

**ANALYSIS OF FISH VALUE CHAIN: THE CASE OF GILGEL  
GIBE DAM I RESERVOIR SOUTHWEST OF ETHIOPIA**

**M.Sc. Thesis**

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**September, 2016**

**Jimma University**

# **ANALYSIS OF FISH VALUE CHAIN: THE CASE OF GILGEL GIBE DAM I RESERVOIR SOUTHWEST OF ETHIOPIA**

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By

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September, 2016

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## **DEDICATION**

I dedicated this thesis to my beloved father-in-law Haji Hussein Aba Bulgu Aba Nano for his patience and sacrifice during my academic study and all aspects of the research when he was alive.

## STATEMENT OF AUTHOR

First, I declare that this thesis is solely my original work with close supervision and guidance of my advisors. In addition to this all sources of materials used in the thesis have been accordingly acknowledged. This thesis has been submitted in partial fulfillment for the requirement of MSc degree in Agribusiness and Value Chain Management at Jimma University and is deposited at the University Library to be available to borrowers under rules of the library. I solemnly declare that this thesis is not submitted to any other institution anywhere for the award of any academic degree, diploma, or certificate.

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## **BIOGRAPHICAL SKETCH**

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## LIST OF ACRONYMS AND ABBREVIATIONS

ADLI	Agricultural Development Led Industrialization
AMC	Average Marketing Cost
BoA	Bureau of Agriculture
CEE	Central and Eastern Europe
CLR	Classical Linear Regression
CP	Consumer Price
DA	Development Agent
DFID	Department for International Development
EIAR	Ethiopian Institute of Agricultural Research
ETB	Ethiopian Birr
FAO	Food and Agricultural Organization
FAOUN	Food and Agricultural Organization of United Nation
GMM	Gross Marketing Margin
GMMp	Producers Gross Marketing Margin
GTZ	German Organization for Technical Cooperation
GVC	Global Value Chain
HACCP	Hazard Analysis and Critical Control Points
HLPE	High Level Panel of Experts
Km <sup>2</sup>	Square Kilo Meter
m.a.s.l	Meters Above Sea Level
MoARD	Ministry of Agriculture and Rural Development
NFALRC	National Fisheries and other Aquatic Life Research Center
NGOs	Non-Government Organizations
NMM	Net Marketing Margin
OBARD	Oromia Bureau of Agriculture and Rural Development
OCSI	Oromia Credit and Saving Institution
PHMVA	Post-Harvest Management and Value Addition
PP	Producer Price
PRA	Participatory Rural Appraisal

## **LIST OF ACRONYMS AND ABBREVIATIONS (Continued)**

RMA	Rapid Market Appraisal
SDPRP	Sustainable Development and Poverty Reduction Program
SPSS	Statistical Package for Social Science
TGMM	Total Gross Marketing Margin
US\$	United State Dollar
USAID	United States Agency for International Development
VCA	Value Chain Analysis
VIF	Variance Inflation Factor
VSF	Veterinaries sans Frontiers
WA	Woreda Administrative
WoA	Woreda Office of Agricultural
WSSMEO	Woreda Small Scale Micro Enterprise Organizer Office

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# ANALYSIS OF FISH VALUE CHAIN: THE CASE OF GILGEL GIBE DAM I RESERVOIR SOUTHWEST OF ETHIOPIA

