Funded by the European Union

Fish Value Chain Analysis

in Ash Shihr District - Hadhramaut - Yemen

Implemented by the Small and Micro Enterprise Promotion Service (SMEPS)

With the United Nations Development Programme (UNDP) in Yemen

Funded by the European Union (EU)

2022

SIERY Strengthening Institutional and Economic Resilience in Yemen
مشروع تعزيز المرونة المؤسسية والإقتصادية في اليمن

Fish Value Chain Analysis

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Implemented by the Small and Micro Enterprise Promotion Service (SMEPS)

With the United Nations Development Programme (UNDP) in Yemen

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Note:

Due to weak internet connection in the study area, data was collected using ODK - an electronic data collection platform - using smartphones & without need of the internet connection. Data collected uploaded instantly with an available internet connection. SurveyCTO site was used to store the data.

A photo showing the data collection process through the SurveyCTO application

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Saleem Ali Al-Jaradi
R&D Supervisor
SMEPS

Abbreviations

Symbol	Expression
EU	European Union
FGDs	Focus Group Discussions
kg	kilogram
km	kilometer
m	meter
PESTLE	Political, Economic, Technological-Technical, Social, Legal, and Environmental
SIERY	Strengthening Institutional and Economic Resilience in Yemen
SMEPS	Small and Micro Enterprise Promotion Service
SWOT	Strengths, Weaknesses, Opportunities, and Threats
Ton	Ton (1000 kg)
UNDP	United Nations Development Programme
USD	United States Dollar
[1]YR	Yemeni Riyal

Definitions of Key Terms

Term	Symbol	Definition
Value chain	**VC**	The value chain (VC) is a set of activities and procedures related to each other and necessary to convert the primary resources used (inputs) into products or services (outputs), which in turn go through different stages of production to give the product added value until the latter reaches the final consumer in the chain (Porter, 1985).
Value chain players	**VCA**	Value chain players, value chain actors, or value chain workers are all terms with the same meaning.
Supply Dealers	**---**	Supply dealers are suppliers of input supplies and other products/ needs/ services of chain producers.
Producers	**---**	The producers in this study are the fishermen.
Aggregate Retailers	**---**	Aggregate retailers are traders who buy products (fish) and sell them in retail quantities without any processing to convert them to other products.
Aggregator Wholesalers	**---**	Aggregator wholesalers are traders who buy products (fish) and sell them in undivided quantities and without any processing to convert them into consumable products.
Processing Retailers	**---**	Processing retailers are traders who buy products (fish) and sell them in retail quantities and process them to convert them into other products.
Wholesalers & Retailers Processors	**---**	Wholesalers and retailers are traders who buy products (fish) and sell them in both small and large quantities, processing them to transform them into consumable products.
Enablers	**---**	Enablers are the authorized entities with the power to make decisions and formulate laws and regulations for the sector.
Supporters	**---**	Supporters are entities that seek to support the sector.
Full-Time Employment	**FTE**	The number of jobs during the year where these jobs are 8 hours per day, 26 days per month, and 12 months per year, that is, a total of 312 working days during the year.
SWOT Analysis	**SWOT**	SWOT analysis is a cognitive process that examines the interrelationships between the internal and external environments of the sector or project, where SWOT analysis is based on a mixed (subjective-objective) evaluation of strengths, weaknesses, opportunities and threats (Ghazinoory, Abdi, & Azadegan-Mehr, 2011; Amato, Andreoli, & Rovai, 2021).
PESTLE Analysis	**PESTLE**	PESTLE analysis is a common research tool used to analyze and classify Political (P), Economic (E), Social (S), Technological (T), Legal (L), and Environmental (E) issues (Rastogi & Trivedi, 2016; Song, Sun, & Jin, 2017).

[1] The dollar rate according to the study area was 1,100 YR in March 2022.

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Executive Summary

This report reflects the results of a value chain study and analysis of the fisheries sector in Ash Shihr District, Hadhramaut Governorate, Yemen in 2022. The study was implemented by the Small and Micro Enterprise Promotion Service (SMEPS) with the United Nations Development Programme (UNDP) in Yemen in March 2022 and funded by the European Union (EU).

The study was conducted through collection of primary data from the target area through key informant interviews and focus group discussions; where several interviews and workshops were conducted with multiple stakeholders and value chain actors including input suppliers, producers, traders, consumers, companies, local authorities and other relevant authorities.

The study is divided into four main parts: -

- Background and Overview Section
- Study Methodology
- Findings
- Development Strategy

Key Findings:

The study outcomes analyze seven stages of the fish value chain in Ash Shihr District as shown in the figure below, starting from the input supplies through to the consumption phase.

The SWOT analysis of the sector shows that the main sector's strength lies within its ability meet market demand of local fish consumption, proximity of input sources and meeting minimum market quality. The opportunities for growth in the sector are the increase in demand for fish in other local markets. The main sector weaknesses are a lack of available information, market research on the sector and weakening purchasing power specifically to procure main input supplies including fuel/oil for small producers & supply chain enablers. The threats include currency inflation, increase taxes & tariffs, prolonged conflict & piracy.

Furthermore, findings of the study shows that there is a broad commercial activity in the fish sector. The analysis of the value chain players' map shows that there are seven different commercial channels starting from producers and ending with consumers, with a complex exchange network between traders, processors, and exporters. It is also noticeable that there is significant activity for processors in this sector, which is a natural result of the product's nature, where there are different ways of processing and various types of fish and aquaculture.

The study revealed that input suppliers are divided into several categories according to the type of inputs they sell, such as boat factories, fuel dealers, fishing equipment traders and ice factories - who deal directly with fishermen to provide them with the supplies needed for their fishing operations. Fishermen distribute their production in six main channels with the largest channel in terms of flow and price per kilogram was direct sales from fishermen to wholesale and processing traders (factory owners and companies) by about 30% of the production quantity and at a price of YR. 5,478[2] per kilogram. It is worth mentioning that some of the traders also target factories and companies by marketing to them as aggregate wholesalers and cooperative societies (trading as a wholesaler), and the aggregate retailers distribute some of their products to factories and companies. There are also other marketing channels between the players in the chain, such as retail traders who have additional four marketing channels.

The fisheries sector is significantly regulated by local authorities and supporting organizations. Fisheries Cooperative Associations and the Governorate Fisheries Authority regulate the marketing process in fish landing centers through public auctions to sell fishermen's product; in addition to other services provided by associations to their members such as micro loans, inputs and other support. The Fisheries Authority regulates fishermen's activity by conducting studies and issuing laws that support the continuity of fishing and preserve fish resources in cooperation with other supporting authorities represented by the Marine Sciences Authority, the Ministry of Fisheries Wealth, and local authorities.

The labor force in the fish sector is evident starting from the input supply stages, with a noticeable number of female labors, whether permanent or temporary. Labor in the sector is effective throughout the chain players including within the supply chain specifically in fish processing in companies and factories, with ability to deal with technologies that increase the product quality and value, as well as extending the product's lifespan. This creates a competitive advantage

2 The dollar rate according to the study area was 1,100 Yemeni riyals in March 2022.

for this product, which leads to the formation of skilled labor with high knowledge and skills that play a fundamental role in developing this vital sector.

The study revealed that one of the main problems and obstacles facing all players in the fish value chain in the Ash Shihr district is the high prices and scarcity of oil derivatives, which is due to the lifting of government subsidies on oil derivatives. There are also other problems at every stage of the value chain, such as price fluctuations, increased taxes on input suppliers, piracy, reduced production by fishermen, increased taxes and conflicts among traders, processors, and exporters, who are between the producer and the consumer, as well as the high price of the product and monopolizing sales to consumers or the market, and finally, the lack of expertise and available resources at enabling and supporting entities.

It is also worth to note that that the most significant problems, according to PESTLE classification, were economic, then institutional, then technological - which do not provide an attractive work environment for investors and which does not help to revive the fisheries sector. Most of the players in the value chain agreed that the government is primarily responsible for improving, supporting, and regulating the fish sector in the Ash Shihr district.

Finally, as recommendations for the study, the fish sector in the Ash Shihr District needs to improve production processes by using technologies that reduce fuel consumption and reduce the amount of wasted fish products. It also needs to increase the fish catch volume and improve health, environmental, and personal hygiene conditions during product handling. Proposed interventions in this area include providing refrigerators, cooling and freezing storage, refrigerated trucks, transportation, and training workers in the fishing industry on the environmental requirements that must be provided at all stages of production, marketing, and consumption of fish products.

Additionally, the players in the fish sector, in general, need training in modern technologies and capacity building in the areas of fish preservation, transportation & storage, and the development of a unified market policy in all fish landing centers and with all players in the value chain. Networking among players is also essential to ensure the increase of their productivity and profits.

Background and Overview

This section includes a preface to the project and value chain analysis, and then an introduction and objective of the study

Forward and Preface

In order to develop a number of vital economic sectors in Yemen, the United Nations Development Programme (UNDP), with funding from the European Union, worked on implementing the Strengthening Institutional and Economic Resilience (SIERY) project with a group of local partners. The project aims to strengthen institutional and economic resilience through a value chain approach. The project began implementation at the beginning of 2022 in the governorates of Hadhramaut, Aden, Sana'a, and Hodeida, in a number of different and important sectors in each governorate.

The United Nations Development Programme (UNDP) organized workshops in collaboration with a number of organizations and local implementing partners to involve local authorities, the private sector, associations, unions, and other stakeholders in all targeted directorates of the project in selecting priority economic sectors. The workshops discussed the nominated sectors from the communities and identified the priorities that the project will work on developing. From the outcomes of these workshops, the targeted sectors were selected.

The Small and Micro Enterprise Promotion Service (SMEPS)[3] role in the project is working to enhance the selected economic sectors in each target areas, according to the selection of the sectors by several actors in the target locations. The agency's main role is to first, conduct a detailed value chain study of the selected economic sector in the target area, and provide the needed technical and financial support to the chain actors based on the value addition and gaps. In particular, the agency's role include:

- Support smallholder producers in the selected value chains to overcome the constraints they face in increasing production, productivity, and income, thus improving their livelihoods. In addition, smallholder producers will be supported using the "poverty markets" approach, which will enable them to access markets and financial services by facilitating linkages and encouraging their roles in the market.
- Fill gaps within the selected value chains by strengthening linkages between producers, smallholder farmers, supply chain enablers, and markets, including SMEs and large business associations.

After selecting the targeted economic sectors for the project, the Research and Development team at SMEPS began implementing value chain studies for the identified sectors in each district to determine intervention priorities in these sectors and assist local authorities in developing plans that contribute to the development of the studied areas. The studies were carried out by teams consisting of SMEPS employees, sector experts and technicians. The teams used survey forms specific to the study for each stakeholder along the value chain. The survey process was conducted through individual meetings & focus group discussions with selected samples from all stages of the value chain.

3 The Small and Micro Enterprise Promotion Service, a Social Fund for Development subsidiary, was established in 2006. Its mission is to provide business development services through innovative and creative projects that help the growth of various economic sectors, following a business development approach, value chain analysis, and entrepreneurship. Under the current situation, SMEPS has been implementing emergency projects that aim to assist vital economic sectors to continue providing services to the community (agriculture, coffee, fish, honey, livestock, and health) using the same development approach.

Concepts in the Study

The recent global focus on cost reduction has led to the introduction of suitable methods to achieve this goal under competitive pressure and in the pursuit of excellence. In this context, value chain analysis has emerged as one of the methods for cost reduction due to its advantages in distinguishing between value-adding activities and those that do not add value. With this distinction, it has become possible to identify areas of improvement and places of excellence to enhance them (Omar, 2010). Understanding the value chain of goods & services is important for planning and implementing program interventions, which allows individuals to contribute to the comprehensive economic development of sectors & country strategies. It is useful to understand the relationship between producers, suppliers, transporters and traders.

Value Chain Definition

In 1985[4] Porter introduced the concept of value chain (VC) as a set of interrelated activities and procedures necessary for transforming the primary resources used (inputs) into products or services (outputs), which pass through various production stages to add value until they reach the final consumer in the chain (Porter, 1985). The United Nations Industrial Development Organization (UNIDO) describes the value chain as a complete set of activities necessary to prepare a product that passes through various stages of production, from the initial inputs to the final destination in the market (The UNIDO Approach, 2009). Stabell & Fjeldstad, (1998), go further to propose that value chain analysis should evolve into value components analysis. They defined the value chain as an approach to analyzing the competitive advantage at the enterprise level based on three value-creating technologies and logic, in addition to the value chain. They also added two other value formations: value shop and value network. All three of the above formations are based on the logic of value creation. The value chain relies on transforming inputs into products; the value shop revolves around customer problems and solutions; and the value network is based on connecting customers.

Therefore, the actors in the value chain who are responsible for transporting materials and/or information and/or services share an interest in the final product because changes in the final market affect all players in the chain. Value chain can also be defined as the relationship established between different players in the chain with the aim of adding value and sharing the risks associated with each stage of the product flow, from the production stage to its final consumption. In general, the value chain includes input suppliers, producers, traders, distributors, processors, and final consumers. Partners within the value chain work together to determine their best goals, willing to share risks and profits, and efficiently utilizing time, energy, and resources (UNDP, 2016).

Al-Falouji (2016) summarizes that the value chain is a set of multiple activities that work to prepare a product or service from its early stages in the chain (the product) and through its other stages in the production chain until it reaches the final consumer. The value chain is an analytical tool that links all steps and activities together, including inputs, production, processing, and distribution. Each step is analyzed with the previous and subsequent steps, and the value chain also works

[4] (Michael Eugene Porter) Professor at Harvard Business School, University of Bishop William Louise.

to enhance strengths, address potential weaknesses, avoid threats and exploit possible opportunities using a SWOT analysis tool. This contributes to ensuring the continuity and sustainability of businesses or projects while being able to adapt to current economic conditions. Therefore, the value chain is considered a working methodology for analyzing strengths, weaknesses, and competitiveness at the organizational and production levels. The value chain should be classified into its strategic components to better understand the impact of each component on cost and value.

Value Chain Goals

There are several objectives for studying the value chain as stated by Gereffi, (1999), Omar, (2010) and Zaghloul (2003), which can be summarized as follows:

- Increase value and enhance competitiveness in the labor market for players and value chain establishments.
- Increase benefits for value chain players through the division and organization of integrated activities between value chain players in a sequential and functionally and logically interconnected manner, and providing products or services with a competitive advantage for the end consumer in the value chain
- Develop a joint mechanism for work between value chain players, which in turn will help in decision-making, policy and strategy development, organizing production processes, and using information technology to provide products and services that meet consumer needs.
- Distinguish between value-adding activities (and enhance them) and non-value-adding activities to address them in the value chain.
- Use resources efficiently.

Importance of Value Chain Analysis

The importance of analyzing the value chain lies in identifying the best interventions to enable small producers and other players in the chain to overcome production and food shortages, as well as poverty. This helps improve their income level and continue to develop their businesses. The importance of analyzing the value chain can be summarized as follows, as stated by Ronald (1981) and Omar (2010):

- Generate opportunities and ideas for developing the player in the chain by diversifying products, improving their quality and reducing costs.
- Determine and identify the costs in the supply chain.
- Helping reduce operational cost.
- Helping in arranging performance.
- Identify opportunities for business development.
- Help identify performance indicators for management information systems within the organization.
- Helping improve taking decisions.

It is worth noting that poverty can be reduced through enhancing production by developing value chains. This works to increase the prices of producers and players in the chain, establish strong and inclusive organizations for producers

(cooperatives), effectively reach the most vulnerable groups such as women and lower prices for consumers by improving the efficiency of these chains.

Definition of Value Chain Mapping

Planning the value chain is a central element in the analysis of the value chain. It is used to show the flow of transactions from raw material and input sources to production, processing, marketing and final sale. The maps can also illustrate costs and value added at each stage, critical constraints, and the relative influence of players along the value chain (UNDP, 2016).

Value chain maps provide an easy way to understand the processes and paths leading to production and sales by simplifying the complexities of the industry sector and its value chain. They are particularly useful for analyzing value chains and researching them to determine how they are performing, how they can be improved, or how they can be refined. The maps align sectors and participants and produce a common picture not only of what the industry or sector is doing but also of how it could look. They can also be developed collaboratively to enhance a shared perspective among all participants or some of them. This can be of utmost importance for the ability of concerned companies to innovate, or for them or the sector to develop or improve the value chain (Economic development board, 2015).

1.1 Background Information

1.1.1 Overview of the SIERY Project

The Strengthening Institutional and Economic Resilience in Yemen (SIERY) project aims to improve productivity and resilience in promising value chains, create job opportunities, improve livelihoods, and enhance food security and household nutrition. The SIERY project - Strengthening Economic and Institutional Resilience in Yemen - aims to improve productivity and resilience in promising value chains, create job opportunities, and improve livelihoods and food security, and family nutrition. This follows the project's theory of change, which assumes that if value chains are improved, livelihoods will be improved through job creation, increased income, as well as production and productivity.

This follows the project's theory of change which assumes that if value chains are improved, livelihoods will improve through job creation, increased income, as well as production and productivity.

Therefore, targeted companies and associations will become more resilient and able to effectively deal with the fragile economic context and continue to provide vital commodities related to food security. In addition, communities will be more resilient and able to effectively deal with low levels of food security, decreased health services, low levels of nutrition, and increased poverty, and thus be strong drivers towards recovery and peace building efforts.

The project aims to implement the economic resilience project to strengthen vital value chains in the Yemeni economy, with the main objective of enhancing food security, improving access to health, and creating job opportunities.

The grant will help implement a value chain development approach to support the resilience of micro, small and medium-sized enterprises in selected value chains in the targeted areas, to assist communities, households, SMEs, and the

vulnerable to access the basic building blocks for early recovery, sustainable livelihoods, and improved access to food and health. Therefore, the targeted companies and associations will be more flexible and will be able to deal effectively with the context of fragility and continue to provide vital commodities related to food security. In addition, societies will be more resilient and will be able to deal effectively with current food insecurity, health and nutrition, and poverty, and will be powerful drivers of recovery and peacebuilding efforts.

The project aims to implement the Economic Resilience Project to strengthen the vital value chains of the Yemeni economy, with the main objective of enhancing food security, access to health, and job creation.

The grant will help implement a value chain development approach to support the resilience of Micro, Small, and medium enterprises in selected value chains, and in the same target areas, to help provide communities, families, and vulnerable SMEs with the building blocks to move toward early recovery and sustainable livelihoods and enhance their access to food and health.

1.1.2 The Objective of the Study

Based on the project document, the objective of the study is to assist in conducting primary value chain studies for the targeted sector in order to identify gaps and potential economic opportunities and to identify key players in the chains that require support.

This study will also help in selecting business intermediaries (possible supply chain enablers), small and medium-sized enterprises, innovative businesses, microfinance institutions, markets, and market players such as input suppliers, microfinance institutions, business consultants, and small producers to be targeted by the project.

The study will be conducted by the Research and Development Unit at SMEPS. The studies will cover the targeted areas of intervention with the involvement of stakeholders participating. in the chains, particularly chambers of commerce and local authorities.

Based on the project document, the objective of the study will help in conducting initial value chain studies for the target sector to identify economic gaps, opportunities, and the main players in the chains to be supported.

This study will also assist in the selection of business intermediaries (supply chain enablers), SMEs, entrepreneurship companies, MFIs, markets, and market players such as input supply traders, microfinance institutions, business consultants, and small producers to be targeted in the project.

The study will be conducted by the Research and Development Unit at SMEPS. The studies will cover the targeted areas of intervention with the involvement of stakeholders involved in the chains, particularly chambers of commerce and local authorities.

Importance of Fish Commodity

Fish is one of the most important and prominent food commodities, and remains one of the most traded food commodities worldwide. Studies have shown that from 1990 to 2018, there was a 14% increase in global natural fishery production, a 527% increase in global aquaculture production, and a 122% increase in total fish food consumption (FAO, 2022). Recently, aquaculture has become the fastest growing food production industry in the world. Aquaculture has provided more fish for human consumption than natural fishery, and by 2030, estimates suggest that 60% of the fish consumed by humans will come from aquaculture (FAO, 2022).

According to the Food and Agriculture Organization (FAO, 2020), total global natural fishery production reached an all-time high in 2018 of 96.4 million tons - an increase of 5.4% compared to the average of the previous three years. From a health and livelihood perspective, fish taken from inland fisheries are among the most consumed foods and traded commodities in the world, contributing significantly to livelihoods, food security, and health (Béné, 2016).

The areas that rely most on fishery resources are developing countries. FAO estimates that 120 million people depend on fisheries for their livelihoods, almost 97% of them in developing countries, and more than 90% are involved in small-scale fisheries (FAO, 2022). Most of the fish consumed in the world is traditionally caught from natural marine areas or inland waters such as lakes, rivers and dams (Belton & Thilsted, 2014), and over half of the world's fish catch is obtained through small-scale fisheries, where 90-95% of the catch is consumed locally (FAO, 2022). Fish and other marine and plant species are an integral part of human economies, cultures, and health. Here, we refer to those species collectively as "seafood" and include freshwater and marine species, especially those caught in commercial fisheries or produced through aquaculture.

Fish are highly valued for their health benefits, as fish oils contain a high level of omega-3 fatty acids, especially alpha-linolenic acid, eicosatetraenoic acid (EPA), and docosahexaenoic acid (DHA). Omega-3 fatty acids have many beneficial effects on human health, including reducing the risk of myocardial infarction, lowering blood pressure and triglyceride levels (Harris, 1997). They also protect against various mental disorders, depression, and ADHD in particular. Fish and their products are excellent sources of high-quality protein. The biological availability of fish protein increases by approximately 5-15% compared to plant sources. Fish also contain all the essential amino acids needed for human health (FAO, 2022).

Table no.1 The global employment of fishermen and fish farmers by region (numbers in thousands) Data source. (FAO, 2022)

Area	1995	2000	2005	2010	2015	2018
Africa	2,812	3,348	3,925	4,483	5,067	5,407
(North and South America)	2,072	2,239	2,254	2,898	3,193	2,843
Asia	31,632	40,434	44,716	49,427	49,969	50,385
Europe	476	783	658	648	453	402
Oceania	466	459	466	473	479	473
Total	**37,456**	**47,263**	**52,019**	**57,930**	**59,161**	**59,509**

As shown in the above data, most of the employment opportunities for fishermen and fish farmers are in Asia, where there has been a significant increase of nearly 59%, from 31,632 in 1995 to 50,385 in 2018.

Global General Statistics (FAO, 2022)

- In 2018, an estimated 59.5 million people were engaged in the primary sector of fishing and aquaculture, with approximately 20.5 million working in aquaculture and 39.0 million in fishing, a slight increase from 2016. FAO figures indicate that women represented only 14% of the 59.5 million people employed in the primary sector of fishing and aquaculture in 2018.
- In 2018, around 88% of the total fish production of 179 million tons was used for direct human consumption. The remaining 12% was used for non-food purposes.
- From 1961 to 2017, the average annual growth rate of total fish food consumption increased by 3.1%, exceeding the annual population growth rate of 1.6%.
- In terms of per capita consumption, fish food consumption increased from 9.0 kg (live weight equivalent) in 1961 to 20.3 kg in 2017. Preliminary estimates for per capita fish consumption for 2018 are currently 20.5 kg.
- Fish and fishery products are among the most traded food commodities in the world. Therefore, it is not surprising that in 2018, 67 million tonnes (live weight equivalent) of fish were traded internationally, with a total export value of USD 164 billion. This is equivalent to almost 38% of all fish caught or farmed worldwide.

Expectations (FAO, 2022)

- Total fish production is expected to expand from 179 million tons in 2018 to 204 million tons in 2030.
- Aquaculture production is expected to reach 109 million tons in 2030, an increase of 32% (26 million tons) over 2018.

Fisheries Sector in Yemen

Yemen is located in the southwestern corner of the Arabian Peninsula and is bordered by 2,520 km of coastal strip along the Red Sea, the Gulf of Aden, and the Arabian Sea. Fisheries is one of the promising sectors for social and economic development in Yemen, ranking second in Yemen's exports before the conflict and contributing 2% to the country's Gross Domestic Product (GDP) (UNDP and IFAD, 2012). Yemen's coastal waters are characterized by a high level of fish production, making it a significant feeding and nursery area for marine species with more than 600 commercial species of fish and marine organisms recently registered. Yemen has been classified as a major regional fish producer, representing more than 50% of fish production and exports across the Red Sea and the Gulf of Aden (Scaling Up Nutrition, 2019). Furthermore, the fisheries sector provides job opportunities for more than half a million people, playing a significant role in boosting Yemen's economy.

However, since the conflict in 2015, the fisheries sector has deteriorated significantly due to the limited access of fishermen to the sea, the high cost and scarcity of fuel for boats and generators, and the destruction of basic fishing equipment. This also affected the decline in exports and revenues from exported fish due to the closure of maritime ports and instability of exchange rates (Middle East Centre, 2018).

The statistical report issued by the Yemeni Cooperative Fishery Union shows that the percentage increase in production between 2009-2019 was about 0.50%, with an average fish production of 198,305 thousand tons. The fisheries sector was significantly affected between 2013-2016, with a 30% decrease in fish production, averaging 158,000 thousand tons compared to an average production before 2013 of 226,197 thousand tons. This is due to the impact of the conflict, including the destruction of fishing equipment, closure of maritime ports, and the scarcity and high cost of fuel affecting the productivity of the fisheries sector and also affecting the country's exports and consumption during this period.

The chart below shows that productivity increased between 2017-2019 by 36% compared to the average production between 2013-2016, averaging 214,594 thousand tons as a result of the relative stability in the country and the emergency intervention of donors agencies in supporting fishermen and coastal communities by providing technical and financial support, such as grants to purchase fishing equipment (marine engines, boats, modern equipment, nets, spare parts, maintenance equipment, etc.) and training fishermen on modern techniques to improve fish production efficiency. This has had a positive impact on reducing costs, time, and effort for fishermen and increasing their productivity by using modern equipment and techniques to provide high-quality seafood in markets and increase the country's revenue.

Yemen exports 52% of its fresh and frozen seafood products, 60% to Arab countries such as Saudi Arabia, Oman, Egypt, the United Arab Emirates, Jordan, and others. 30% is exported to Asian countries such as China, Thailand and Vietnam, while 10% is exported to European countries. 48% of production is consumed locally. The most important types of seafood exported are kingfish (thamad), followed by red snapper, grouper, dorade, lukham (shark), shrimp, prawns, squid and cuttlefish. The graph below shows the fluctuations in productivity, exports and consumption during 2009-2019.

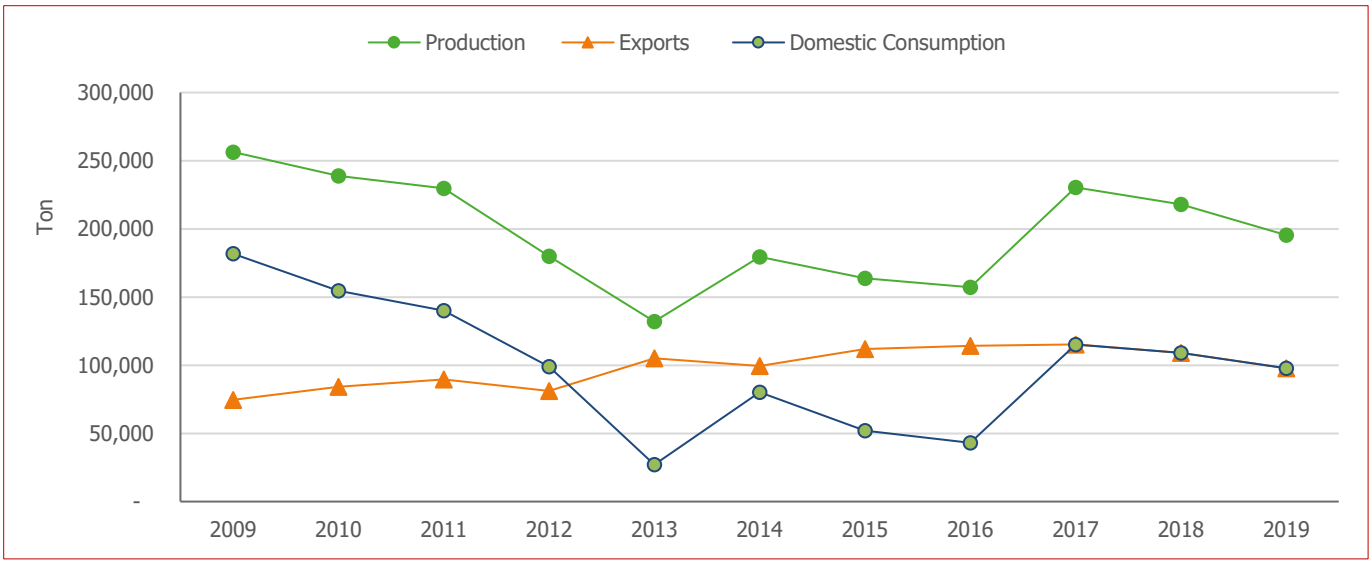


Figure no. 1: Fish production, exports, and domestic consumption in Yemen 2009 - 2019

Reports from the Yemeni Fish Cooperative Union also showed that the percentage of increase in production value (sales value of seafood products) between 2009-2019 was about 18%, with an average production value of 63,717 tons. The fisheries sector was significantly affected between 2013-2016, with a 10% decrease in production value, averaging 44,414 tons compared to the average production value before 2013 of about 49,316 tons due to the impact of the conflict. The production value also increased between 2017-2019 by 145% compared to the average production value between 2013-2016, with an average of 108,656 tons due to the relative stability of the country and the emergency support provided by donors to the fisheries sector. In addition, between 2016 and 2017, domestic consumption increased by 167% increasing the total production value. This played a significant role in revitalizing the sector during this period by improving the efficiency and quality of the produced fish and selling them at higher prices both domestically and internationally.

