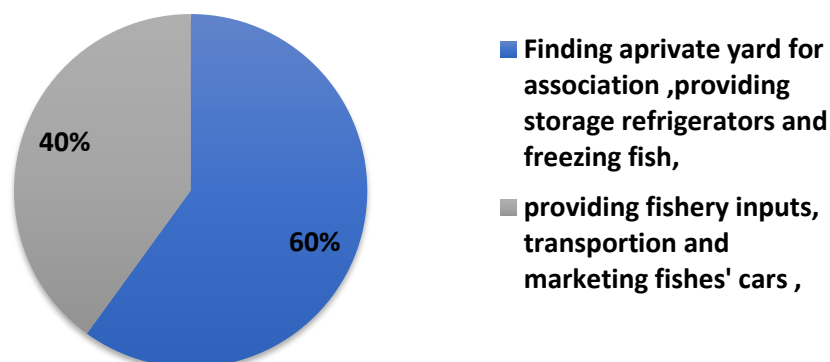
In summary, the services offered by input suppliers are evenly split between pure equipment supply and equipment combined with financial facilities, underscoring the importance of integrated support mechanisms for fishers. It is recommended that development initiatives targeting the fishing sector promote the expansion of integrated

supply packages that combine fishing equipment with accessible financial services, while also strengthening the provision of specialized equipment supplies, thereby addressing the dual needs of fishers and enhancing overall sector productivity.

The data in (Figure 17) illustrates the proposed interventions required from associations to support fishing input suppliers, highlighting the distribution of priorities between two specific strategies. The results depicted in the figure indicate that 60% of the required intervention focuses on finding a private yard for an association, providing storage refrigerators, and freezing fish. This suggests that the majority of support needed by fishing input suppliers lies in establishing appropriate infrastructure for storage and preservation, which is essential for maintaining fish quality and reducing post-harvest losses. The remaining 40% of the intervention is allocated to providing fishery inputs, transportation, and marketing fishes' cars, emphasizing the importance of logistical and marketing support to facilitate the distribution and sale of fish products.

This finding aligns with the hypothesis that infrastructure development (storage and preservation facilities) is a primary requirement for enhancing the efficiency of fishing input suppliers. The data imply that without adequate storage and refrigeration, the supply chain suffers significantly, affecting the overall productivity and profitability of the fishing sector. Moreover, the emphasis on transportation and marketing underscores the interconnected nature of the supply chain, where logistical support is crucial for ensuring that fish reach markets in optimal condition.

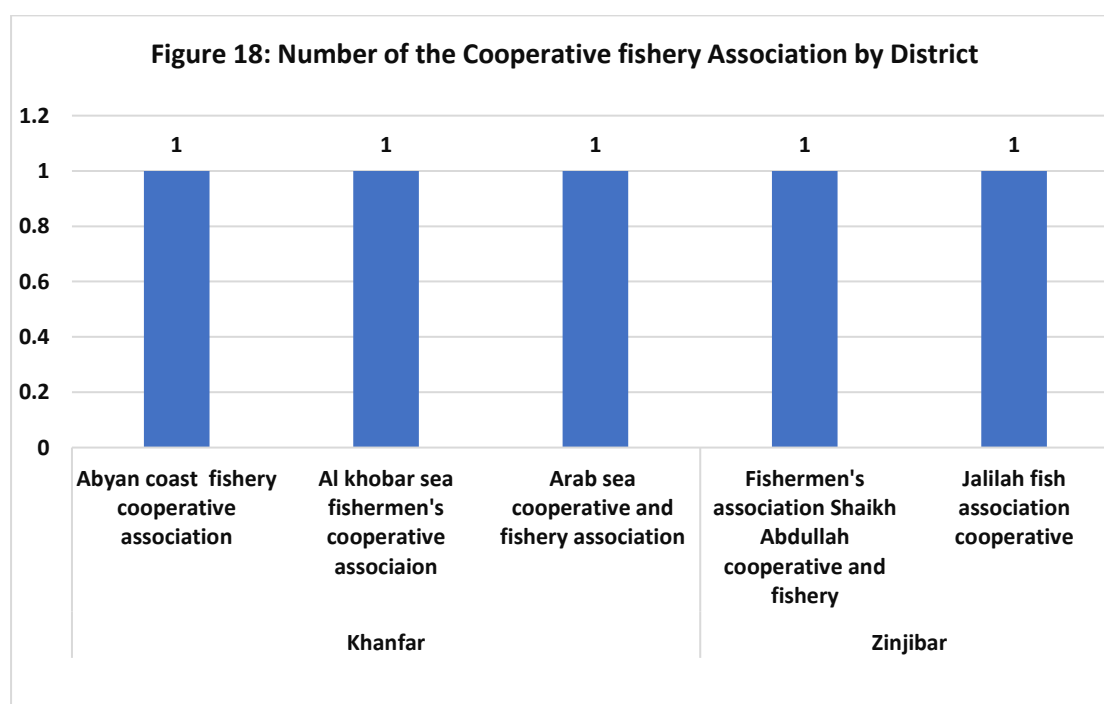
Figure 17: Proposed intervention required from associations to support fishing input suppliers



Accordinging this data the associations must prioritize the provision of storage and freezing infrastructure to address the major needs of fishing input suppliers, while also recognizing the substantial role of transportation and marketing support in sustaining the sector. In summary, the intervention strategy should focus primarily on developing private storage facilities with refrigeration capabilities to improve fish preservation, complemented by adequate transportation and marketing resources. It is recommended that associations allocate resources preferentially to establish private storage yards equipped with refrigerators for fish freezing, alongside investing in transportation and marketing infrastructure, to comprehensively support fishing input suppliers and enhance the overall efficiency of the fishery supply chain.

4.3.2 Cooperatives, Infrastructure, and Policy

Figure 18 presents the distribution of cooperative fishery associations across districts, illustrating the number of associations in each of the examined regions. The results reveal a uniform distribution of cooperative fishery associations among the studied districts, with each district hosting exactly one association. This homogeneity suggests that the organizational structure of fishery cooperatives is evenly established across the regions under investigation. In the context of the study's questions regarding the organizational capacity and regional distribution of fishery cooperatives, the data imply that the districts exhibit similar levels of institutional support for fisheries, thereby supporting the hypothesis that cooperative formation is uniformly encouraged or facilitated across the area. The uniform presence of one association per district may indicate effective policy implementation or local initiatives that promote the establishment of fishery cooperatives as a singular representative body in each region. However, the lack of variation raises further inquiries about the functional differences or operational efficiencies among these associations, which could be explored in subsequent analyses to assess their impact on fishery management and economic outcomes.



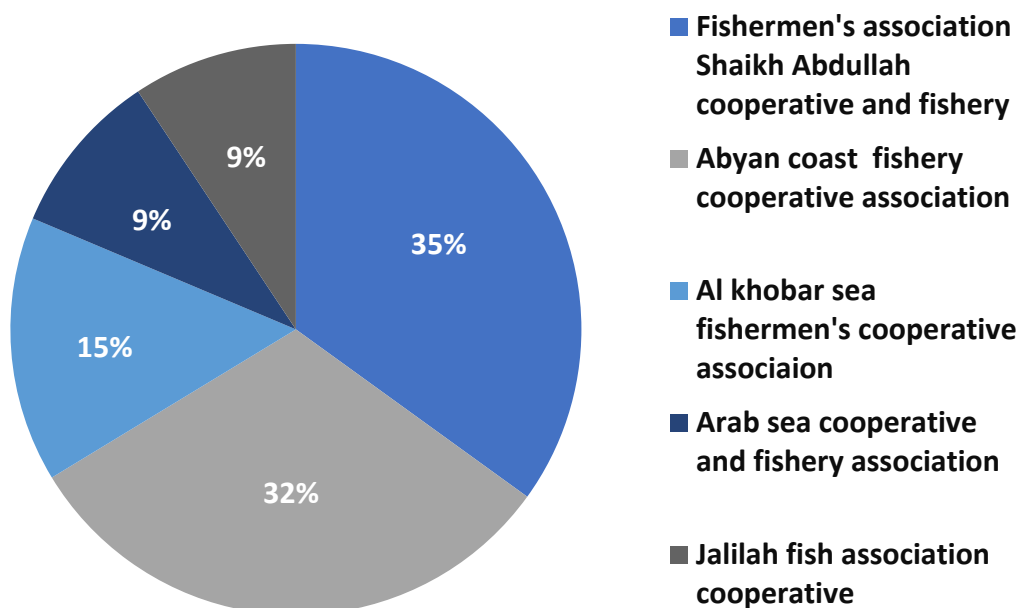
The cooperative fishery sector in the studied districts is characterized by a consistent, single-association structure, reflecting balanced institutional coverage but limited organizational diversity.

In conclusion, the analysis underscores the need to examine the qualitative aspects and operational effectiveness of these uniformly distributed associations to understand their true contribution to fishery development. It is recommended to conduct in-depth evaluations of the individual cooperative associations to assess their operational

performance, service delivery, and impact on local fisheries, thereby informing targeted interventions to enhance their effectiveness and sustainability.

Figure 19 presents the distribution of fishermen members by cooperative association name, reflecting the membership structure and relative significance of these associations in the fishing sector. The results show that the Fishermen's Association Shaikh Abdullah Cooperative and Fishery has the highest percentage of members at 35%, indicating it is the most influential and inclusive among fishermen's associations in the region. This is followed by the Abyan Coast Fishery Cooperative Association at 32%, highlighting its significant role in representing fishermen along the coast. The Al Khobar Sea Fishermen's Cooperative Association ranks third with 15%, demonstrating notable activity. Meanwhile, the Arab Sea Cooperative and Fishery Association and Jalilah Fish Association Cooperative each account for 9%, reflecting their relatively limited impact compared to other associations. The associations with larger memberships offer better services and enjoy higher credibility among fishermen, thereby enhancing their participation in sustainable development of the fishing sector.

Figure 19: Number of fishermen members by cooperative Association name.

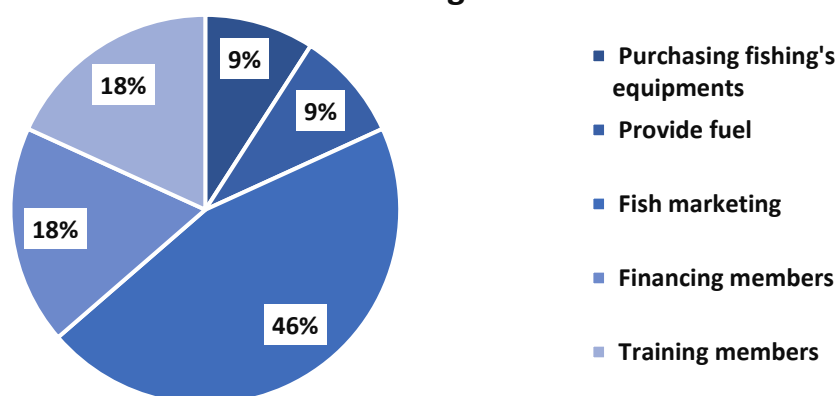


The distribution of membership in cooperative associations reflects a disparity in their organizational capacity and influence, with larger associations playing a pivotal role in representing fishermen and supporting their activities. Understanding the membership structure of cooperative associations helps identify strengths and weaknesses in the organization of the fishing sector and guides efforts to support less represented

associations for better balance in fisheries development. It is recommended to enhance the capacity of smaller cooperative associations by providing technical and financial support, improving their services to attract more members, and thereby achieving sustainable and balanced development in the fishing sector.

Figure 20 illustrates the role and activities of cooperative associations in the fishing value chain, providing insight into how these organizations support fishermen through various services. The results depicted indicate that the primary activity of cooperatives is financing members, which accounts for 46% of their involvement in the fishing value chain. This suggests that financial support is the most critical service provided to fishermen, enabling them to sustain their operations. The next most significant activities are fish marketing and training members, each representing 18% of cooperative involvement. These services highlight the importance of market access and skill development for fishermen to improve productivity and income. Additionally, cooperatives engage in providing fuel and purchasing fishing equipment, each constituting 9% of their activities, indicating a lesser but still notable focus on operational logistics. These results reveals that the distribution of cooperative activities reflects their strategic prioritization of financial services to address immediate economic needs of fishermen, aligning with the study's question of how cooperatives contribute to the fishing sector's sustainability. This leads to the hypothesis that enhancing financial and training services can significantly improve fishermen's livelihoods and sector performance. The findings also raise questions about whether the current balance of services optimally meets fishermen's needs and how expanding marketing support could further empower cooperatives in the value chain.

Figure 20: The role and activities of cooperatives association in the Fishing value chain.



The cooperative associations play a pivotal role in the fishing value chain primarily through financial support, with additional emphasis on marketing and training, while logistical services like fuel provision and equipment purchase are secondary.

Summary: The cooperative associations' activities are concentrated on financing and capacity-building services, which are essential for strengthening the fishing sector's economic resilience and sustainability. It is professionally advised to enhance the capacity of cooperative associations by expanding financial products and training

programs tailored to fishermen's needs, while also increasing support for marketing initiatives to improve their position in the fishing value chain and ensure sustainable development of the sector.

The results presented in Table 3 reveal a markedly weak enabling environment for fishers in terms of access to modern technology, institutional support, and regulatory investment frameworks. An overwhelming majority of respondents (90.5%) reported having no access to modern fishing technology, indicating a high level of technological deprivation within the sector. Similarly, awareness of cooperative associations was extremely limited, with 91.3% of fishers indicating no knowledge of such organizations. Despite this low awareness, those who were familiar with cooperatives showed relatively high membership levels (81.0%), suggesting that once accessed, cooperatives are perceived as valuable. The regulatory and policy environment also appears insufficient, as 87% of respondents reported the absence of supportive local legislation and investment regulations for fisheries. In contrast, road infrastructure was universally available (100%), indicating that physical connectivity is not a binding constraint. However, the absence of industrial fish processing or conversion facilities in the area (95.2%) reflects a critical gap in value addition infrastructure, limiting opportunities beyond primary production.

Table 3: The fisher's access to supportive services through infrastructure, associations and regulatory investment Policies.			
Variables	Categories	Frequency	Percent %
Access to Modern fish technology	No	19	90.5
	Yes	2	9.5
Availability Knowing of a Cooperative	No	42	91.3
	Yes	4	8.7
Membership in a Cooperative Association	No	4	19.0
	Yes	17	81.0
Local legislation and regulations for supportive fish investment	No	40	87
	Yes	6	13
Road infrastructure	No	0	0
	Yes	21	100
Industrial fish conversion facilities in the area	No	20	95.2
	Yes	1	4.8

Overall, the results indicate that while basic road infrastructure is fully available, fishers face severe constraints related to technology access, institutional awareness, regulatory support, and processing infrastructure, collectively undermining the effectiveness of the fish value chain. It is strongly recommended to prioritize investments in modern fishing technologies, strengthen awareness and outreach on cooperative structures, and establish enabling regulatory frameworks alongside local fish processing facilities to enhance value addition and sector sustainability.