## ABSTRACT

*The fishery science in Ethiopia is at infant stage and its value chain is not such studied in the country. This study was aimed at analysis of fish value chain in Gilgel Gibe dam I reservoir Southwest of Ethiopia with specific objectives of mapping fish value chain and identify the major actors, investigating the fish market channels and performance, analyzing the determinants of value addition on fish by the producers and analyzing the determinants of fish supply to the market. A three stage sampling procedure which includes both purposive and random sampling were used to select sample respondents. Primary data were collected from 128 randomly selected individuals' interview using structured questionnaire via enumerators and secondary data were acquired from published and unpublished sources. Descriptive statistics and econometric analysis were used to analyze the data. The result of value chain analysis shows that the direct fish value chain actors of this study area are fishermen, local collectors, fishery cooperatives, whole sellers, retailer and restaurants and hotels while the major enablers are WoA, and WA, NGO's, BoA, MFI research center and Jimma university. The fish marketing channels and performance analysis result shows 196,885 kg of fish were produced by the respondent which is 79% passed through twelve main alternative marketing channels and 16.4 % was consumed by producer. The result of GMM shows the producer get the higher margin (at channel II and XII which is 75% and 73.7%) when they sell to cooperatives and collectors and in general restaurants and hotels get the highest margin in this fish value chain(i.e. 142-146%). The result of binary logit model indicated that the fish value addition is significantly affected by education level, fishing equipment, extension service, access to market information and credit service. The multiple linear regression model results also indicated that volume of fish supply is positively and significantly affected by fishing experience, price of fish in 2015, producer membership to fishery cooperative and access to credit service. Therefore; it needs strong government intervention on supporting fishermen in providing modern input and technologies, processing and value addition, empowering fishery cooperatives, strengthening of market extension and linking them with financial service provider and improving extension system are recommended to accelerate the fishery value chain's development thus income of individual fishermen could be enhanced.*

**Key words:** Binary logit model, Fish Value chain, Gilgel Gibe dam I reservoir, Market performance, Multiple linear regression model.

# 1. INTRODUCTION

## 1.1. Background

Many millions of people around the world find a source of income and livelihood in the fisheries and aquaculture sector (FAO, 2014). Fish is also a major source of livelihoods and income, particularly in developing countries. It is estimated that more than 158 million people in the world depend directly on fish-related activities (fishing, fish farming, processing, and trading). More than 90 percent of them are small-scale operators living in developing countries (HLPE, 2014). The most recent estimates indicate that 58.3 million people were engaged in the primary sector of capture fisheries; hence 37 percent were engaged full time and the employment opportunity in the sector has grown faster than the world's population and it remains among the most traded food commodities worldwide. In 2012, about 200 countries reported exports of fish and fishery products (FAO, 2014), from the fish marketed for edible purposes in this year 46 percent (63 million tonnes) was in live, fresh or chilled forms. The sector contributes to development and growth in many countries; playing an important role for food security and nutrition, poverty reduction, employment and trade, provided livelihoods and income (Roger, 2013). It is one of the livelihood strategies that have contributed much to people in developing countries to achieve food, income and other social benefits and serves as an important source of diet for over one billion people in the world (Manasi *et al.*, 2009).

As Asseffa (2014) reported; it is estimated that the inland fisheries of Africa produce 2.1 million tonnes of fish, which represents 24% of the total global production from inland waters (FAO, 2004). In comparison to marine fisheries, inland fisheries production is relatively small, representing only 6% of global production. In Africa, marine fisheries production (4.7 million tonnes) is also much larger compared to inland fisheries (2.1 million tonnes) but in a smaller scale than at the global level.

More than 85% of the Ethiopian population residing in the rural area is engaged in agricultural production as a major means of livelihood. Ethiopia is an agrarian country where

agriculture remains the dominant sector of the economy contributing about 43% of the GDP, 85% of employment and 90% of total export earnings as well as providing about 70% of the raw materials for the industrial sector (Demese et al., 2010). It is considered here in its broadest definition to include crops, livestock, fisheries, forestry and natural resource management. The country is well endowed with enormous cultivable land, livestock and fishery resources, which are largely unexploited yet could boost the economy and improve the livelihoods of the rural people that depend on agriculture.

ADLI strategy is among the pillars of Sustainable Development and Poverty Reduction Program (SDPRP) in Ethiopia. In line with this strategy the Ministry of Agriculture (MoA) thus considers the fishery subsector as one of the potential intervention areas to achieve the objective of enhancing food security, employment and provide alternative sources of income to improve the livelihoods of rural people in a sustainable manner. It is also attempted to promote fish culture along with the water resource development programs such as water harvesting and formation of multifaceted reservoirs (Hussien *et al.*, 2010).

The importance of fisheries to the Ethiopian economy until 50 years ago was insignificant due to abundant land-based resources and a sparse population density. But, from the 1940s and 50s the rapid population growth, which resulted in a shortage of cultivable land and depletion of land resources forced the people to look for other occupations and sources of food from water resources at a subsistence level (Alayu, 2012). Also the rapidly growing demand for fish throughout the country's towns and cities dwellers contributed to the start of commercial fishing and needs its supply to the market through value chain as a new practice in the country (Assefa, 2013).