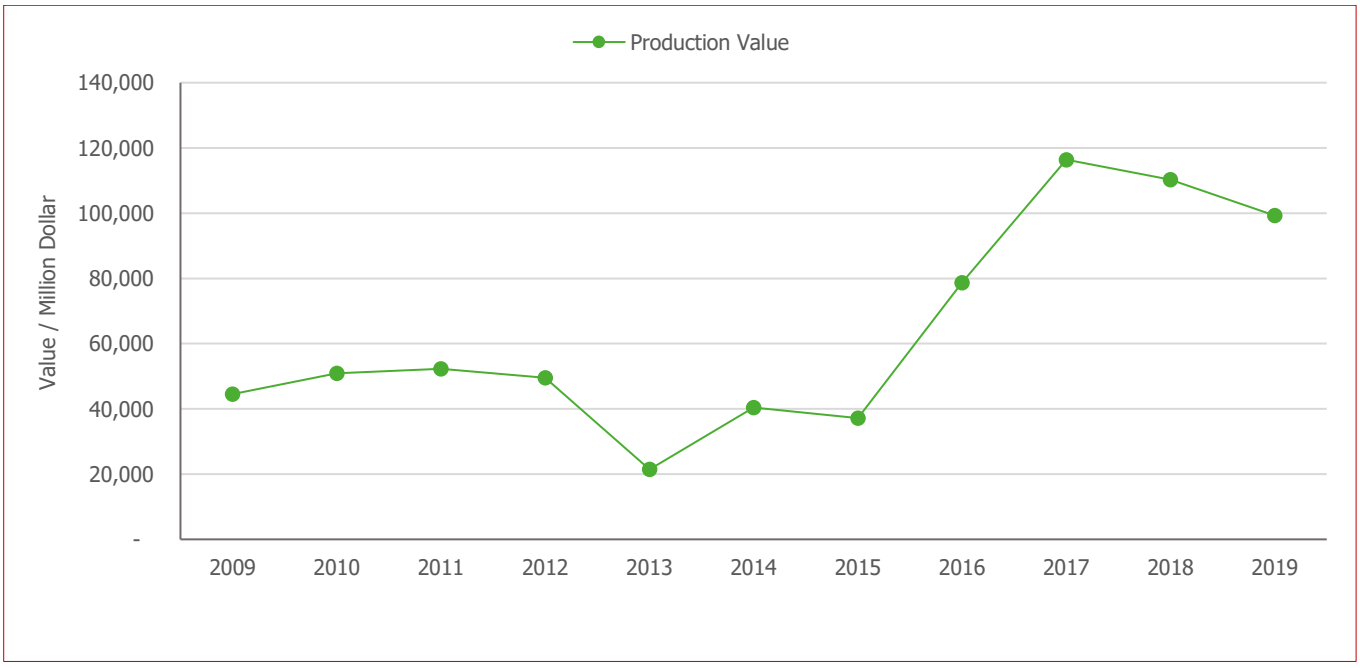


Figure no. 2: Fish production value in Yemen during 2009 - 2019 (National Information Center, 2020)

The Fisheries sector in Ash Shihr District

Fishing is one of the most important main activities practiced by the people of Hadhramaut governorate. The number of fishermen in the whole governorate is estimated at 18,876 with the number of fishing boats of about 6,925, and the number of fishery associations is at 23. The quantity and value of the production of fish and other marine organisms caught through traditional fishing in Hadhramaut governorate in 2021 was 46,975 tons worth YR 23,487 million (Ministry of Fisheries Wealth, 2021)

Ash Shihr District is in Hadhramaut Governorate and is a city located on the coast of Hadhramaut. It's population according to 2019 estimates the is about 112,873 (Integrated Food Security Phase Classification, 2020). Ash Shihr District is approximately 70 km from the city of Mukalla (the capital of Hadhramaut), and has an area of about 7,000 km^2.

The fishing sector in Ash Shihr District is considered one of the most important vital sectors that provides livelihoods for thousands of households in coastal communities.

In Ash Shihr, there is 7,149 fishermen with 1,300 boats in 2019 (General Indicators of Survey and Census Results for Associations - the Fisheries Cooperative Union). There are also 5 fishery associations in the district that contributed, through their members, to producing about 16,679 tons of fish and other marine organisms caught by traditional fishing with a total value of YR 8,339,453 million (Ministry of Fisheries Wealth, 2021).

Pictures from Ash Shihr District

Ash Shihr district is distinguished by its large production of fish and marine life, and is considered one of the most important districts in fish production in Hadhramaut governorate. The production of Ash Shihr represents up to 17% of the total fish production in Hadhramaut, estimated at around 51,037 tons in 2021. Figure 3 illustrates Ash Shiur's production from 2017 to 2021, and it is clear that there has been an increase in the growth rate of fish production by about 13% since

2017 until 2020. However, in 2021, there was a recession in the growth rate of fish production in the district due to several reasons:

- Natural floods and heavy rains took place
- The spread of the coronavirus pandemic
- Lack of oil derivatives
- Difficulty obtaining large fishing equipment and 40-60 HP motors due to government regulations

These factors led to a decrease in fishing activity in 2021, with a growth rate of about -11%

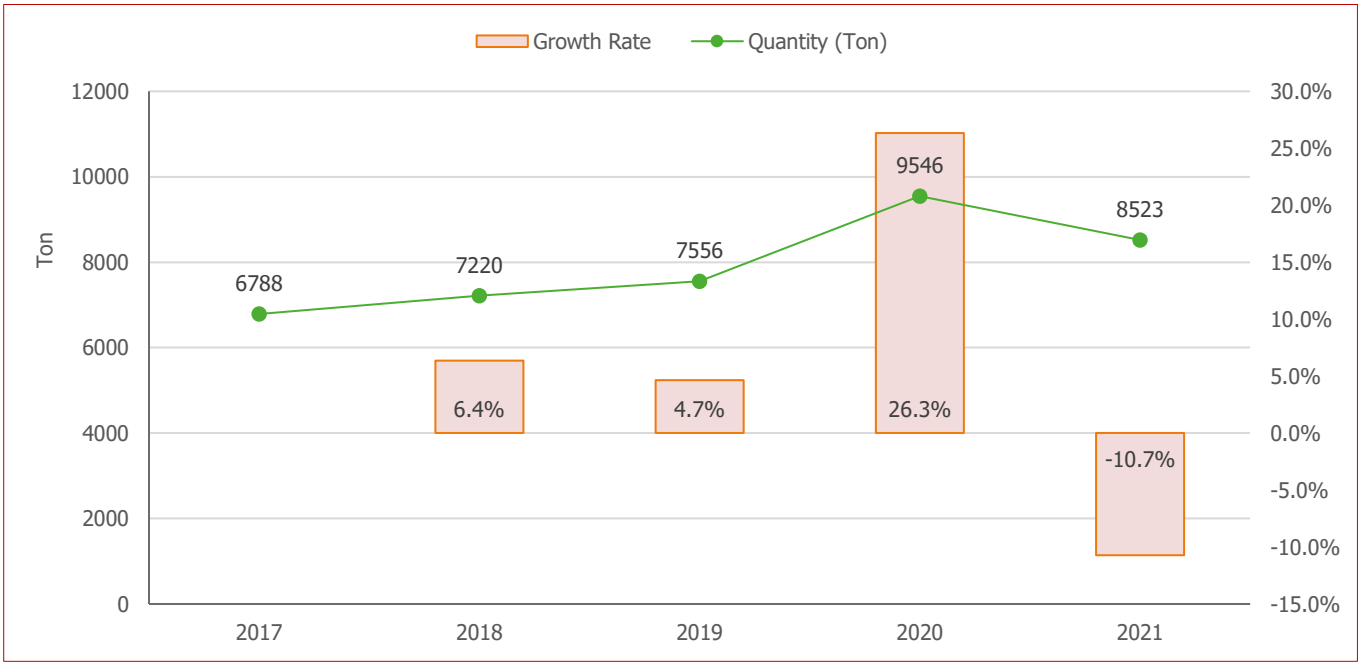


Figure no. 3: The quantity of fish and marine organisms produced between 2017-2021 in Ash Shir District (Fisheries Authority, 2022)

Impact of Climatic Change

According to FAO (2020), the contribution of aquaculture to global fish production continued to increase, reaching 82.1 million tons (46%) of the estimated total global production of 179 million tons. Additionally, the share of aquaculture production in global fish production is expected to increase from 46% to 53% by 2030. Fish populations are threatened by overfishing and pollution. Current rates indicate that human consumption of fish reached 157 million tons in 2020, the second highest level ever recorded, and rates are expected to double by 2050. Therefore, the fisheries sector has become a priority for decision-makers due to the increasing threat of climate change and waste accumulation.

Recently, climate change has had an impact on the fisheries sector, global food security, nutrition, and livelihoods. Despite some uncertainties regarding the effects of climate change on aquaculture, many projections suggest that the entire aquaculture value chain is vulnerable to climate change impacts (Maulu et al., 2021), including direct effects on the physiology and physics of fish stocks in production systems, as well as indirect effects by changing primary and secondary

productivity, ecological system structure, input supplies, or by impacting product prices, fish oil, and other goods and services needed by fishermen and aquaculture producers (Maulu et al., 2021).

Fish provide protein supplies for at least half of the world's population. There is currently great concern about over exploitation and the harmful effects of pollution in seas and inland waters, which threaten this food source according to United Nations reports. Warmer surface waters in oceans and inland waters, along with rising sea levels and melting ice, may have harmful effects on many fish species. Although some marine species have already begun to migrate to higher latitudes (Antarctic), others in freshwater areas, have nowhere to go and are therefore at risk of extinction. In addition, oceans are absorbing increasing amounts of carbon dioxide, resulting in acidic effects on marine life (Gomez-Zavagliaa, Mejuto, & Simal-Gandara, 2020). In this context, marine life is highly vulnerable to climate change, and studies indicate that the fisheries sector in Yemen is one of the most vulnerable sectors to climate change (i.e., fourth among Asian countries and nineteenth in the world).

In addition, Yemen has been identified as one of the countries where climate change will have an impact and there will be a decline in primary production in the seas and oceans due to climate change. It is likely that changes in fish physiology will occur in the short term (i.e. within a few years). All of these impacts will affect the fisheries sector, through changes in fishing, production, and marketing costs, changes in sales prices, and potential increases in risks of damage or loss of infrastructure, fishing tools, housing, and the livelihoods of less stable fishermen (UNDP and IFAD, 2012). According to a study (Al-Jibly, 2016) all regions of Yemen will become warmer, and warmer during cold winter months. The annual average temperatures in all regions of Yemen are expected to rise by 1.7°C to 2.4°C, with an average of 2°C by 2050, and similarly, all seasonal average temperatures will also see increases by 2050; these increases throughout the four seasons are consistent across the country. The largest seasonal temperature increase is expected to be between 1.8°C and 2.6°C, with an average of 2.3°C during winter. On the other hand, summer shows the least increase, from 1.4°C to 2.4°C, with an average of 1.9°C. However, basic data that would allow for an understanding of the extent to which the fisheries sector in Yemen is exposed to the impacts of climate change and other environmental challenges is unavailable.

Study Methodology

The study was structured in a methodological, scientific manner and organized in several steps to ensure efficient and quality data.

Approach

The study adopted the descriptive and analytical approaches of value chain analysis as the study went through the following five stages:

- **First** Stage: Stakeholder Engagement & Consultation through Workshops, Development of Survey Questionnaires.
- In the **second** stage: Selection & Training of Field Surveyors and Finalization of Survey Questionnaires.
- In the **third** stage: Data Collection, Processing & Verification.
- In the **fourth** stage: Data Review & Analysis.
- The final **fifth** stage**:** Report Writing & Validation with Stakeholders.

Details of the implementation stages of the study are shown below in Table no. 2.

Table no. 2 Stages of the implementation of the Value Chain Study

Stages	Actions	Outputs
Selection of target sector	• Participation of stakeholders in the target area and setting of their priorities. • Participation of the players of the targeted chain sectors in identifying the players of the chain and the problems of the sector. • Coordination with the concerned authorities to start studies and the project.	• Induction workshops by the donor team. • Workshops by the SMEPS team. • Sector problem analysis forms at the level of each player in the chain.
Preparing study needs	• Desk review and revision of accessible reports and statistics • Define and map the players and value chains of sectors, and the initial analysis of stakeholders • Selection and evaluation of the work team (specialists + team leaders + data collectors + reviewers and verification of data + coordinators + translators + editors). • Preparing an electronic portfolio for the work team that includes (a simplified value chain guide + electronic survey guide + work procedures guide + templates and forms for the project and study and other necessary papers and documents). • Development of primary data collection tools (paper and electronic data collection forms (ODK-CTO) and value chain study report template). • Training for the work team and distribution of samples and tasks	• Available reports and statistics • Training workshops • Lists of target value chain players • Electronic portfolio • Data collection forms - Paper and electronic • Data collection lists
Data collection and its verification	• Field visits and communication with targeted people to collect data for target sectors of the value chain • Reviews data and its verification • Processing data	• Data collected in the agency system • Lists of visits and communication with the targeted people • Reports of work team • Photos of communication with targeted people
Data review and analysis	• Reviews of the key technical and financial data of the study • Statistical data analysis • Mapping the value chain players of the targeted sectors • SWOT analysis and analysis of sector-related problems • Analyze the quantitative and financial flows of a product across chain players. • Suggest recommendations for the development of the target sectors.	• Analysis: results • Map of value chain players • SWOT analysis and quantitative and financial flows. • Recommendations
Report writing and publication	• Writing the initial version of the report • Re-drafting the report and designing graphs and figures. • Writing the final version of the report and translating it into Arabic and English. • Printing the report • Distribution and sharing of the report with stakeholders	• Draft report • The final report in Arabic and English • Wrap-up workshops.

Study Scope

Implementation Date

The study data were collected in March 2022.

Study Area

The study targeted Ash Shihr District in Hadhramaut Governorate - the largest governorate of Yemen. Ash Shihr district is located in the southern part of the governorate with the coordinates 14.76964, 49.61144, as shown in Figure no. 4.

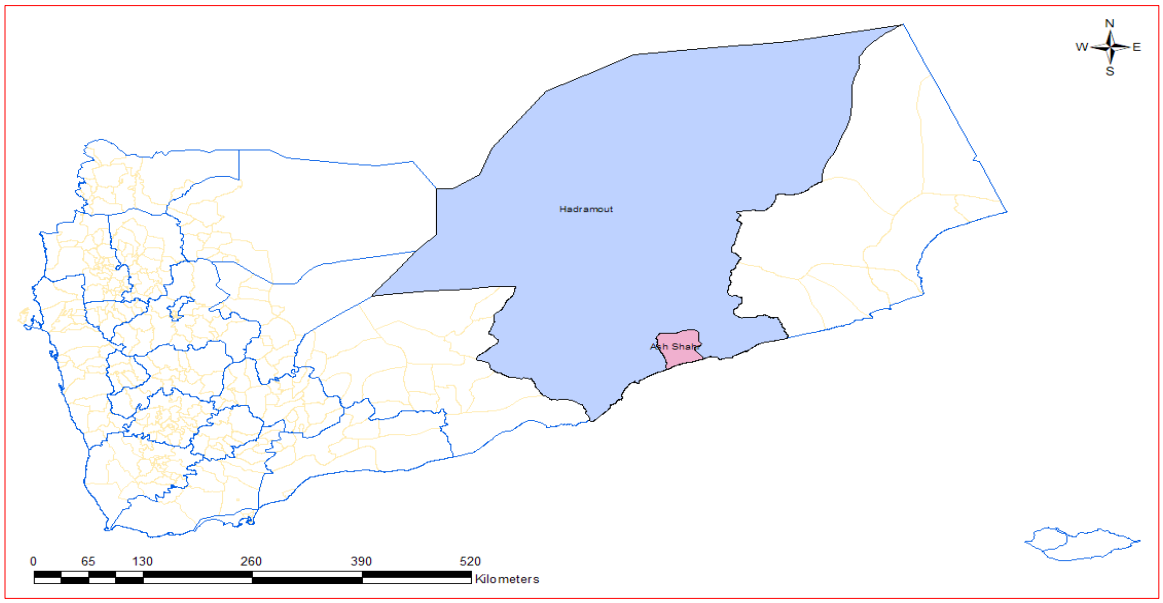


Figure no. 4: Map of Study Area

Team

The work team consisted of 13 members, divided according to an organized work structure (refer to the work team page at the beginning of the study for more details). This structure ensured the order of work, the sequence of the data collection mechanism, and a study free from any errors and with accurate and logical content. The work team structure consists of the following:

- One Supervisor charge of implementing the study + data analyst
- Two technical and administrative assistants
- Two study experts (consultants)
- One data collection team leader
- Four field data collection team members
- One data reviewer + verification + data analysis
- Two editors & reviewers SMEPS & UNDP
- One English translator

In addition, another team of SMEPS staff worked on reviewing and reformulating the articles, headings and data of the study to develop a highly efficient and accurate study.

Sampling

Figure no.5: A map showing the sites of the study sampling

Figure no.5 shows the sites and distribution of the study samples on a map. Table no. 3 shows the details of the sampling at the level of the stage of the value chain stages.

With the launch of the value chain study activities in the target sector, a discussion workshop was held, in which a sample of actors or players in the value chain participated. Several individuals from each link or job in the chain were divided into groups on separate tables.

At the beginning of the workshop, the participants were introduced to the study and its significance, and how it could have a role in reviving the sector. The problems of the sector were discussed, and innovative solutions were proposed by attendees to help develop the sector. These discussions enhanced the community's response to the data collection team. In addition, each group had the opportunity within the workshops to talk and express within the limits of their role and position in the chain their concerns and the most significant challenges they face. The workshops also provided an opportunity for the actors in each chain stage to hear each other and cooperate. During the workshops, participants filled out a pre-prepared questionnaire. The participants recorded the most significant problems facing them, the causes and effects of these problems on the sector, proposed solutions to these problems, and the parties responsible for implementing these solutions.

Table no. 3 Size of sampling classified at the level of fish value chain stages in Ash Shihr District (Primary Data, 2022)

Type	Description	Trader Supply	Producers	Traders / Processors/ Exporters	Consumers/ market	Government and Supporters	Total
FGDs	Number of persons per group	0* (0)	1 (4)	3 (18)	0* (0)	1 (5)	5 (27)
KIIs & Q	Chain players	21	89	62	38	16	226
Total number of sampling		**21**	**94**	**83**	**38**	**21**	**258**

***=Type of data collection tool**: **FGD**=Focus Group. **KII**=Key Interviews. **Q**=Questionnaire.

Note: Because of the preoccupation of both the supply dealers and consumers, they were unable to attend the inaugural workshops, which consisted of focus groups of the most prominent players in the chain at the beginning of the study, however data was collected from them later in interviews.

Data Collection and Verification

Data Collection

Before starting the study and collecting data from the field, secondary sources and references were gathered, and primary data collection forms were prepared for all players in the value chain. The study team was then prepared to collect primary data electronically using the SurveyCTO collect program. The survey covered several levels of the targeted sector's value chain, where primary actors in the chain, such as producers, input suppliers, traders, distributors, and end consumers, were interviewed. The interviews also included supportive entities in the chain, such as associations, cooperatives, enablers or legislators in the chain, represented by local authorities. To carry out the study, teams were prepared with expertise related to the targeted sector, and specialists and consultants were contacted and tested to select the working team.

Before collecting any data from the field, an opening workshop was held for players in the value chain of the targeted sector, and they were divided into groups, with each group representing a specific function in the targeted value chain. The attendees were then introduced to the project and its objectives, and the most important problems in the sector at the level of each group (function) in the value chain were discussed. Primary data was collected for the problems of each function, along with proposed solutions to these problems. Data collection forms were then prepared in a way that was appropriate and compatible with the targeted sector and its players.

Photos showing the FGDs for each fish value chain player in Ash Shihr District

During the preparation and implementation of the workshops, a report template and data collection forms were prepared on paper and converted into electronic forms to facilitate data collection. The forms included all possible answers and options to facilitate the data collection process and increase the level of accuracy. Field visit models, achievement levels for field teams, and a model for reporting field tasks were also prepared. Additionally, three guides were prepared for the team, including a guide to the concepts of the value chain, a guide to ethical fieldwork, and a guide to the data collection process to facilitate the team's work.

After that, the work team (team leaders and field surveyors) was trained for five days. During the training period, the team was introduced to the project and its objectives, the importance of the information that will be collected, its accuracy and credibility, and how to download and activate the electronic form. The training also included aspects related to ethical and regulatory fieldwork, how to deal with the target groups, how to fill out forms, models, and daily and final reports to complete the task. At the end of each training day, the work plan and fieldwork documents and attachments were distributed, and the target sample was distributed among the team.

Photos showing the training period of the field survey team

After preparing and equipping for all the study's needs, the field survey team set out to meet the players (stakeholders) in the targeted sector value chain. The field survey process continued for 10 working days, during which the players at all levels and stages of the chain were interviewed, and the data was sent directly to the agency's database, which was pre-equipped to receive data via SurveyCTO Collect servers. The data was immediately reviewed, verified, and any errors from the field were corrected.

According to the study plan, a clear methodology was developed for the data collection process from the field team. The sample distribution list was distributed to the team so that all stakeholders in the targeted value chain were targeted. The study included several aspects, including technical, financial, production location, work environment, and problems and obstacles faced by the players in the chain. Upon completing the data collection, the team leader checks the completeness of the forms with his team to ensure that all the form data has been completed before sending it to the data collection server.

The team leader also reviewed the daily survey team reports, ensures the level of achievement, and follows up with the team through a social communication group (WhatsApp) to monitor all updates facing the team and solve their problems immediately, disseminating any observations among team members. Additionally, he receives any emergency instructions from the research and development team to disseminate to the team.

The photo shows the work team during data collection from the field

Data Verification

To verify the validity and accuracy of the data, a specialist was appointed to review the data as it was received. The specialist was trained on how to receive, review and follow up the data first-hand to avoid repetition of data and errors from field enumerators, and to enhance the quality of data to the highest possible degree.

Photo showing meetings and training for the processing and verification team

During the data collection process, an interactive dashboard was created that was linked to the study's database. The dashboard was used to monitor the progress of the field survey team and guide the team to focus on all levels of the value chain. It was also used to track the team's progress speed, the areas that were visited, and the number of forms submitted to the database for each player in the value chain, as shown in Figure no. 6.

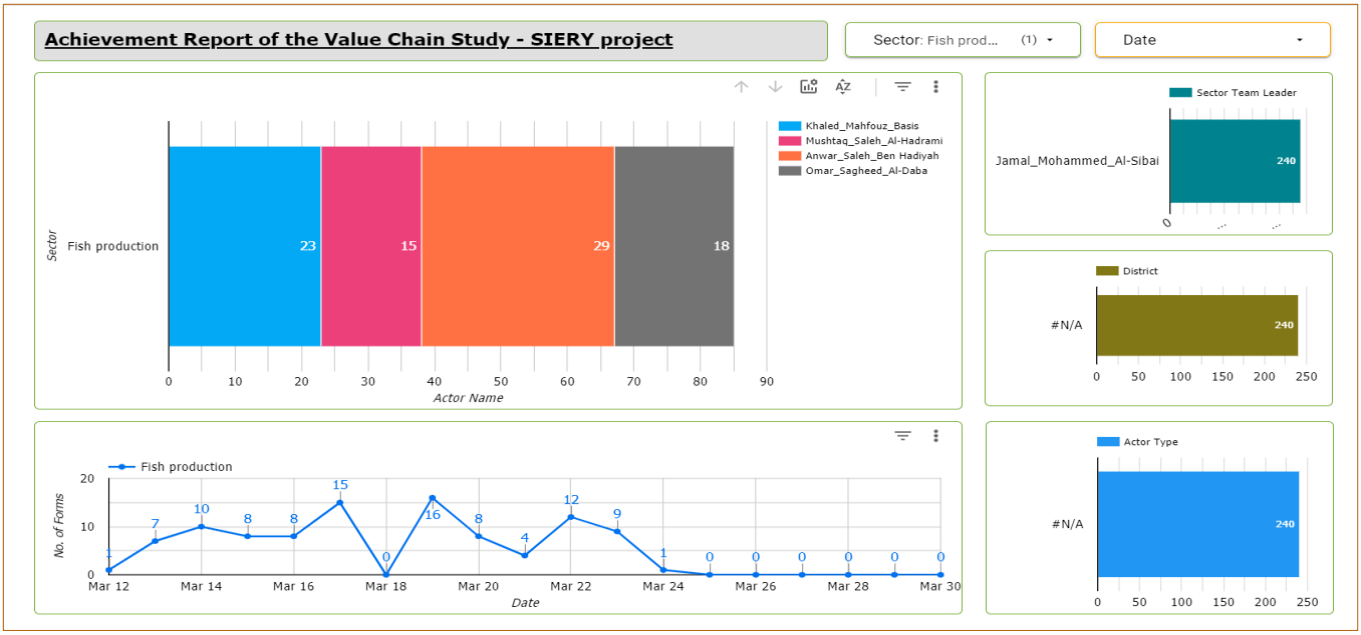


Figure no. 6: An interactive dashboard to track the daily achievement of the data collection team

After completing the data collection process, the data was verified by the specialist who contacted a sample of the target group by phone to verify the accuracy and credibility of the data, ensuring that it matched what was collected from the field. Any missing data or illogical data were completed and corrected in coordination with the field team leaders and field surveyors.

Data Processing, Analysis and Cleaning

To process the data, a specialist was trained for each study to review and process the data and verify it. The data processing specialist was trained on the workflow and the concept of the value chain, how to receive and verify data, and review it in real-time to avoid duplicating data or any obstacles or incorrect information from the field data collection team. The reviewer was connected to the interactive dashboard to monitor the flow of data received from the field and to determine the level of progress of the field survey team and guide the team to focus on all links in the value chain.

Photo showing the training of the specialist in data review, processing and verification

During the data collection process, the accuracy of the data was verified by a specialist in review and verification. Random samples of the surveys that had been received in the database were contacted by phone to verify important questions and to match the answers given in the survey. Data was processed upon arrival and any missing data was completed in coordination with the field team leaders and field surveyors.

After processing and verifying the data, a meeting was held with the study specialist to discuss the mechanism for data analysis, and how to coordinate the work between the monitoring and evaluation team, the review specialist, and the study specialist in order to write the findings in a report format, and to ensure coherence between the information and to maintain consistency in the report. Data analysis was conducted using Google Sheets for technical and statistical analysis, and some mathematical and statistical methods were used for variables such as averages, ranges, highest and lowest values, percentages, and other statistical measures.

The study included several aspects in its analysis, including production costs, sales prices, profit margins, and product flow channels through the studied value chain. The cash flow between the players in the chain was analyzed, and a map of the players was drawn. The SWOT analysis model was used to review the most important problems and challenges, and how they can be addressed. The strengths and opportunities were highlighted, and recommendations were proposed to develop the sector and improve the performance of the value chain in the future.

Photo showing the meetings with the study specialist and discussions on the analysis method and report writing

Data Analysis

The quantitative and qualitative data were analyzed using systematic scientific methods to reach the financial and economic indicators related to the studied value chain. One of the most important indicators studied in this report is the value added by the players in the chain, where their most important shares are distributed in the value chain, what is the profit margin and marketing margin for the players in the value chain, and other necessary financial and economic indicators for this study. The data were classified into two parts: qualitative or descriptive indicators, and quantitative or numerical indicators:

Qualitative Data

The descriptive data is considered a laborious analysis in the analysis process, due to the standardization and encoding of the data, dividing it into several levels and classifying it into groups and then analyzing it. One of the most important descriptive analyses of the study is the analysis of players, functions, and channels of the value chain, as well as SWOT and PESTLE analysis, analysis of obstacles and problems, and analysis of the development strategy for the targeted sector.

Quantitative Data

There are many indicators that were used to measure the performance and analyze the value chain, including the necessary financial and economic indicators for evaluating the financial performance of the chain. The data for these indicators were obtained from the data collection forms for this study. The most important of these indicators are outlined below.