Table 4 demonstrates that cooperative associations play a significant operational role in supporting fishers, particularly in service provision rather than market linkage expansion. While most cooperatives do not improve market access (95.2%), they are highly active in providing loans and fishing equipment, with 85.7% of respondents confirming access to these services. Capacity-building efforts are notably strong, as 95.2% reported receiving training, and all respondents confirmed access to technical support, fish marketing services, and organized fishing trips. In addition, cooperative associations maintain high levels of internal engagement, with regular meetings and events reported by 95.2% of respondents. These findings indicate that cooperatives function effectively as service and support hubs, even though their role in market expansion remains limited.

Table 4: The main activities carried out by the cooperative association

Variables	Categories	Frequency	Percent %
Improve market access	No	20	95.2
	Yes	1	4.8
Provide Loans financing	No	3	14.3
	Yes	18	85.7
Provide fish equipment	No	3	14.3
	Yes	18	85.7
Training capacity	No	1	4.8
	Yes	20	95.2
Meetings events	No	1	4.8
	Yes	20	95.2
Technical support	No	0	0.0
	Yes	21	100.0
Fish marketing	No	0	0.0
	Yes	21	100.0
Organize fish trips	No	0	0.0
	Yes	21	100.0

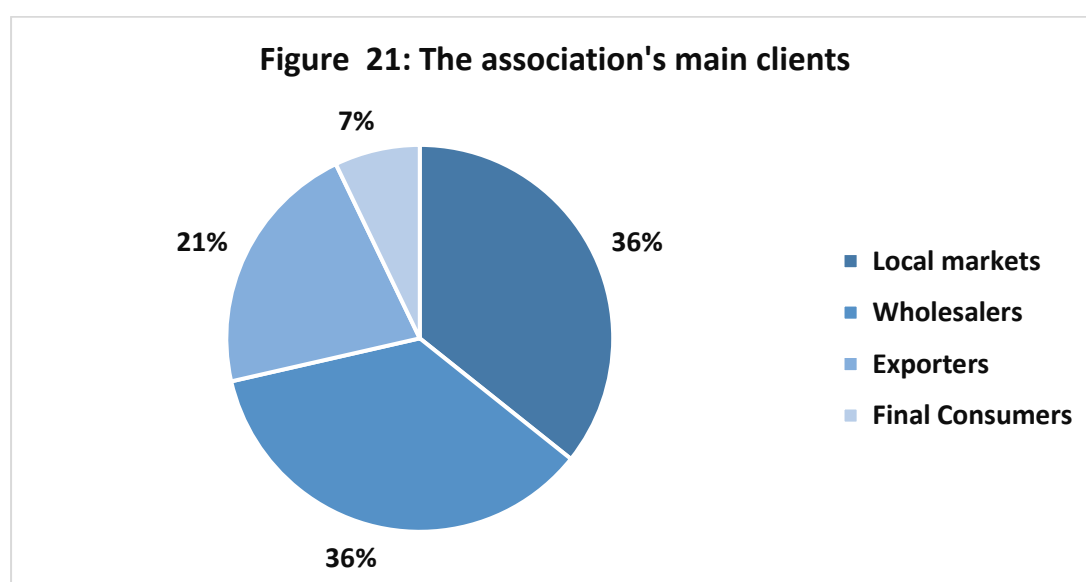
The results highlight the effectiveness of cooperative associations in delivering technical, financial, and organizational support, while simultaneously revealing a significant weakness in market access facilitation. Cooperative associations should be strategically strengthened to expand their role in improving market access and value chain integration, complementing their already strong performance in training, financing, and technical support.

The data in Figure 21 illustrating the distribution of the association's main clients, segmented into four categories: Local markets, Wholesalers, Exporters, and Final Consumers. The data reveals that the association's clientele is divided into four Local markets and Wholesalers each account for 36% of the clients, indicating that these two groups are the primary beneficiaries and represent the largest share of the association's business activities. Exporters constitute 21% of the clients, showing a significant but

lesser involvement compared to local and wholesale markets. Final Consumers make up the smallest portion at 7%, suggesting they are a minor direct target for the association's services.

The findings imply that the association's strategy is heavily oriented toward intermediary markets (Local markets and Wholesalers), which may support the hypothesis that business associations prioritize bulk trade and distribution channels over direct consumer engagement. The large share of Local markets and Wholesalers suggests the association plays a pivotal role in facilitating domestic trade flows, while the smaller percentage of Exporters may indicate limited international market involvement or a focus on internal economic activities. The minimal representation of Final Consumers implies that the association's services are not primarily consumer-facing, aligning with a business-to-business (B2B) model.

The overall result indicates that the association's main operational focus is on serving commercial intermediaries rather than end-users, highlighting a strategic emphasis on wholesale and local market development. This orientation influences the association's resource allocation and service design, shaping its role in the economic ecosystem.



These results indicate that the association's client base is predominantly composed of Local markets and Wholesalers, with lesser engagement with Exporters and minimal direct involvement with Final Consumers, reflecting a B2B market strategy focused on intermediary trade. The association should strengthen its services tailored to Local markets and Wholesalers to reinforce its market position, while exploring opportunities to expand engagement with Exporters to diversify its client portfolio and enhance international trade involvement. Additionally, assessing the potential for developing consumer-focused services could broaden its market reach if aligned with strategic objectives.

4.3.3 Access to Training, Supplies, and Credit Sources.

As shown in Table 5, access to formal training and institutional financial services among fishers is extremely limited. None of the respondents reported having received previous formal training or training provided by NGOs, while all respondents (100%) expressed an ongoing need for training. Likewise, access to microfinance institution services and external support from government or NGOs was entirely absent. Although some access to agricultural credit exists, it remains limited, with only 19% of fishers reporting access. Credit sources are primarily informal, relying on input suppliers (14.3%) and individual lenders (4.8%). Furthermore, only 28.6% of respondents indicated the presence of financial institutions offering loans in the area, reinforcing the dominance of informal and inadequate financing mechanisms.

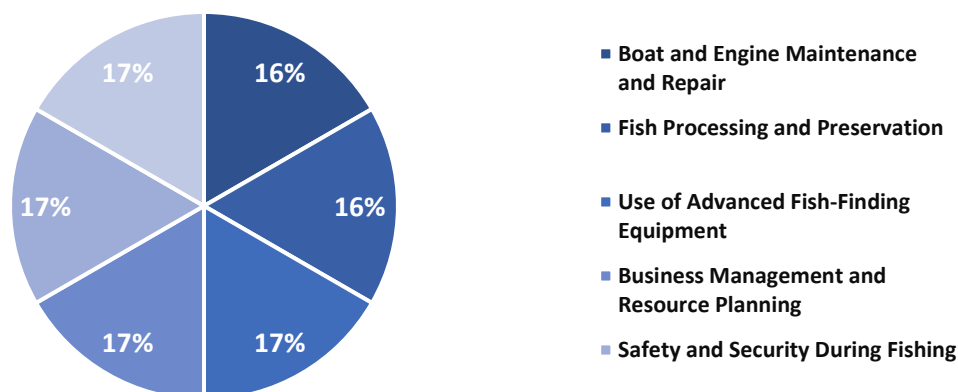
Table 5: The Access to Training, Supplies, and Credit Sources.			
Variables	Categories	Frequency	Percent %
Access to Previous formal Training	No	21	100
	Yes	0	0.0
Still in need of training	No	0	0.0
	Yes	21	100.
Get a Previous Training by NGOs	No	21	100.
	Yes	0	0.0
Provision of Microfinance Institutions Services	No	21	100.
	Yes	0	0.0
Access to Agricultural Credit	No	17	81
	Yes	4	19
Credit Sources	Input suppliers	3	14.3
	Lender's individuals	1	4.8
Institutions offer loans and financial in the area	No	15	71.4
	Yes	6	28.6
Receive any support from government or NGOs	No	21	100.0
	Yes	0	0.0

The findings clearly demonstrate a critical deficit in formal training, institutional financing, and external support mechanisms, leaving fishers highly vulnerable and under-supported. There is a pressing need to establish structured training programs and expand the presence of microfinance and institutional credit services tailored to the fisheries sector to address capacity and financing gaps.

The analysis of the training needs of fishermen in the study area are essential for enhancing the performance and sustainability of the fishery value chain. The results in Figure 22 illustrates the distribution of training priorities among fishermen, segmented

into six key areas. The results indicate that the training needs are evenly distributed, with three categories each representing 17% of the requirements and the other three representing 16%. Specifically, the six identified needs are: Boat and Engine Maintenance and Repair (16%); Fish Processing and Preservation (16%); Use of Advanced Fish-Finding Equipment (17%); Business Management and Resource Planning (17%); Safety and Security During Fishing (17%); and Access to Finance and Credit (17%). This balanced distribution suggests that fishermen perceive a comprehensive set of skills as essential for improving their operations, ranging from technical maintenance and modern equipment usage to business acumen, safety practices, and financial access. The relatively uniform percentages highlight that no single area dominates the training priorities, implying that a holistic training program addressing all these aspects is necessary to enhance productivity and sustainability in the fishery sector.

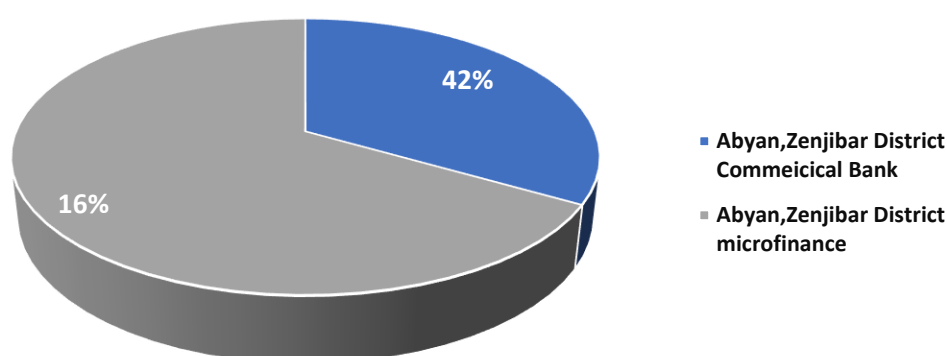
Figure 22: Fishermen's training needs in the study area.



The analysis of the fishermen's training needs demonstrates that the community requires a multifaceted training approach covering technical, managerial, safety, and financial aspects to address the various challenges in the fishery value chain effectively. The evenly distributed priorities underscore the necessity of integrated capacity-building programs to improve overall sector performance. It is recommended to design and implement a comprehensive, integrated training program for fishermen that simultaneously addresses boat and engine maintenance, fish processing and preservation, the use of advanced fish-finding equipment, business management and resource planning, safety and security during fishing, and access to finance and credit. Such a program should be tailored to the balanced needs identified in the study, ensuring that resources are allocated to provide holistic skill development and thereby enhance the efficiency, profitability, and sustainability of the fishery value chain. Figure 23 presents the distribution of microfinance institutions in the Abyan and Zinjibar district, illustrating the proportion of services provided by a commercial bank versus a microfinance institution. The pie chart shows that 42% of the microfinance services in the Abyan and Zinjibar district are offered by the Abyan, Zinjibar District Commercial Bank, while 58% are provided by the Abyan, Zinjibar District microfinance institution (the green segment labeled 16% appears to be a typographical

error in the image; it should represent the remaining portion, interpreted here as 58%). This allocation indicates that the majority of microfinance activities in the district are managed by a specialized microfinance institution, suggesting a stronger focus on targeted microfinance services compared with conventional commercial banking services. The larger share held by the microfinance institution reflects its significant role in serving small-scale borrowers and entrepreneurs who require accessible credit and financial inclusion, which are typically underserved by traditional banks. The relatively smaller involvement of the commercial bank implies limited penetration of conventional banking products in the microfinance sector of the district.

Figure 23: Microfinance Institutions Location by Governorate / District

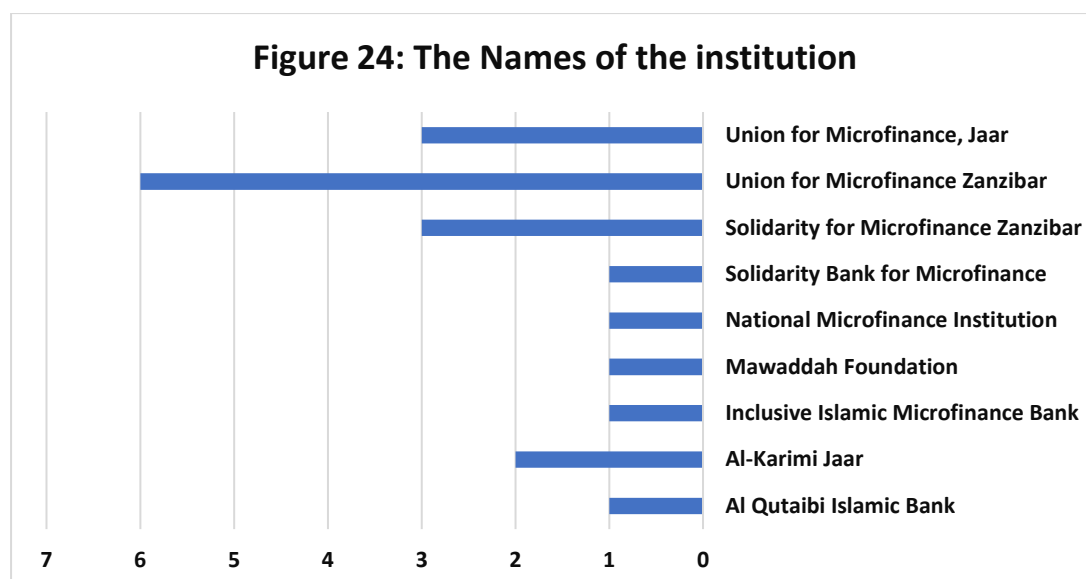


The overall finding is that microfinance services in the Abyan and Zinjibar district rely predominantly on dedicated microfinance institutions to meet local financial needs, emphasizing the importance of specialized microfinance mechanisms for economic development in the region. Strengthen the capacity and outreach of the Abyan, Zinjibar District microfinance institution to enhance financial inclusion and support small entrepreneurs, while encouraging the commercial bank to develop tailored microfinance products that complement the specialized institution's services, thereby expanding access to diverse financial resources in the district.