Variable Costs (VC)

Variable costs or operating costs are the costs that change with the change in the number of production units. When the number of production units increases, the variable costs increase, and when the production costs decrease, the variable costs decrease. Variable costs include fertilizers, feed, fuel, pesticides, treatments, vaccinations, transportation, water, and production labor (i.e., temporary labor), etc. The **average variable costs** can be obtained according to the following equation:

$$\text{Average Variable Costs (AVC)} = \frac{Total\ Variable\ Costs\ (TVC)}{Yield\ (Y)}$$

Where: **AVC** is the average of the variable costs **TVC** is the total variable costs **Y** is the number of units produced

Fixed Costs (FC)

Fixed costs are costs that do not vary with changes in the production volume, and they are the opposite of variable costs. These are costs that must be paid whether or not the production process is carried out. Fixed costs include fees,

subscriptions, maintenance costs, rent, permanent labor costs, and others. The **average fixed costs** can be obtained according to the following equation:

$$\text{Average Fixed Costs (AFC)} = \frac{Total\ Fixed\ Costs\ (TFC)}{Y}$$

Where: **AFC** is the average fixed costs **TFC** is the total fixed costs, **Y** is the total of units produced

Total Costs (TC)

Total cost is the sum of fixed costs and variable costs, and **average total costs** can be obtained according to the following equation:

$$\text{Average Total Costs (ATC)} = AFC - AVC$$

Where: **ATC** is the average total costs, **AFC** is the average fixed costs **AVC** is the average variable costs

Depreciation (Dp)

Depreciation is a gradual and continuous decrease in the value of fixed assets. The depreciation rate is estimated annually, and the depreciation expense is calculated by subtracting the estimated salvage value from the cost of the asset and dividing it by the asset's useful life in years. The **annual depreciation value** can be obtained according to the following equation (Abdul Larif):

$$\text{Depreciation (Dp)} = \frac{AFC - dd}{Time\ (T)}$$

Where: **Dp** is the depreciation share **AFC** is the average of fixed costs **dd** is the value of selling the asset after the depreciation period
T is the asset consumption period by years

Total Revenue (TR)

Total Revenue which includes the sale value and other project revenues, is the total number of units produced multiplied by the selling price or market price. **Total revenue** can be obtained according to the following equation:

$$\text{Total Revenue (TR)} = Price\ (P) * Yield\ (Y)$$

Where: **TR** is the sales **P** is the selling/ market price **Y** is the total of units sold

Average total revenue can be obtained by the following equation:

$$\text{Average Total Revenue (ATR)} = \frac{TR}{Y}$$

Where: **ATR** is the average total sales **TR** is the total sales **Y** is the number of units produced

Profit (PF)

The profit indicator is one of the key financial indicators for measuring the efficiency of the performance of the economic units and projects. (Al-Falouji, 2016). **Profit** can be obtained according to the following equation:

$$\text{Profit (Pf)} = \text{TR} - \text{TC}$$

Where: **PF** is the average net Profit **TR** is the total sales **TC** is the total cost

And **gross profit** can be obtained by the following equation:

$$\text{Gross Profit} = \text{Net Sales} - \text{Cost of Sales}$$

Gross Margin (GM)

Gross margin is a short-term indicator and measure of the performance of the enterprise or project. One of the determinants of this indicator is that it is not related to the time value of money (Lampkin & Measures, 1994, 2001). Gross margin is the difference between the total revenue and total variable cost of the enterprise. It can be obtained by the following equation (Barnard & Nix, 1979):

$$\text{Gross Margin (GM)} = (Q * p) - TVC$$

Where: **GM** is the total profit margin **Q** is the quantity of the sold product **P** is the price of each sold unit

TVC is the total variable or operating costs

Net Profit (NPF)

Average net profit is the average value of sales minus the average fixed and variable costs together. The **average net profit** can be obtained according to the following equation:

$$\text{Average Net Profit (ANPf)} = \text{Average sale value } (ASV) - (AFC + ACV)$$

Where: **ANPF** is the average net profit **ASV** is the average annual sales value **AFC** is the average fixed costs
AVC is the average variable costs

Value Added (VA)

The value added is the value generated at each stage of production and marketing along the value chain and ends when the product reaches the final consumer. This indicator is used to measure the importance and competitiveness of the production project and its contribution to enhancing the country's GDP. That means the more the added value of the project, the more the project contributes to increasing the national domestic product (Al-Falouji, 2016). This indicator is one of the necessary planning indicators in distributing resources to the various projects to achieve social benefit (Al-Ezzi, 1989).

The value added can be measured for the product in the value chain as the difference between sales revenue and the cost of external purchases and services (direct production cost). The following equation illustrates the method for calculating value added (Karpik & Belkaoui, 1990):

$$\text{Value Added (VA)} = \textit{Revenue } (R) - \textit{Variable Costs } (VC)$$

Where: **VA** is the value added at the level of each player. **R** is the returns or revenues (outputs) **VC** is the operating costs (inputs)

The added value is estimated for the players, links, or levels of the chain between the producer and the consumer by calculating the price difference between the selling price and the purchase price (Al-Falouji, 2016):

$$\text{Value Added (VA)} = \textit{Sale Price } (SP) - \textit{Purchase Price } (PP)$$

Where: **VA** is the value added at the level of each player **SP** is the selling price **PP** is the purchase price.

The same equation above is used to estimate the marketing margin (MM) for each of the chain players.

Share of Value added (SoVA)

This indicator is used to know the share or proportion of each player in the studied value chain, which as stated by (Kulmiye, 2010), is the ratio of value at each stage of product manufacturing and/or product distribution or at the level of wholesalers, retailers, and other players in the chain. This value can be obtained by dividing the value added at any player's level in the chain by the total value of all players in the chain. For example, the value added at the product level is the sale price minus the production cost, while the value added for other players in the chain is the difference between the sale price and the purchase price divided by the total value added for all players in the chain. The share of value added can be obtained through the following equation (Al-Falouji, 2016):

$$\text{Share of Value added (SoVA)} = \frac{\textit{Value Added at Market Level } (VAi)}{\textit{Total Value Added } (TVA)} * 100$$

Where: **SoVA** is the share/ proportion of the value added **VAi** is the added value for each player in the value chain
TCA is the sum of value added for all value chain players

There is another term called "Share of Value" similar to "Share of Value Added", and the SoV approach is used to compare the Gross Margins of players or entities in the value chain.

$$\text{Share of Value (SoV)} = \frac{GMi}{TGMvc} * 100$$

Where: **SoV** is the share/proportion of the value added **GMi** is the total profit margin for each player in the value chain
TGMvc is the sum of the total profit margin for all value chain players

Marketing Margin (MM)

The marketing margin is an indicator of the value or cost paid for the processing and marketing services for the product at each stage of production (Al-Falouji, 2016), which is the difference between the selling price and the purchase price of the product. The value of the marketing margin can be found through the following equation (Hag, 2011):

$$\text{MM} = \textit{Sale Price } (SP) - \textit{Purchase Price } (PP)$$

Where: **MM** is the marketing margin, **SP** is the selling price, **PP** is the purchase price

Report Writing, Translation and Publication

Report Writing

The study team built a detailed plan for what the report would include at the beginning of the study planning phase. Based on that, a report structure was developed, including chapter titles and section headings, as well as tables, charts, and appendices. This helped the team prepare the first draft of the report to present the main outputs and initial results to the team and receive feedback to develop the report. The team reviewed the first draft of the report, reformulated and wrote it, and designed graphics, figures, and tables professionally. They produced the final version of the report to be translated and shared with relevant parties, supporters, and the funding entity for the study (EU-UNDP).

Report Translation

The team prepared the report in its initial version in Arabic, and a specialized consultant was hired to review the final version of the report and hand it over to the consultant for translation into English. This took approximately two weeks to finish the translation, language review and professionally rephrasing for publication and sharing with stakeholders.

Report Publication

After completing the final report and printing it in both English and Arabic, it became possible to share the report with relevant stakeholders, whether they are players in the value chain or related donors and entities in the same sector, as well as official bodies. Reviewing the results, presenting the outputs and recommendations will contribute to the development of an independent value chain sector. The report includes a detailed presentation of the gaps that can be addressed and the efficiencies that can be enhanced among stakeholders in the value chain. The report also includes proposals that may contribute to improving and raising the efficiency of the sector value chain and increasing local production and exports, while reducing operating costs. It will also significantly contribute to raising the country's economy and providing many job opportunities.

The report will also help relevant stakeholders and supporters to facilitate decision-making and design appropriate projects based on the needs of stakeholders in the chain, to support and enhance the development of the sector value chain in Yemen. The report can be downloaded in both Arabic and English through the agency's and UNDP's websites, and promoted through social media platforms to provide an opportunity for all interested parties and individuals to access it.

Cover of the Arabic Version

Cover of the English Version

Barcode to access the study via the web

Findings

Multiple channels of the fish value chain create an unstable situation for the fishery sector in Ash Shihr District

Dynamic Fish Value Chain System

There are four main components or headings through which the dynamics of the complex fish value chain system in the Ash Shihr District will be identified and understood. These headings are as follows:

- **First**: Defining the stages, players, and functions of the fish value chain.
- **Second**: Describing the mechanism of the chain stages with SWOT analysis and PESTLE analysis, and defining the trading channels (buying and selling) between the players in the chain.
- **Third:** Describing the process of quantitative cash flows between the players in the chain and analyzing the profitability (profit margin) of the fish value chain players.
- **Fourth**: Analyzing the marketing channels and profit margin of each player at the level of each marketing channel.

The details of these headings are as follows:

Identifying the Fish Value Chain

Stages of Fish Value Chain

The study team was able to divide, sort, and group all players in the complex fish value chain in the Ash Shihr district into seven 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. Figure 7 illustrates the stages of the fish value chain in the Ash Shihr district. Each stage will be detailed separately under the following headings:

Figure no. 7: Stages of the fish value chain in Ash Shihr District - Hadhramaut - Yemen (Primary Data, 2022)

Value Chain Players and their Functions

In order to understand the mechanism and dynamics of the fish value chain in the Ash Shihr district, the players and their functions were defined as shown in Figure no. 17, and players and functions can be distributed according to the stages of the fish value chain as follows:

- **Input Suppliers:** There are four types of players at this stage; suppliers of motors and fishing boats, suppliers of fishing gear, suppliers' refrigeration materials, and suppliers of fuel and oils. Each stage will be addressed with its players and their functions in detail under the upcoming headings.
- **Production Stage:** This includes the producers (fishermen), nearly all of who are organized into several associations. Only 2% of the fishermen do not belong to an association.
- **Trade, Processing and Export Stage:** It includes five types of players; wholesalers and retailers, processors (factories and fish companies), aggregate wholesalers (including fishermen associations working as wholesalers), aggregate retailers, and processor retailers (local industries).

- **Consumption:** The final stage in the chain is the consumption stage, with two types of consumers, local consumers (citizens, restaurants, and consumers in provinces outside Hadhramaut) and foreign consumers.

The direct chain stages do not exhaust all the relevant players, however. There are other players that we can call secondary players in the chain - enablers and supporters. Figure no. 8 shows the forms of both the primary and secondary players in the chain. The following headings will provide details of the stages, players, and activities of the fish value chain in Ash Shihr District.

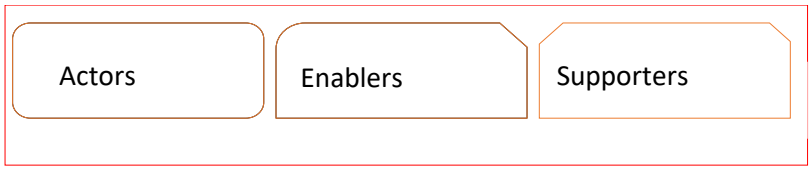


Figure no. 8 shows the forms of players, enablers, and supporters of the value chain (Primary Data, 2022)

The Work Mechanism in the Value Chain Stages with SWOT & PESTLE Analysis

Stage 1: Input Suppliers

The fishermen in Al-Shihr receive all their fishing needs from the input suppliers or providers within the same district. Input suppliers in the fish value chain play an important role in supplying fishermen with the basic needs that enable them to continue their work and production. The roles and activities of input suppliers in the chain differ according to the nature of their business. According to the study, suppliers vary in providing inputs. Some provide boats and engines, while others are interested in providing only engines, and others provide fishing tools and equipment such as nets, cords, and fishing rods, etc. There are also suppliers who work on providing refrigerated containers, ice, and others who provide fuel & oil. Figure no. 9 shows the opinions of input suppliers about the impact of importing products from abroad into Al-Shihr.

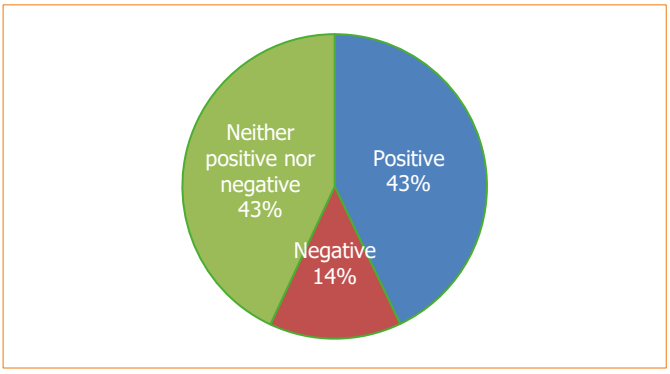


Figure 9: The views of inputs providers about the impact of importing products from abroad

It appears that all the fishing inputs provided by the input suppliers in Al-Shihr are imported from abroad. Even the boats and fish containers that are locally made, as well as the fishing nets woven by female craftswomen and the lead weights for baits, are mostly made from materials and raw materials imported from abroad. Approximately 43% of input suppliers believe that the impact of importing from abroad in the fish sector has a positive impact because imported products are cheaper, available and affordable to support in increasing products. This helps to cover the customer base and to increase the number of customers due to the availability of desired products, and a second positive impact of importing is providing products at reasonable prices for customers. Importing from abroad also positively affects filling the demand gap in the fish input market in Al-Shihr. On the other hand, around 14% believe that there is a negative impact of importing inputs on the fish sector, while 43% of input suppliers do not see any impact on the process of importing fishing inputs from abroad. Figure 9 shows the opinions of input providers about the impact of imports.

The data from Figure 10 shows that most fish input traders in the Ash Shihr District do not face difficulties in the process of purchasing inputs from abroad, nor in transporting the product to them or in the unavailability of products in the market. 86% of traders confirm that purchasing procedures are very easy, and the remaining 14% say they are neither easy nor difficult. This is because there are nearby sea and land ports, such as Ash Shihr, Mukalla, Nashtoon and Aden ports, and Shahan land crossing. These facilitate the arrival of inputs from abroad. Also, the relevant government agencies do not impose any long or complicated procedures for importing fishing supplies.

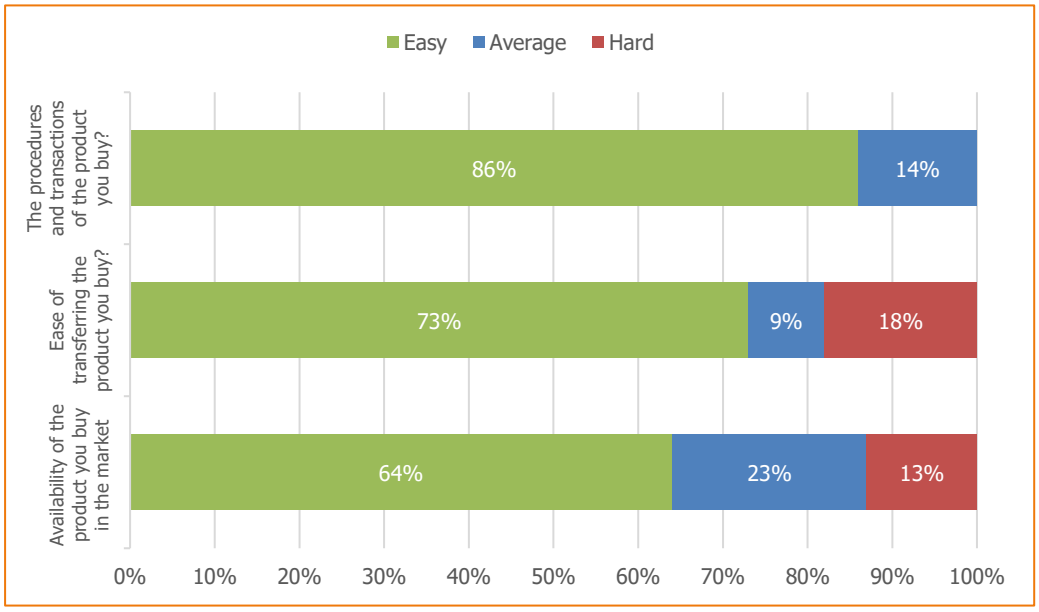


Figure 10: Views of input traders about the procedures, ease and availability of products

On the other hand, about 18% of input traders find it difficult to receive and transport fish production inputs, and about 13% of them find it difficult to obtain the products. These are mainly traders of oil derivatives and fishing rope traders, due to the general oil crisis in Yemen.

Input suppliers or traders provide fishermen with basic inputs such as fuel, oil, ice, fishing tools such as baits, ropes, fishing nets, Magellan GPS devices, and fish detection devices, as well as boats and marine engines. The private sector is the main source of these inputs for fishermen and other players in the value chain. Figure no. 11 shows the highest, lowest, and average selling prices for inputs, and this range is the result of changes in the type, source, and quality of the input.

The data shows that fishing nets, ropes, and maintenance tools have the highest percentage of reaching the highest selling price, with the highest percentage of the average being 238%, 213%, and 199%, respectively, compared to the average selling price. The lowest percentage for the highest selling price from the average selling price was for artificial bait, anchors, and oil derivatives, with a percentage of 9%, 10%, and 15%, respectively.

On the other hand, the lowest selling price compared to the average selling price was for artificial bait, followed by the GPS device, and then fishing traps at a rate of 9%, 10%, and 20%, respectively. The highest percentage for the lowest selling price compared to the average selling price was for poles, marine lead (sinkers with bait), and ropes at a rate of 91%, 69%, and 69%, respectively.

As a result, fish sector inputs are diverse and multi-variety, which is good for fishermen in terms of the availability of several types and levels of the same input, and for increasing competitiveness among input traders to achieve the highest quality with the lowest price.

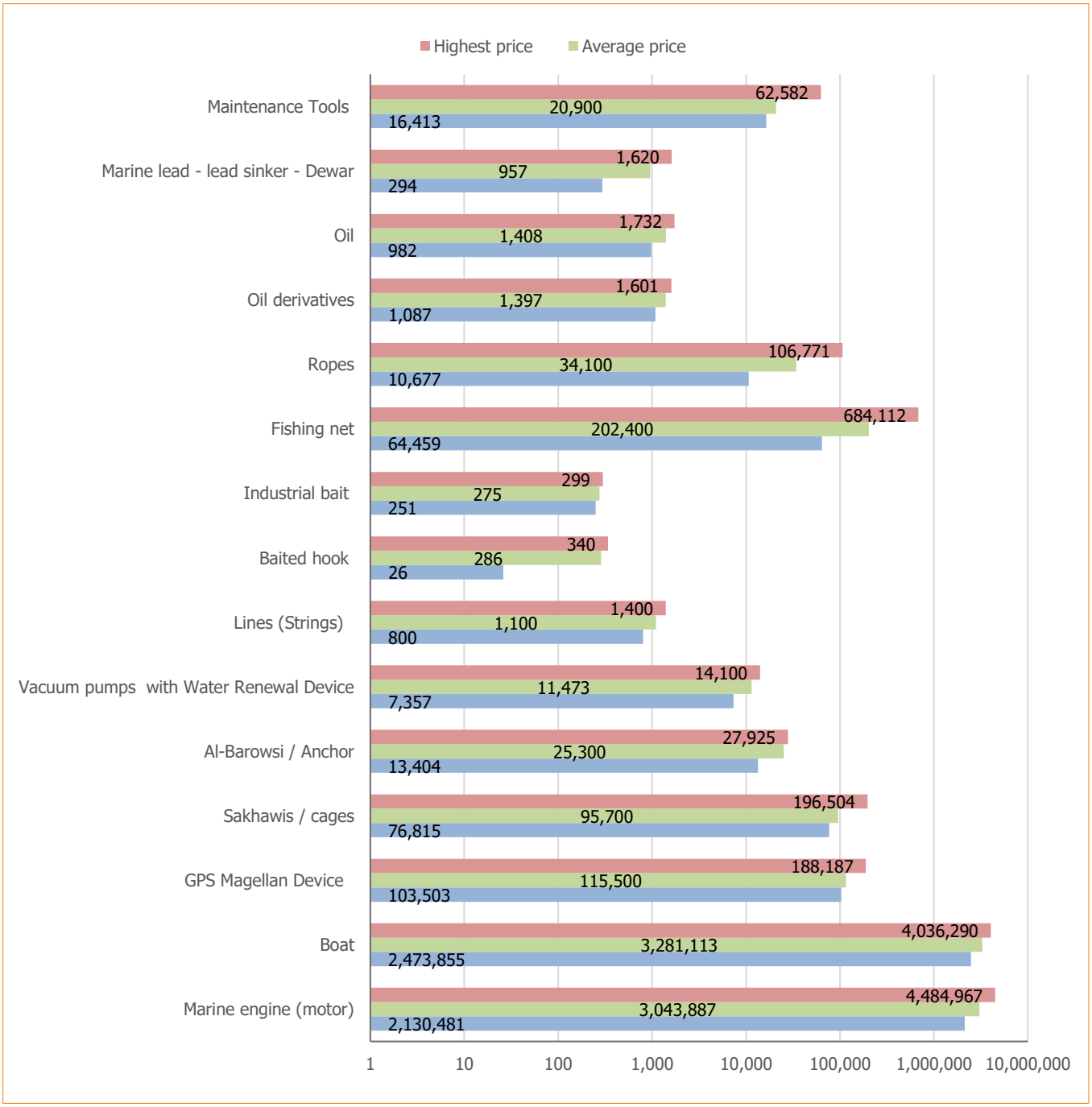


Figure no. 11: The types, range, and average input prices per quantity in Yemeni Riyal (YR)

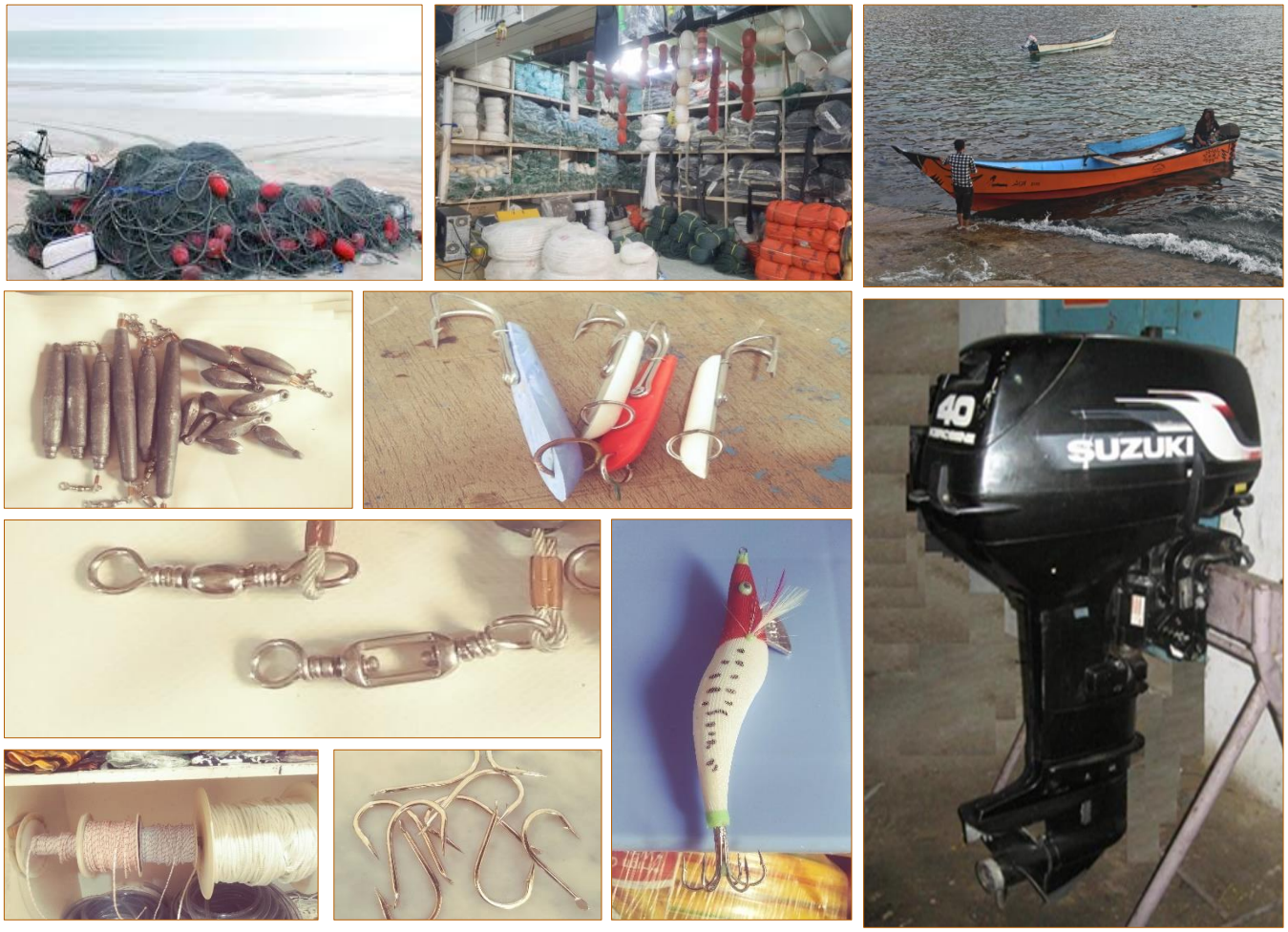
When asked about the prices of the inputs they own, fish input traders were very reserved about disclosing purchase prices. The study was not able to analyze the profit margins for this category due to the confidentiality of the data.

When asked about the source of information on purchase prices, the study showed that fish input traders do not have multiple channels to obtain information about the prices of the inputs they buy. All traders know purchase prices only through the traders who buy from them. This indicates that there is a strong relationship between fish input traders and their sources of purchase.

The study shows that the most traded and desired inputs for customers and the most sold by input traders in the fish sector during the year arranged according to the most sold were:

- **Motor oils**, essential for boat engines and are used as fuel with petroleum and have high viscosity.

- **Petroleum**, the primary fuel for boat engines with the red-colored petroleum preferred.
- **Artificial baits**, which are shaped and colored to attract fish.
- **Fishing lines** that are indispensable to fishermen.
- **Baited hooks**, small and large sized baited hooks being the most sold.



Photos showing some inputs to the fish value chain

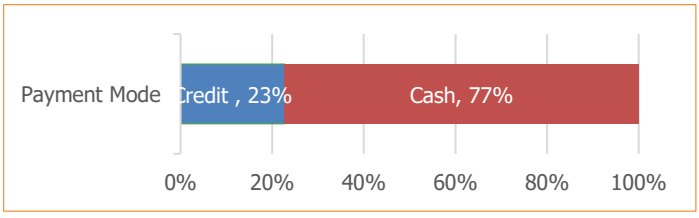


Figure 12: The method of sales between input traders and customers

Figure 12 shows the payment methods used by fish input traders and their customers. It is clear from the figure that around 23% of input traders offer deferred payment options (credit), and payment guarantees are based on trust between the parties. Meanwhile, 77% of traders prefer cash payments between themselves and their customers.

Figure no. 13 reveals that the best month for business in the fish input sector in the Ash Shihr district is March, followed by a gradual decline in activity until July. After July, there is an increase in business activity among input traders until March, marking the start of a new business cycle. In contrast, prices are highest in January and gradually decline until May, which has the lowest prices. After May, prices start to rise again until July, which is the month with the lowest activity level among traders. Then, prices start to decline for two months before rising again until January, when a new business cycle begins.

The decline in sales activity in July is due to the strong winds that coincide with the "star of the town"[5], increasing the risk of fishing trips over long distances at sea. Fishermen take advantage of this period to rest from their arduous fishing trips, while also preparing for their needs and purchasing fishing inputs. As a result, input prices increase noticeably during this period. Fishermen resume fishing in August when wind speeds decrease, temperatures gradually drop, and their activity levels increase until they peak in March.

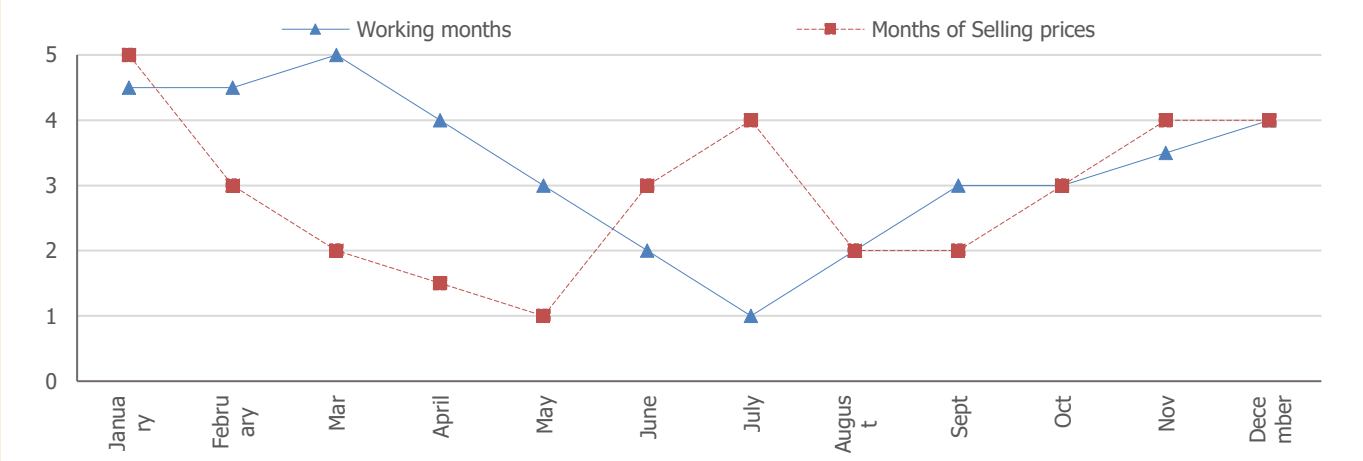


Figure no. 13 Months of work and sale by supply input traders in the fish sector in Ash Shihr District

5=more/much better. **4**=more/better. **3**=Average. **2**=Less/Worse. **1**=less/very worse.

Looking at the level of satisfaction of input traders with infrastructure in general in the Ash Shihr district, more than half of the input traders (52%) are not satisfied with the infrastructure, while 14% of them are somewhat satisfied, and the remaining 34% are satisfied with infrastructure services in general. When looking at the details of the infrastructure services, there are seven shown in Figure 14. Energy and electricity services were among the services that most traders were not satisfied with, at a rate of 67%. The reason for this is due to frequent daily power outages.

Meanwhile, the second most unsatisfactory services were sanitation services, telecommunications and internet services, health and medical care services, and road services and ease of movement, each with a dissatisfaction rating of 57% each. The reasons for their dissatisfaction ratings were as follows:

- **Sanitation services:** Fish input traders in Ash Shihr believe there is no sanitation in the district and that there are no sanitary drainage networks in the area. This causes the spread of sewage onto roads due to blockages, which leads to discomfort for citizens and input traders due to foul odors rising from this sewage. There are in fact sanitary drainage system in some neighborhoods in the coastal area established by private companies, however, despite the clear population growth in Ash Shihr there are no projects in place for sanitation.
- **Telecommunications and internet services:** Fish input traders in Ash Shihr mentioned that telecommunications and internet services suffer frequent interruption and instability, sometimes being cut off completely. If there are any problems with internet access, there are not responsive specialists to fix issues, leading to waits of several days to repair any internet-related problems.

[5]It is one of the climatic features associated with the Georgian months and starts in mid-July according to the Gregorian calendar.

- **Health and medical care**: There are no specialized hospitals, and the available hospitals do not provide good health services. There are no good medical staff members who are concerned with treating those in need.
- **Road services and ease of movement**: Lack of interest in roads and maintenance by the concerned authorities causes transportation problems and continuous disruptions.

The lack of educational services and the availability of schools in the area raised a dissatisfactory mention from 48% of input dealers in Ash Shihr District because of the lack of highly qualified experienced staff in existing schools. The educational curriculum is perceived as weak, leading to low educational levels among students. They also saw that teachers' salaries are low and do not cover the needs of the teachers, which causes neglect of education in schools.

Of the infrastructure services mentioned, input traders viewed water facilities and the availability of water in the area as the most satisfactory service, with a satisfaction rate of about 48%. They confirmed that water is generally available. However, 19% of input traders were not satisfied with water facilities and the availability of water, and see permanent water shortages in their areas.

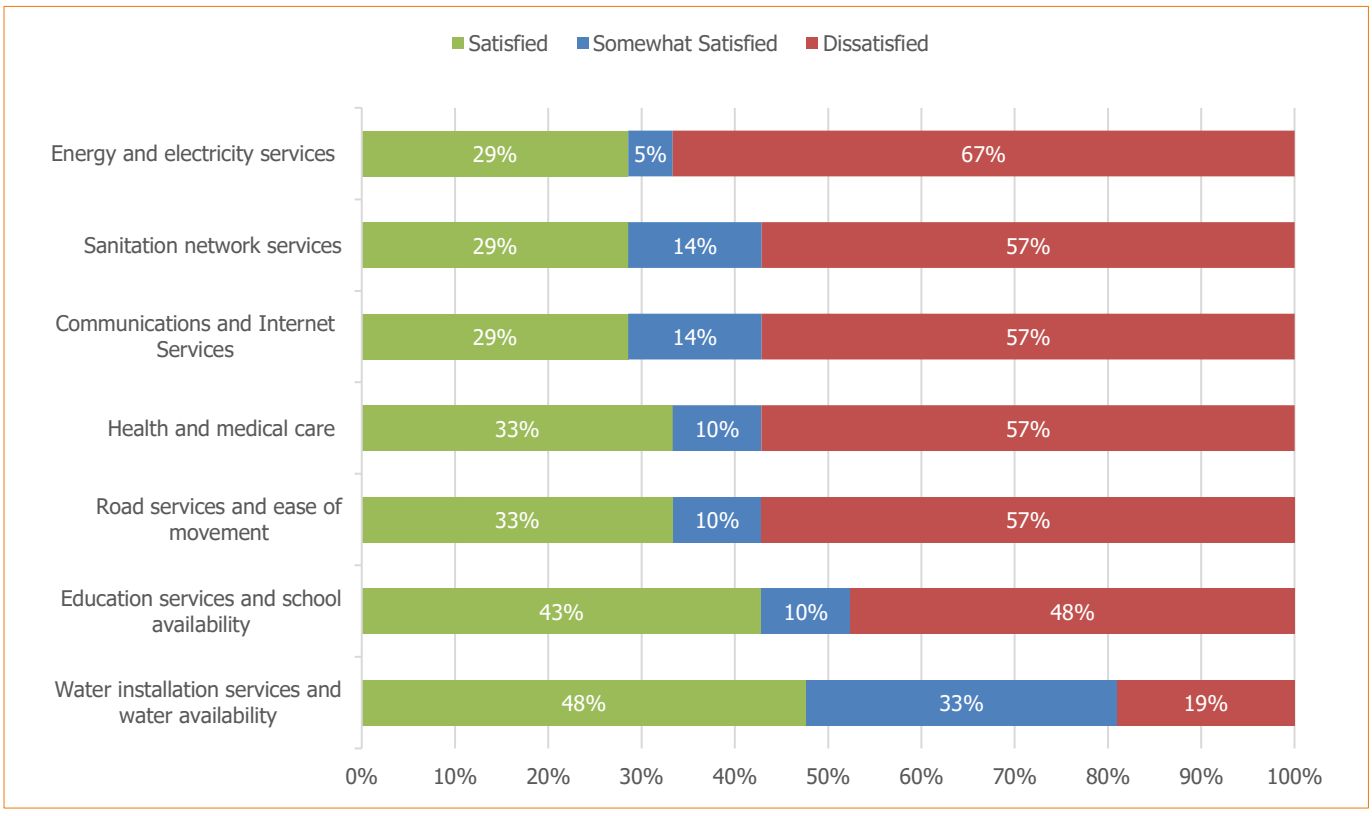


Figure no. 14: Satisfaction levels of input traders on infrastructure in Ash Shihr District

SWOT and PESTLE Analysis - Input supplies

In general, the SWOT and PESTLE analysis relied on ranking the points according to their frequency of mention among the players of the value chain, not according to their importance, as in the analysis of problems / challenges (see Appendix (2): SWOT and PESTLE Analysis Details). The findings and details at each stage level of the SWOT and PESTLE analysis are addressed under the following headings for the fish value chain in Ash Shihr District.

Strengths

The results in Table no. 8 showed the most important strengths for this stage. It was observed that the strengths that distinguish the sector at the input stage according to the PESTLE classification were primarily economic, as shown in detail in Table no. 13 and in the appendices. The most frequently mentioned strength was the availability of some quality products in the market, such as engines and boats, at approximately 15%. The ownership of storage facilities by input traders at this stage was the second most frequently mentioned strength, at 13%. The third most frequently mentioned strength was the ability of traders at this stage to provide supply (products) according to customer demand, at about 12%. Input traders in the Ash Shihr fish sector also see their proximity to relevant authorities in the fish sector as a strength, with a frequency of about 8%, and according to the PESTLE classification, this point is considered an institutional classification[6]. These economic and institutional points play a pivotal role in providing a suitable and competitive work environment for input traders in Ash Shihr District.

Opportunities

The opportunities in this stage were primarily economic opportunities, represented by an increase in demand for fish in Ash Shihr District, where the latter formed the highest opportunity with a frequency rate of 41%. Secondly, according to input traders' opinions, institutional opportunities were related to security stability, where the frequency rate was about 10%. Additionally, proximity to the market for producers was the third opportunity mentioned by input traders, with a frequency rate of 10%. These economic and political opportunities can play a significant role in expansion, especially

[6] In this report, the political and legal categories of the PESTLE analysis were merged into one called "institutional".

beyond the local framework of the district, which increases investment opportunities for input traders in this stage of the fish value chain.

Weaknesses

Most of the weaknesses in this stage were economic, represented by the use of low-quality equipment according to purchasing power, with a frequency rate of 12%, and the lack of market research, with a frequency rate of 12%. Additionally, there was weak purchasing power for oil derivatives, with a frequency rate of 12%, and these points have a negative impact on the efficiency of the fishing process and higher operating costs.

Threats / Challenges

The input stage in Ash Shihr District faces multiple threats, including an economic threat of rising oil derivative prices with a frequency rate of 19% and price volatility with a frequency rate of 10%. There are also institutional threats such as tax and customs increase with a frequency rate of 15%, and wars and conflicts with a frequency rate of 7%. These threats hinder the activities of this stage and increase its costs. They also undermine the fishermen's inclination to continue in this activity, especially among young people.

Stage 2: Production

Table no 4 shows that fishing in Ash Shihr District varies from regular trips to difficult ones that fishermen undertake to make a living. Their trips range from 1-36 hours and can extend to days on large boats for each trip.

The quantity and types of catch differ depending on the boats used in the fishing process, which range from small to medium to large. Small boats are usually under 5 m^2 in area, use 15-20 horsepower engines and are operated by 1-3 fishermen. Their trips are short, extending up to 6 hours, covering a distance of 3-30 nautical miles at sea. They usually prefer specific places for fishing, such as Al-Garaph, Al-Luabah, Al-Sumuqi, Al-Qazam, Kabshi and others. The average catch quantity for these boats is 21 kg/trip at sea, making them one of the most commonly used boats for fishing in the area. Most fishermen use these boats because they are one of the cheapest types available, with prices reaching up to YR 4,950,000.

On the other hand, medium boats range in area from 6-20 m^2 and require 20-60 horsepower engines to operate. They are relatively expensive, making them limited in use, and most fishermen cannot afford them because the people in the region have limited incomes. Their prices range from YR 8,250,000-8,800,000 or more, depending on the length of the boat and the engine power. These boats are considered better than small boats because they can cover distances ranging from 30-135 nautical miles, allowing fishermen to obtain a catch quantity of approximately 375 kg/trip at sea. Fishing trips on medium boats last from 6-36 hours, and 3-9 fishermen work onboard.

Large boats with an area of more than 20 m^2 are of limited use, and only a few are owned by fish associations or some high-income companies or fishermen. The engines used in these boats are considered to have high capacities exceeding 60 horsepower and reaching up to 250 horsepower. The large boats are called “Al-Abari” and are large and expensive, with prices exceeding YR. 110,000,000. Ordinary fishermen from the area cannot afford to own or operate these vessels. Therefore, they are limited use and owned by parties that can afford the high costs of purchasing and operating them. In terms of productivity, the catch quantity is very high compared to other types of boats, ranging between 2,000-4,000 kg per sea trip. The fish caught are stored in fish preservation tanks on board the large boats. These fishing trips can last more than 135 hours, and sometimes up to 20 days, depending on the availability of fish. These trips cover long distances from the seashore, sometimes reaching Somalia and Aden, and the financial return from these trips is higher than that for smaller of boats.

The quantities of fish caught and traded in the Ash Shihr District vary according to the fishing season and the presence of fish in the areas near the coast. Most of the quantities come from small boats due to their abundance and ease of use. The fish quantities brought by medium and large boats are low due to the small number of these vessels in the area. The product price is set according to the availability of fish, their types, and the quantities that have reached the trading areas, as the quantity of fish caught at the same time determines the product price (excess supply). The price is low whenever the supply is more, and the price is high whenever the supply is less. However, the effect of product quality on price is limited, as the price is determined based on the quality of the fish exported to foreign markets.

Table no 4 Types of producers based on the boats used for fishing (Primary Data, 2022).

Type of boat	Boat surface area (m^2)	Engine power (horsepower)	No. of fishermen	Fishing trip time (hours)	Distance traveled (nautical miles)	Average catch (kg / trip)
Small boats	Less than 5	15 - 20	1-3	1 - 6	3 - 30	21
Medium boats	6 - 20	20 - 60	3-9	6 - 36	30 - 135	375
Large boats	> 20	> 60	> 9	36 - 480	> 135	2,000 – 4,000

Most fishermen set off early in the morning, before dawn, having prepared their fishing gear and supplies. They bring enough food and drink according to the length of the trip, as well as enough fuel for the distance they intend to cover at sea. After ensuring the safety of the boat and the motor, and preparing all the fishing equipment and positioning devices, the fishermen set off with their assistants catch fish.

Most fishermen in Ash Shihr use fishing nets with natural or artificial bait. They throw the nets in different directions from the boat and wait for the fish to get caught in them, then they pull the nets out of the sea and place the fish in the boat's storage. Some fishermen use trawl nets, hedge nets and regular nets. The use of these nets requires fishermen to work in the middle of the night, so they can return to the landing centers when the fish merchants and wholesalers are present to sell their catch at a suitable price that covers their trip costs.

When returning to the landing centers, there is a central disembarkation center in the city of Ash Shahr. The small port and the landing center are where the fishermen sell their fish to the authorized marketers of the associations to wholesaler and retail traders, as well as to the traders in manufacturing industries who fall under the category wholesaler, and to citizens directly.

Photos of producers (fishermen) of the fish value chain at the fishing location in the Ash Shihr District

Analysis of Production Costs

To implement a project for fishermen with one boat, there are several considerations that must be taken into account to achieve profitable productivity. One of the most important of these considerations is to purchase a boat with an area of around 15m^2 with an engine that can carry over 42kg of fish daily. The estimated average cost of such a boat is 6,325,000 YR. Additionally, a Magellan GPS device must be purchased, which helps a fisherman accurately determine his location and reduce diesel loss due to getting lost at sea. The average cost of the device is approximately 115,500 YR. The above is considered fixed an asset along with nets, cages, anchors and water pumps.

Table no. 6, shows the total fixed costs for one boat are approximately YR 11,148,676. According to the profitability and payback period analysis producers (boat owners) are able to recover the cost of construction/fixed costs within 0.53 years. **It should be noted that the producers use cages (nets) which are environmentally harmful and are banned from use by local authorities.**

Producers (fishermen) incur other daily production costs besides construction/fixed costs (the average number of working days per year for producers is 271 days). There are operating/variable costs such as fuel for boats, ropes, and other costs mentioned in

Table no. 5 that total approximately YR 19,345,931 per year. In order to establish a project for producers (fishermen) in the fishery sector in the Ash Shihr District for a single boat, the total overall costs (fixed and operating) are approximately YR 30,494,607. The average annual production cost after depreciation and operating costs are removed is approximately YR 21,208,110, to produce around 11,419 kg of fish annually per boat. Based on the above, we can say that producing one kg of fish requires YR 1,859 YR before factoring in fish lost, and the production cost per kilogram after loss is approximately YR 1,925.

Table no. 5 Average quantity and cost of producers' inputs per boat/year in Yemeni Riyal (YR) (Primary Data, 2022)

Description	Unit	Quantity	amount	Total	Notes Depreciation Ratio |...
Constructional costs/ fixed					
Offshore engine	Motor	1	3,043,887	3,043,700	14%
Boat	Boat	1	3,281,113	3,281,300	14%
GPS Magellan device	Device	1	115,500	115,500	20%
Sakhawi / cages	pcs	48	95,700	4,634,300	20% | Harmful to the marine environment
Al-Borsi / anchors	pcs	2	25,300	50,600	30%
Vacuum pump with water renewal device	pcs	2	11,473	23,100	50%
Variable Costs / Operating					
Lines	pcs	2,710	1,100	2,981,000	
Baited hooks	pcs	7,023	286	2,015,200	
Artificial bait	pcs	7,700	275	2,117,500	
Fishing nets	pcs	7	202,400	1,416,800	
Ropes	pcs	7	34,100	238,700	
Oil derivatives	Liter	5,832	1,397	8,147,700	
Oil	Liter	340	1,408	477,400	
Marine lead - lead sinker - Dewar	pcs	70	957	67,100	
Mode of transport	Number of	271	1,914	518,100	
Maintenance charges and tools	Once	1	330,000	330,000	
Nutrition	Meal	271	3,828	1,037,300	
Total construction cost / fixed (FC)				**11,148,676**	
Total variable costs / operating (VC)				**19,345,931**	
Total yearly depreciation (DP)		1,862,179			
Total production costs (variables + depreciation)		21,208,110			
Total costs (TC)				**30,494,607**	

Profitability and Feasibility of the Production

From Table no. 6, it is clear that the investment cost for one boat is around YR 11,148,676, and the average net cash flows are YR 21,208,110. Using these two figures, we can calculate the payback period, which equals the average investment cost divided by the average net cash flow. The payback period for this project is 0.53 years. Based on this, we can conclude that such projects are economically feasible and profitable for producers (for one boat).

The average investment index in Yemen for 2022 is about 27% according to Trading Economics (2022). Based on the analysis, it is clear that there is profitability and feasibility for productive projects for producers (fishermen). According to the return on investment (ROI) indicator[7], the value of this indicator for such projects is about 187.80%, which is above the average investment indicator for Yemen (27%). This indicates that the project is profitable and feasible when implemented by a group of fishermen for one boat with an average area of 15 m^2.

Table no. 6 Productive and economic efficiency indicators for fish value chain producers in Ash Shihr District, estimated at (boat/year) (Primary Data, 2022)

Production and economic efficiency indicators (calculation mechanism)	Symbol	Unit	Product (Fisherman)
Input (Production Unit)	P(U)	Text	Boat*
Quantity/production per year	Q-In	(1)	1
Work period since establishment until the first production	Per (0)	Month	0
Period/life cycle of the product/service after the establishment	Per(n)	Day	1
Number of production/service cycles (after establishment) per year	---	Day	271
Yield Unit)	Y(U)	Text	Kg
Production quantity - Output per each production unit - In for each life cycle	Q-Out/In	Kg/Boat	42.14
Productivity for all production units - inside (after establishment) / year (Yield)	Q-Out	Kg/Boat/Year	11,419
Rate of Loss of productivity per year (Loss)	Loss	%	3.4
Total investment cost (establishment + fixed)	TFC	YR/Boat	11,148,676
The depreciation rate for each year (of assets) (% of item 10)	CFC	%	17
Total variable/operational cost per year	TVC	YR/Boat/Year	19,345,931
Total marketing cost per year	TMC	YR/Boat/Year	0
Total capital (10+12+13)	TC	YR/Boat	30,494,607
Total production cost for each year ((*1*-11) *10+12+13)	PCT	YR/Boat/Year	21,208,110
Unit Selling price (Price / Unit-Sell)	SP	USD/Kg	3,652
The unit purchase price or unit production price (Price / Unit-Buy)	PP	USD/Kg	1,925
Returns/incomes (after establishment) for the year (16*(*1*-9) *8)	R	YR/Boat/Year	40,283,056
Returns/other revenues (support/ selling assets/ etc...) Per year	OR	YR/Boat/Year	0.00
Total returns/revenues per year	TR	YR/Boat/Year	40,283,056
Profit or total Profit margin or cash flow for each year	Pf or GM	YR/Boat/Year	20,937,114
Net profit	NPf	YR/Boat/Year	19,074,935
Daily net profit	Pf or GM	YR/Boat/Day	70,389
Net profit per fisherman on the boat per day	Pf or GM	YR/Fisher/Day	16,368
Benefit-cost ratio (profit)	GM	%	52
Payback period (10/21)	PBP	Year	0.53

Italicized number = real figure and calculated as a number and not a number for the element (item).
* = Data received as an average of the specifications of the boat with an average area of 15 m^2.

[7] Rate of return on investment = average annual net cash flows/initial investment * 100 (فهيم، 2015)

SWOT and PESTLE Analysis - Production

Strengths

The production stage has economic strengths, as shown in Table no. 8, represented by the ability to provide supply according to demand with a repeatability rate of 17%. Then, their proximity to sources with a repeatability rate of 15%, followed by market quality with a rate of 15%. The producers in the chain also excel in achieving profits with a rate of 11%, and these strengths enable the sector to produce at lower costs.

Opportunities

There are economic opportunities for this sector that will contribute to enhancing productivity, reducing production costs, and increasing productivity. These opportunities are increasing demand for fish as the highest opportunity with a repeatability rate of 25%, in addition to proximity of the market to the producer with a repeatability rate of 11%. Also, the large number of companies with a repeatability rate of 11% is an opportunity for this sector to increase competition in the market, and the presence of ice factories with a repeatability rate of 10%.

Weaknesses

The fisheries sector faces economic weaknesses primarily in the production stage, represented by a 17% frequency rate decrease in production. This is economically unviable for the sector due to the low demand for local fish products, as their prices are high compared to the average income per person. In addition, the weak level of exports and the lack of coordination (15% frequency) are other weaknesses that negatively affect the activities of producers in terms of the high production costs and weak purchasing power for oil derivatives (11% frequency).

Threats

The threats facing the fisheries sector in the production stage vary. The economic threat of high oil derivative prices, which account for the majority of production costs, is a significant threat (25% frequency), and institutional threats such as increasing taxes and customs (15% frequency) can negatively impact the sector. There is also an environmental threat to the sector due to coastal pollution (10% frequency), which can significantly affect product quality. Additionally, wars and conflicts (8% frequency) can raise production costs and sometimes disrupt production.

Stage 3: Trade, Processing and Export

Figure no. 15 illustrates the details of the trade, processing, and export stages between the production and consumption stages in the fish value chain in Ash Shihr District. This figure is part of the complete fish value chain map shown in Figure no. 20: Map of quantitative and cash flow among fish value chain players in Ash Shihr District - Hadhramaut - Yemen. According to the study, the trade, processing, and export stages have been divided into five players, as follows:

- **Fisheries Cooperative Associations** working as supporters and wholesalers in the fish value chain
- **Aggregator retailers**
- **Processer retailers (local manufacturing)**
- **Aggregator wholesalers**
- **Processing wholesalers and retailers (fish factories and companies)**

The following headings will show the description and work mechanism of each player in these stages between the production and consumer stages:

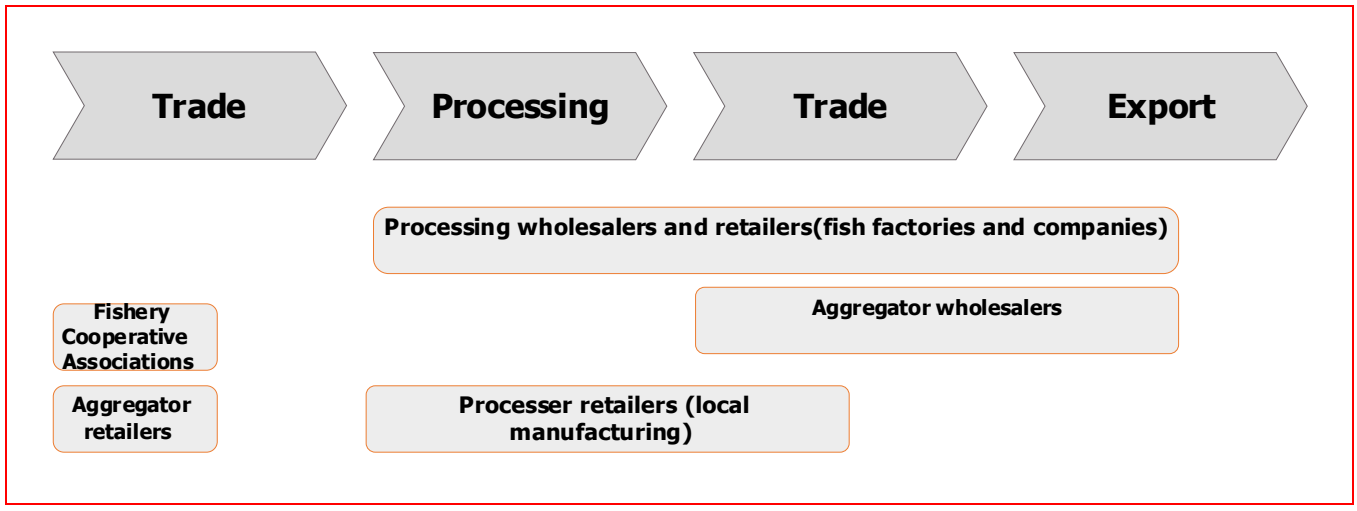


Figure no. 15: Trade, processing and export stages in detail and the functions of these stages of the fish value chain in Ash Shihr District (Primary Data, 2022)

Fisheries Cooperative Associations - as Wholesalers.

Under Law No. 39 of 1998, cooperatives and associations were established with the aim of developing production and agricultural sectors, unifying efforts, ensuring the rights of producers, organizing the production process, and linking institutions and individuals working in the agricultural and industrial sectors. Producers were introduced to associations that organize the production process and serve as a link between fishermen and the private commercial sector. According to the (Fisheries Authority, 2022) there are five fishery cooperatives managing the production process of fishermen in Ash Shihr District.

In general, the cooperative's activity mainly revolves around marketing fish and aquaculture at the fish landing centers through public auctions managed by association agents. Agents then negotiate with traders, intermediaries, factory owners and companies to sell the fish. After the fishermen complete their work, they bring their catch to the official

agents of the cooperatives at the landing centers. Then, the cooperative's role begins through individuals (marketers) present at the landing centers who inventory all the fishermen's catch and hold a public auction for buyers.

Usually, fish prices in auctions vary depending on the seasons and the type of fish, where prices per kilo during the fishing season are as follows:

- YR 2,000 - 4,000 tuna
- YR 1,500 - 2,000 sharks
- YR 6,000 - 8,000 emperors
- YR 30,000 - 50,000 dried squid

During non-fishing seasons, prices increase to around 95% of the fishing season prices due to the reduced quantity of fish and the lower number of fishermen, who engage in other work such as construction and painting during these seasons. Fish prices per kilogram outside the fishing season are as follows:

- YR 6,000 - 8,000 tuna
- YR 3,000 - 5,000 sharks
- YR 9,000 - 11,000 emperors
- YR 60,000 - 80,000 dried squid

After the purchase process is completed, the marketer gives the fisherman a voucher for the total production amount as agreed upon at the auction, minus the agreed percentage. The average percentage deducted by all cooperatives is around 5%, which is distributed as follows:

- 2% for cooperative services (salaries, rents, furniture etc.).
- 1% for a cooperative support fund that provides assistance to members in need (only one of the five cooperatives operate this fund)
- 2% for social security (only two of the five cooperatives operate this)
- 4% for fishermen savings that can be withdrawn whenever needed (only two one of the five cooperatives operate this)

After the sale process and receiving the voucher, the fisherman goes to the cooperative office, which is usually located at the landing center, and receives the amount specified in the voucher.

The cooperatives add a commission of 3% of the sale value from the same buyer, which is paid after loading the purchased fish. This commission is collected after the loading by means of guarantees or trust, in the case of individuals known to the cooperatives. The commission is added to cooperative services (salaries, rent, furniture, etc.).



Photos showing the auction process at the landing centers

Aggregate Retailers

Retailers buy fish from landing centers through association agents during public auctions or directly from fishermen, and distribute them to the rest of the actors in the chain. They distribute them on four channels, consumers such as restaurants and the fish market sell directly to the consumer, factories and private fish companies, wholesalers, and process retailers.

After purchasing from the source, aggregate retailers sell it directly to private fish factories and companies, wholesalers, and processing retailers. Some of the fish is transported to the fish market, about 100 m from the landing center. At the fish market, there are storage tanks for each retailer, where the fish are stacked and chilled with ice. The fish are placed in the tank and then covered with ice, and another group of fish is placed on top of it and covered with ice until the tank is full, then sealed tightly. Each day, the retailer takes a portion of the fish, removes the guts, head, and tail, and sometimes scales them before selling them to consumers.

Photos show retailer's market

Processing Retailers (Local manufacturing)

Processing retailers (local manufacturers) are responsible for converting fish into various local products through various processing methods and techniques. They are one of the important links in the fish value chain in Ash Shihr District, which works to balance supply and demand by absorbing excess fish during times of abundance and turning them into products that can be used during times of scarcity. The fish industry is one of the projects that provides a source of livelihood for many unemployed young people and retirees, with an average total workforce of about 20 workers per factory.

After purchasing the fish, processing retailers transport them to their factories to carry out local processing. There are three main processing operations they perform: drying, salting, and pickling. We will discuss each operation separately, as these factories produce many fish products, the most important being dried fish, an essential product in local industries that is derived from shark. Dried fish is the preferred and most consumed type of fish in Ash Shihr and surrounding districts, where converting shark to dried fish was very common.