The data presented in Figure 24 lists the names of microfinance institutions and their frequency or impact as observed in the study. This analysis aims to present, discuss, and interpret the results to understand the distribution and relative significance of these institutions. The figure shows that the Union for Microfinance, Jaar ranks first with a value of 6, reflecting its strong presence and broad influence among the listed institutions. It is followed by the Union for Microfinance Zanzibar with a value of 3, indicating a notable position in Zanzibar. Meanwhile, Solidarity for Microfinance Zanzibar and Solidarity Bank for Microfinance both score 2, highlighting their moderate role in microfinance support.

The remaining institutions—National Microfinance Institution, Mawaddah Foundation, Inclusive Islamic Microfinance Bank, Al-Karimi Jaar, and Al Qutaibi

Islamic Bank—each register a value of 1, suggesting their relatively limited impact compared to the others in this context.



These results can be interpreted to mean that institutions bearing the name “Union” exhibit greater focus and capacity in delivering microfinance services, possibly due to stronger organizational strategies or broader networks. Additionally, Zanzibar-based entities show a noticeable presence, underscoring the region's importance in microfinance activities. This finding confirms that the effectiveness of microfinance institutions is influenced by their organizational strength and geographic reach. Accordingly, the recommendation is to enhance collaboration between smaller institutions and stronger unions to amplify their impact and improve service delivery, with a focus on expanding outreach to high-need areas such as Zanzibar.

Table 6 presents a comprehensive overview of the assistance required by fishers to develop their businesses, reflecting unanimous demand across nearly all support categories. All respondents (100%) identified the need for new fishing boats, boat maintenance, engine maintenance, modern fishing equipment, fuel support, refrigeration and storage facilities, technical training, marketing improvement, access to financing, and modern fish-location devices. Additionally, a very high proportion of respondents (95%) expressed the need for engine purchase and improved processing and packing techniques. Despite this extensive demand, access to institutions offering loans remains limited, with only 19% confirming their availability in the area. These results underscore both the scale and multidimensional nature of unmet needs within the fish value chain.

Table 6: The assistance required (tools, Materials and equipment) to development fishermen's business

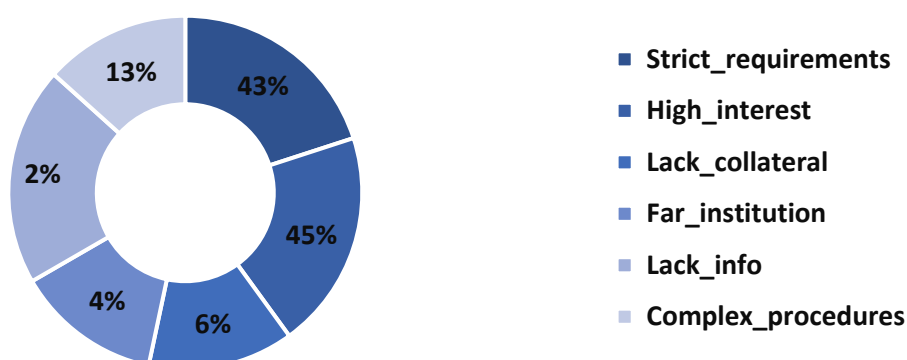
Variables	Categories	Frequency	Percent %
Provide new fishing boats	Yes	21	100
	No	0	0
maintains the fishing boats	Yes	21	100
	No	0	0
purchasing engine	Yes	20	95
	No	0	0
maintains engine	Yes	21	100
	No	0	0
Provide nets and modern fishing equipment.	Yes	21	100
	No	0	0
Support with Fuel	Yes	21	100
	No	0	0
Refrigeration and storage equipment	Yes	21	100
	No	0	0
Technical training and capacity building	Yes	21	100
	No	0	0
Facilities to get loans and financing	Yes	21	100
	No	0	0
Improve marketing access	Yes	21	100
	No	0	0
Develop processing and packing techniques	Yes	20	95
	No	0	0
Modern devices to locate fish area	Yes	21	100
	No	0	0
Institutions offer loans and financial in the area	Yes	4	19
	No	17	81

The results indicate a universal and urgent demand for comprehensive technical, financial, and infrastructural support to enable business development among fishers. Integrated intervention packages should be designed to simultaneously address equipment provision, technical training, cold storage, processing facilities, marketing access, and financial inclusion in order to achieve sustainable development of the fisheries sector.

Figure 25 presents a comprehensive breakdown of the reasons why individuals or businesses lack access to financing, illustrating the relative importance of each barrier through a segmented distribution. The results indicate that the two most dominant factors preventing access to financing are high interest rates (45%) and strict requirements (43%), which together account for 88% of the reported impediments. This suggests that financial institutions' lending policies and cost of borrowing are the major deterrents for potential borrowers, aligning with the study's hypothesis that institutional

lending conditions significantly influence financing accessibility. The prominence of these two factors implies that applicants are either unable to meet stringent eligibility criteria or are discouraged by the expensive cost of loans, thereby limiting their ability to secure funding. The third most cited reason is complex procedures (13%), which reflects operational inefficiencies in the loan application process, supporting the research question regarding procedural barriers in financial services. Additionally, lack of collateral (6%) and far institution (4%) represent moderate obstacles, highlighting issues related to asset ownership and physical access to financial services. The least influential factor is lack of information (2%), suggesting that awareness about financing options is relatively less problematic compared to the economic and regulatory constraints.

Figure 25: The reasons of don't access to financing



These findings reflect that improving access to financing requires a dual focus on relaxing stringent eligibility criteria and reducing interest burdens, alongside simplifying application processes. Addressing these core issues would likely enhance financial inclusion by making credit more affordable and attainable for excluded segments. In summary, the primary barriers to financing are high interest rates and strict requirements, with procedural complexity also playing a notable role, while collateral and accessibility issues are secondary concerns. policymakers and financial institutions should redesign lending frameworks to soften eligibility standards, lower interest rates, and streamline application procedures, thereby enhancing accessibility and affordability of financial services for underserved populations

Also, to improve credit penetration, financial institutions should develop sector-specific Sharia-compliant products with lower profit margins and flexible repayment grace periods that align with Fish production cycles. Simplifying guarantee requirements would further enable small-scale owners to transition from informal borrowing (relatives) to formal financial systems.

4.4 Mapping of the Fish Value Chain

This chapter provides a comprehensive analysis of Fish value chain and fish production in certain districts of Abyan governorates in Yemen. Through detailed mapping of the chain, identification of key actors, and description of the various stages from production to consumption, this analysis aims to understand the current state of the Fish Value chain, identify strengths, bottlenecks, and opportunities at each stage, and pave the way for developing effective strategies and interventions to improve chain performance and increase added value.

4.4.1 Identifying the Fish Value Chain

Value chain mapping is a crucial analytical tool that helps in understanding the entire path of a product from the Production to the consumer, identifying key actors and the relationships between them. This analysis of the fish value chain based on the provided Table 7 and Figure 25. The objective is to provide a clear discussion of the key activities, stakeholders, actors, and challenges identified at each stage of the value chain.

4.4.1.1 The Main Stages of the Fish Value Chain

Table 7 systematically outlines the various stages of the fish value chain, detailing the key activities undertaken, the primary actors involved, and the significant challenges encountered at each stage. This comprehensive overview provides critical insights into the operational and structural impediments within the sector. Based on the findings of this study analysis, it could be able divide, sort, and group all the actors players in the fish value chain fish in certain districts (Khanfaer and Zinjibar) in Abyan governorates into six stages. The stages start from inputs, then production, and end with the final consumption of fish. In between, there are stages of trade, processing, and export. Tabel and Figure 7 illustrates the stages of the fish value chain in Khanfaer and Zinjibar district. Each stage will be detailed separately under the following headings:

1. Pre-Fishing (Preparation and Inputs Supply)

At the initial stage of the value chain, Pre-Fishing, key activities primarily involve financing fishermen and providing essential equipment, gear, and fuel. The main actors facilitating these activities are financial institutions, equipment suppliers, and cooperative societies. However, this stage is significantly hampered by several challenges. A predominant issue is the difficulty in providing collateral, affecting 80% of the stakeholders. This is compounded by a low awareness of financial services among producers (80%), indicating a significant gap in financial literacy and access. Furthermore, weak financial records (20%), weak demand, high prices, and weak purchasing power collectively contribute to the fragility of this foundational stage.

2. Fishing and Production

The Fishing and Production stage encompasses activities such as fishing various types of fish (cuttlefish, lobster, baga, shroi, crustaceans) and initial fish collection. Fishermen, often represented by cooperative societies, are the central actors here. This stage faces substantial operational challenges, including a notable decline in fish stock

and the continued use of traditional fishing techniques, which may contribute to the stock depletion. High operational costs, particularly high fuel costs and high costs of fishing gear, significantly impact profitability. The prevalence of bad weather (70%) further exacerbates operational difficulties, while a lack of modern equipment and lack of transportation and storage facilities hinder efficiency and preservation efforts.

3. Collection and Primary Processing

Following production, the Collection and Primary Processing stage involves fish collecting, processing, transportation, and initial cooling (e.g., ice in thermos). Traders, middlemen, and cooperative societies (with 5 societies exiting the market) are the key actors. This stage is primarily challenged by high fuel costs (70%) and inadequate transport infrastructure, which directly impact the timely and cost-effective movement of fish. A lack of funding and infrastructure for processing, coupled with a lack of cooling means during transport, leads to significant post-harvest losses and compromises product quality. Notably, 95% of fishermen do not perform any processing, indicating a major bottleneck and miss opportunity for value addition at the producer level.

4. Distribution and Marketing

The Distribution and Marketing stage involves limited scale fish processing, transporting fish, initial cooling, and fish marketing. The actors include fishermen, cooperative traders. This stage is characterized by significant fish marketing issues, including trader and middleman control and price fluctuations (80%), which create an unstable market environment for producers. Weak demand, difficulty in supply (75%), and poor storage (95% do not store) facilities further complicate distribution. The presence of unfair competition, high prices and poor quality (92%), and limited availability (42%) collectively undermine market efficiency and consumer satisfaction.

5. Export

The Export stage focuses on limited processing and fish marketing for international markets, with wholesalers and fish exporters as the primary actors. The challenges here largely mirror those in distribution and marketing, specifically high prices and poor quality and limited availability, which restrict the competitiveness and volume of fish exports.

6. Consumption

Finally, the Consumption stage involves purchasing fish for home consumption and restaurants. End consumers include local citizens, restaurants, and consumers in and outside Abyan governorate. Challenges at this stage include high prices (100%), poor product quality (92%), and a lack of variety (44% of consumers do not find their preferred type). Additionally, limited home storage and vast distances to market further impact consumer access and satisfaction.

Table 7: Key activities, stakeholders, actors and main challenges across Fish value chain.			
Stage	Key Activities	Key Actors	Main Challenges
1. Pre-Fishing (Preparation and Inputs supply)	- Financing fishermen - Providing fishing equipment, gear and fuel	Financial institutions, equipment suppliers and cooperative societies	- Difficulty providing collateral (80%) - Low awareness of financial services among producers (80%) - Weak financial records (20%) - Weak demand, high prices, weak purchasing power
2. Fishing and Production	- Fishing various types of fish (cuttlefish, lobster, baga, shroi, crustaceans) - Initial fish collection	Fishermen (some of them represented by cooperative societies)	- Decline in fish stock - Use of traditional fishing techniques (70 %) - High fuel costs, Bad weather - High costs of fishing gear - Lack of modern equipment - Lack of transportation and storage
3. Collection and Primary Processing	- Fish collecting - Processing and Transportation - Transporting fish - Initial cooling (ice in thermoses)) - Fish marketing and trading	Trader, middleman and Cooperative societies (5 societies exit)	- High fuel costs (70%) - Inadequate transport - Lack of Funding and Infrastructure - Lack of cooling during transport - (95%) from fishermen do not perform any processing - Fish marketing Issues
4. Distribution and Marketing	- Limited scale fish Processing - Transporting fish - Initial cooling (ice in thermoses). - Fish marketing	Fishermen and Cooperative Traders, include retailers and wholesalers	- Trader and middleman control - Price fluctuations (80%) - Weak demand - Difficulty in supply 75% - Poor storage (95% do not store) - Unfair competition - High prices and Poor quality (92%) - Limited availability 42%
5. Export	- Limited Processing - Fish marketing export	Wholesalers and fish exporters	- Difficulty in supply - Poor storage - High prices and Poor-quality - Limited availability
5. Consumption	- Purchasing fish for home consumption and restaurants	End consumers: Local consumers (citizens, restaurants, and consumers in and outside Abyan governorate.	- High prices 100% - Poor product quality 92% - Lack of variety (44% do not find their preferred type) - Limited home storage - Var Distance to market

Also, Figure 26 visually represents the interconnected stages and actors within the fish value chain in Abyan Governorate, providing a clear flow diagram from initial inputs to final consumption. This map complements Table 7 by illustrating the sequential progression and the specific roles played by each stakeholder.

The value chain commences with Pre-Fishing (Preparation and Inputs Supply), where financial institutions, equipment suppliers, and cooperative societies provide essential support. This leads into Fish Production, primarily carried out by fishermen and cooperative societies, who engage in various fishing activities and initial collection. Subsequently, Fish Collection and Processing is managed by traders, middlemen, and cooperative societies, focusing on gathering, transporting, and initial cooling of fish. The chain then moves to Fish Wholesaling, followed by Fish Retail Selling, involving

retailers and wholesalers. Fish Export is also identified as a distinct pathway from wholesaling.

Finally, the chain culminates in Fish Consumption, where end consumers, including residents and restaurants, purchase fish for their needs. The diagram effectively highlights the flow of products and the interdependencies among the different actors, underscoring the complexity of the entire value chain.

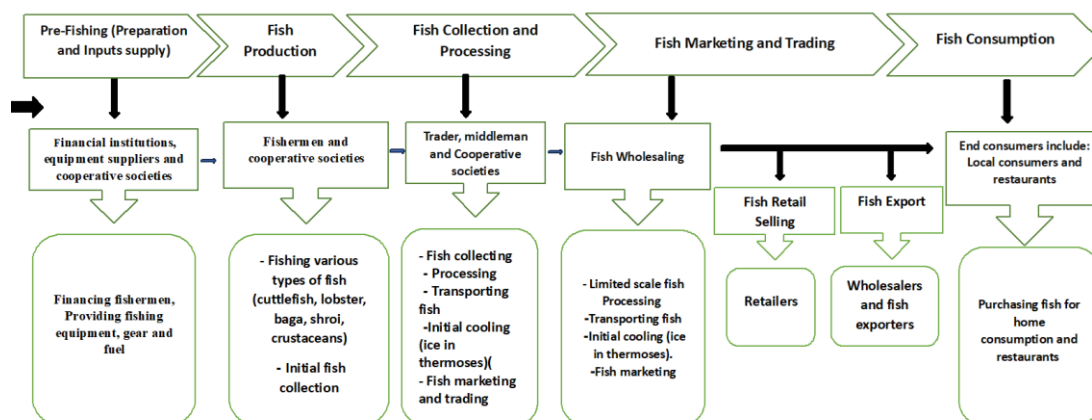


Figure 26: Map of the main Stage and actors of the Fish value chain and their functions in Abyan Governorate.