Drying process:

After the processing retailers obtain the fish from the landing center, they transport them by special vehicles to their factories, where the first industrial operations begin. Workers then:

- Unload the fish from the transport vehicles
- remove the fish guts and cut off their heads
- thoroughly wash the remaining fish body before cutting the fish
- put suitable amounts of salt into the cuts and leave them for about 2-3 hours to allow the salt to penetrate inside the fish body
- place the fish in the drying area. It is preferable to put smooth stones under the bodies of the fish. The advantage of these stones is that they heat up in sunlight which helps the drying process.
- after the fish are placed in the drying area, they are left until sunset and then lifted or covered to avoid moisture or rain and spoilage
- the fish are exposed to sunlight the next morning and this process continues for 3-5 days, during which time the fish are turned in all directions until they are well dried
- after drying, the fish are prepared for sale and transported to special warehouses, then distributed to their sales centers or customers

The fins, especially shark fins, are sold for hard currency and exported abroad where it is said they are used in medical products.

Photos showing drying process conducted by processing retailers

Process of salting and drying (Al-Haneed)

In this process, the fish (usually tuna) is processed in the following way:

- The guts, head, fins and tail are removed
- The salting process begins, where the fish are placed in special containers with a mixture of water and salt (10 kg of salt per 100 kg of fish). The fish are boiled between 25-45 minutes depending on the fuel used (house gas or firewood). After boiling, the fish is left to cool, then peeled, the bones removed, and dried for 2-3 days.

The final product is ready for consumption and is called "Al-Haneed".

Photos showing the Al-Haneed (salting and drying) process conducted by processing retailers

Process of salting:

The salting process is usually done with tuna or similar fish and is carried out as follows:

- The fish is gutted and the head, fins and tail are removed. The fish is filleted so that only the meat remains.
- The fish is washed and left to dry completely.
- Then a portion of the fish is placed in containers that can be tightly sealed or in plastic barrels according to the quantity, a suitable amount of salt added, and a layer of smooth, medium-sized stones are added. The process is repeated with more layers of fish, salt and stone until the container is filled.
- The containers are covered and tightly sealed, placed in special stores away from moisture and air, and left for 40-45 days. During this time, the salt draws the liquid from the fish by the principle of reverse osmosis, where water moves from the lower salt concentration medium (inside the fish) to the higher salt concentration medium surrounding the fish. The liquid accumulated in the container acts as a preservative for the fish. Here we would like to mention that the role of the stones is to prevent the layers of fish from sticking together.
- After 40-45 days, the fish is ready for consumption.

In the local dialect is it called "Al-Malih" (salty) and the fish remains in the liquid it was preserved in until it is consumed. Removed from the liquid, the fish spoils quickly.

Photos showing the salting process conducted by Processing Retailers

Table no. 7 shows an economic comparison between the local fish industries in the Ash Shihr district, which are dried, salted and dried (Al-Haneed), and salted fish. The most commonly used fish for the Al-Haneed and salted fish industries is tuna. The dried fish shark market is based on the meat produced from all types of sharks, and there is usually a high

demand for dried shark meat. Its popularity is partly because it can be stored for long periods without spoiling, up to 60 days. Also, its versatility in consumption as it can be eaten without cooking or cooked in multiple different ways, and its delicious taste are all other reasons for its popularity.

In terms of demand, salted fish comes in second place, though with only moderate demand due to its high price and limited shelf life. The fish goes off if left uncovered for several hours or is exposed to humidity. Salted fish in its liquid can be stored for up to 20 days and is considered an appetizing meal.

The salt and dried (Al-Haneed) fish has least demand in the market because when dried, it becomes solid and difficult to consume. It is not considered as appetizing compared to other fish available.

Dried fish has the highest demand (50%) in the market, and it is considered an in demand and popular product. The profit margin for dried fish is about 1,000 YR / kg, while the profit margin for salted fish is the highest at around 1,450 YR / kg. However, only 30% of the local market demand is for salted fish, while the demand for dried fish is higher. The Al-Haneed fish have the lowest profit margin, and a market demand of less than 20%. It is purchased by necessity mainly by poorer citizens.

The dried and the salted fish industries offer high investment opportunities, and if value is added to these products, they can be distributed on a larger scale outside of Ash Shihr, creating more job opportunities in the region.

Table no. 7 Comparison between types of local fishing industries in Ash Shihr District (Primary Data, 2022)

Comparison aspects	Fish Dried	Fish Al-Muhannada (Hardened)	Fish Salted
Fish purchase price (YR / kg)	2,000 (Shark/Lukham)	2,000 (Tuna - Second Class)	3,000 (Tuna - First Class)
Loss per kilogram After processing (%)	25	9	5
Fish weight after lost processing (kg)	750	910	950
Fish purchase price after loss compensation (YR / kg)	2,500 (Shark/Lukham)	2,180 (Tuna - Second Class)	3,050 (Tuna - First Class)
Processing cost (YR / kg)	2,500	1,500	2,000
Fish sale price after processing (YR/Kg)	6,000	4,500	6,500
Profit margin (YR)	1,000	820	1,450
Storage period (Day)	60	60	20
Demand for purchases	Very High	Medium	High
Percentage of local industry type (%)	50	20	30
Identify your customers	Citizens / restaurants / merchants	Citizens / traders	Citizens
Buyer's economic level	Poor/middle/high income	poor	High average

Aggregate Wholesalers

Aggregate wholesalers are those that buy directly from landing centers through fisheries cooperative association agents or directly from fishers. They usually own refrigerated tracks and distribute fish to larger markets in the country, as shown in figure 20.

These traders are highly interested in certain types of fish requested by their customers usually factories and exporting companies as they are the main providers of a large portion of their fish demands specifically high demand species such as shark and squid. They also provide fresh fish to central markets in the governorates, and some of these traders can export fish to some markets abroad.

The packaging of fish by these wholesalers usually follows minimum standards to keep the fish fresh. Fish is packages in layers of fish and ice, in large crates and transported in refrigerated vehicles. Primary local markets include Taiz and Sana'a, and export markets for wholesalers is manly Oman.

Photos showing aggregate wholesalers

Processors - Wholesalers/Retailers

This category includes processors who are both wholesalers/ retailers owning factories and companies. The high production of fish in Ash Shihr led to the establishment of an industrial site in the district where most of the processing companies and factories are based. Data obtained from the (Fisheries Authority, 2022) state there are around 15 factories and companies working in fish processing, preparing and export in Ash Shihr district. These companies perform a wide range of activities such as fish collection, salting, peeling, fish production, packaging, cutting and freezing. These include popular products such as tuna, lobsters and squid.

These factories and companies also produce by-products of fish such as fish powder, made from fish and marine residue that is rich in protein and used in the manufacture of animal and poultry feed and fish feed in fish farming. Some of these factories also produce fish oil rich in Omega-3 vitamins which is used in many medical and therapeutic industries. These factories and companies also produce crushed ice, which is used in the preservation of fish and marine life during transport, storage and distribution.

These companies and factories attract a lot of labor from young people, engineers and fisheries specialists. Each company employs an average of about 54 employees who are involved in several operations such as storing and preserving fish, cleaning and washing fish, transportation and distribution and other activities.

Fish factories and companies in the Ash Shihr District receive the largest share of fish production in the directorate daily, which has a significant impact on the demand for fish at the landing centers. It is worth noting that there are several players in the chain that sell fish products to these companies and factories, which is evidence of their effective role in producing and selling most of the fish and marine life production in the Ash Shihr District. According to data obtained from the (Fisheries Authority, 2022), the average production capacity of fish factories and companies in the Ash Shihr District is approximately 26 tons a day per company, with an average total storage capacity of about 966 tons a day per company and an average freezing capacity of 18 tons a day per company.

Since fish products are perishable, these factories and companies play a significant role in reducing the waste in fish products through processing and quick treatments that preserve fish from damage. Upon arrival at these companies and factories, operations are quickly carried out, such as gutting the fish, cutting off the head and fins, filleting and cleaning. They then transfer the products to refrigerators to "shock" freeze them at very low temperatures, down to - 40 degrees Celsius. After freezing, the fish is packed and stacked in boxes with the company name, address, and contact details in preparation for export. Most companies export their fish to foreign markets, including Oman, Saudi Arabia and the UAE. Some products are also distributed to the local market, with the main cities being Sana'a and Taiz. It should be noted that these companies and factories have a role and contribution in promoting and providing food security for the Yemeni people by providing fish and marine products with nutritional value.

Photos showing the stores of some fish companies and some of their products

SWOT and PESTLE Analysis - Trade, Processing and Export

Strengths

By analyzing the strengths from Table no. 8 for all the stages between producers (fishermen) and consumers in the chain, including traders who sell directly in the market, retailers, and wholesalers/processors (fish companies and factories it appears that they all possess strong economic strengths. The three most frequently mentioned strengths are their ability to provide supply according to demand, which is the highest ranked strength at 20%, the second strength is proximity to sources at a rate of 15%, followed by product quality (fish) in the market at a rate of 14%. The fourth strength is social and represented by the availability of labor in the Ash Shihr District where the employment of a significant number of workers contributes significantly to reducing the unemployment problem in the country.

Opportunities

The available opportunities for this sector are represented in the processing stage, with economic opportunities supporting the continuity of the sector. The highest opportunity for traders is the increase in demand for fish, at a rate of 30%, in addition to the proximity of the market to the product at a rate of 13%. The decrease in the price of the product is at a rate of 8%, which is accompanied by an increase in demand for products, especially for tuna and shark products, where small operators work due to the low capital for this activity. The availability of mobile phones for players in this sector is at a rate of 8%, making communication and marketing more accessible and efficient. There is also an institutional opportunity represented by security stability at a rate of 7%, providing an opportunity for traders to continue their activities safely in this sector.

Weaknesses

The weaknesses of this stage varied due to the diversity of activities within it. The economic weaknesses were related to not studying the market, at a rate of 14%, in addition to a decrease in production at a rate of 13%, and a lack of coordination at a rate of 12%. There were also economic weaknesses in this stage related to the weak purchasing power of oil derivatives at a rate of 11%, which represents an obstacle to facilitating their work and increasing their costs.

Threats / Challenges (Threats)

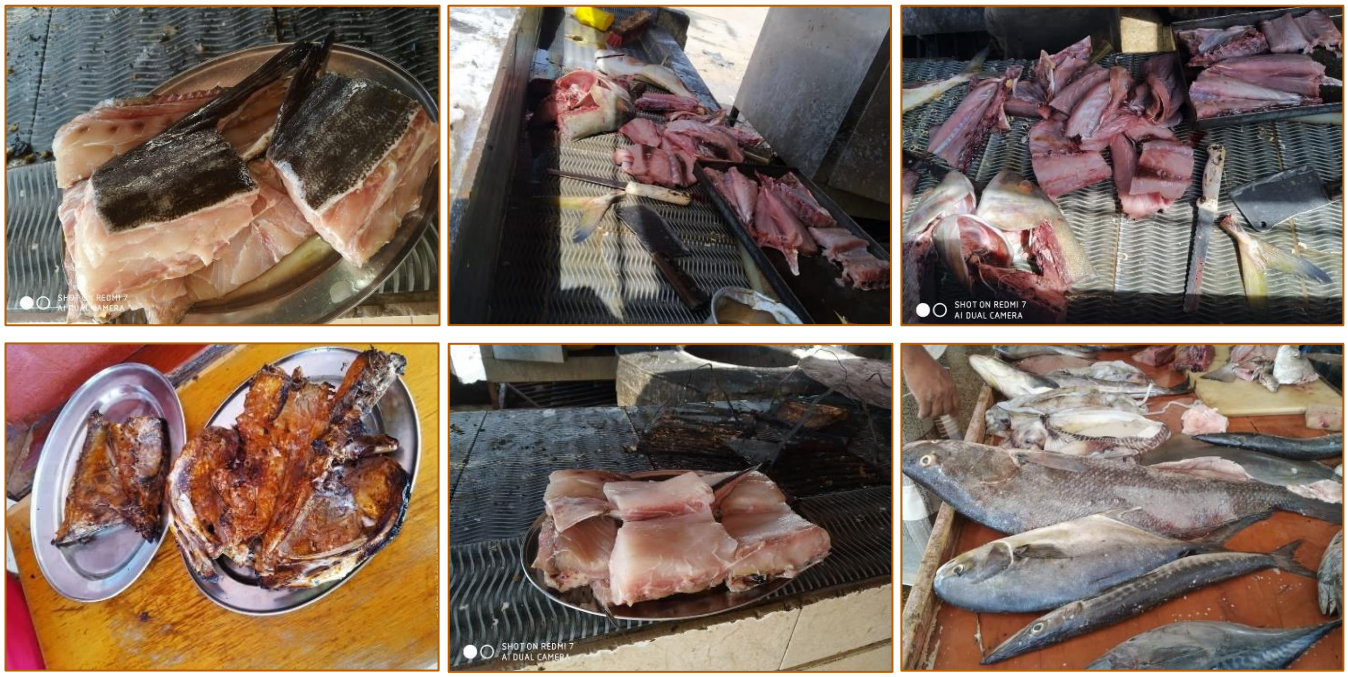
traders in this stage face economic threats, including the rise in oil derivative prices at a rate of 28%, price volatility at a rate of 11%, and an increase in taxes and customs at a rate of 11%. These threats affect the cost of production, including an increase in product prices, which consequently affects the consumer demand, especially local consumers. Moreover, there is an institutional threat represented by wars and conflicts, which affect the continuity of the processors' trading activity in this stage at a rate of 11%.

Consumption

The final stage in the fish value chain is the consumption stage. There are two types of consumers in the fish value chain: the local market and the foreign market. The consumer is the ultimate beneficiary in the chain and is the one who consumes the product, either by buying it from retail markets or by ordering ready-to-eat products from restaurants. Restaurants are considered one of the most important local consumers in the Ash Shihr District. Often, restaurant owners have representatives at the landing centers to purchase fish. After purchasing the fish, it is transported to their restaurants where workers gut the fish, remove the head and tail, and clean it thoroughly. Then the fish is cut into equal pieces and displayed for immediate sale in a refrigerated display. The pieces requested by customers are then cooked.

Usually, fish are stored as they are in refrigerators that store for a longer period, usually between 1-7 days, and with an average storage capacity ranging between 500-1,000 kg. Fish products are taken from traders based on consumers' demands. The many kinds of fish and seafood available are cooked in different ways by the restaurants and as consumers request, and in return, restaurants charge an additional fee of about 50% on the purchase price of fish from the source.

Restaurants in the Ash Shihr District typically buy one kilogram of fish at an average price of YR 3,000, and approximately 32% is added to the purchase price to cover the cost of transportation, labor, water, electricity, etc. The fish is sold at an average price of around YR 4,500 per kilogram. Therefore, the net profit percentage for one kilogram of fish at restaurants is about 18% of the purchase price.



Photos from restaurants showing their fish products

SWOT and PESTLE Analysis - Consumption

Strengths

From Table no. 8, the most significant strength for the final consumer of the fish value chain in Ash Shihr District according to PESTLE classification is economic. These strengths include the ability to provide supply according to demand at a rate of 14%, proximity to fish product sources at a rate of 11%, in addition to proximity to relevant authorities at a rate of 11%. The ability of final markets such as restaurants to achieve profits was also a strong point at about 11%. These strengths have a positive impact on the price, quality, and demand for products by the final consumer.

Opportunities

Economic opportunities for final markets were represented by the availability of a large coastal strip at a rate of 24%, which presents an opportunity for diverse markets along the coast. In addition, the quality of marine products at a rate of 19% presents another opportunity to gain a position and compete in the market. Increased demand at a rate of 17% and proximity to the market for the product at a rate of 10% provide an opportunity to reduce production and transportation costs, and consequently offer suitable prices in the final market.

Weaknesses

The economic weaknesses in the final markets are represented by low productivity with a frequency rate of 33%, resulting in low sales movement in the market. In addition, there is a weakness in the purchasing power of oil derivatives at a rate of 27%, which affects prices and consequently reduces demand for the product. There is also a social weakness for consumers represented by a lack of awareness at a rate of 20%. Furthermore, there is an institutional weakness due to the lack of a suitable work environment at a rate of 13% for the final markets through weak regulation.

Threats

Environmental threats had the highest impact on the markets and consumers alike, represented by environmental pollution of beaches with a frequency rate of 14%. This had an impact on the quality of final products. This environmental threat is due to unregulated fishing practices, where fishermen catch a mixture of mature and immature fish near the shores, harming the breeding season and the sustainability of the marine environment. The economic threat of rising oil derivatives at a rate of 12% is another threat to the final markets and consumers, in addition to price fluctuations at a rate of 12%, which combined affect the purchasing power of consumers. Wars and conflicts also pose a threat at a rate of 7% to the market and consumers.

Enablers / Legislative and Supporting Bodies

Enablers and legislative bodies are responsible for regulating the fish sector in the Ash Shihr District and coordinating between research institutions and institutions working in the sector and their relationship with foreign and local organizations supporting the sector. They also regulate the fishing process by issuing laws that define fishing boundaries, seasons, and specifications of the equipment & tools used. All these tasks and responsibilities fall on government institutions and organizations, represented by the Fisheries Authority, the Ministry of Fisheries, the local authority in the governorate, the Office of Planning and International Cooperation, and the Office of Social Affairs and Labor, which supervises the work of cooperative societies and unions.

Supporters are the category that connects all value chain categories by providing many options that contribute to raising and improving the capabilities of all players. Their absence from the chain, especially under these circumstances, causes losses to all players, especially producers, which may lead to the inability of producers to continue their activities. This cooperation between the supporters and players in the chain, especially producers, can be divided into the following:

- **Advisory support**, by providing or having specialists provide guidance and technical support to chain players.
- **Financial support**, by providing equipment or tools (marine engines, GPS devices, and fish finding devices), or through supporting fishery facilities (fish landing centers, selling and distribution markets), or supporting the fishery associations.
- **Information and technical support**, by enabling producers and other players to acquire the skills and knowledge that enable them to continue their activities. One of the most important of these activities is training fishermen on maintaining marine engines, which producers benefit from maintaining their production tools and enabling them to deal with problems and malfunctions during sea trips.
- **Legislative support** through the state enacting laws and regulations to ensure the continuity of this chain.

The following headings contain details of the enablers and supporters of the fish value chain in the Ash Shihr District:

Ministry of Fisheries - Enabler

The Ministry aims to develop, protect, and encourage the investment and utilization of fisheries wealth, raise its production levels, and develop it in a way that ensures an increase in the national income and supports the national economy. This is based on the general constitutional principles of the state, economic and social development plans, laws, and applicable regulations. The Ministry of Fisheries is responsible for the following tasks and responsibilities:

- Proposing policies, plans, and programs aimed at developing and preserving fisheries wealth, preparing plans and programs for their implementation within the framework of the state's policy, development plans, and applicable laws.
- Conducting technical, applied, and field research and studies aimed at developing fisheries wealth and working to implement the results of the research.

- Preparing and implementing fishery guidance plans that guarantee the development of the skills of fishermen, improve their performance, develop their production methods and knowledge, and provide services and facilities to raise their standard of living.
- Proposing projects for laws that aim to regulate and develop fisheries wealth, and following up on their approval and implementation.
- Supervising the institutions, branches, and offices affiliated with the Ministry, coordinating between them, and monitoring and evaluating their activities.
- Regulating and encouraging investment in the fisheries sector and providing necessary facilities in light of the state's general policy and capabilities.
- Preparing marketing and storage policies, estimating the needs for supplies, and participating in suggesting prices for products.
- Proposing research into methods for exploiting fisheries wealth and working to provide the necessary support and facilities for its members.
- Preserving fisheries resources, utilizing them efficiently, and protecting them in coordination with relevant bodies.
- Working to provide citizens' needs for fish production and increasing exports according to the available capabilities.
- Concluding agreements related to fisheries wealth with friendly countries, Arab funds, and regional organizations through relevant bodies and following up on their implementation.
- Establishing and strengthening relationships with similar ministries in Arab and other foreign countries, representing the Republic in the field of fisheries wealth before Arab, regional, and international organizations, participating in conferences, seminars, and specialized committees.

The Ministry of Fisheries includes the Fishery Authority, which has several departments:

1. The General Authority for Fisheries in the Red Sea (Hodeidah -Taiz)
2. The General Authority for Fisheries in the Gulf of Aden (Aden - Abyan - Lahj)
3. The General Authority for Fisheries in the Arabian Sea (Shabwa - Hadhramaut - Mahra - Socotra)

Fisheries Authority - Enabler

The Fisheries Authority is a legislative office established in 2012, formerly known as the Office of Fisheries Wealth and also the Office of Fish Landing Centers. The office is under the General Administration of the Fishery Authority, which is based in Mukalla. The Fishery Authority focuses its activities on conducting research related to developing the sector, regulating the activities of fishermen, and conserving fish resources. They also enact laws that prohibit fishing in certain seasons, such as breeding seasons, and banning the use of small-mesh fishing nets that catch small fish and negatively affects fish reproduction. The most important tasks and activities of this entity include:

- Supervising the implementation of fishing laws and regulations.

- Supervising the functioning of the fisheries associations and companies.
- Regulating fishing operations and preventing illegal fishing.
- Supervising the landing centers and regulating their work.
- Providing support and facilities to the supporting bodies in the fisheries sector.
- Conducting research and studies.
- Resolving problems faced by associations and fishery companies.

The Fishery Authority suffers from limited powers that reduce its ability to perform its tasks, including issuing laws and imposing deterrent penalties on violators. As for the other roles related to issuing licenses and collecting annual obligations from companies and factories, it is done through the headquarters of the General Administration of the Authority in Al-Mukalla. The Office of the Authority in Ash Shihr District suffers from a lack of any revenue for the office, to the extent that a percentage is imposed on the value of fish exports from companies, which is also forwarded to the Authority Office in Al-Mukalla.

Marine Science Authority - Enabler

The Marine Science Authority, which is under the Fisheries Authority, is responsible for conducting research and studies that serve the fisheries sector. Currently, it is focusing on studies related to identifying fish breeding and mating seasons to take the necessary measures to determine fishing seasons and closures to preserve fish stocks and marine life.

Local Authorities - Enabler

The local authority in the Ash Shihr District is the primary legislator aimed at organizing the lives of citizens and ensuring their access to services and entitlements. It also has a supervisory role over the executive offices in the district, including the Fisheries Authority, Public Works and Roads Office, and Population Planning Office. Its most prominent tasks include:

- Providing fuel.
- Supervising the fish landing sites in terms of security, hygiene, and administration.
- Providing support and protection in the event of accidents at sea.
- Coordinating with associations and the Fisheries Authority in all matters related to the fisheries sector.

Fish Landing Centers - Supporter

Al-Daka (the landing bench) is the name of the only landing center in the Ash Shihr District. The landing center is affiliated with the Fisheries Authority. The center used to generate revenues for the authority at the rate of 3% of the value of the fish sales that taking place at the landing center as service fees, but this stopped recently with the weakening of state institutions, including the Ministry of Fisheries. The center is currently managed by the fisheries associations.

Fishermen's Associations - Supporter

Fishermen's associations are cooperative fishery associations located in Ash Shihr district and include many members (fishermen), with the number of members ranging from 370-2,000 fishermen. Some associations own fuel stations, shops and ice factories, and profits are distributed to members after deducting liabilities. The associations perform many tasks, including:

- Monitoring fishermen's production and marketing products at public auctions
- Communicating with official authorities and seeking support for fishermen
- Resolving problems related to the fishery sector
- Providing health and social services to fishermen paid for by small deductions from fishermen
- Providing oil derivatives in the event of their absence
- Seeking to own investment projects that benefit the fisherman

Fishermen's associations work on marketing products at fish landing centers through public auctions by giving the fisherman a voucher that includes the total production, with a small percentage deducted for the support fund. The fund provides assistance to members that are elderly, in need, and where fishermen face emergencies. In addition, the association addresses the relevant local authorities to ensure the continuity of fishermen's work, provides oil derivatives when otherwise unavailable, and communicates with organizations and supporting institutions to bring support to fishermen. They also communicate with the General Administration of the Fisheries Authority to organize fishermen's work, develop the fishery sector, and resolve problems related to fishermen. It is worth noting that associations seek to own investment projects that have profitable returns that benefit fishermen. At the end of each year, these amounts are distributed to members as shares according to each person's participation and production.

Fish Cooperative Union - Supporter

The Fish Cooperative Union is the organization that includes all fish cooperatives in the Republic and speaks on their behalf. Its management is elected by the heads of the cooperatives through an electoral process, but in recent years, the role of the union has been suspended, and it does not have an office in the Ash Shihr District.

Civil society organizations - Supporter

There are many organizations working to support the fisheries sector in the Ash Shihr District, and among the most important of these is the Small and Medium Enterprise Promotion Service (SMEPS) that run several activities to support producers (fishermen) with financial and consultative support. It works to empower producers to continue their activities despite the conditions and obstacles they have previously faced. The fish cooperative associations play an active role in addressing the needs of producers, as some cooperatives provide some privileges to their members, such as health insurance and some short-term easy loans to cover the costs of fishing trips.

SMEPS has already supported several projects in the fisheries sector, such as supporting fish exporters to participate in international exhibitions, where a special booth was reserved for the participation of five fish-exporting companies from different governorates of the Republic, in addition to the YSEA association. The agency also supported fishermen by providing more than 400 marine engines and over 100 fishing boats in various regions of the Republic. It trained more than 340 fishermen on how to use GPS devices, and over 280 fishermen on using fish-finding devices. It also trained over 500 fishermen on marine engine maintenance and distributed subsidized tools to them. SMEPS supported fish companies and cooperatives through the BRAVE project, supported by the Islamic Development Bank, by establishing profitable projects from grants of up to USD 50,000 for each project.

SWOT and PESTLE Analysis - Enablers and Supporters

Strengths

The enablers and supporting entities, including fish cooperatives, local authorities, the Fisheries Authority, and the Ministry of Fisheries, play a significant role in the fish sector chain by regulating and supporting it. Therefore, they possess institutional strengths that are represented in the planning with a frequency rate of 27%, which protects investors. This is evident within the framework of fisheries cooperatives in Hadhramaut province, including Ash Shihr District. Additionally, their proximity to the relevant authorities is a strength at a rate of 19%. The coordination strength with other entities comes next at a rate of 19%, due to their spread across all fish sector regions and the sector's strength in the region. This contributes to compliance with fishing laws as they represent fishermen officially and thus facilitate transactions with the relevant authorities. Moreover, the operation staff are collaborative at a rate of 11% indicating the strength of the supporting entities' in facilitating their tasks. Also, they possess modern systems that enhance technical skills and support the concerned authorities' activities in the fish sector. This highlights the importance of the effective role played by these parties for the fishing sector.

Opportunities

Although fishing activity mainly exists in coastal areas, it requires continuous support for the development and improvement of the fishing and production processes in this sector. Therefore, the existence of supporting organizations and institutions with a frequency rate of 26% is an economic and developmental opportunity for this sector. Yemen has a coast of 2,520 km with diverse marine habitats, encouraging supporting entities to finance activities in this sector. Associations, institutions, supporting bodies and organizations seek to invest economically to develop this sector and secure marine protein for people and eradicate poverty. Cooperatives, at a rate of 23%, work to organize the fishing sector at the public level, through technical activities, solving fishermen's problems, and representing them officially before other parties. Additionally, the high number of companies at a rate of 11% represents an economic opportunity that works on revitalizing the sector and enhancing coordination activities, linking them to fishermen. Furthermore, the availability of a large coastal strip, at a rate of 11%, is encouraging for enablers and supporting bodies to finance the sector's activities.

Weaknesses

The analysis of the weaknesses of the enablers and supporting entities revealed institutional weaknesses, represented by a lack of market research with a repeatability percentage of 16%, which makes the sector ambiguous for them. This is accompanied by a low level of development at a rate of 14%, in addition to a lack of training and rehabilitation at a rate of 12%. Weak attention to job loyalty within these entities was also identified as a weakness at a rate of 6%. In addition, low wages for employees, at a rate of 6% was identified as a weakness resulting from the deterioration of exchange rates and the high cost of living. Therefore, the enabling and supporting entities need to build modern institutional capacity, and expand their activities and relations with neighboring countries to expand the sector's activities outside the country.

Threats

The highest economic threat to the enabling and supporting entities is the increase in oil derivative prices, with a repeatability percentage of 23%. The analysis also showed that the enabling entities face an environmental threat from beach pollution, at a rate of 16%, which will affect the fishing activity in the future and, therefore, the possibility of their presence on the ground. Therefore, the enabling and supporting entities are keen to avoid harming the environment in their interventions in any sector and to comply with the implementation of fishing sector laws. The closure of ports and airports, at a rate of 10%, is a institutional threat that undermines the possibility of exporting fish products by air, depriving the sector of a profitable market with increasing international demand, in addition to hindering their own movement. Reopening airports and rehabilitating air freight facilities will enable Yemeni products to be repositioned in neighboring, regional and Asian markets. This is due to the political threat represented by war and conflicts at a rate of 7%, in addition to the lack of government support at a rate of 5%, which hinders their regular business activity.

SWOT and PESTLE Analysis Summary for Fish Value Chain in Ash Shihr

The SWOT analysis adopted arranges points according to their frequent recurrence among the players of the chain rather than their importance, as in the analysis of the problems. Therefore, the analysis showed that the strength points at the level of all players in the chain are providing supply according to demand as the strongest point, and this economic strength will enable the sector to grow economically if there are good opportunities to increase demand locally and regionally. This is followed by proximity to sources and then quality in the market as economic strengths that enable Yemeni products to compete in local and regional markets.

The analysis of favorable opportunities for the fish sector in this study also showed the increased demand for fish as the greatest economic opportunity. Through it, the economic value of Yemeni coastal fish can be exploited by developing fishing activities, processing, increasing productivity, and then achieving profitability in this sector. The proximity of the market to the product and the abundance of companies represents other opportunities, and therefore this can reduce production costs and increase profitability.

No sector is free of weaknesses, including the fish sector in Yemen. The analysis showed that the greatest weakness was the lack of market research. There were no previous studies existed to evaluate the fish stock during and post the war, The last stock assessment was conducted in 2003, and thus it is unknown whether the war negatively or positively affected the quantity of fish stock, nor are there recent and reliable data on the size of the fishing fleet, the workforce or market pricing. Conducting periodic studies that include all the activities of the sector will make it possible to identify the strengths and weaknesses of this sector and optimally utilized. The diminishing purchasing power for oil derivatives due to high prices, the removal of subsidies, and sometimes their non-existence is another economic weakness, as it is central to all activities, including fishing, transport, production, cooling and export.

The main threat facing players are the high price of oil derivatives, which affects all activities along the value chain, causing an increase in operating costs, then price of the product in the market, and then its demand. This economic threat can be countered by re-subsidizing oil derivatives for fishing activities as previously, and the returns of investment in this sector will contribute to raising the GDP of the country. Increasing taxes and customs also represent an institutional threat. It limits the possession and use of modern fishing devices that save energy and fuel, and increase the cost of processing. Finally, fear of war and conflicts rates as the third most significant institutional threat to this sector, making fishermen and traders reluctant to continue in the fishing sector, especially young people.

Table no. 8 SWOT analysis for the stages of the fish value chain in Ash Shihr District (Primary Data, 2022)

Chain Stages	Supply Inputs	Production	Trade, Processing and Export	Consumption	Enablers and Supporters
Strengths	• Quality in the market (15%) • Owning warehouses (13%) • Ability to provide for the supply as per demand (12%) • Proximity to stakeholders (8%) • Making profits (8%)	• Ability to provide for the supply as per demand (17%) • The proximity of sources (15%) • Quality in the market (15%) • Making profits (11%) • Proximity to stakeholders (9%)	• Ability to supply on demand (20%) • The proximity of sources (15%) • Quality in the market (14%) • Employment availability (6%)	• Ability to supply as per demand (14%) • The proximity of sources (11%) • Proximity to stakeholders (11%) • Making profits (11%)	• Planning (27%). • Proximity to stakeholders (19%) • The strength of coordination with the rest of the entities (19%) • Operational staff cooperation (11%)
Opportunities	• Increase demand (41%) • Stability of the security situation (10%) • Market proximity for the product (10%) • Plenty of companies (7%)	• Increase demand (25%) • Market proximity for the product (11%) • Plenty of companies (11%) • Ice factories (10%)	• Increase demand (30%) • Market proximity for the product (13%) • Low product price (8%) • Mobile availability (8%) • Stability of the security situation (7%)	• Long coastal strip available (24%) • Quality of offshore products (19%) • Increase demand (17%) • Market proximity for the product (10%) • Stability of the security situation (9%)	• Presence of supporting organizations and institutions (26%) • Presence of fish cooperatives (23%) • Stability of the security situation (11%) • Plenty of companies (11%) • Long coastline available (11%)
Weaknesses	• Use of low-quality equipment based on purchasing power (12%) • Lack of market research (12%) • The weak purchasing power of oil derivatives (12%) • Weak advertising (8%)	• Production decrease (17%) • Lack of coordination (15%) • The weak purchasing power for oil derivatives (11%) • Lack of private generators (7%) • Lack of oil derivatives (8%)	• Lack of market study (14%) • Production decrease (13%) • Lack of coordination (12%) • The weak purchasing power for oil derivatives (11%)	• Production decrease (33%) • The weak purchasing power for oil derivatives (27%) • Lack of awareness (20%) • Lack of appropriate work environment (13%)	• Lack of market research (16%) • Low development level (14%) • Lack of training and qualifications (12%) • Poor interest in job loyalty (6%) • Lack of wages (6%)
Threats	• Rising price of oil derivatives (19%) • Increase of taxes and customs (15%) • Prices volatility (10%) • Wars and conflicts (7%)	• High oil derivative prices (25%) • Tax and customs increase (15%) • Coastal environmental pollution (10%) • Wars and conflicts (8%)	• Rising price of oil derivatives (28%) • Price volatility (11%) • Tax and customs increase (11%) • Wars and conflicts (11%)	• Coastal environmental pollution (14%) • High oil derivative prices (12%) • Price volatility (12%) • Wars and conflicts (7%)	• Rising price of oil derivatives (23%) • Coastal environmental pollution (16%) • Closure of ports and airports (9%) • Wars and conflicts (7%) • Lack of government subsidy (5%)

* Details of the table are available in Appendix (2): SWOT and PESTLE Analysis Details

Multiple Channels and a Complex Sector

There is a clear inflation in the number of intermediary channels between producers and the final consumer in the fish value chain in Ash Shihr District, which increases the cost of the product reaching the final consumer. Figure no. 17 shows that there are six channels for producers (fishermen) in the fish value chain.

The study results show that about 27% of fishermen sell their products to wholesale and retail traders (factories or fish export companies), while about 7% of fishermen sell their products to aggregator wholesalers, who in turn distribute fish products to Yemeni governorates and export to foreign countries.

In the third channel about 11% of fishermen sell their products to the fish cooperative associations in Ash Shihr, who in turn sell the fish for a profit margin ranging from 3-7% of the sales value. It is worth noting that the associations play a prominent role in providing multiple services to fishermen such as providing small, short-term loans covering the costs of fishing trips, to the purchase of oil derivatives, bait, and labor so that the fishermen can continue fishing. Additionally, some fish associations provide additional services such as health insurance and easy loans for fishermen to purchase engines, boats, and fishing supplies.

In the fourth channel, about 19% of fishermen sell their products to wholesale retailers who in turn sell them to local markets in full.

In the fifth channel, about 8% of fishermen sell their products to local processors who carry out local fish processing operations such as drying and salting. Finally, about 24% of fishermen sell their products directly to the final consumer at the fish market (by auction).

Photos showing where producers trade their products at the landing center

It is evident from Figure no. 17 that wholesalers and retailers (owners of fish companies and factories) are the most diversified players in terms of the sources of their fish supply. They rely on four different channels to purchase fish, which are:

- Directly from fishermen through their agents at fish landing centers in very small quantities estimated at only 0.7% of their imports
- From aggregate retailers at approximate quantities of 0.3%
- From fish cooperative associations through public auctions held at fish landing centers where the associations provide about 30% of the imports of wholesalers and retailers (fish companies and factories)
- The last supply channel for wholesalers and retailers (fish companies and factories) is from other wholesale traders. This channel is considered one of the largest supply channels, accounting for approximately 69% of the total supply to wholesalers and retailers.

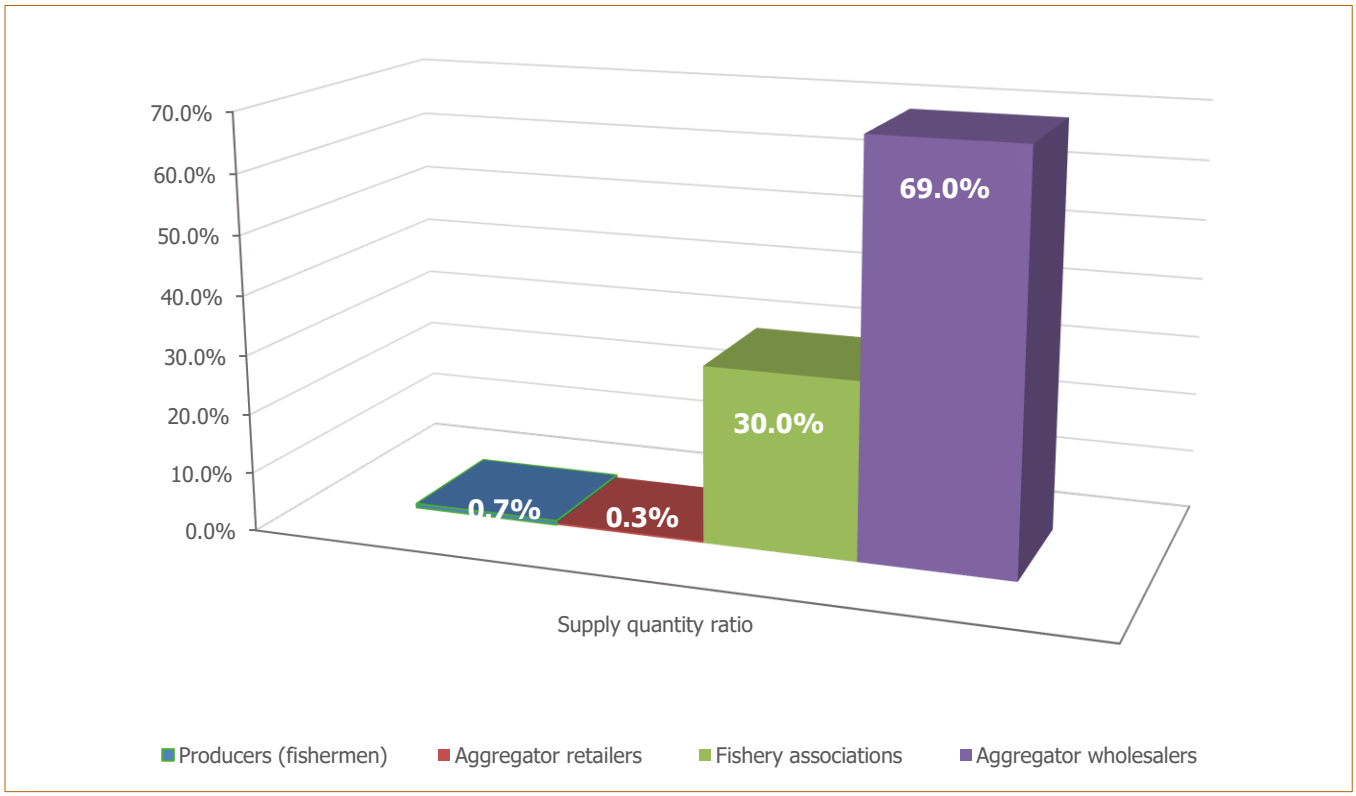


Figure 16: Sources of fish supply for wholesalers and retailers (fish companies and factories) (Primary Data, 2022)

These companies and fish processing factories (wholesalers and retailers) target different local and international markets with multiple products, including canned and frozen fish.

The second-ranking for the number of supply channels in the fish value chain in Ash Shihr District are wholesalers, who utilize three channels from which to buy fish. The first is from fishermen directly through agents at landing centers, though in very small quantities estimated at only 0.7% of their imports. The second is through fish cooperative associations, and

the third via aggregate retailers. The largest supply channel for wholesalers is through fish cooperative associations that hold about 88% of the total supply through the three channels via public auctions held by the associations at fish landing centers.

These players in the fish value chain work to process the product into a transportable form by refrigeration and salinization, and they target three markets:

- processing wholesalers and retailers (owners of fish companies and factories).
- the external (export) market
- the local market

In addition, we note from Figure no. 17, that aggregate retailers have only one supply channel, which is buying directly from the fishermen. However, they have the largest number of distribution channels (four):

- processing wholesalers and retailers (fish companies and factories)
- aggregate wholesalers.
- retailers (local industries) who perform processing and marketing
- local markets, including citizens, restaurants and governorates

It is now possible to identify all the supply and distribution channels for all stages and players of the fish value chain in the Ash Shihr District (see Figure no. 17). The following section will address product quantities and prices among the channels and chain players.

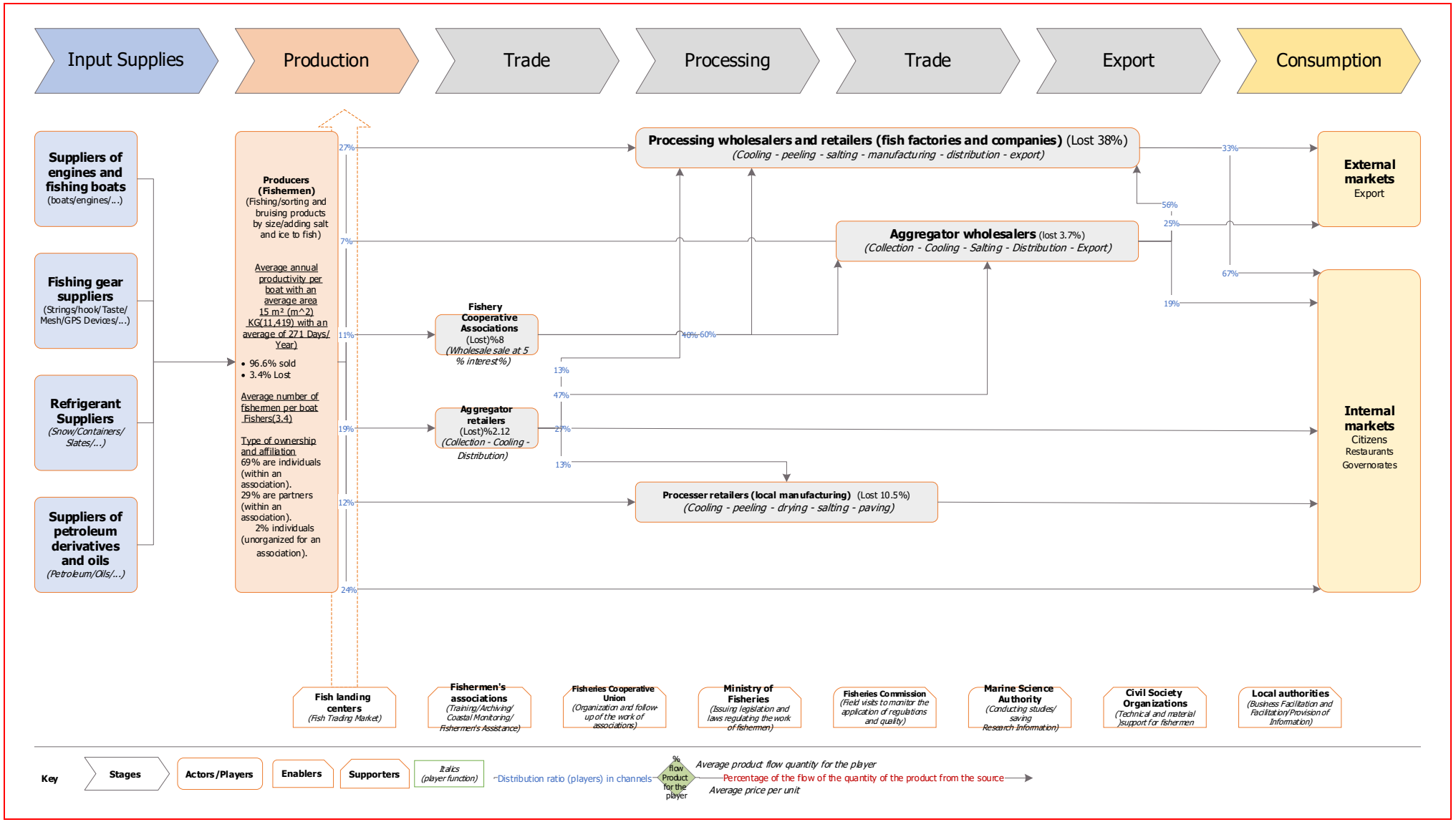


Figure no. 17: Map of stages, players, and functions of the fish value chain in Ash Shihr District - Hadhramaut - Yemen (Initial data, 2022)

Quantitative, Cash, and Profitability flows in the Fish Value Chain

The study confirms that producers (fishermen) represent the weakest link in the value chain in terms of profitability where fishermen incur high costs during the fishing process in exchange for low selling prices. Despite the existence of six channels for product flow, all of which start from the producers (fishermen), the selling prices in all channels are close, with low profit margins for fishermen, with an average selling price ranging between YR. 5,478 - 2,695 per kilogram of seafood.

Production quantities flow through the six channels at different rates. The data shows that approximately 30% of product from fishermen are directed to wholesalers and retailers (factories and companies) through the first channel, with the highest average purchase price among other players reaching YR 5,478 / kg. The high selling price in this category of the value chain is attributed to their purchase of certain types of high-priced seafood, such as lobster, which has an average price of about YR 11,000, and squid, which has an average price of about YR 6,600.

The second channel for fishermen's product is directed towards the final consumer, accounting for 24% of the production quantity, with an average price of YR 2,695 / kg. Small-sized fish are sold directly from the fishermen to consumers in small markets near the fish landing sites.

In the third channel, aggregator retailers buy 19% of fishermen's product at an average price of YR 3, 454 / kg, the high price due to concentration on high demand products such as lobster and squid.

Fish associations make up the fourth channel in terms of fish marketed through the chain at about 11%, with an average purchase price from fishermen of YR. 2,750 / kg. These quantities pass to wholesalers, companies and factories, where cooperatives sell them with an average profit margin of 3-7%. In the fifth and sixth channels, wholesalers and processors (owners of local industries) purchase about 8% of the produced quantities each, with an average selling price of about YR 2,750 / kg and YR 2,959 / kg, respectively.

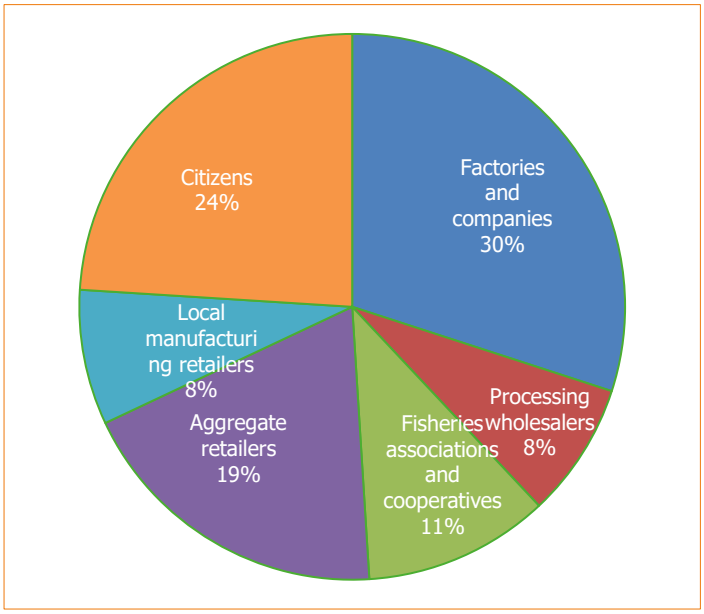


Figure no.18 Percentage of quantities of production flow by fishermen to the players of the Chain through its various channels

The study showed that most of the quantities produced by fishermen flow towards wholesaler and retail processors (factories and companies) at the highest profit margins among all players in the chain. These processors export to foreign markets about 57% of the rare and high-priced species, such as lobster and squid, at an average selling price of YR 15,103 / kg. The remaining 43% of production is sold to local markets and distributed to other governorates in different forms, including frozen and canned fish, with an average selling price of YR 5,049 YR / kg.

Wholesalers occupy the second largest proportion of production, as marine products flow to them from three channels: directly from fishermen with an average purchase price of YR 2,827 / kg, from cooperatives at an average of YR 2,750 / kg, and from retailers at an average purchase price of YR 3,916 / kg. They are also part of the largest supply chain for wholesalers (factories and companies), selling about 69% of their product at an average price of about YR 4,323 / kg.

An exceptional role in the chain is represented by fishery associations, which provide many services to their members, including financial support, easy loans, and health insurance. The associations also guarantee the marketing of seafood for fishermen in a public auction system, with a profit margin of 3-7% of the sales value. This auction gives fishermen better opportunities to get higher prices, especially when there is a shortage of production or when high-quality fish are available. The price is evaluated by the participants in the auction, who compete to buy seafood publicly, depending on their quality and available quantities. Factories, companies and wholesalers participate in the auction.

Retailers (distributors) choose their production of fish according to the marketing channel they focus on. These players are distributed in four marketing channels: The first and highest-priced channel with an average price of about YR 5,225 / kg is for the processing retailers, owners of local factories and industries, and the second channel is for the owners of factories and companies with an average selling price of about YR 4,268 / kg. They also sell to wholesalers in the third marketing channel with an average price of about YR 3,916 / kg, while the fourth channel targets the local market and direct sales to citizens with an average price of about YR 3,674 / kg.

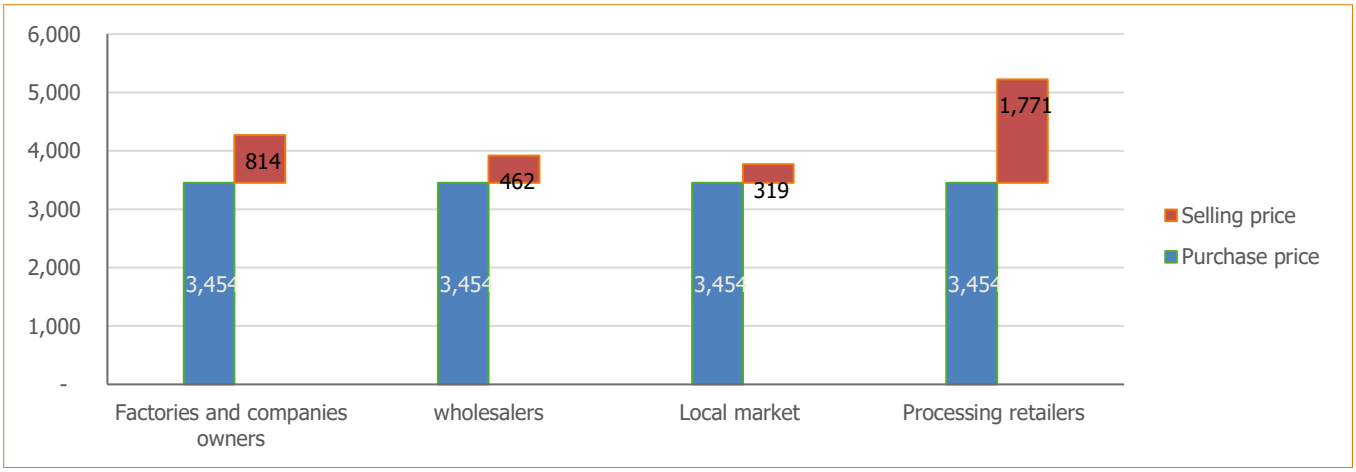


Figure no. 19: Channels and selling prices for aggregate retailers in the fish value chain in Ash Shihr District

The owners of local factories and industries have the highest prices for the local market after companies and factories, with an average price of YR 4,268 / kg. This is attributed to the processing operations they carry out on fish products before marketing them to the final consumer. Activities such as salting, drying and refrigeration, all increase the shelf life of fish until they are sold in local markets within the Al-Shihr District or in local markets in other governorates.

The lowest price among the chain channels is the direct channel between the fisherman and the final consumer, with an average price of YR 2,695 YR / kg. The low prices reflect the low quality or small size of the fish sold. These are the remaining fish that are sold in the fish market adjacent to the fish landing center.

It was better for the study to include the profit margin for all chain players. However, all chain traders were reserved to disclose their operating costs and profits, and here were compensated by another analysis, which is the analysis of the margin through the prices of selling and buying, and the following title contains the details.

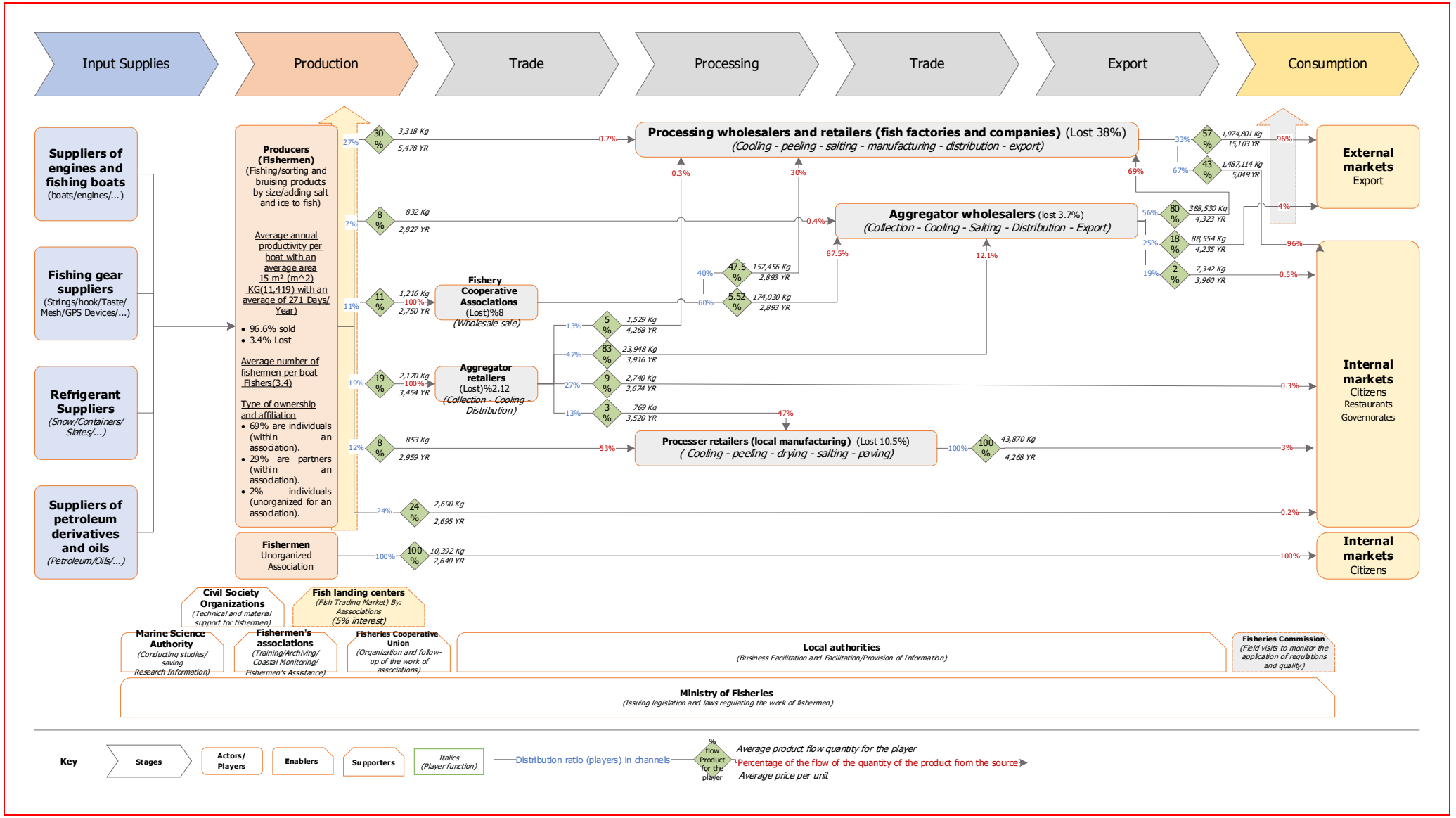


Figure no. 20: Map of quantitative and cash flow among fish value chain players in Ash Shihr District - Hadhramaut - Yemen (Primary Data, 2022)

Marketing Channels and Marketing Margin Analysis for Chain Players

From Figure no. 21 it is clear that there are seven marketing channels for producers (fishermen) in the fish value chain in the Ash Shihr District. The best marketing channel for producers seems to be channel 7, because it provides them with the highest **marketing margin** for the product alone, as the marketing margin is the difference between the price paid by the end consumer and the price received by the producers.

Marketing margin analysis helps determine the proportion or share of producers in the price paid by the end consumer in the chain. The share of traders between producers and consumers in the chain can also be determined. The greater the share of producers in the marketing margin, the higher the marketing efficiency in the chain. Marketing efficiency increases with fewer intermediary players in the chain between producers and consumers due to the lower value added to the product (Arafah & and Humam, 2015).

As mentioned above, marketing channel no. 7 is the best channel for producers because they get the highest share of the marketing margin, as fishermen sell directly to consumers in this channel. However, from Figure no. 20, we find that only about 24% of fishermen go to this channel, and the average amount sold by each fisherman in this channel is also about 24% of the production quantity. Yes, it is the best channel, but it is the most difficult channel for fishermen to sell their products because they must go to landing centers which forces them to go to other marketing channels.

The second-best channel after channel 7 is channel 5, with a marketing margin for producers of approximately 81%. In this channel, there are two retailers, one is an aggregate retailer, and the other is a processing retailer. However, only about 12% of fishermen go to this channel, and the average amount sold by each fisherman in this channel is only 8% of the production quantity.

The third-best marketing channel for producers is channel 6, followed by channel 1, then channel 4, and channel 2. The channel with the lowest marketing margin for producers is channel 3. From the above, we find that there are many marketing channels for producers, and the marketing margin varies from one channel to another. Each channel has its positives and negatives, but what matters now is that channels 7, 5, and 6 are the best and most suitable channels for investment for the benefit of producers. Organizing marketing channels between players in the fish value chain in the Ash Shihr District requires more coordination and arrangement to bring together all players and increase the benefit for all players in the chain, especially producers.