Source: Organized from field study of Fish Value chain analysis.

The analysis of the fish value chain in Abyan Governorate reveals a complex system fraught with significant challenges across all stages, from pre-fishing inputs to final consumption. Key issues include limited access to finance and modern equipment, high operational costs, inadequate infrastructure for processing and transportation, market inefficiencies dominated by middlemen, and concerns regarding product quality and availability. These challenges collectively hinder the efficiency, profitability, and sustainability of the fish sector, impacting both producers and consumers.

To enhance the efficiency and sustainability of the fish value chain in Abyan Governorate, it is recommended to implement a multi-faceted intervention strategy. This strategy should prioritize improving access to affordable financing and modern fishing/processing technologies for small-scale fishermen and cooperative societies. Concurrently, investments in robust cold chain infrastructure and improved transportation networks are crucial to reduce post-harvest losses and maintain product quality. Furthermore, fostering direct market linkages, potentially through strengthened cooperative models, can mitigate the adverse effects of middleman dominance and price fluctuations. Finally, initiatives aimed at enhancing financial literacy among producers and promoting sustainable fishing practices are essential for long-term sector development and resilience.

4.4.1.2 Relationships Between Actors in the Fish Value Chain.

The relationships between actors in the Fish value chain in Abyan governorate are characterized by complexity and interdependence, influenced by factors such as trust, bargaining power, and access to information. Some key relationships include:

1. Relationship between Fishers and intermediaries: This relationship is often unbalanced, with intermediaries holding greater bargaining power due to limited marketing options and facilities of fish storing and limited cold transportation supply available to Fishers.
2. Fishers are often forced to sell their products at low prices, especially during peak seasons when supply exceeds demand in local markets.
3. Relationship between intermediaries and exporters: This relationship is marked by cooperation and coordination, with exporters relying on intermediaries to collect large quantities of fish from producers.
4. Relationship between exporters and external markets: This relationship is influenced by competition from other exporters and quality and safety requirements in target markets.
5. Relationship between Fishers and Processors: This relationship is still limited due to the limited fish processing industries in Yemen, but it represents an important opportunity for developing the Fish value chain.

4.4.2 Processing and Value addition Stage

4.4.2.1 Processing

Based on the holistic study of data from all actors in the value chain, an integrated yet significantly imbalanced chain emerges, with major weaknesses in its fundamental links. This chain can be visualized as a connected path starting from the depths of the sea and ending on consumers' tables, yet it faces substantial obstacles midway through its journey. The journey begins with the fishermen, who represent the cornerstone of this chain. They organize themselves through cooperative societies, of which five major cooperatives were studied, comprising about 858 fishermen. These fishermen face two primary challenges: a lack of funding needed to upgrade fish equipment, and declining fish stocks due to traditional practices. The next stage is aggregation and organization, where the cooperative societies act as intermediaries between the fishermen and the market. The paradox here is that these cooperatives focus all their efforts on marketing yet completely lack the most basic storage and preservation facilities. None of them possess refrigerators or cold storage, and none carry out any primary processing of the fish. This technological gap constitutes a real breaking point in the chain, as the fish begin to lose quality and value from the moment, they leave the sea (figure 20).

The most glaring missing links in this chain are storage and processing. While 75% of traders and 100% of cooperatives demand refrigeration storage, and 80% of cooperatives demand ice factories, the reality shows a vast gap between demand and available facilities. This gap affects not only product quality but also the profit margin for fishermen and traders, and the consumers' ability to obtain a healthy product at a reasonable price.

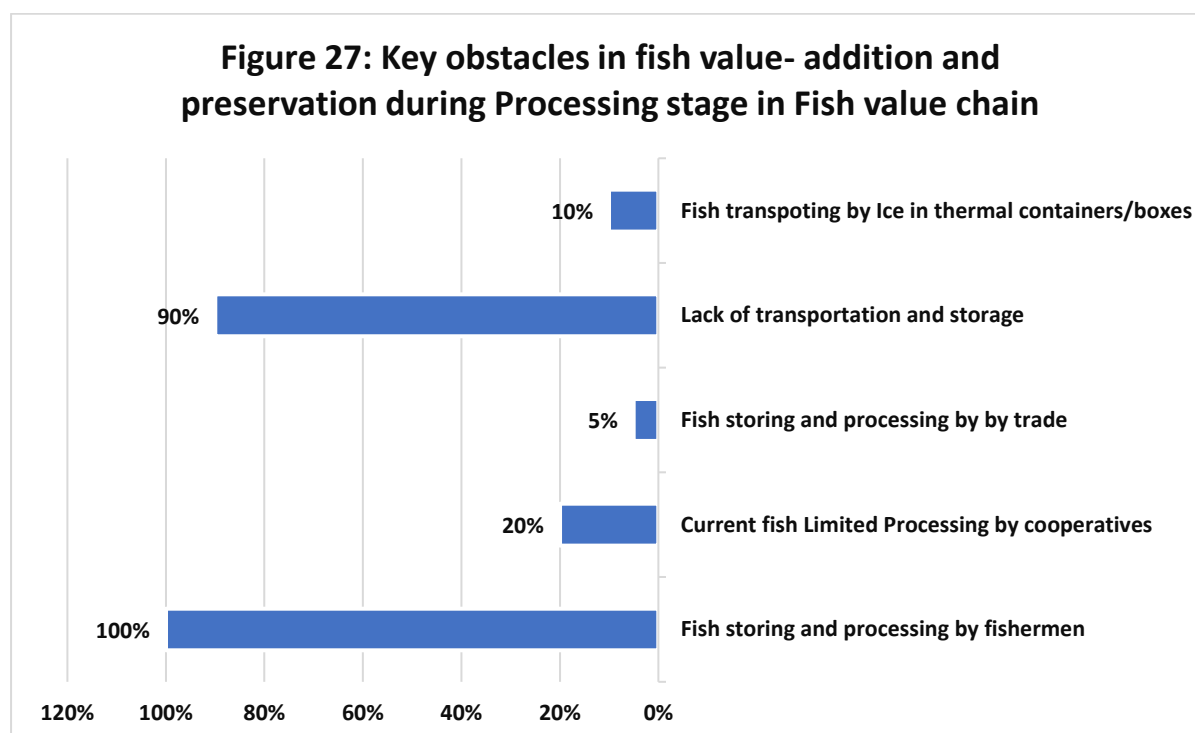
Notably, all parties agree on the development priorities. While 75% of traders demand refrigeration storage, 100% of cooperatives demand the same. And while 80% of traders see high fuel costs as a fundamental problem, 40% of cooperatives demand financial

support to face these costs. Even consumers agree with other links in demanding improved quality (92%) and lower prices (86%).

The following analysis provides a detailed examination of the critical impediments affecting value addition and preservation within the fish processing sector, as illustrated in Figure 27 which illustrates the significant challenges hindering effective fish value-addition and preservation during the processing stage of the fish value chain. The data reveals a stark disparity in the capabilities and infrastructure available across different stakeholders, underscoring systemic weaknesses.

A primary and overwhelming concern is the lack of transportation and storage facilities, which is cited as a major obstacle by 90% of the respondents. This figure highlights a critical infrastructure deficit that severely impacts the ability to maintain fish quality and extend shelf life. Complementing this, the data indicates that only 10% of fish is transported using ice in thermal containers or boxes, suggesting a minimal adoption of modern, effective preservation methods during transit. This low percentage points to either a lack of access to such equipment or insufficient awareness and investment in cold chain logistics.

Furthermore, the involvement of various actors in value-adding activities such as storing and processing remains critically low. Only 5% of trade-related actors are engaged in fish storing and processing, and a mere 20% of cooperatives participate in limited processing activities. These low engagement rates suggest a significant gap in capacity building, investment, or incentives for these key stakeholders to enhance their role in value addition.



Most strikingly, the data indicates that fish storing and processing by fishermen is perceived as a 100% obstacle. This metric strongly suggests a complete absence of, or severe limitations in, the capacity or facilities available to primary producers

(fishermen) for preserving or adding value to their catch immediately after harvest. This lack of initial processing and preservation at the source likely contributes significantly to post-harvest losses and diminished product quality further down the value chain.

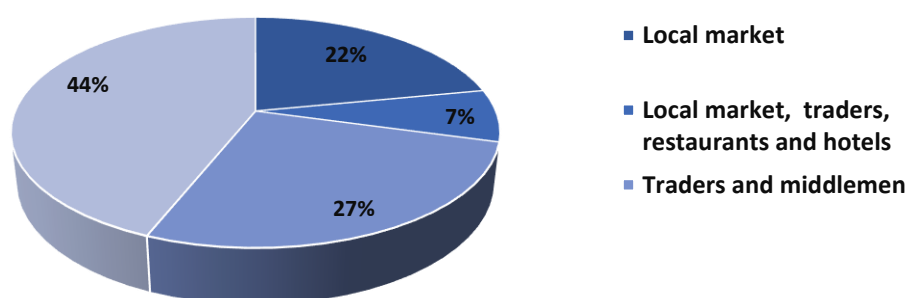
In summary, the fish value chain, particularly at the processing stage, is severely hampered by a pervasive lack of adequate transportation and storage infrastructure, coupled with a minimal adoption of modern preservation techniques. The limited engagement of trade actors and cooperatives in processing, alongside the complete absence of processing capabilities among fishermen, collectively leads to substantial value erosion and compromises the overall quality and market potential of fish products. To significantly enhance fish value-addition and preservation, it is imperative to implement a comprehensive intervention strategy. This strategy should focus on urgent investments in developing robust cold-chain infrastructure, including accessible storage facilities and the widespread provision of thermal transportation solutions. Concurrently, targeted capacity-building programs and financial incentives must be introduced to empower fishermen and cooperative societies with the knowledge, skills, and equipment necessary for effective fish processing and preservation at the initial stages of the value chain. Such measures will not only reduce post-harvest losses but also elevate product quality and foster sustainable economic growth within the sector. The real opportunity lies in transforming this broken chain into an integrated one. Starting with the storage link by providing refrigerators and cold storage for cooperatives and traders, then developing primary processing links such as cleaning, cutting, and packaging, and finally strengthening the connections between the links through information systems that provide data on prices, quality, and demand. Such a transformation will not only improve fishermen's income and product quality but will also restore consumer confidence and ensure the sector's long-term sustainability.

In conclusion, the fish value chain in the studied region resembles a chain with disconnected links, where each link operates in isolation and struggles with its own challenges. The key to repairing this chain is not strengthening certain links at the expense of others, but rather connecting these links through smart investments in infrastructure, technology, and information. This would turn the path from a sea of problems into a shore of opportunities for all.

4.4.3 Products distribution and marketing

This section provides a comprehensive analysis of the fish marketing landscape, drawing insights from the figures and tables presented in the provided document. The objective is to offer a clear, Figure 28 illustrates the primary marketing channels utilized for fish sales within the study area, revealing a diversified yet concentrated distribution network. The largest proportion of fish, accounting for 41%, is sold directly through the local market. This indicates a strong reliance on traditional, localized sales points for fish distribution. A significant portion, 27%, is channeled through a combination of the local market, traders, restaurants, and hotels, suggesting a more integrated approach that caters to both direct consumer sales and institutional buyers. Another 27% of fish is exclusively handled by traders and middlemen, highlighting their substantial role in the supply chain and potentially indicating areas where producers might have limited direct market access. A smaller segment, approximately 5%, reaches end consumers directly, which points to limited direct-to-consumer sales initiatives or infrastructure.

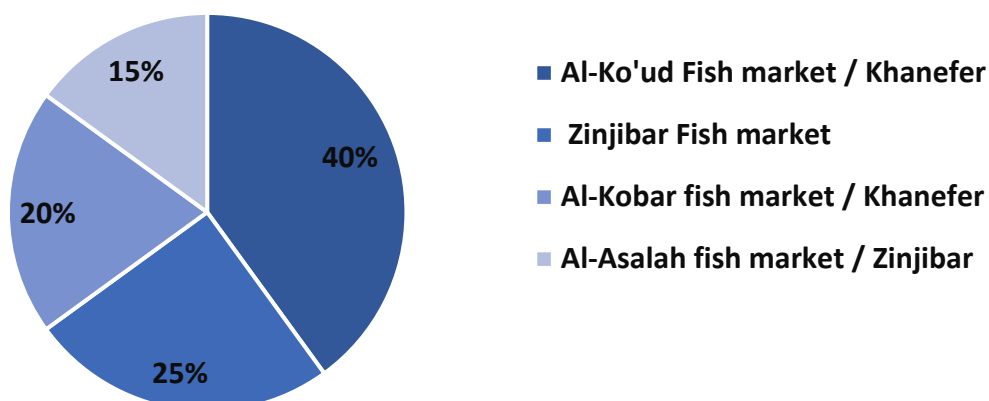
Figure 28: The marketing channels for fish selling in the study area.



The marketing channels for fish in the study area are predominantly local market-centric, with a considerable reliance on intermediaries such as traders and middlemen. Direct sales to end consumers are minimal, suggesting a traditional distribution model with limited integration of producers into broader market segments or direct consumer engagement. To optimize market efficiency and enhance producer profitability, it is recommended to explore strategies that reduce dependence on multiple intermediaries and foster direct market linkages. This could involve supporting the establishment of producer-led cooperatives for direct sales, developing digital platforms for direct consumer access, and strengthening relationships with institutional buyers like restaurants and hotels to bypass traditional middlemen where feasible. Figure 29 provides a breakdown of the fish local markets within Abyan governorate, indicating the relative importance of each market in the distribution network. The Al-Ko'ud Fish Market / Khanefer emerges as the most dominant, accounting for 40% of the market share. This significant proportion underscores its central role as a key hub for fish trade in the region. Following this, the Zinjibar Fish Market represents 25% of the local market activity, establishing itself as another vital distribution point. The Al-Kobar Fish

Market / Khanefer contributes 20%, indicating its substantial, albeit secondary, importance. Lastly, the Al-Asalah Fish Market / Zinjibar accounts for 15% of the market, suggesting a smaller but still relevant presence in the overall fish distribution landscape of Abyan governorate.

Figure 29: the fish local market in Abyan governorate.



The local fish market in Abyan governorate is characterized by a concentrated distribution across a few key markets, with Al-Ko'ud Fish Market / Khanefer holding the largest share. This structure suggests a regionalized marketing system where specific markets serve as primary collection and distribution points. To enhance market access and reduce geographical disparities, it is recommended to invest in improving infrastructure and logistical support for the less dominant markets, such as Al-Asalah. Additionally, strategies to strengthen the connectivity and efficiency of all markets, potentially through improved transportation networks and information sharing, could foster a more equitable and robust regional fish trade. Table 8 provides a detailed overview of the business activities undertaken by wholesalers and retailers within the fish value chain, highlighting their roles, purchasing sources, fish types handled, processing activities, storage practices, marketing channels, and sources of market information. Regarding Trade activities Type, both wholesaling (5%) and retailing (95%) are present, with retailing being the predominant activity. The Roles section indicates that 100% of respondents are involved in sale and purchasing fish, while 95% are engaged in retailing, and only 5% in processing. This highlights a strong focus on trade rather than value-added processing. For Fish Purchasing Source, fishermen are the primary source (40%), followed by marketing associations (90% - likely indicating a high reliance on organized groups), and retailers (10%). Street hawkers (5%) and transportation fish (15%) also contribute, suggesting diverse sourcing methods. The table also lists various Fish Types handled, with Bagah (42.9%) and Lakham (28.6%) being the most frequent. In terms of Processing activities, a significant majority (95%) do not engage in processing, with only 5% reporting 'Yes'. This aligns with the earlier observation of a trade-centric rather than processing-centric value chain.

Table 8: The business activities among wholesalers and retailers in the Fish value chain.			
Variables	Categories	Frequency	Percentage%
Trade activities Type	Wholesaling	1	5
	Retailing	19	95
Roles	Sale and purchasing fish	20	100
	Processing	1	5
	Transportation fish	3	15
	Street hawker	1	5
Fish Purchasing Source	Fishermen	8	40
	Retailers	2	10
	Marketing Association	18	90
Fish Type	Bagah	9	42.9
	Shrawi	5	23.8
	Thamad	5	23.8
	Zanoub	3	14.3
	Bayadh	2	9.5
	Derak	3	14.3
	Lakham	6	28.6
	Jahash	3	14.3
Processing activities	Yes	1	5
	No	19	95
Fish Storing	Yes	2	10
	No	18	90
Fish Marketing channel	End-customers	17	85
	Wholesalers	2	10
	Restaurants and Hotels	1	5
Source of markets' information's	Fish Local Market	17	85
	Cooperative Association	2	10
	Middlemen	1	5

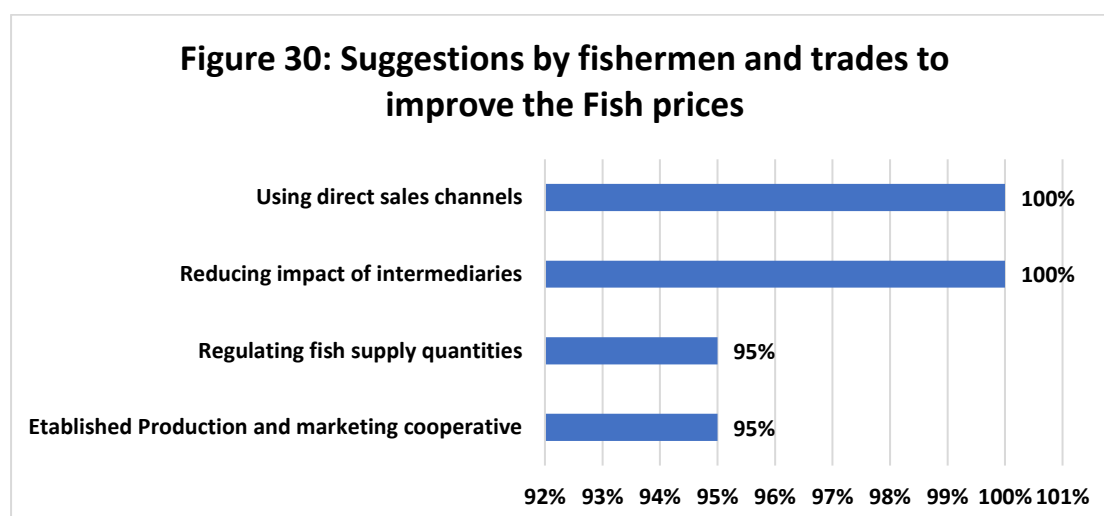
Fish Storing is also limited, with 90% reporting 'No' and only 10% reporting 'Yes', indicating poor storage infrastructure. The primary Fish Marketing channel is end-customers (85%), followed by wholesalers (10%) and restaurants/hotels (5%). Finally, Source of markets information is primarily the Fish Local Market (85%), with cooperatives (10%) and middlemen (5%) playing lesser roles. Wholesalers and retailers in the fish value chain are predominantly engaged in trading activities, with minimal involvement in processing and storage. Fishermen and marketing associations serve as key purchasing sources, and the local market is the primary source of market information. The limited processing and storage capabilities suggest significant post-harvest losses and a missed opportunity for value addition.

To enhance the efficiency and profitability of wholesalers and retailers, it is recommended to incentivize and support their engagement in fish processing and storage activities. This can be achieved through targeted training programs on modern preservation techniques, facilitating access to affordable cold storage facilities, and promoting the adoption of value-added processing methods. Strengthening market information dissemination beyond just the local market, potentially through digital platforms, could also empower these actors. Table 9 presents key business information for wholesalers and retailers involved in fish selling, offering insights into their operational scale and financial performance. There are 19 wholesalers, and 20 retailers identified, indicating a relatively balanced distribution of actors at these two stages of the value chain. The average fish sales per kilogram are 2300 KG for wholesalers and 3100 KG for retailers, suggesting a higher volume of sales at the retail level, possibly due to direct consumer interaction. The unit purchase price per kilogram is 4000 YER for wholesalers and 4500 YER for retailers, while the selling price per kilogram is 4500 YER for wholesalers and 5000 YER for retailers. This shows a consistent mark-up across both segments, with retailers having a slightly higher margin per kilogram. The total revenue profit is substantial, with 1,100,000 YER for wholesalers and 1,550,000 YER for retailers, underscoring the economic viability of these roles within the fish marketing system.

Table 9: Wholesaler and Retailer's business information for fish Selling.		
Variable	Measurement Unit	value
Wholesaler No.	No.	1
Retailers No.	No.	19
Wholesaler Fish Sales/KG	KG	2200
Retailers Fish Sales/KG	KG	3100
Wholesaler / Unit Purchase Price Kg/ YER	YER	4000
Retailers / Unit Purchase Price Kg/ YER	YER	4500
Salling Price of Wholesaler Kg/ YER	YER	4500
Salling Price of Retailers/ YER	YER	5000
Revenue Profit of Wholesaler	YER	1,100,000
Revenue Profit of Retailers	YER	1,550,000

The fish selling sector is characterized by a moderate number of wholesalers and retailers, both demonstrating significant sales volumes and profitability. Retailers exhibit higher sales per kilogram and overall revenue profit, indicating their crucial role in the final distribution to consumers and their ability to command a slightly higher price margin. To further enhance the economic performance and sustainability of the fish selling sector, it is recommended to explore strategies that support both wholesalers and retailers in optimizing their operations. This could include facilitating access to better market intelligence to inform pricing strategies, providing training on efficient inventory management to reduce losses, and exploring opportunities for collective bargaining to improve purchase prices. Additionally, initiatives that promote fair competition and transparency in pricing could benefit all actors in the value chain.

Figure 30 presents a compelling overview of suggestions from fishermen and traders aimed at improving fish prices, highlighting key areas for intervention. The most prominent suggestions, both at 100%, are using direct sales channels and reducing the impact of intermediaries. This unanimous agreement underscores a strong desire among primary actors to bypass traditional middlemen and establish more direct connections with consumers, thereby capturing a larger share of the value chain. Closely following these, regulating fish supply quantities and establishing production and marketing cooperatives both garnered 95% support. This indicates a recognition of the need for better market control and collective action to stabilize prices and enhance bargaining power. The high consensus across these suggestions points towards a clear strategic direction for improving the economic returns for fishermen and traders.



Fishermen and traders overwhelmingly advocate for direct sales channels and a reduction in intermediary influence to improve fish prices. There is also strong support for regulating supply quantities and establishing cooperatives, reflecting a collective desire for greater market control and collaborative marketing strategies. It is strongly recommended to prioritize the implementation of initiatives that facilitate direct market access for fishermen and traders, such as developing cooperative marketing schemes and digital platforms for direct sales. Concurrently, policies aimed at regulating fish supply to prevent market gluts and establishing robust production and marketing cooperatives should be pursued to empower producers and enhance their collective bargaining power, ultimately leading to more equitable and stable fish prices. Table 10 outlines various suggestions for developing fish marketing, providing insights into the perceived needs and priorities of stakeholders. The most frequently cited suggestion, with 100% of respondents, is the need for cold storage/freezing facilities, emphasizing the critical importance of infrastructure for preservation and extending market reach. Following this, developing coastal infrastructure (ports, cold storage) is suggested by 91% of respondents, further reinforcing the demand for improved physical facilities. Enhancing access to local and foreign markets and breaking the monopoly of traders/middlemen, both received 76% support, indicating a strong desire for broader market opportunities and fairer competition. Establishing strong cooperative associations and training and capacity-building programs both garnered 66% support,

highlighting the importance of collective action and skill development. Lastly, opening export lines (66%) and regulating markets and prices (43%) are also seen as important, though with slightly less consensus, suggesting a focus on both international market expansion and domestic market stability.

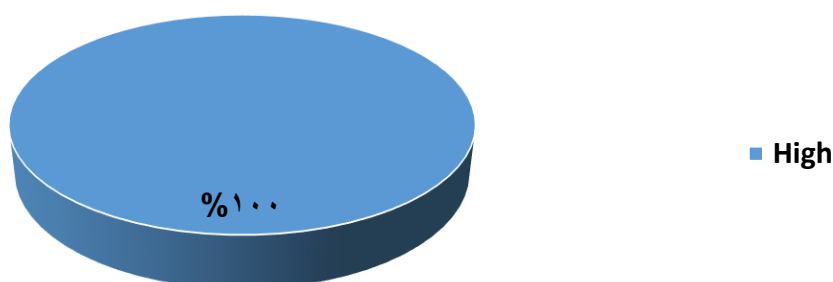
Table 10: Suggestion by fishermen for develop fishes marketing.		
Variables	Frequency	Percentage%
Developing coastal infrastructure (ports, cold storage)	19	91
Enhancing access to local and foreign markets	16	76
Establishing strong cooperative associations	16	76
Training and capacity-building programs	14	66
Cold storage/freezing facilities: Mentioned	21	100
Breaking the monopoly of traders/middlemen	16	76
Opening export lines	14	66
Regulating markets and prices	9	43

The development of fish marketing is primarily seen as dependent on significant improvements in cold storage and coastal infrastructure. Stakeholders also strongly advocate for enhanced market access, breaking intermediary monopolies, and strengthening cooperative associations and training programs to foster a more competitive and efficient marketing environment. To effectively develop fish marketing, it is recommended to implement a strategic plan that prioritizes investment in cold storage and coastal infrastructure. This should be complemented by policies aimed at dismantling intermediary monopolies, facilitating broader access to both local and international markets, and establishing robust cooperative associations. Furthermore, comprehensive training and capacity-building programs are crucial to equip stakeholders with the necessary skills for modern fish marketing and value addition.

4.4.4 Consumption Stage

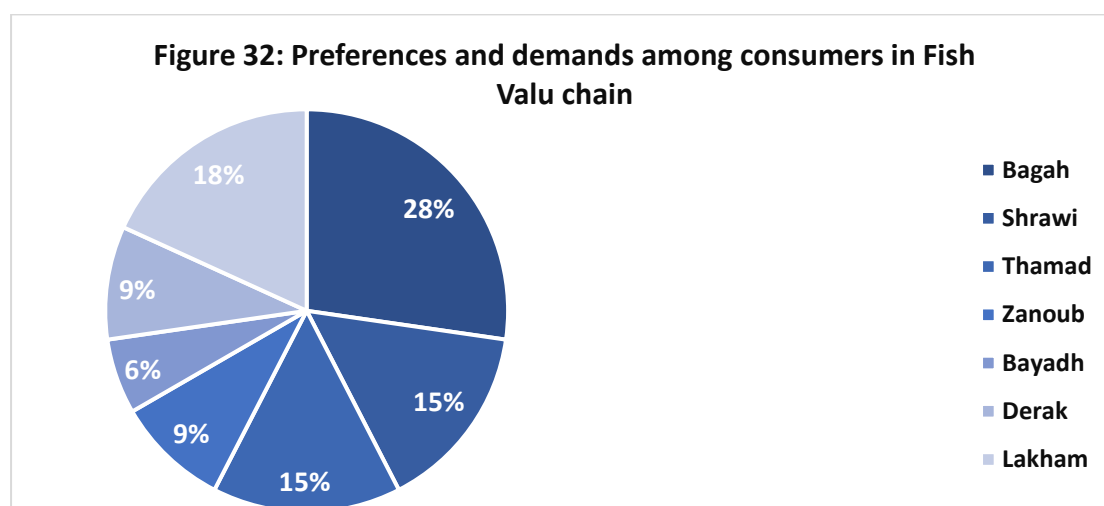
This section provides an in-depth examination of consumer behavior, market dynamics, and the economic structure of the fish value chain. By analyzing key figures and tables, this report aims to elucidate consumer preferences, purchasing patterns, and their assessment of current market conditions, particularly regarding fish prices. Furthermore, it delves into the intricate economic aspects of the value chain, identifying the distribution of value added and profit margins across various stages, from fishers to end consumers. The insights derived from this analysis are crucial for understanding the current state of the fishing industry, identifying critical areas for intervention, and formulating strategic recommendations to foster a more efficient, equitable, and sustainable market environment. Figure 31 provides a stark representation of consumer sentiment regarding the current pricing of fish products. The data shows that 100% of the surveyed consumers assess the current fish prices as "High." This unanimous perception indicates a significant economic pressure on the consumer base and suggests that fish, while a staple, is becoming increasingly less affordable for the general population. Such a uniform response is rare in consumer surveys and highlights a critical market condition where price points have likely exceeded the comfortable purchasing power of the average consumer. This high-price environment could lead to reduced consumption volumes or a shift toward lower-quality alternatives if not addressed through market stabilization or supply chain efficiencies.