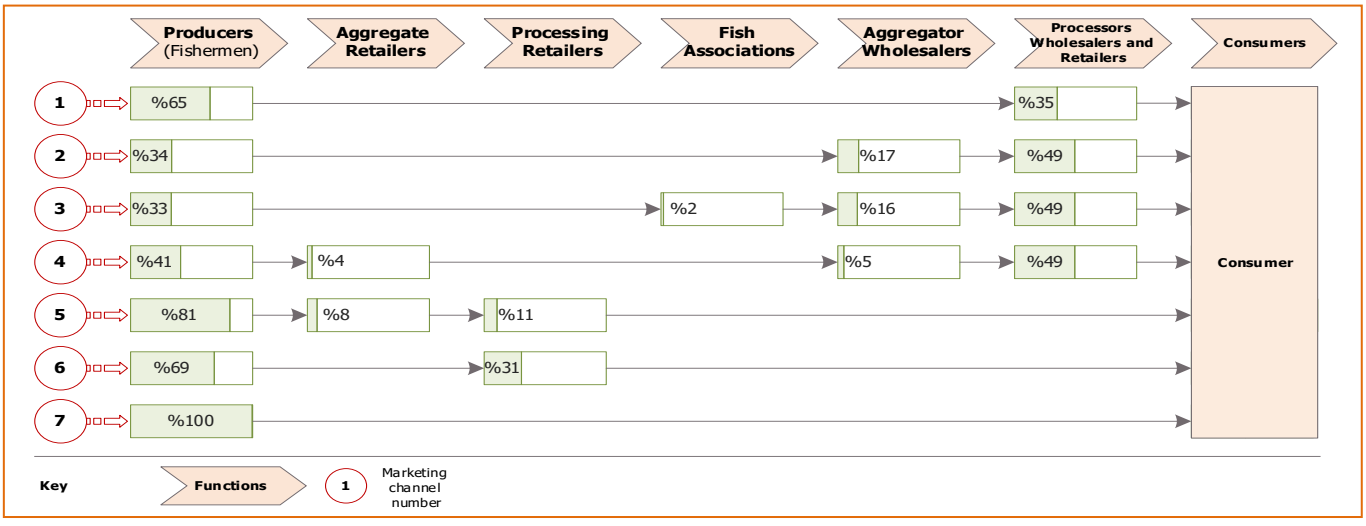


Figure no. 21: Marketing channels and the share of each player in the fish value chain in Ash Shihr District (preliminary data, 2022)

Jobs Opportunities in the Fish Value Chain

Table no. 9 indicates the presence of both permanent & temporary workers in the various players of the fish value chain during the year. It is worth to note that most of the workers work with the processors - (wholesalers and retailers), where the number of workers per factory is recorded at 54.4 workers per entity; followed by fisheries cooperative associations with an average of 30.6 workers per association then restaurants (consumer) with 16.8 permanent workers.

In terms of working as fishers, the sector is predominantly men oriented due to the nature of the work and cultural norms. However, women laborers/ workers play a visible role in the fish value chain as workers who work in some stages of the chain. Most of them are permanent workers noticeably with retail traders where the female employment rate of permanent workers is about 4.1%. Their important role in this stage includes sorting, assembling, and packaging, as well as their presence within the wholesalers and processors; although with a small percentage of around 1.9% - where they work to supervise packaging and freezing operations. The percentage of permanent female workers increases to 6.1% in fish companies and factories where their presence is effective in processing stages of fish.

Female temporary workers are also present across the value chain and are an important element to keep in mind. The study shows an increase in the recent year of temporary female workers across the input suppliers and within processing companies with a percentage of 16.7& and 17.9% respectively, as shown in table 9.

Women contribute to achieving an increase in productivity, reducing waste and product defects. They also work among retail processors at a rate of 4.1%.

There are also workers from the same families/households working within the same industry and players. The study shows that the further the product is from the production site, the lower the family labor - both temporary and permanent. Due to the value addition added to the product by labor the total annual labor cost varies among the players in the chain indicating where processing and manufacturing operations are located for the markets with highest labor, and highest returns.

Table no. 9 Average employment opportunities for fish value chain players during the year at Yemeni Riyal (YR) cost (Primary Data, 2022)

Players Value chain	Number of permanent workers	Percentage of female permanent workers	Percentage of household employment	Provisional Number of employment	Percentage of female Temporary Workers	Percentage of household employment	Number of Provisional Days of Work	* Permanent labor cost/month (YR)	* Temporary Labor Cost/Day (YR)	Total labor cost/year (YR)	Total labor	Total Working Days
Fisherman's Input Supplier	5.0	0	20.2	3.6	16.7	6.5	80.5	187,000	3,410	12,090,760	6.8	1,549.8
Producer (fisherman)	4.3	0	46.7	6.7	0	35.2	63.3	120,010	8,250	10,161,470	11.9	1,564.7
Aggregator retailer	3.5	4.1	46.4	2.6	0	6.5	121.7	64,130	5,610	4,424,090	6.1	1,198.4
Processing retailer	9.0	0	18.9	9.8	0	12.8	130.0	130,900	14,850	33,056,100	18.8	3,542.0
Fishery Association	30.6	0	0.4	3.0	0	0	112.0	70,840	1,650	26,566,870	33.6	8,047.2
Aggregator wholesaler	4.8	1.9	37.1	4.1	4.9	14.6	103.9	78,100	8,250	7,856,090	8.9	1,635.6
Processing wholesaler and retailer	54.3	6.1	5.5	14.0	17.9	0	133.3	165,000	5,830	114,367,220	68.3	15,549.8
Consumer (Restaurant)	16.8	0	10.9	3.5	0	0	48.0	78,980	4,400	16,661,590	20.3	4,401.6
Average single player	**6.6**	**1.3**	**24.7**	**5.9**	**7.3**	**10.7**	**91.9**	**98,670**	**7,260**	**11,606,540**	**12.5**	**2,205.4**

* The averages contained in the table are for males. The average labor cost for females is 59.7% the male labor cost for permanent employment and 28.9% the male labor cost for temporary employment

Analysis of Fish Value Chain Constraints / Problems

The problem analysis in the study revealed that the fish value chain faces many constraints and problems, which have been exacerbated by the current situation in the country. The three most important constraints and problems that hinder the development of the fish sector in Ash Shihr District are as follows:

Supply Inputs

Traders of fish sector inputs in Ash Shihr District face many constraints and problems that hinder their effective role in developing the sector in the region.

Table no. 10 shows the three major problems ranked based by importance. The first problem or obstacle faced by input supply traders was the fluctuating, high price and scarcity of oil derivatives (fuel) that leads to selling of fuel in the black market with relatively higher costs and a decline in returns.

This problem is considered an economic problem according to PESTLE classification, which contributes to input supply & small traders' dissatisfaction and freight from operating in the area to other fishing areas. Input traders believe that the consequences of the high prices and scarcity of oil derivatives are increased operating and import costs and low profits. The suggested solutions are for the government to subsidize oil derivatives and to ensure sufficient availability of fuel in fishing communities

The second problem, according to input suppliers, is the fluctuation of the currency which continue to diminish purchasing power of consumers. Input suppliers believe that the government should reduce the exchange rate to revive and develop the fish sector in Ash Shihr District from the continuous deterioration.

The third problem that affects the input supply stage is the increase in illegal taxes (in some cases) and customs. This is due to the absence of the government's role. This is one of the reasons for the decrease in revenues and weak incomes for input suppliers. They believe that the Ministry of Fisheries Wealth and the Fisheries Office should cancel or reduce taxes on the fish sector. This problem is considered a legal (institutional) problem according to PESTLE classification, which affects traders' confidence and their continuity of operations in the region. To solve the problem of illegal taxes a clear mechanism should be put in place by the relevant governmental authority.

Production Stage

As with the input suppliers, the study shows that the main problem small producers (fishermen) face in the sector is the availability and affordability of fuel for fishing trips. one of the reasons for fishers' affordability of fuel is the fluctuating currency. In addition, fishermen are among the most affected players in the value chain as there is a significant deterioration in their livelihoods due to high operating costs ultimately leading to the loss of their productive assets which are their main source of income. Fishermen believe that the state should support oil derivatives to reduce their operating costs, which is an economic problem that affects them and drives them to abandon fishing and search for other sources of livelihoods

Piracy was the second most important problem for producers (fishermen). This problem restricts fishing operations and limits the activity of fishermen at sea. This issue also causes constant conflict between fishermen themselves, and fishers believe that the government should support in providing them with the needed security through activating coast guards and securing fishing areas from piracy.

The third problem is the low production of fishermen due to their inability to enter into deeper waters because of their limited capabilities due to lack of suitable equipment, boat size and other needed equipment Fishermen believe that the relevant authorities and organizations should support them with high-capacity fishing equipment and tools that enable them to enter deeper waters and catch larger quantities of fish which will increase their production and profits.

Trade, Processing, and Export

Table 10 indicates that all stages and players in the fish value chain in Ash Shihr District suffer from the same central problem of the utmost importance. Traders, processors and exporters also all suffer from the high prices and unavailability of oil derivatives due to the lifting of government subsidies. This causes an increase in their operating costs which ultimately decreases their profit margins. This problem is an economic problem according to PESTLE classification.

The second problem for traders, processors, and exporters is the increase in taxes and customs duties due to the prolonged conflict in the country. This impacts operations, incomes and revenues. To solve this problem, they believe that the government should cancel or reduce taxes and customs duties in the fisheries sector. This problem is one of the institutional problems that must be addressed by the government.

The third problem classified by these value chain players is the prolonged conflict itself that continues to hinder private sector operations in the country. This impacts the role of the government, which has been weakened by the conflict. Government support in the sector is crucial to aid in alleviating barriers and challenges in terms of facilitating policies, regulations, reforms, taxes, customs etc., that can greatly support the whole sector activities.

Consumption / Market Stage

As with other player, the lack of / the increase in prices of oil derivatives was classified as a main challenge within the market (consumption) stage of the value chain, and the fluctuating currency. Both of these continue to decrease purchasing power and affordability of products and goods in basic consumption markets. Many of the players believe that the solution lies with the government, in terms of supporting oil subsidies and aiding in controlling of the currency fluctuation & inflation to stabilize prices.

In addition, the increase in fish prices was selected as the second challenge by consumers & markets. With diminishing livelihoods and impact in general unemployment, affordability of food products including fish is a challenge for many households. This compounded with increased prices due to producer increased operational costs, makes affordability of fish products even more challenging. Consumers believe if producers receive necessary support o reduce their operational costs, and increase their production, fish products will increase in local markets and prices will decrease as well.

The third issue pointed by consumers was unclear and unregulated marketing channels for fish in local markets which supports monopoly of specific traders in the market. These traders have access to the best quality fish and end up manipulating market prices and scarcity of specific fish in local markets. A suggested solution is increasing market competition by removing barriers to smaller traders, increasing market surveillance by the governments and facilitating trading & marketing in landing sites.

Enablers and Supporters

The current crisis in Yemen is one of the most important challenges highlighted by supporters and enablers in the fish value chain who were included in the study. The prolonged conflict has weakened the role of the government in various aspects of which has resulted in many problems including high cost of living, loss of income sources for many people including affected workers in the fish sector, weakened role of government in market regulations, weakened government role in supporting taxes, customs and tariffs etc., According to the study, one of the solutions that will reduce the severity of this problem is for the government to intervene, even within the prolonged conflict, in supporting the sector to continue operations with minimal challenges.

Furthermore, these bodies have lost experienced personnel, and are incapable of attracting younger, educated caliber due to lack of salaries/ payments for experienced personnel. Most of the qualified personnel are either elderly or have left the country for other opportunities. This has weakened services being provided by these value chain actors, specifically the Fisheries General Authority, which is responsible for providing expertise in the sector. Short term solutions to this include training of existing staff in these bodies, with a medium-term goal of qualifying and attracting new capacity from university graduates in the fisheries. Marine science school.

The third challenge pinpointed by these value chain actors was the lack of resources for governmental institutions and authorities, which impacts the role and functions of the executive bodies representing these authorities at local level Therefore, strengthening the executive bodies by the government and enabling them to perform their work and providing sufficient support represents the most appropriate solution to this problem.

Table no. 10 Analysis of the three most important obstacles/problems in the stages of the fish value chain in Al-Shahr District ranked from the most important to the least important (Primary Data, 2022)

Stages in Chain	Rank Based on Importance	Description Obstacle/problems	Classification* (PESTLE) * *	Main cause Obstacle/problem	Most important obstacle/impact Obstacle / Problem	Suggested Solution to the Intervention (According to stakeholders)	Person in charge of Implementing solutions.
Inputs Supply	1	High price and scarcity of oil derivatives	Financial Economic	Lifting subsidies on oil derivatives	High operational costs and low profits	Subsidizing oil derivatives, regulating their flow in markets, and enhancing the role of the oil company	Gov
	2	Exchange rate fluctuation and currency instability	Financial Economic	Currency collapse, currency inflation, depreciation, volatility, and instability of the Yemeni riyal	Lack of demand	Reducing the exchange rate, reducing currency inflation, enhancing the value of the Yemeni riyal, and reducing speculation in exchange rates	Gov
	3	Increase in taxes, customs, and illegal levies	Financial (Legal)	Absence of Government role	Lack of revenues and low income	Abolition or relief of taxes on the fisheries sector	Fisheries Authority Office
Production	1	High price and scarcity of oil derivatives	Financial Economic	Exchange rate volatility and instability of the local currency	High prices and poor living conditions	Fuels subsidy	Supporting organizations, Gov
	2	The spread of pirates in the Arabian Sea and the Gulf of Aden	Administrative / organizational Legal	Hunger and security instability in the region	Fighting	Moving pirates away from the borders, activating international agreements on combating maritime piracy, and supporting the Coast Guard to do its part	Gov
	3	Reduced production, limited fish stocks, and poor quality	Technical (Technological)	Not entering deeper because of a lack of capabilities	Lack of access to a large quantity of the product	Providing support to increase production & productivity	Supporting Organizations
Trade / Treatment / Exports	1	High price and scarcity of oil derivatives	Financial Economic	Lifting subsidies on oil derivatives	High costs	Subsidize oil derivatives for fishermen	Gov
	2	Additions to taxes and customs	Administrative / organizational (Political)	War and conflict	Weak income	Abolition or reduction of taxes and customs	Gov
	3	Prolonged conflict	Administrative / organizational (Political)	Absence of Government role	Diminishing living conditions	The government has to take charge of things on the ground.	Gov
Consumption / Market	1	High price and scarcity of oil derivatives	Financial (Economic)	Lifting subsidies on oil derivatives	High cost of living	Reducing the prices of oil derivatives - importing oil derivatives by the government	Gov
	2	High product price	Financial Economic	Higher operational costs of the fisherman	Inability to buy	Supporting fishermen and providing them with facilities	Supporting organizations
	3	Monopoly	Financial (Legal)	Traders' manipulation	Rising prices	Control	Gov
Entities Supporting and enabling	1	High price and scarcity of oil derivatives	Financial Economic	War and conflict	High cost of living	Subsidize oil derivatives	Ministry of Oil
	2	Loss of expertise and migration of foreign expertise due to the security situation in the country and the lack of qualified technical personnel and specialized competence	Administrative / organizational (Technological)	Loss in Expertise in the Sector	Weak results	Establishing training and qualification courses	Supporting organizations General Directorate of Fisheries Authority
	3	Weak Capacity	Administrative / organizational (Legal)	Tension and instability	Weak executive bodies	Strengthen executive bodies	Supporting organizations, Gov

*** = Overall Rating**: **1**. Technically. **2**. Financial. **3**. Administrative/organizational. *** * = PESTLE Classification**: **1**. Political **2**. Economic **3**. Social **4**. Technological **5**. Legal **6**. Environmental

Development Strategy

Some possible solutions and strategies that will contribute to the development of the fish sector in the Ash Shihr District

Development Strategy

In the previous sections, the main problems facing the fisheries sector at all stages of the value chain in Ash Shihr District were identified with their causes. The most important possible interventions were proposed to contribute to the revival of the fisheries sector according to the value chain actors/ stakeholders' opinions. Based on this, we were able to analyze some of the challenges and gaps within the chain, and to propose some development strategies as shown in table 11, which looks at both short-, medium- and long-term interventions classified under technical, financial & administrative solutions. These include:

1. Input Supply Stage

The study found that most of the inputs and requirements used in all stages of production and marketing are traditional or outdated and the use of modern technology in the production process is limited. Therefore, interventions aimed at localizing modern inputs and spreading them in the fisheries sector in all stages of the value chain are extremely important to reduce production costs, increase production, and utilize modern technology to facilitate work in all areas. Examples of areas that require interventions in the dissemination of modern technology in the fisheries sector include modern large boats equipped with modern technologies, fishing equipment, fish preservation equipment, modern drying techniques, on boat support to fish preparation such as packaging, cutting, freezing, and transportation.

In addition, input traders need to access information and knowledge in the financial and administrative aspects to strengthen their operations and to enable them to manage their facilities in a well-thought-out and correct manner; contributing to proper management of their work, increasing profits, and developing facilities and businesses for those working in this field which will have a positive impact on the sector as a whole.

2. Production Stage

The fish sector needs to improve production processes through techniques that reduce fuel consumption, as well as minimizing the amount of spoilage in fish products, improve health and environmental impacts, and emphasize on hygiene in the handling of fish products. Proposed interventions include providing financial support to producers, facilitating their access to financial grants & soft loans, and working with financing and lending institutions to develop concessional programs to make loans accessible to all workers in the fish sector to help them access proper production equipment & tools. In addition, input suppliers need to provide specific equipment for fish production that can meet quality standards. That will contribute to helping producers to continue production and exit from the recession in the input market which will support the national economy, increase production and improve fish quality.

Furthermore, this stage also needs interventions that are aimed at spreading awareness & technical support to producers on ways of adopting modern production technologies, especially aspects of proper preservation and handling of fish products as well as basic financial and administrative knowledge to enable producers to manage their production, incomes and support to access markets and financial services. This will ultimately improve their micro enterprises in ways that can contribute to job creation, increase in profits, revenues and livelihoods.

In addition, interventions aimed at strengthening the roles of fisheries associations and enabling them to continue their work through enhancing their institutional capacities in terms of governance to include more fishers & provide better membership services will greatly help the sector's productivity. These associations could also be supported to have better facilities and equipment such as the provision of large fishing boats with proper in shore processing equipment & tools that can help fishers access deeper waters to have better production.

Furthermore, other input suppliers supporting fishers such as boat manufacturers and maintenance centers and fisheries graduate that can benefit from technical trainings, financial support to provide better services and equipment to producers, technologies and exposure visits to adapt better techniques. Additionally, interventions in aquaculture will also contribute to introducing a new resource into the sector that will create job opportunities for young people and distribute products and sources of income to local communities.

Trade, Processing, and Export

The fish processing sector is considered a fundamental pillar in the fish value chain and requires targeted interventions to build capacity in manufacturing and the preservation of fish products, as well as the dissemination of industrial technologies and food conversion, such as preserving fish through smoking and drying, and creating rehabilitation plans and programs for workers in fish food technology through training on global standards and specifications for food safety and health.

Interventions can be made through a range of targeted measures that contribute to adding value to fish products, such as primary fish processing (handling, cleaning, and preservation) and preparing fish for export by improving packaging, storage, and preservation methods, building workers' capacities through training and qualification on the required global practices in this field.

Infrastructure development can also be achieved in the areas of fish processing, preparation, and preservation by providing refrigerators, cooling storage, refrigerated and frozen trucks, transportation, and training workers in this field to increase their capabilities in handling fish products.

Training processors & fishermen on proper fish handling methods, as well as post-harvest treatments such as preservation, transportation, and handling, establishing centers for fish preservation, preparation, and processing, and linking

manufacturers to producers to facilitate access to the required products for manufacturing according to the required standards and specifications can greatly support this stage of the chain These interventions encourage producers and workers in the field of fish product manufacturing and conversion to produce multiple high-quality products.

The financial capabilities of workers in the fisheries sector are limited, as producers, traders, and processors suffer from a lack of the capacity to develop their businesses due to their low and limited income. Financial institutions can provide concessional loans and funding for workers in the sector, making it easier for them to access the funds and enabling them to develop their projects and sources of income, opening up new projects that contribute to creating new and innovative products and job opportunities for members of local communities.

Consumption Stage

The marketing sector needs infrastructure development through the provision of refrigerators, refrigerated warehouses, refrigerated and frozen trucks, and transportation to be used in retail fish outlets in local markets. Workers in this field need to be trained to improve their capabilities in handling products, and efforts should be made to link fish landing sites by unifying the prices of products in all locations.

Efforts should also be made to improve local marketing conditions by facilitating the transportation of products between regions, facilitating the work of companies operating in them, and linking marketers and companies to foreign markets. Interventions can also target the rehabilitation of facilities owned by associations and the private sector, such as fish landing sites, storage, and transportation, Markets and sales outlets in local markets can be built and rehabilitated, including special equipment for processing, preparing, and preserving fish for use in retail fish sales in local markets to provide employment opportunities and to solve the problem of marketing fish products.

These interventions with the end consumer of fish products in mind, in terms of reducing costs and improving quality, will ultimately contribute to improving health and food security conditions in Yemeni society. Efforts should be made to raise awareness among consumers about the importance of consuming fish and seafood through awareness programs via the media and social networking sites. Nutritional culture should be promoted in institutions and awareness should be raised about the importance of consuming fish in maintaining the overall health of children and women, reducing the incidence of thyroid disease and reducing cholesterol levels. In addition, centers for preparing and processing fish should be established in residential areas, whether fixed or mobile, to facilitate access to fish and seafood for consumers.

Facilitators and supporters (Enablers/Supporters)

The fisheries sector needs to issue regulations and laws that regulate the proper handling and safety of fish products, as well as training workers at all stages of the fish value chain on international food safety standards and health requirements.

Good hygienic practices in harvesting, handling, manufacturing and transportation of fish and fish products, coupled with adequate refrigeration throughout the chain of custody, can preserve the quality of fish and ensure the safety of consumers from outbreaks of fish-borne illness. Internationally recognized systems of quality assurance have gained worldwide acceptance as cost effective and reliable. These systems are based on risk identification and minimizing such risks through the design and layout of the physical environment in which high standards of hygiene may be assured and by setting measurable standards and establishing a system to monitor them. These are the pre-requisites for the fisheries sector to make a substantial jump in its contribution to the economy of Yemen, yet much of this lack in the sector.

It is also, important to work on enacting regulations to enforce adoption of best hygienic practices and to enact laws that contribute to preserving the environment and minimizing environmental impacts in the sector. Furthermore, value chain actors across all stages must receive proper training workers in the fisheries sector on the environmental & climate change matters, based on their functions and roles in contributing to best practices.

Enabling institutions and governmental bodies need to have better management and governance of their roles and functions. There should be a collective effort among organizations working to support the fisheries sector to plan in mobilizing resources to enhance the roles and functions of authorities working in the fisheries sector. This will help in having proper structures, regulations, reforms and most importantly facilitation for value chain actors specifically producers.

Financial institutions should be encouraged to provide specialized and facilitative financing programs for players in the fisheries sector, that have lenses on improving best practices in the sector including hygiene and quality standard adaptation and environmentally friendly practices. Academic and research institutions should also be catalyzed to conduct sector specific studies and to train specialists in modern technologies, modern production and manufacturing methods, transactions, such as modern fishing methods, using large and modern boats and equipment in fishing, as well as fish farming, marketing, software, manufacturing, value addition, and preservation of fish products.

The government role in supporting the sector is also very important in terms of tackling the main issues identified by the value chain actors. These include their role in subsidizing and ensuring the availability of fuel/ oil, decreasing taxes, customs and tariffs related to the sector imports & exports. The government should also facilitate transport and movement of fish products from area to area to aid in accessibility of fish products to local markets i.e., facilitate movement of fish through the many security check points between governorates in the country.

Table no. 11 Strategies for developing the stages of the fish value chain in Ash Shihr District

Stages of VC	Type	Development Support	Appropriate Interventions	Expected Impact
Inputs Logistics	*Technical*	1. Regular provision of information and a list of technical specifications for modern fishing equipment and tools. 2. Technical support to producers on understanding modern emerging & fishing techniques 3. Support to the relevant input suppliers in the ecosystem supporting producers such as manufacturers of input supplies, enhancing expertise & building/ investing in human capital in the sector 4. Provision of maintenance services and after sales services to small fishermen	1. Technical training and capacity building in modern & emerging technologies. 2. Building financial and administrative capacities and keeping records. 3. Linking with the supporting agencies for technical support and linkages with financial service providers. 4. Studying the market regularly to know the needs of the sector and modern technologies. 5. Enhancing and building relations between small and large traders in the fish supply chain.	• Sustaining the production and/or encouraging the production of main products and services locally • • Introducing modern technologies in the field of fishing, which will contribute to raising productivity, improving incomes, and reducing Building the capacities of input suppliers and developing their knowledge. • Reduce time, effort and costs.
	Financial	1. Financial literacy training and linkage of producers to financial institutions 2. Providing financial support through grants and soft loans. 3. Provision of financial systems for better enterprise management 4.		
	Administrative / organizational	1. Reducing taxes and customs duties on modern fishing equipment and tools. 2. Training on enterprise management & administrative aspects.		
Production	*Technical*	1. Improving and increasing the quantity and quality of fish products. 2. Introducing modern technologies for preserving and processing of fish and paying attention to added value (canning - drying - freezing - cutting frozen slices).	1. Training in the use of modern technologies & emerging techniques such as fish farming. 2. Capacity building in processing and preserving fish products. 3. Creating a unified market policy in all fish landing centers, networking between associations/fishermen, and better linking marketing to spatial integration and ensuring unified prices across neighboring landing sites. 4. Support with modern means of transporting fish products internally and externally, which meet the technical and health specifications that maintain the quality of fish and marine life. 5. Establishing and supporting fish associations and associations of fish producers and exporters, and paying attention to the value chain. 6. Paying attention to fisheries guidance and awareness, caring for the marine environment, limiting climate changes, and preserving fish products. 7. Training on the optimal use of available resources and the reduction of occupational risks. 8. The need to provide financial grants and/or loans at low-interest rates Increasing financial and material support from the government and supporting organizations in the fish sector.	• Reducing pre-harvest and post-harvest losses. • Creating job opportunities and reducing unemployment. • Reducing the percentage of financial risks i.e., through increased incomes and profits • Improving food security and increasing income for fishermen. • • Improving the quality and quantity of nutrition for fishermen's families.
	Financial	1. Reducing financial risk for fishers 2. Providing financial support through grants and soft loans. 3. Support and interest from the relevant authorities in fisheries sector		
	Administrative / organizational	1. Organizational building and raising the technical, financial, and administrative capabilities of fish associations. 2. Absorption of fishermen to well established fisheries cooperative associations		
Trade / Processing /	*Technical*	1. Applying quality control standards and specifications. 2. Attention to quality and added value products.	1. Training on the level of standards and specifications for international food safety and health standards.	• Reducing losses in handling fish products.

Stages of VC	Type	Development Support	Appropriate Interventions	Expected Impact
Exports		3. Raising efficiency by adopting acceptable international health standards and criteria. 4. Development of the production and trade of dried and smoked fish. 5. Improving hygienic practices in the preparation and processing of fish products.	2. Training workers on primary fish processing and transformational industries. 3. Use proper packaging material and tools. 4. Providing loans at low-interest rates to support workers in the fisheries sector. 5. Establishing centers for preparing and processing fish and transporting them through the local and foreign markets	• Increasing the availability of pelagic and demersal fish during the fishing seasons. • Providing multiple fish products with high specifications. • Enhancing the ability of stakeholders from the private and public sectors to diversify production and raise fish exports. • Improve incomes and livelihoods • Job creation and employment.
	Financial	1. Providing soft loans. 2. Support from the relevant authorities in fisheries.		
	Administrative / organizational	1. Developing plans and programs for qualifying workers in fish food processing technology.		
Consumption / Market	*Technical*	1. Consumer awareness of the importance of nutrition of fish and marine life and quality specifications.	1. Educating consumers about the importance of eating fish and its nutritional importance in maintaining public health. 2. Creating effective brochures, posters, and promotional/marketing campaigns. 3. Providing multiple, easy-to-access points of sale that take into account food and health quality standards. 4. Using technology, information technology, extension, and knowledge through a platform specialized in fish.	• Opening marketing outlets in main local markets and neighboring foreign markets, participating in international fish exhibitions, and paying attention to the export side. • Improving food and health consumption.
	Financial	1. Adjusting and standardizing prices		
	Administrative / organizational	1. Increasing fish exports and issuing legal legislative regulations regulating foreign export.		
Entities Enablers and Supporters	*Technical*	1. Activating inspection control services for healthy practices for handling fish products. 2. Specific programs to support sector players with the flexibility to achieve self-sufficiency.	1. Qualification and tracking training by ISO&CODEX Data collection for fish at every stage of the post-harvest chain from the net to the consumer. 2. Support with specialized devices to control the quality of fish products 3. Establishing a database specialized in the fish sector. 4. Adopting regulations and studying the markets to ensure fair prices in the markets.	• Increasing control and inspection services for fish products. • Improve market surveillance to unify prices and control monopoly. • Improving health and hygiene requirements for fish handling in wholesale and retail markets and transport fleets. • Availability of new job opportunities in preparing, trading, and distributing fish products. • Reducing the rise and fluctuations in the prices of fish and marine life.
	Financial	1. Support and interest from the authorities related to fisheries		
	Administrative / organizational	1. Periodic cluster meetings to organize and integrate interventions in the sector. 2. Updating a unified database among all stakeholders in the fisheries sector.		