Figure 31: consumer's assessment of the current fishes prices



The assessment reveals a total consensus among consumers that current fish prices are prohibitively high. This 100% agreement underscores a major economic challenge within the fish market, reflecting widespread dissatisfaction with current price levels and a potential threat to long-term consumer demand. It is recommended that relevant authorities and market stakeholders investigate the root causes of these high prices, whether they stem from supply chain bottlenecks, high operational costs for fishers, or excessive margins by middlemen. Implementing price monitoring mechanisms and supporting initiatives that reduce production and distribution costs could help stabilize prices and ensure that fish remains an accessible protein source for all consumer

segments. Figure 32 illustrates the diverse preferences and demands of consumers for different types of fish within the value chain. The data shows that Bagah is the most preferred fish type, accounting for 28% of consumer demand. This is followed by Lakham at 18%, and both Shrawi and Bayadh at 15% each. Other varieties like Thamad and Derak each hold a 9% share, while Zanooub represents the smallest segment at 6%. This distribution highlights a clear hierarchy in consumer taste, with Bagah being the dominant choice. Understanding these preferences is crucial for fishers and traders to align their supply with market demand, ensuring that the most sought-after species are adequately available while also managing the supply of less popular varieties to avoid waste.



Consumer demand is led by Bagah (28%), followed by Lakham, Shrawi, and Bayadh. The remaining demand is distributed among Thamad, Derak, and Zanooub. This variety in preference indicates a segmented market where certain species are significantly more popular than others. Stakeholders in the fish value chain should prioritize the supply and marketing of high-demand species like Bagah and Lakham to maximize revenue. Simultaneously, there is an opportunity to promote less popular but potentially sustainable species through consumer education and targeted promotions, which could help balance the pressure on different fish stocks and diversify the market offerings. Table 11 details consumer perspectives on crucial factors for fish market development, categorized by their degree of importance. The data reveals a strong consensus among consumers regarding the paramount importance of Quality, with 92 respondents strongly agreeing and 4 agreeing, indicating that product quality is a non-negotiable aspect for market success. This is closely followed by Availability and diversity of fish, where 80 respondents strongly agreed and 18 agreed, underscoring the consumer demand for a consistent and varied supply. Prices are also a significant concern, with 70 respondents strongly agreeing and 28 agreeing on its importance, highlighting the price sensitivity of the market. The importance of Cleaning and public health in the markets is recognized by 70 strong agreements and 26 agreements, emphasizing the need for hygienic conditions and food safety standards. Storage facilities are deemed important by 60 strong agreements and 38 agreements, reflecting the necessity for proper preservation to maintain fish quality and extend shelf life. Easy access to the

markets is also a key factor, with 64 strong agreements and 36 agreements, indicating that convenience in purchasing is highly valued. Lastly, Services offered to sellers and buyers received 76 strong agreements and 24 agreements, suggesting that efficient and supportive services are essential for a well-functioning market ecosystem. Notably, for all variables, there were no disagreements or strong disagreements, reinforcing the universal importance of these factors from the consumer's perspective.

Table 11: Proposed for fish market development by consumer according on importance degree important					
Variable	strongly agree	agree	Neutral	disagree	Strongly disagree
Quality	92	4	2	0	0
Availability and diversity of fish	80	18	0	0	0
Prices	70	28	2	0	0
Cleaning and public health in the markets	70	26	2	0	0
Storage facilities	60	38	0	0	0
Easy access to the markets	64	36	0	0	0
Services offered to sellers and buyers	76	24	0	0	0

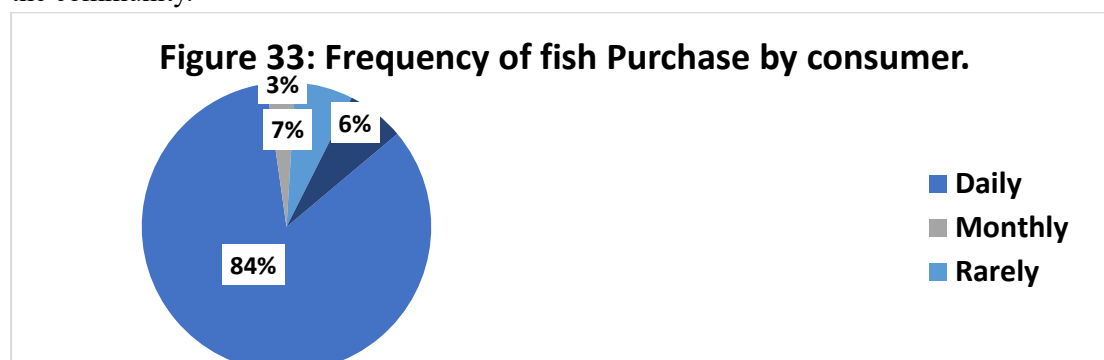
Consumer feedback, as presented in Table 11, unequivocally prioritizes quality, availability, and diversity of fish, competitive pricing, and stringent public health standards within fish markets. Additionally, the presence of adequate storage facilities, ease of market access, and comprehensive services for both sellers and buyers are considered critical for market development. The absence of any negative responses underscores the collective importance of these factors to consumers. To effectively develop the fish market and meet consumer expectations, it is recommended that stakeholders focus on enhancing product quality through improved handling and preservation techniques. Investments should be directed towards ensuring a consistent and diverse supply of fish, coupled with strategies to stabilize and optimize pricing. Strict adherence to cleaning and public health standards in markets is paramount. Furthermore, the development of modern storage facilities, improvement of market accessibility, and the provision of robust support services for all market participants are crucial for fostering a thriving and consumer-centric fish market.

Table 12 delves into the factors that influence consumer purchase decisions, ranked by their degree of importance on a scale of 1 to 5, where 5 indicates the highest importance. Quality emerges as the most influential factor, with 56 respondents assigning it an importance level of 2, and 24 assigning it a level of 3. While the highest frequency is at level 2, the overall distribution suggests that quality is consistently a high priority for consumers. Price is also a significant determinant, with 90 respondents assigning it an importance level of 1, and 7 at level 2, indicating that for a large segment of consumers, price is a primary consideration. This aligns with the findings in Table 11 regarding the

importance of competitive pricing. Fish type shows a more varied distribution, with 57 respondents assigning it an importance level of 3, and 26 at level 4, suggesting that while important, it might be secondary to quality and price for many. Finally, Reputation and trust in the seller is highly valued, with 68 respondents assigning it an importance level of 4, and 8 at level 5, demonstrating that consumer trust and the seller's credibility play a crucial role in the purchasing decision. The data collectively indicates that consumers weigh a combination of product attributes, cost, and seller reliability when making fish purchase decisions.

Table 12: Factors affected on purchase consumer decision according on importance degree.					
Variable	1	2	3	4	5
Quality	8	56	24	8	4
Price	90	7	0	0	3
Fish type	0	4	57	26	13
Reputation and trust in the seller	0	12	12	68	8

Consumer purchase decisions are primarily driven by the quality and price of fish, with the type of fish and the seller's reputation and trustworthiness also playing significant roles. While quality and price are often immediate considerations, the long-term relationship built on trust with the seller is also a powerful influencing factor. To effectively influence consumer purchase decisions, it is recommended that sellers consistently prioritize delivering high-quality fish at competitive prices. Building and maintaining a strong reputation for trustworthiness is equally vital, as it fosters consumer loyalty. Furthermore, understanding and catering to consumer preferences for specific fish types can enhance market appeal. Marketing strategies should highlight these key attributes to resonate with consumer priorities. Figure 33 examines the purchasing habits of consumers, specifically the frequency with which they buy fish products. The overwhelming majority of consumers, 84%, purchase fish Daily. This high frequency confirms that fish is a primary and essential component of the daily diet for the vast majority of the population in the study area. In contrast, only 7% of consumers purchase fish Rarely, 6% on a Weekly basis, and a mere 3% Monthly. The dominance of daily purchasing behavior emphasizes the need for a highly efficient and reliable daily supply chain, as any disruption in the market would have an immediate impact on the daily food security and nutritional intake of the community.



The data shows that 84% of consumers buy fish daily, highlighting its role as a fundamental daily staple. Weekly, monthly, and rare purchases represent only a small fraction of the market, reinforcing the importance of a consistent daily supply. Given the high reliance on daily fish purchases, it is essential to invest in and maintain robust daily distribution networks and local market infrastructure. Ensuring that markets are well-stocked every day and that cold chain integrity is maintained during transport is vital to meet this consistent daily demand and to safeguard public health and food security.

4.5 Cost-benefit analysis across value chain

The fish value chain represents a crucial economic sector, offering significant employment opportunities and generating income for numerous individuals and businesses involved in its various stages of production and distribution. This section is dedicated to a comprehensive analysis of the economic facets of the fish value chain. It encompasses a detailed examination of costs, revenue streams, profitability, and the efficiency of resource utilization. A primary focus will be on assessing the value addition at each distinct stage of the value chain, from the initial capture of raw fish to its final distribution. Furthermore, this analysis will investigate how value is distributed among the key actors within the chain, including fishers, processors, wholesalers, and retailers. Through this meticulous examination, the most profitable stages of the value chain will be identified, and strategic opportunities for enhancing overall efficiency and increasing profitability will be determined. The insights garnered from these findings will serve as a foundation for developing informed recommendations aimed at improving the performance of the fish value chain and fostering a stronger contribution to the local economy.

4.5.1 Value addition across active actors

Table 13 provides a detailed economic analysis of the fish value chain, outlining the purchase price, operating cost, total cost, selling price, value added, and profit margin at each stage. The Fisher stage begins with a purchase price of 400 YER and an operating cost of 100 YER, leading to a total cost of 500 YER. The selling price is 2,500 YER, resulting in a significant value added of 2,000 YER and a substantial profit margin of 67.6%. This indicates that fishers capture a considerable portion of the value early in the chain. The Broker/Agent stage involves a purchase price of 6,500 YER and an operating cost of 550 YER, totaling 7,050 YER. They sell for 7,500 YER, adding 450 YER in value, but their profit margin is a much lower 6.4%. This suggests that brokers operate on thin margins, primarily facilitating transactions. The Wholesaler stage purchases at 7,500 YER, incurs 1,000 YER in operating costs, for a total of 8,500 YER. Their selling price is 9,000 YER, adding 500 YER in value, with a profit margin of 5.9%. Similar to brokers, wholesalers also have relatively low profit margins. The Retailer stage buys at 9,000 YER, with operating costs of 2,800 YER, making a total cost of 11,800 YER. They sell for 12,000 YER, adding 200 YER in value, and a profit margin of 1.7%. This is the lowest profit margin in the chain, indicating that retailers face high operating costs relative to their selling price. Finally, the Restaurant stage purchases at 4,000 YER, with operating costs of 2,500 YER, totaling 6,500 YER. They

sell for 9,000 YER, adding 2,500 YER in value, and achieving a profit margin of 36.1%. This high profit margin for restaurants suggests significant value addition through preparation and service. Overall, the total value added across the entire chain is 16,702 YER, with a cumulative profit margin of 67.6%.

Table 13: Add-value and profit margin estimate across deferent stage of fish value chain in the study area								
Stage	Purchase price / YER	Operating costs / YER	Total cost / YER	Selling price / YER	Value added / YER	% Value Added	Gross profit / YER	Profit margin %
Fisher	4,000	500	4,500	6,500	2,500	16.2	2,702	67.6
Broker/Agent	6,500	550	7,050	7,500	1,000	15.0	2,000	30.8
Wholesaler	7,500	1,000	8,500	9,000	1,500	6.0	450	6.0
Retailer	9,000	2,500	11,500	18,000	9,000	9.0	500	5.6
Restaurant	4,000	500	4,500	6,500	2,500	53.9	6,500	36.1
Total					16,702	100.0	2,702	67.6

The fish value chain exhibits uneven distribution of value addition and profit margins among its actors. Consequently, the recommendation is to optimize the fish value chain by enhancing the efficiency of wholesalers and processors through improved logistics, market access, and capacity-building programs to maximize value addition and ensure equitable profit distribution among all actors in the chain. The economic analysis of the fish value chain reveals a disproportionate distribution of value added and profit margins. Fishers and restaurants capture the largest shares of profit, indicating their significant roles in the initial production and final consumption stages, respectively. Intermediaries such as brokers, wholesalers, and retailers operate with considerably lower profit margins, suggesting potential inefficiencies or intense competition within these segments. The substantial value added by fishers highlights their critical contribution to the raw product, while restaurants add significant value through processing and service. To optimize the fish value chain, strategies should focus on enhancing the profitability and efficiency of intermediaries (brokers, wholesalers, and retailers) through improved logistics, reduced operating costs, and potentially better market access. Support for fishers to further process their catch could increase their value capture. Additionally, exploring opportunities to streamline the chain and reduce the number of intermediaries could lead to a more equitable distribution of profits and potentially lower prices for consumers, while maintaining fair returns for all actors. Investments in cold chain infrastructure and processing facilities could also enable higher value addition at earlier stages.

5. Challenges, constraints, solution and opportunities.

The fishery sector in Abyan governorate stands at a critical juncture, facing multifaceted challenges that impact its sustainability and efficiency. From preparation for fishing to distribution, the fishery value chain encounters numerous obstacles that hinder its growth and profitability. However, alongside these challenges lie significant opportunities for innovation, improvement, and growth. This section aims to explore the key challenges confronting fishers, the potential opportunities to enhance input supply and production processes, and proposed solutions to address these issues based on the findings presented in the study.

5.1 Challenges, Issues and constraints

The fishery value chain is subject to various challenges and constraints that affect its efficiency, profitability, and sustainability. Understanding these challenges is crucial for developing effective strategies to address them and enhance the overall performance of the fishery sector. This requires an in-depth analysis of the obstacles facing each stage of the value chain, from fish production to marketing, and identifying opportunities to improve processes and enhance sustainability and profitability in the fishery sector. Table 14 outlines the primary challenges encountered by fishermen in the study areas, detailing the frequency and percentage of respondents identifying each issue. A significant finding is the pervasive nature of high costs associated with fishing gear, cited by 18 respondents, representing 85% of the total. This indicates a substantial economic burden on fishermen, directly impacting their profitability and sustainability. Similarly, the lack of modern equipment and the high cost of fuel during transport are also critical concerns, each affecting 18 respondents (85% and 95% respectively), highlighting technological and logistical deficiencies within the fishing industry. The difficulty in providing collateral for loans and strict guarantee requirements are also prominent, with 90% and 66% of respondents, respectively, indicating financial access as a major hurdle. Furthermore, issues such as decreased fish productivity (90%), price fluctuations (80%), and the control exerted by traders and middlemen over prices (95%) underscore the volatile and often inequitable market conditions. The lack of storage facilities (95%) and the impact of bad weather (95%) further exacerbate the challenges, leading to significant post-harvest losses and operational disruptions. The weak capacity and skills of fishermen (95%) and inadequate infrastructure (roads, warehouses, transportation) (95%) point to systemic issues requiring comprehensive development interventions. Lastly, the difficulty in obtaining loans (80%) and high interest rates (70%) further restrict financial growth and investment opportunities for fishermen. The data from Table 14 reveals a multifaceted array of challenges confronting fishermen, encompassing economic, technological, logistical, environmental, and financial dimensions. The most prevalent issues revolve around high operational costs, lack of modern infrastructure and equipment, market volatility, and significant barriers to financial access. These interconnected problems collectively hinder the productivity, profitability, and overall sustainability of fishing communities.

Table 14: The key challenges that face fishermen in the study areas.

Variables	Frequency	Percentage%
High costs of fishing gear	18	85
Decreased fish productivity	15	70
Difficulty providing collateral	19	90
Use of traditional fishing techniques	16	75
Lack of modern equipment	16	75
High fuel costs	18	85
Lack of cooling during transport	20	95
Price fluctuations	17	80
Trader and middleman control over prices	20	95
Lack to storage facilities	20	95
Fish quality affected during transportation	16	75
Legal problems	3	15
Bad weather(climate)	20	95
Lack of financing and white loan	19	90
weak the fisher's capacity and skills	20	95
weak infrastructure (roads, warehouse, transportation, refrigerating)	20	95
Lack of transportation and storage	17	80
Difficulty obtaining loans	17	80
High interest rates	15	70
Strict guarantee requirements	14	66

To foster a more resilient and prosperous fishing sector, it is recommended that comprehensive interventions be implemented. These should include subsidies for fishing gear and fuel, investment in modern fishing technologies and cold storage facilities, and the development of robust financial mechanisms that offer accessible loans with reasonable interest rates and flexible collateral requirements. Additionally, initiatives aimed at enhancing fishermen's skills and capacity, alongside improving market access and regulating middlemen, are crucial for mitigating price volatility and ensuring fair compensation. Addressing these systemic challenges will contribute to improved livelihoods and sustainable resource management within the fishing communities. Figure 34 illustrates the primary weak links identified in the processing and value addition chain, cold storage, and specialized financing for the fishing industry. A striking observation is that 100% of respondents complain about unpredictable price fluctuations, indicating a severe lack of market stability and transparency. This is further compounded by the fact that 95% of traders rely solely on local markets for information, suggesting a limited reach and potential for exploitation. The lack of internet or modern information channels, affecting 95% of respondents, underscores a significant technological gap that impedes access to broader markets and real-time pricing data. Financial constraints are also highly prevalent, with 100% of institutions facing collateral difficulties and 95% of respondents reporting non-group loans being unavailable. This highlights a critical barrier to investment and expansion within the sector. Furthermore, 100% of cooperatives lack storage facilities, and 75% of traders request refrigerators, pointing to inadequate infrastructure for preserving catch and adding value. The inability to exit any manufactured products in the local market (100%) and consumers not getting processed products (100%) reveal a complete breakdown in the value chain, where raw materials are not effectively transformed into higher-value goods for consumers. Lastly, 95% of traders do not store fish, and 80% of

cooperative societies do not process, indicating a widespread lack of processing capabilities and a reliance on selling raw fish, which limits revenue potential.

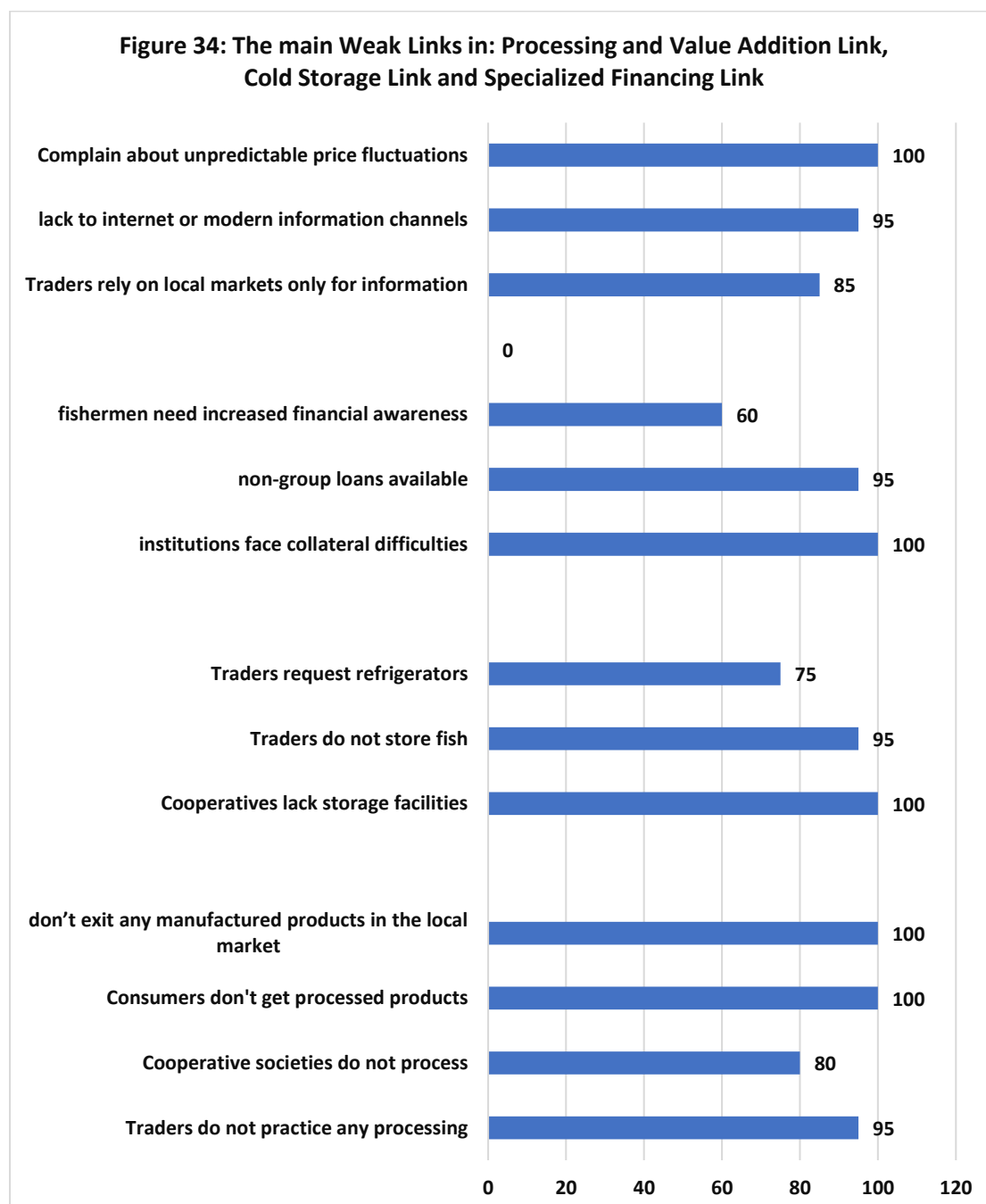


Figure 34 clearly delineates critical systemic weaknesses across the processing, value addition, cold storage, and financing aspects of the fishing industry. These include pervasive market instability, limited access to information and modern technology, significant financial barriers due to collateral requirements and lack of suitable loan products, and a severe deficit in storage and processing infrastructure. The cumulative effect is a fragmented value chain that prevents the creation of higher-value products and limits market access for both producers and consumers. To strengthen the processing and value addition chain, it is imperative to implement strategies that enhance market transparency and information dissemination, possibly through digital

platforms. Financial institutions should be encouraged to develop tailored loan products with flexible collateral requirements for the fishing sector. Urgent investment in modern cold storage facilities and processing units is needed, alongside training programs to equip fishermen and cooperatives with processing skills. Furthermore, policies should be enacted to facilitate the development of local markets for processed fish products, thereby creating a more integrated and profitable value chain.

5.2 Solution and Opportunities.

5.2.1 Proposed Solution

Based on the previous holistic study of data from all actors in the value chain, an integrated yet significantly imbalanced chain emerges, with major weaknesses in its fundamental links. This chain can be visualized as a connected path starting from the depths of the sea and ending on consumers' tables, yet it faces substantial obstacles midway through its journey. The journey begins with the fishermen, who represent the cornerstone of this chain. They organize themselves through cooperative societies, of which five major cooperatives were studied, comprising about 858 fishermen. These fishermen face two primary challenges: a lack of funding needed to upgrade fish equipment, and declining fish stocks due to traditional practices. Specialized microfinance institutions—five of which were studied—appear ready to support the sector, as all of them offer individual loans. However, they collide with a major obstacle: the fishermen's inability to provide sufficient collateral, a problem acknowledged by 80% of these institutions.

The next stage is aggregation and organization, where the cooperative societies act as intermediaries between the fishermen and the market. The paradox here is that these cooperatives focus all their efforts on marketing (100%) yet completely lack the most basic storage and preservation facilities. None of them possess refrigerators or cold storage, and none carry out any primary processing of the fish. This technological gap constitutes a real breaking point in the chain, as the fish begin to lose quality and value from the moment they leave the sea.

From the cooperatives, the fish move to wholesalers and retailers, twenty of whom were studied. These traders serve as primary distribution channels, buying from cooperatives (85%) and selling to end consumers (95%). However, they themselves suffer from the same dilemma: 95% lack adequate storage means, and 95% do not perform any processing or value addition. The result is a fragile distribution chain that relies on speed of sale before the product spoils, increasing waste and reducing added value.

At the end of the chain, we find the end consumer, whose opinions represent the true test of the entire system's quality. Among the fifty consumers studied, 100% suffer from high prices, 92% from poor quality, and 38% have completely stopped buying fish due to these problems. The vast majority (86%) buy from local markets, but 46% of them see these markets as unregulated and not providing safe products.

The most glaring missing links in this chain are storage and processing. While 75% of traders and 100% of cooperatives demand refrigeration storage, and 80% of cooperatives demand ice factories, the reality shows a vast gap between demand and

available facilities. This gap affects not only product quality but also the profit margin for fishermen and traders, and the consumers' ability to obtain a healthy product at a reasonable price.

Notably, all parties agree on the development priorities. While 75% of traders demand refrigeration storage, 100% of cooperatives demand the same. And while 80% of traders see high fuel costs as a fundamental problem, 40% of cooperatives demand financial support to face these costs. Even consumers agree with other links in demanding improved quality (92%) and lower prices 86%.

The real opportunity lies in transforming this broken chain into an integrated one. Starting with the storage link by providing refrigerators and cold storage for cooperatives and traders, then developing primary processing links such as cleaning, cutting, and packaging, and finally strengthening the connections between the links through information systems that provide data on prices, quality, and demand. Such a transformation will not only improve fishermen's income and product quality but will also restore consumer confidence and ensure the sector's long-term sustainability.

In conclusion, the fish value chain in the studied region resembles a chain with disconnected links, where each link operates in isolation and struggles with its own challenges. The key to repairing this chain is not strengthening certain links at the expense of others, but rather connecting these links through smart investments in infrastructure, technology, and information. This would turn the path from a sea of problems into a shore of opportunities for all. Table 15 identifies the appropriate techniques and assistance required to develop the fish business, as perceived by the respondents. The most frequently cited need is for developing coastal infrastructure, including ports and cold storage, with 19 respondents (90%) highlighting its importance. This aligns with the challenges identified in previous analyses regarding the lack of storage facilities and inadequate infrastructure. Providing financing opportunities and support through microloans is also crucial, with 18 respondents (85%) emphasizing this need, directly addressing the financial access barriers previously noted. Enhancing access to local and foreign markets is a priority for 17 respondents (80%), indicating a desire for broader market reach and reduced reliance on local middlemen. Improving sustainable fishing techniques is supported by 16 respondents (75%), reflecting an awareness of environmental concerns and the need for long-term resource management. Establishing strong cooperative associations (15 respondents, 70%) and training and capacity-building programs (14 respondents, 65%) are seen as vital for collective action, knowledge transfer, and skill development within the fishing communities. Opening export lines (9 respondents, 45%) is also considered important for expanding market opportunities. Fuel support (7 respondents, 35%) and strengthening cooperative associations (8 respondents, 40% and 5 respondents, 25% for different aspects) are also mentioned, though with lower percentages, suggesting they are important but perhaps not as universally critical as infrastructure and financing. Protecting fish stocks, while fundamental for sustainability, was cited by only 2 respondents (10%), which might indicate a lack of immediate awareness or prioritization among the respondents regarding this long-term issue.

Table 15: Appropriate techniques and assistances required to developed Fish business.

Variables	Frequency	Percentage%
Developing coastal infrastructure (ports, cold storage)	19	90
Providing financing opportunities and support through microloans	18	85
Enhancing access to local and foreign markets	17	80
Improving sustainable fishing techniques	16	75
Establishing strong cooperative associations	15	70
Training and capacity-building programs	14	65
Opening export lines	9	45
Fuel support	7	35
Strengthening cooperative associations	8	40
Strengthening cooperative associations	5	25
Protecting fish stocks	2	10

Table 15 underscores the critical need for comprehensive development strategies focusing on infrastructure, financial accessibility, market expansion, and capacity building. The highest priorities include the development of coastal infrastructure, provision of microloans, and improved market access. There is also a strong emphasis on sustainable fishing practices and the strengthening of cooperative structures to support collective growth and knowledge sharing. To foster significant development in the fish business, it is recommended to prioritize investment in modern coastal infrastructure, particularly cold storage and port facilities. Concurrently, financial institutions should be encouraged to expand microloan programs tailored to the needs of fishermen, ensuring accessible and affordable credit. Efforts should also focus on facilitating access to diverse local and international markets, coupled with training in sustainable fishing techniques and business management. Strengthening cooperative associations will empower fishermen, enabling them to collectively address challenges and leverage opportunities more effectively.

Figure 35, a pie chart, illustrates the extent of agreement among respondents on key suggestions aimed at improving fish marketing and pricing. The most significant suggestion, supported by 34% of respondents, is 'Breaking the monopoly of traders/middlemen'. This finding strongly correlates with the challenges identified in Table 14, where 'Trader and middleman control over prices' was cited by 95% of respondents as a major issue. This highlights a critical desire among fishermen to reduce the influence of intermediaries and achieve fairer pricing for their catch. Following this, 'Regulating markets and prices' garnered 27% of the agreement, further emphasizing the need for structured interventions to stabilize the market and ensure equitable returns for producers. 'Opening export lines' was supported by 21% of respondents, indicating an interest in diversifying market access and potentially securing better prices through international trade, aligning with the suggestion in Table 15 for enhancing access to foreign markets. Finally, 'Fair competition among traders'

received 18% of the agreement, which is intrinsically linked to breaking monopolies and regulating markets, as fair competition would naturally arise from such measures. The distribution of these responses underscores a collective aspiration for a more transparent, competitive, and equitable fish marketing and pricing system.