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Appendices

Appendix (1): Adaptive Reuse Matrix

Table no. 12 SWOT - PESTLE adaptive reuse matrix in the value chain (Ioannis, et al., 2021)

Sustainability Indicators	Strengths	Opportunities	Weaknesses	Threats
(Po) Political	(Po1) Blocking Neglect Policy	Po2 Urban Re-development Strategies / Incentives	(Po3) Political Support Level	(Po4) Political Inertia
(Ec) Economic	(1Ec) Economic Growth Boost	(2Ec) Capitalization of Cultural Value	(3Ec) Inability to Estimate Economic Viability	(4Ec) Investment Returns
(SC) Socio-Cultural	(SC1) Cultural Values Preservation	(SC2) Quality of Life Improvement	(SC3) Facadism	(SC4) Gentrification
(TT) Technological-Technical	(TT1) Technological Innovation	(TT2) Cooperation in a wide range of scientific fields	(TT3) Asset Condition	(TT4) Technical Difficulties
(Le) Legal	(Le1) Current Legislative Context	(Le2) Land use plan and zoning	(Le3) Current Building Standards	(Le4) Ownership Status
(En) Environmental	(En1) Reduced Environmental Footprint	(En2) Eco-Building	(En3) Achieving Net-Zero Energy Goals	(En4) Indoor Environmental Quality

Appendix (2): SWOT and PESTLE Analysis Details

Table no. 13 Details of SWOT (**strengths**) and PESTLE analysis for Fish Value Chain Players (Primary Data, 2022)

Chain Players For each Stage	***Description***	***Classification*** *(1/2/3)*	***PESTLE***** *(1/2/3/4/5/6)*	***Frequency***	***Rate***	***Ranking***
Supply Inputs	Quality in the market.	Financial	Economic	9	15%	1
	Ownership of warehouses	Financial	Economic	8	13%	2
	Ability to supply on demand	Financial	Economic	7	12%	3
	Proximity to the concerned parties	Administrative/organizational	Political	5	8%	4
	Making profits	Financial	Economic	5	8%	4
	Customer service	Administrative/organizational	Social	4	7%	6
	Fishery product variety	Financial	Economic	3	5%	7
	Planning	Administrative/organizational	Economic	2	3%	8
	Operational staff collaboration	Administrative/organizational	Social	2	3%	8
	Owning fish savers (cases)	Financial	Economic	2	3%	8
	Availability of capital	Financial	Economic	2	3%	8
	Liquidity provisioning	Financial	Economic	2	3%	8
	Location of the facility from the coast	Administrative/organizational	Economic	2	3%	8
	Modern systems	Technological	Technological	1	2%	14
	Market strategic location	Administrative/organizational	Economic	1	2%	14
	Social networking use	Technological	Technological	1	2%	14
	Availability of manpower	Technological	Social	1	2%	14
	Strong coordination with the rest of the parties	Administrative/organizational	Political	1	2%	14
	Points of sale	Financial	Economic	1	2%	14
	Maintenance technician	Technological	Technological	1	2%	14
Production	Ability to supply as per demand	Financial	Economic	41	17%	1
	Close to sources	Administrative/organizational	Economic	37	15%	2
	Quality in the market	Financial	Economic	36	15%	3
	Making profits	Financial	Economic	27	11%	4
	Close to concerned authorities	Administrative/organizational	Political	21	9%	5
	Variety of fishery products	Financial	Economic	16	7%	6
	Availability of scientific expertise	Administrative/organizational	Social	13	5%	7
	The strategic location of the market	Administrative/organizational	Economic	12	5%	8
	Customer service	Administrative/organizational	Social	9	4%	9
	Providing maintenance workshops	Financial	Technological	7	3%	10
	Having manpower	Administrative/organizational	Social	6	2%	11
	Providing capital	Financial	Economic	4	2%	12
	Providing liquidity	Financial	Economic	3	1%	13
	Owning fish savers (cage)	Financial	Economic	3	1%	13
	Planning	Administrative/organizational	Economic	2	1%	15
	Providing maintenance	Technological	Social	2	1%	15
	Providing distributors	Administrative/organizational	Social	2	1%	15
	Owning warehouses	Financial	Economic	1	0%	18
	Having transport means	Financial	Economic	1	0%	18
	Owning some modern equipment	Technological	Technological	1	0%	18
Trade /Process /Exports	Ability to supply according to demand	Financial	Economic	46	20%	1
	Close resources	Administrative/organizational	Economic	35	15%	2
	Quality in the market	Financial	Economic	33	14%	3
	Providing manpower	Administrative/organizational	Social	14	6%	4
	Planning	Administrative/organizational	Economic	11	5%	5
	Strong coordination with the rest of the entities	Administrative/organizational	Political	11	5%	5
	Variety of fishery products	Financial	Economic	11	5%	5
	Making profits	Financial	Economic	9	4%	8
	Collaboration of the operational staff	Administrative/organizational	Social	7	3%	9
	Owning transport means	Financial	Economic	7	3%	9
	Market strategic location	Administrative/organizational	Economic	5	2%	11

Chain Players For each Stage	***Description***	***Classification*** *(1/2/3)*	***PESTLE***** *(1/2/3/4/5/6)*	***Frequency***	***Rate***	***Ranking***
	Owning warehouses	Financial	Economic	5	2%	11
	Providing liquidity	Financial	Economic	5	2%	11
	Points of sale	Financial	Economic	5	2%	11
	Location of the facility (installation) to the coast	Administrative/organizational	Economic	3	1%	15
	Close to the concerned authorities	Administrative/organizational	Political	3	1%	15
	Storage containers	Financial	Economic	3	1%	15
	Scientific expertise available	Administrative/organizational	Social	3	1%	15
	Using social media websites	Technological	Technological	2	1%	19
	Providing capital	Financial	Economic	2	1%	19
	Providing distributors	Administrative/organizational	Social	2	1%	19
	Modern systems	Technological	Technological	1	0%	22
	Customer service	Administrative/organizational	Social	1	0%	22
	Owning some modern equipment	Technological	Technological	1	0%	22
	Providing after-sales services	Administrative/organizational	Economic	1	0%	22
	Providing maintenance technician	Technological	Social	1	0%	22
	Existence of examination labs	Technological	Technological	1	0%	22
	Existence of a strong achieving system	Technological	Technological	1	0%	22
	Ability to supply according to demands	Financial	Economic	46	20%	1
	Close to resources	Administrative/organizational	Economic	35	15%	2
	Quality in the market	Financial	Economic	33	14%	3
	Providing manpower	Administrative/organizational	Social	14	6%	4
	Planning	Administrative/organizational	Economic	11	5%	5
	Strong coordination with the rest of the entities	Administrative/organizational	Political	11	5%	5
	Variety of fishery products	Financial	Economic	11	5%	5
	Making profits	Financial	Economic	9	4%	8
	Cooperation of the operational staff	Administrative/organizational	Social	7	3%	9
Consumption / Market	Ability to provide supply based on demand	Financial	Economic	4	14%	1
	Close to resources	Administrative/organizational	Economic	3	11%	2
	Close to the concerned authorities	Administrative/organizational	Political	3	11%	2
	Making profits	Financial	Economic	3	11%	2
	Quality in the market	Financial	Economic	2	7%	5
	Owning warehouses	Financial	Economic	2	7%	5
	Variety of fishery products	Financial	Economic	2	7%	5
	Scientific expertise available	Administrative/organizational	Social	2	7%	5
	Customer service	Administrative/organizational	Social	1	4%	9
	Market strategic location	Administrative/organizational	Economic	1	4%	9
	Possession of fish savers	Financial	Economic	1	4%	9
	Availability of capital	Financial	Economic	1	4%	9
	Liquidity provisioning	Financial	Economic	1	4%	9
	Availability of manpower	Administrative/organizational	Social	1	4%	9
	After-sales services:	Administrative/organizational	Economic	1	4%	9
Enablers and supporters	Planning	Administrative/organizational	Economic	10	27%	1
	Proximity to concerned parties	Administrative/organizational	Political	7	19%	2
	Strong coordination with the rest of the entities	Administrative/organizational	Political	6	16%	3
	Operational staff collaboration	Administrative/organizational	Social	4	11%	4
	Having a strong archiving system	Technological	Technological	3	8%	5
	Investor protection	Administrative/organizational	Legal	2	5%	6
	Provide scientific expertise	Administrative/organizational	Social	2	5%	6
	Modern systems	Financial	Technological	2	5%	6
	Legal advisory efficiency	Administrative/organizational	Legal	1	3%	9

=**Classification **1**. Technological. **2**. Financial **3**. Administrative/organizational * *= PESTLE**: **1**. Political 2. Economic 3. Social 4. Technological 5. Legal 6. Environmental

Table no. 14 Details of SWOT (**opportunities**) and PESTLE analysis for Fish Value Chain Players (Primary Data, 2022)

Chain Players For each Stage	***Description***	***Classification**** *(1/2/3)*	***PESTLE*** *(1/2/3/4/5/6)*	***Freq***	***Rate***	***Ranking***
Supply Inputs	Excess demand	Financial	Economic	20	41%	1
	Stability of security situation	Administrative/organizational	Political	6	10%	2
	The proximity of the market for the product	Financial	Economic	6	10%	2
	Plenty of companies	Financial	Economic	4	7%	4
	Low product price	Financial	Economic	3	5%	5
	Existence of supporting organizations and institutions	Financial	Economic	3	5%	5
	Long coastline available	Financial	Economic	2	3%	7
	Support	Financial	Economic	1	2%	8
	Mobile availability	Technological	Technological	1	2%	8
	Provision of water services	Financial	Economic	1	2%	8
	Ice factories	Financial	Economic	1	2%	8
	Existence of fish cooperatives	Administrative/organizational	Social	1	2%	8
Production	Excess demand	Financial	Economic	74	25%	1
	The proximity of the market to the product	Financial	Economic	32	11%	2
	Plenty of companies	Financial	Economic	31	11%	3
	Ice factories	Financial	Economic	28	10%	4
	Existence of fish cooperatives	Administrative/organizational	Social	28	10%	4
	Stability of security situation	Administrative/organizational	Political	19	6%	6
	Long coastline available	Financial	Economic	17	6%	7
	Existence of supporting organizations and institutions	Financial	Economic	17	6%	7
	Low product price	Financial	Economic	15	5%	9
	The presence of marketers	Administrative/organizational	Social	6	2%	10
	Existence of marine products	Financial	Economic	5	2%	11
	Availability of transportation	Financial	Economic	4	1%	12
	Provision of suppliers	Financial	Economic	4	1%	12
	Support	Financial	Economic	3	1%	14
	Availability of some fishing gears	Technological	Technological	3	1%	14
	Mobile availability	Technological	Technological	3	1%	14
	Export possibilities	Financial	Economic	3	1%	14
	Possibility to expand farming	Administrative/organizational	Economic	1	0%	18
Trade / Process / Exports	Increase demand	Financial	Economic	64	30%	1
	The proximity of the market to the product	Financial	Economic	28	13%	2
	Low product price	Financial	Economic	16	8%	4
	Stability of security situation	Administrative/organizational	Political	15	7%	5
	Mobile availability	Technological	Technological	17	8%	3
	Large coastline available	Financial	Economic	11	5%	6
	Quality of marine products	Financial	Economic	9	4%	7
	Plenty of companies	Financial	Economic	9	4%	7
	Ice factories	Financial	Economic	9	4%	7
	Availability of some fishing gears	Technological	Technological	8	4%	10
	Availability of transportation	Financial	Economic	7	3%	11
	Availability of some fishing gears	Technically	Technological	2	1%	13
	Availability of water services	Financial	Economic	2	1%	13
	Availability of suppliers	Financial	Economic	2	1%	13
	Existence of fish cooperatives	Administrative/organizational	Social	3	1%	12
	The presence of marketers	Administrative/organizational	Social	2	1%	13
	Support	Financial	Economic	1	0%	18
	Provision of internet service	Technological	Technological	1	0%	18

Chain Players For each Stage	***Description***	***Classification**** *(1/2/3)*	***PESTLE*** *(1/2/3/4/5/6)*	***Freq***	***Rate***	***Ranking***
	Export possibilities	Financial	Economic	1	0%	18
	Presence of supporting organizations and institutions	Financial	Economic	1	0%	18
Consumption / Market	Long coastline available	Financial	Economic	21	24%	1
	Quality of marine products	Financial	Economic	17	19%	2
	Excess demand	Financial	Economic	15	17%	3
	The proximity of the market to the product	Financial	Economic	9	10%	4
	Stability of security situation	Administrative/organizational	Political	8	9%	5
	Existence of fish cooperatives	Administrative/organizational	Social	4	5%	6
	Availability of transportation	Financial	Economic	3	3%	7
	Presence of supporting organizations and institutions	Financial	Economic	3	3%	7
	Availability of suppliers	Financial	Economic	2	2%	9
	Plenty of companies	Financial	Economic	2	2%	9
	The presence of marketers	Administrative/organizational	Social	2	2%	9
	Mobile availability	Technological	Technological	1	1%	12
	Ice factories	Financial	Economic	1	1%	12
Enablers and supporters	Presence of supporting organizations and institutions	Financial	Economic	9	26%	1
	Existence of fish cooperatives	Administrative/organizational	Social	8	23%	2
	Stability of security situation	Administrative/organizational	Political	4	11%	3
	Plenty of companies	Financial	Economic	4	11%	3
	Long coastline available	Financial	Economic	4	11%	3
	Mobile	Technological	Technological	2	6%	6
	Support	Financial	Economic	2	6%	6
	Proximity to the government facility	Administrative/organizational	Social	1	3%	8
	Low product price	Financial	Economic	1	3%	8

Classification **1**. Technological. **2**. Financial **3**. Administrative/organizational * ***= PESTLE**: **1**. Political 2. Economic 3. Social 4. Technological 5. Legal 6. Environmental

Table no. 15 Details of SWOT **(weaknesses)** and Pastel Analysis for Fish Value Chain Players (Primary Data, 2022)

Chain Players Per each Stage	***Description***	***Classification**** *(1/2/3)*	***PESTLE*** *(1/2/3/4/5/6)*	***Freq***	***Rate***	***Ranking***
Supply Inputs	Use of low-quality equipment based on purchasing power	Technological	Technological	3	12%	1
	Lack of market study	Administrative/organizational	Economic	3	12%	1
	The weak purchasing power of oil derivatives	Financial	Economic	3	12%	1
	Ad Weakness	Technological	Technological	2	8%	4
	Decrease in output	Financial	Economic	1	4%	5
	Lack of training and qualification	Technological	Technological	1	4%	5
	Underpaid wages	Financial	Economic	1	4%	5
	Low level of development	Administrative/organizational	Economic	1	4%	5
	High operating costs	Financial	Economic	1	4%	5
	Lack of control over damage to products	Technological	Technological	1	4%	5
	Poor marketing	Administrative/organizational	Economic	1	4%	5
	Shortage of production equipment	Technological	Technological	1	4%	5
	Lack of an appropriate educational environment.	Administrative/organizational	Social	1	4%	5
	Lack of export activity	Financial	Economic	1	4%	5
	Sale on credit	Financial	Economic	1	4%	5
	Inability to improve workplace	Administrative/organizational	Social	1	4%	5
	Lack of maintenance training.	Technological	Technological	1	4%	5
	Lack of courses in occupational safety and security	Technological	Technological	1	4%	5
Production	Decrease in output	Financial	Economic	26	17%	1
	Lack of coordination	Administrative/organizational	Political	22	15%	2
	The weak purchasing power of oil derivatives	Financial	Economic	17	11%	3
	Lack of electricity generators	Technological	Technological	10	7%	4
	Lack of production equipment	Technological	Technological	10	7%	4
	Difficulty in providing new equipment	Technological	Technological	9	6%	6
	Lack of training and qualification	Technological	Technological	8	5%	7
	Lack of awareness	Administrative/organizational	Social	8	5%	7
	Lack of market research	Administrative/organizational	Economic	8	5%	7
	Scarcity of product options	Financial	Economic	7	5%	10
	Lack of control over damage to products	Technological	Technological	5	3%	11
	High operating costs	Financial	Economic	4	3%	12
	Vulnerability of the infrastructure of the facility	Technological	Technological	4	3%	12
	Underpaid wages	Financial	Economic	3	2%	14

Chain Players Per each Stage	***Description***	***Classification**** *(1/2/3)*	***PESTLE*** *(1/2/3/4/5/6)*	***Freq***	***Rate***	***Ranking***
	Low level of development	Administrative/organizational	Economic	2	1%	15
	Use of low-quality equipment based on purchasing power	Technological	Technological	2	1%	15
	Ad weakness	Technological	Technological	1	1%	17
	Poor interest in job loyalty	Administrative/organizational	Social	1	1%	17
	Marketing	Administrative/organizational	Economic	1	1%	17
	Lack of Employment encouragement	Administrative/organizational	Social	1	1%	17
	Lack of safety tools	Technological	Technological	1	1%	17
	Poor performance of available capabilities	Technological	Technological	1	1%	17
Trade /Process/ /Export	Lack of market research	Administrative/organizational	Economic	18	14%	1
	Decrease in output	Financial	Economic	17	13%	2
	Lack of coordination	Administrative/organizational	Political	15	12%	3
	The weak purchasing power of oil derivatives	Financial	Economic	14	11%	4
	Lack of electricity generators	Technological	Technological	13	10%	5
	Lack of training and qualification	Technological	Technological	9	7%	6
	Low income.	Financial	Economic	6	5%	7
	Low level of development	Administrative/organizational	Economic	5	4%	8
	Lack of control over damage to products	Technological	Technological	4	3%	9
	Lack of awareness	Administrative/organizational	Social	4	3%	9
	High operating costs	Financial	Economic	3	2%	11
	Underpaid wages	Financial	Economic	3	2%	11
	Marketing	Administrative/organizational	Economic	3	2%	11
	Use of low-quality equipment based on purchasing power	Technological	Technological	2	2%	14
	Scarcity of product options	Financial	Economic	2	2%	14
	Difficulty importing raw materials	Financial	Economic	2	2%	14
	Lack of supply as per demand	Financial	Economic	1	1%	17
	The facility is far from the coast	Administrative/organizational	Economic	1	1%	17
	Logistics	Administrative/organizational	Economic	1	1%	17
	Poor manufacturing sector	Technological	Technological	1	1%	17
	Lack of employee encouragement	Administrative/organizational	Social	1	1%	17
	Lack of safety tools	Technological	Technological	1	1%	17
	Vulnerability of the infrastructure of the facility	Technological	Technological	1	1%	17
	Lack of production equipment	Technological	Technological	1	1%	17
Consumption / Market	Decrease in output	Financial	Economic	5	33%	1

Chain Players Per each Stage	***Description***	***Classification**** *(1/2/3)*	***PESTLE**** *(1/2/3/4/5/6)*	***Freq***	***Rate***	***Ranking***
	The weak purchasing power of oil derivatives	Financial	Economic	4	27%	2
	Lack of awareness	Administrative/organizational	Social	3	20%	3
	Lack of an appropriate work environment.	Administrative/organizational	Social	2	13%	4
	Inability to improve the workplace	Administrative/organizational	Social	1	7%	5
Enablers and supporters	Lack of market study	Administrative/organizational	Economic	8	16%	1
	Low level of development	Administrative/organizational	Economic	7	14%	2
	Lack of training and qualification	Technological	Technological	6	12%	3
	Poor interest in job loyalty	Administrative/organizational	Social	3	6%	4
	Underpaid wages	Financial	Economic	3	6%	4
	Institutional corruption	Administrative/organizational	Political	2	4%	6
	Different qualifications	Administrative/organizational	Social	2	4%	6
	Lack of employee encouragement	Administrative/organizational	Social	2	4%	6
	Lack of an appropriate work environment.	Administrative/organizational	Social	2	4%	6
	Reduction of financial and human resources	Financial	Economic	2	4%	6
	Lack of employability of sufficient labor	Administrative/organizational	Social	2	4%	6
	Different qualifications	Administrative/organizational	Social	2	4%	6
	Poor Logistics	Administrative/organizational	Economic	2	4%	6
	Lack of awareness	Administrative/organizational	Social	1	2%	14
	Lack of water policy	Administrative/organizational	Legal	1	2%	14
	Lack of examination lab.	Technological	Technological	1	2%	14
	Lack of safety tools	Technological	Technological	1	2%	14
	There are no control boats	Administrative/organizational	Legal	1	2%	14
	Ad weakness	Technological	Technological	1	2%	14

=**Classification 1. Technological. **2**. Financial **3**. Administrative/organizational *=PESTLE**: **1**. Political 2. Economic 3. Social 4. Technological 5. Legal 6. Environmental

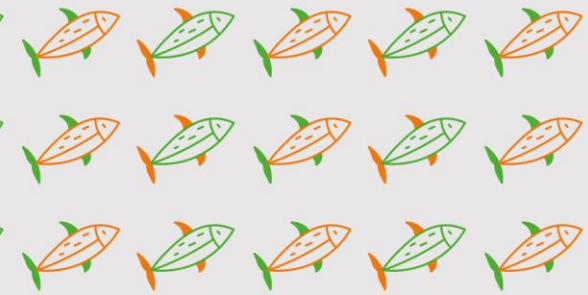
Table no. 16 SWOT analysis (**threats/risks**) and PESTLE players of fish added value chain (Primary Data, 2022)

Chain Players For each phase	***Description***	***Classification**** *(1/2/3)*	***PESTLE**** *(1/2/3/4/5/6)*	***Freq***	***Rate***	***Ranking***
Supply Inputs	Increase in the prices of oil derivatives	Financial	Economic	13	22%	1
	In addition to taxes and customs	Administrative/organizational	Legal	10	17%	2
	Prices volatility	Financial	Economic	7	12%	3
	War and conflict	Administrative/organizational	Political	5	8%	4
	Closure of ports and airports	Administrative/organizational	Political	3	5%	5
	Exchange rates instability	Financial	Economic	2	3%	6
	Strong competitiveness	Administrative/organizational	Economic	2	3%	6
	Lack of state support	Administrative/organizational	Political	2	3%	6
	Lack of oil derivatives	Financial	Economic	2	3%	6
	Weak state control	Administrative/organizational	Legal	2	3%	6
	Scarcity of raw materials in the market	Financial	Economic	2	3%	6
	Increase in export cost	Financial	Economic	2	3%	6
	Banning the import of some devices by the countries of the coalition	Administrative/organizational	Legal	1	2%	13
	Emigration of the foreign expertise	Administrative/organizational	Social	1	2%	13
	Lack of infrastructure in the facilities	Technological	Technological	1	2%	13
	Lack of spare parts	Financial	Economic	1	2%	13
	Political situation	Administrative/organizational	Political	1	2%	13
	Security and economic situation	Administrative/organizational	Political	1	2%	13
	Coastal environmental pollution	Technological	Environmental	1	2%	13
Production	Increase in the prices of oil derivatives	Financial	Economic	76	25%	1
	In addition to taxes and customs	Administrative/organizational	Legal	45	15%	2
	Coastal environmental pollution	Technological	Environmental	29	10%	3
	War and conflict	Administrative/organizational	Political	24	8%	4
	Price volatility	Financial	Economic	19	6%	5
	Demolition of pastures by large ships	Technological	Environmental	14	5%	6
	Piracy	Administrative/organizational	Political	14	5%	6
	Closure of ports and airports	Administrative/organizational	Political	14	5%	6
	Weak state control	Administrative/organizational	Legal	9	3%	9
	Lack of government subsidy	Administrative/organizational	Political	7	2%	10
	Lack of oil derivatives	Financial	Economic	7	2%	10
	High export costs	Financial	Economic	6	2%	12
	Lack of a fish port	Financial	Economic	5	2%	13
	Lack of facility infrastructure	Technological	Technological	5	2%	13
	Reduction of catches.	Financial	Economic	5	2%	13
	Political situation	Administrative/organizational	Political	4	1%	16
	Security and economic situation	Administrative/organizational	Political	4	1%	16
	Rug roads	Technological	Environmental	3	1%	18
	Lack of boat factories	Technological	Technological	3	1%	18
	Non-compliance with harvest laws	Administrative/organizational	Legal	3	1%	18
	More competitors	Financial	Economic	2	1%	21
	Scarce raw materials in the market	Financial	Economic	2	1%	21
	Impose of levy on the fishermen	Administrative/organizational	Legal	1	0%	23
	Lack of spare parts	Financial	Economic	1	0%	23
	Losing people with experience	Administrative/organizational	Social	1	0%	23
Trade / Process / Exports	Increase in the prices of oil derivatives	Financial	Economic	50	28%	1
	Prices volatility	Financial	Economic	20	11%	2
	The rise in taxes and customs	Administrative/organizational	Legal	19	11%	3
	War and conflict	Administrative/organizational	Political	11	6%	4

Chain Players For each phase	***Description***	***Classification**** *(1/2/3)*	***PESTLE*** *(1/2/3/4/5/6)*	***Freq***	***Rate***	***Ranking***
	Coast pollution	Administrative/organizational	Environment [org structure]	11	6%	4
	Closure of ports and airports	Administrative/organizational	Political	8	5%	6
	Lack of government support	Administrative/organizational	Political	6	3%	7
	Decline of fishing	Technological	Economic	6	3%	7
	Lack of oil derivatives	Financial	Economic	5	3%	9
	Political situation	Administrative/organizational	Political	4	2%	10
	Non-compliance with the laws of fishing	Administrative/organizational	Legal	4	2%	10
	Poor government planning	Administrative/organizational	Legal	4	2%	10
	More competitors	Financial	Economic	4	2%	10
	Poor government control	Administrative/organizational	Legal	3	2%	14
	Impose of levy on fishermen	Administrative/organizational	Legal	3	2%	14
	Security and economic situation	Administrative/organizational	Political	3	2%	14
	The scarcity of raw materials in the market	Financial	Economic	3	2%	14
	More checkpoints on the road	Administrative/organizational	Political	2	1%	18
	Rug roads	Technological	Environmental	2	1%	18
	Lack of boat factories	Technological	Technological	2	1%	18
	No refrigerators to save the finished product	Financial	Economic	1	1%	21
	Weak work of the Environment Authority in the drop-off centers	Administrative/organizational	Legal	1	1%	21
	Demolition of pastures by large ships	Technological	Environmental	1	1%	21
	Strong competitiveness	Administrative/organizational	Economic	1	1%	21
	Spare parts not provided	Financial	Economic	1	1%	21
	High export costs	Financial	Economic	1	1%	21
Consumption / Market	Environmental pollution	Technological	Environmental	36	14%	1
	Increase in the prices of oil derivatives	Financial	Economic	32	12%	2
	Prices volatility	Financial	Economic	31	12%	3
	War and conflict	Administrative/organizational	Political	19	7%	4
	Lack of consumer protection	Administrative/organizational	Legal	16	6%	5
	Political situation	Administrative/organizational	Political	14	5%	6
	High product price	Financial	Economic	14	5%	6
	Lack government subsidy	Administrative/organizational	Political	13	5%	8
	Weak government planning	Administrative/organizational	Legal	13	5%	8
	Lack of oil derivatives	Financial	Economic	12	5%	10
	Security and economic situation	Administrative/organizational	Political	12	5%	10
	Weak state control	Administrative/organizational	Legal	12	5%	10
	Closure of ports and airports	Administrative/organizational	Political	11	4%	13
	Export before local sufficiency	Administrative/organizational	Economic	7	3%	14
	Additional taxes and customs	Administrative/organizational	Legal	7	3%	14
	Demolition of pastures by large ships	Technological	Environmental	5	2%	16
	Lack of facilities and infrastructure	Technological	Technological	3	1%	17
	Imposition of levies on fishermen	Administrative/organizational	Legal	2	1%	18
Enablers and Supporters	Increase in the prices of oil derivatives	Financial	Economic	13	23%	1
	Coastal pollution	Technological	Environmental	9	16%	2
	Closure of ports and airports	Administrative/organizational	Political	5	9%	3
	War and conflict	Administrative/organizational	Political	4	7%	4
	Lack of government subsidy	Administrative/organizational	Political	3	5%	5
	Political situation	Administrative/organizational	Political	3	5%	5
	Piracy	Administrative/organizational	Political	3	5%	5
	Lack of facilities and infrastructure	Technological	Technological	2	4%	8
	Losing expertise	Administrative/organizational	Social	2	4%	8

Chain Players For each phase	***Description***	***Classification**** *(1/2/3)*	***PESTLE**** *(1/2/3/4/5/6)*	***Freq***	***Rate***	***Ranking***
	Additional taxes and customs	Administrative/organizational	Legal	2	4%	8
	Lack of oil derivatives	Financial	Economic	2	4%	8
	Price volatility	Financial	Economic	2	4%	8
	Non-compliance with harvest laws	Administrative/organizational	Legal	1	2%	13
	Exchange rate instability	Financial	Economic	1	2%	13
	Weak government planning	Administrative/organizational	Legal	1	2%	13
	The decline in fishing catches	Financial	Economic	1	2%	13
	Export before domestic sufficiency	Administrative/organizational	Economic	1	2%	13
	Use of prohibited fishing gear	Technological	Environmental	1	2%	13

= classification 1**. Technological. **2**. Financial **3**. Administrative/organizational *=PESTLE**: **1**. Political 2. Economics **3**. Social 4. Technological - Technical. **5**. Legal. **6**. Environmental



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