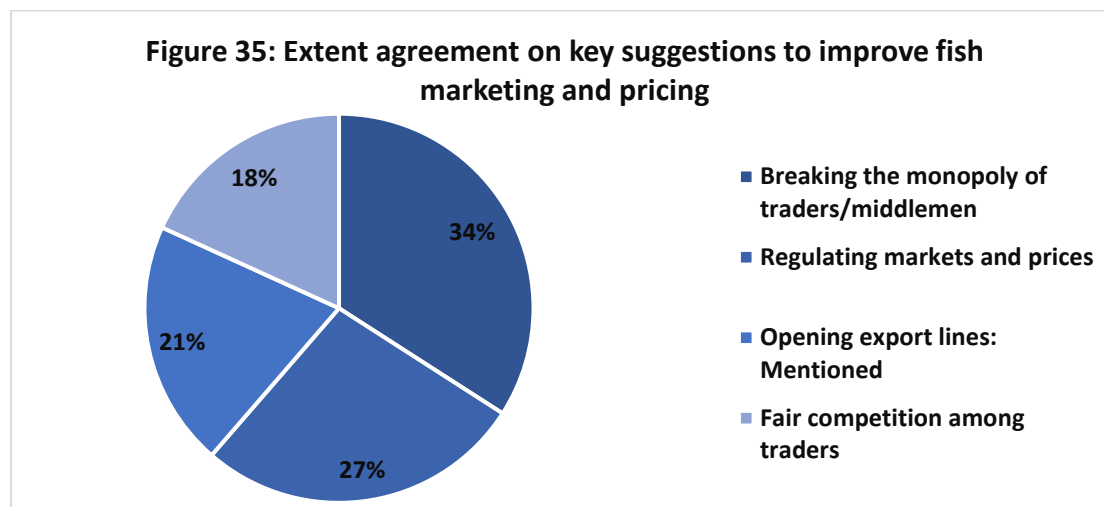


Figure 35 clearly indicates that the primary concern regarding fish marketing and pricing is the monopolistic control exerted by traders and middlemen. A substantial majority of respondents advocate for breaking these monopolies, regulating market prices, and fostering fair competition. There is also a notable interest in exploring export opportunities to improve market dynamics and pricing. To significantly enhance fish marketing and pricing, it is recommended that regulatory bodies implement policies aimed at dismantling monopolistic practices by traders and middlemen. This should be complemented by establishing transparent market mechanisms and price regulation frameworks to ensure fair compensation for fishermen. Furthermore, initiatives to facilitate the opening of new export markets should be pursued, providing fishermen with alternative sales channels and reducing their dependence on local intermediaries. Promoting fair competition through these measures will lead to a more robust and equitable marketing ecosystem for the fishing industry.

The comprehensive analysis of the challenges and opportunities within the fishing sector reveals a critical need for systemic reform. Fishermen face significant economic burdens due to high operational costs, exacerbated by a lack of modern equipment and inadequate infrastructure for storage and transportation. Financial access remains a major hurdle, with difficulties in obtaining loans and stringent collateral requirements. Market dynamics are heavily influenced by unpredictable price fluctuations and the monopolistic control of middlemen, leading to unstable and often unfair pricing. The value chain is further weakened by a severe lack of processing capabilities and limited access to broader markets. These interconnected issues collectively hinder productivity, profitability, and the sustainable development of fishing communities.

To foster a resilient, equitable, and sustainable fishing industry, a multi-pronged approach is essential. This includes strategic investments in modern coastal infrastructure, particularly cold storage and port facilities, coupled with financial reforms that ensure accessible and affordable microloans with flexible terms.

Regulatory frameworks must be established to break monopolistic practices, stabilize market prices, and promote fair competition among traders. Concurrently, efforts should focus on enhancing fishermen's skills through training and capacity-building programs, promoting sustainable fishing techniques, and facilitating access to diverse local and international markets. Strengthening cooperative associations will empower fishermen to collectively address challenges and leverage opportunities, ultimately leading to improved livelihoods and long-term environmental stewardship.

5.2.2 Strategic Proposed for Upgrading the Fisheries Value Chain

This section aims to present a comprehensive developmental vision for the fisheries sector, transitioning from a diagnostic of the current reality to the targeted model. To achieve this, the Current Value Chain (As-Is) has been analyzed in Figure 26, revealing logistical and technical gaps that limit economic returns and impact consumer satisfaction. In contrast, **a proposed Value Chain Upgrading Model in figure 36** has been designed, adopting radical solutions such as specialized financing, cold chain infrastructure, and value-added manufacturing processes. The visual comparison between the two models not only highlights existing challenges but also outlines a clear roadmap to bridge operational gaps, transforming the sector into a sustainable economic driver that meets consumer expectations and fulfills the highest quality standards.

Based on the established sequence, the fisheries value chain can be interpreted as an integrated journey that begins from the sea and culminates in consumer satisfaction. Each link in this chain contributes significantly to enhancing product quality and increasing its economic value.

1. Foundation and Support Phase (Fishermen & Financing)

The chain begins with the fishermen, who represent the cornerstone of the industry. To operate efficiently, they require specialized financing that enables them to acquire modern vessels and sustainable fishing gear, ensuring a high-quality flow of raw materials (fish) from the very first moment.

2. Logistics and Organization (Associations & Infrastructure)

Following the catch, the role of fisheries associations emerges to organize the efforts of the fishermen. This phase focuses on "Value Preservation" by providing cold chain solutions (storage and refrigeration) to prevent spoilage. This is accompanied by continuous training for human resources on professional best practices to ensure the proper handling of the catch.

3. Industrial Transformation (Processing & Value Addition)

At this stage, the product transitions from its raw state to a higher-value product. Within processing centers, fish are sorted and cleaned, followed by value-addition operations. Transitioning from selling raw products to manufacturing, these include manufacturing such as canning, premium packaging and luxury packaging and investing in modern technology and infrastructure for processing fish waste into organic fertilizers. within specialized processing centers to increase sector income and open new markets through production of fish derivatives which opens new markets and increases sector revenue.

FISHERIES VALUE CHAIN

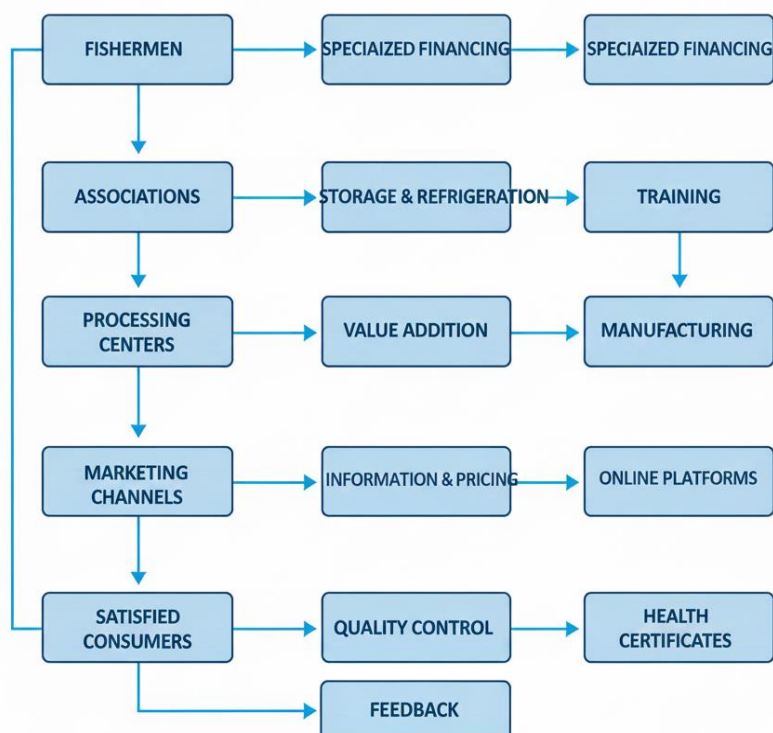


Figure 36: Proposed Fish Value Chain Upgrading Model.

4. Marketing and Digital Intelligence (Information & Platforms)

The chain is incomplete without smart marketing channels. This phase relies on providing accurate information and pricing to ensure transparency and prevent monopolies. This is facilitated through digital platforms that connect producers to the wholesale and retail sectors with high speed and efficiency.

5. Trust and Quality (Points of Sale & Health Standards)

As the product reaches points of sale (markets and retail stores), the focus shifts to gaining consumer trust. This is achieved through rigorous quality control measures and obtaining the necessary health certifications that guarantee food safety and compliance with both local and international standards.

6. The Concluding Loop (Consumers & Sustainability)

The chain concludes with satisfied consumers who have received a high-quality product. However, the relationship does not end there; a new cycle begins through "Feedback". Consumer insights are utilized to develop the preceding stages and improve performance, ensuring the overall sustainability and growth of the value chain.

6. Overall Conclusions and Recommendations

According to the results of this assessment, the main finding can be concluded as the following key point:

6.1 Key Conclusions

The Fish value chain Abyan Governorates demonstrates clear relevance for livelihood resilience, income generation, and local economic recovery in a highly fragile context. The analysis confirms that Fish remains one of the few viable agricultural activities accessible to small-scale rural households, requiring limited land and capital while providing opportunities for income diversification.

6.1.1 Actor Profile and Production Characteristics:

1. Demographics:

- Male dominance: 100% of fishermen are male, reflecting limited female participation in fishing.
- Low educational level: 38% of fishermen have only secondary education, and 5% are illiterate, hindering the adoption of modern practices.
- Aging workforce: 62% of fishermen are over 41 years old, with weak youth participation (only 19%).
- Diverse income sources: 95% rely on fishing as the primary source of income, with secondary activities such as animal husbandry (52%) and beekeeping (42%).

2. Production and Technical Practices

- Dominance of traditional methods: 76% use traditional fishing nets, with limited adoption of modern technologies.
- Weak storage infrastructure: 100% of fishermen sell their catch immediately without storage, and none use refrigeration.
- Lack of fish processing: 95% do not perform any primary processing, resulting in lost added value.
- Concentration on specific species: 47% of fishing focuses on Indian mackerel, indicating a risk of overexploitation.

3. The Enabling Environment – Critical Constraints:

- Limited access to finance: 90% of fishermen face difficulties in providing collateral to obtain loans.
- Absence of formal training: 100% have not received formal training, and 100% need it.
- Weak infrastructure: 95% of cooperatives lack cold storage units.
- Dominance of intermediaries: 95% of fishermen indicate that traders and intermediaries control prices.

4. Value Chain Mapping and Performance:

The chain consists of six stages, Pre-fishing, Production, Collection, Distribution, Export, and Consumption. Mapping revealed critical logistical gaps; 100% of cooperative societies lack refrigeration facilities, and 95% of fishermen perform no

processing, leading to immediate value loss after the catch. The fish value chain in Abyan has significant potential for achieving food security and creating jobs, but it faces acute structural challenges that require integrated interventions. Success depends on linking the chain's stages (fishermen, cooperatives, markets) through smart investments in infrastructure, technology, and finance, while ensuring fair participation for women and youth.

5. Markets and Consumption

- High prices: 100% of consumers perceive fish prices as high.
- Weak marketing channels: 41% of sales are made through the local market only, with dominance of intermediaries.
- Limited geographical distribution: Marketing activities are concentrated in specific markets (e.g., Al-Ko'd/Khanfar market, 40%).

6. Economic Analysis and Value Added

- Uneven profit margins: Fishermen achieve a 67% profit margin, while retailers achieve only 1.7%.
- Loss of value added: Most profit goes to fishermen and restaurants, with weak value added in intermediate stages.
- High operational costs: Fuel and equipment costs account for 85% of fishermen's challenges.

6.2 Key Recommendations

Based on the evidence and analysis presented in this report, the following recommendations are proposed to strengthen the Fish value chain in Abyan:

1. Enhancing Infrastructure and Storage

- Establishing cold storage units at landing sites and cooperatives.
- Providing insulated boxes for fish transportation to maintain quality.
- Developing coastal infrastructure (ports, storage facilities).

2. Improving Access to Finance and Training

- Designing specialized financing programs for fishermen with flexible collateral and grace periods.
- Implementing comprehensive training programs covering engine maintenance, primary processing, maritime safety, and financial management.
- Enhancing financial inclusion through microfinance institutions.

3. Developing Cooperatives and Enhancing Participation

- Supporting cooperatives to provide storage, marketing, and training services.
- Encouraging women's and youth participation in post-harvest activities (processing, packaging, marketing).
- Creating digital platforms to connect fishermen directly with local and international markets.

4. Diversifying Products and Enhancing Value Added

- Training fishermen on primary processing operations (cleaning, cutting, drying, smoking).
- Encouraging the production of value-added products such as canned or frozen fish.
- Utilizing fish waste in producing organic fertilizers.

5. Improving Market Efficiency and Reducing Intermediary Dominance

- Regulating pricing mechanisms and setting reasonable price ceilings.
- Supporting direct sales channels from fishermen to consumers.
- Opening new export lines to reduce dependence on the local market.

6. Enhancing Environmental Sustainability and Management

- Implementing sustainable fishing practices to conserve fish stocks.
- Monitoring and regulating fishing seasons to protect endangered species.
- Raising awareness among fishermen about the impact of overfishing on biodiversity.

7. Enhancing Governance and Institutional Integration

- Strengthening coordination between the Ministry of Fisheries, cooperatives, and financial institutions.
- Establishing an information system to monitor market prices and product flows.
- Adopting quality and health certifications to facilitate access to international markets.

6.3 Strategic Recommendations for Upgrading the Fish Value Chain

1 .Support for Establishment and Financial Capacity: Providing specialized financial solutions that enable fishermen to own modern boats and sustainable fishing gear to ensure the quality of raw materials from the start.

2 .Development of Logistical Infrastructure: Activating the role of associations in providing cold storage units (cold chain) to prevent spoilage, along with continuous training of personnel on best practices.

3 .Maximizing Value Added: Transitioning from selling raw products to manufacturing (such as canning and luxury packaging) and investing in modern technology and infrastructure for processing fish waste into organic fertilizers. within specialized processing centers to increase sector income and open new markets

4 .Digital Transformation and Market Transparency: Establishing electronic platforms that provide accurate price information to ensure transparency, prevent monopolies, and efficiently connect producers with retail sectors.

5 .Quality Assurance and Health Safety: Strengthening quality control measures at points of sale and obtaining global health certifications to ensure food safety and compliance with international standards.

6 - Sustainability of Consumer Relationships: Building an integrated feedback system to convert consumer opinions into a driver for developing previous stages and improving the overall performance of the chain.

7. Governance and Institutional Interconnectivity: Enhancing the linkage between all stages of the chain (from fishermen to consumers) to ensure value flow and fair distribution of economic **returns**.

7. Documentation



During Data Collection using survey with the fishermen in Abyan



During Data Collection Using Survey With Consumers



**During Data Collection Using Survey with
Cooperative Associations**

8. Annexes



Fishery Value Chain
Analysis Survey.pdf



Actors in the Fish
Value Chain.pdf