The country's water bodies are classified into four systems: lakes, reservoirs, rivers and small water bodies with substantial quantity of fish stocks. These are 12 river basins and 11 fresh and 9 saline lakes, 4 crater lakes and over 12 major swamps or wetlands (MCE, 2001). The total area of the lakes and reservoirs stands at about 7000 to 8000 km<sup>2</sup> and the important rivers stretch over 7,000 km in the country (Assefa, 2014). In addition, minor water bodies such as some of 857 km<sup>2</sup> of reservoirs, 275km<sup>2</sup> small water bodies (Mesfin, 2012). There are 180

different species of fish in Ethiopia and 30 of those are native to the country (Ethiopian Embassy London, 2012).

Most of the fishing so far takes place in the lakes (85%) with only 15% in the rivers (MoARD, 2009). Riverine fishing activities are performed mostly on two of the rivers, the Baro near Gambela in the western part of the country and the Omo River in the Southern area near the border with Kenya and mostly it depends on the inland waters for the supply of fish as a cheap source of animal protein (Alemu *et al*, 2014). The country has no significant aquaculture development (Gordon et al., 2007).

As reported by (Assefa, 2014), Ethiopia is the largest livestock populations in Africa. The livestock sector accounts for over 26 percent of agricultural GDP (2009/10) and 8 percent of export earnings (2010) (CSA 2010 National Statistics Agency) and can produce over 51,500 tonne of fish per annum which can meet only 44 percent of the projected demand in 2015 (i.e. 44% of 117,002tonne), based solely on population size. However, their exploitation and consequently their contributions to food security and growth in the country are minimal despite the technologies capable of resolving the problems of livestock and fisheries production. Artisanal freshwater fishery is one of the most important economic activities in Ethiopia, (FAO, 2012). Therefore, improvements in fishery sector would contribute to poverty alleviation and environmental sustainability in Ethiopia (Global Fish Alliance, 2010).

Fish production and marketing is an important source of income and employment opportunity in the study areas. Even though there were no reliable data about the fish resource of this reservoir; being the potential of production and marketing of fish the study areas have access to both domestic and terminal markets for the future. Gilgel Gibe dam I reservoir could offer several opportunities to support the society especially to the youth and women in this area. The potential contribution of these reservoir fisheries is to achieve the regional development objectives includes nutrition and food security, source of sustainable income and create employment opportunity, alleviation of poverty, reduction/substitution of imported canned fish and economic growth for private sector including hotels and restaurants. This, therefore, calls for a strategy to scale up the production and increase the supply of fish in the country so as to meet the excess demand and make small scale producers beneficiary from the fishery

market opportunity. Such an effort can best be achieved through the knowledge of the functioning of the existing supply system and other related factors. Therefore, this study was conducted to analyze fish value chain, the existing fishery marketing system and identify actors participating in fish value chain and their role in Gilgel gibe dam I reservoir in southern part of Ethiopia.

## **1.2. Statement of the Problems.**

Most developing countries in the world have recognized reservoir fisheries as an effective way of increasing the supply of fish as food in rural areas at an affordable price and also provide additional income to rural farmers, thereby contributing to poverty alleviation. It added the advantages in that unlike the more conventional aquaculture practices they are less resource intensive, needs less technical skills at the farmer level and also an effective secondary user of water resources in rural areas.

It is known that the fishery science is at infant stage in Ethiopia. It is becoming apparent that the demand for fish is increasing in the country and the market is not sufficiently supplied with fish (Hussein et al., 2010). It is far higher than the available fish in the market especially; during fasting season (March-April full month and Wednesday and Friday almost in year round) for Orthodox religion believers (Asseffa, 2013). This is because of the supply of fish is constrained by different factors in the country. These constraints are mainly observed at three different supply chain levels (fishermen, fish traders and processors). Availability of fish and fish product to the consumers at the right time, right form, and right place and also at the lowest possible cost requires an effective marketing system (Shamsuddoha, 2007). Agricultural marketing is the main driving force for economic development and has a guiding and stimulating impact on production and distribution of agricultural produce. The increasing proportion of the population living in urban centers and rising level of income require more organized channels for production, processing and distributing fishery products.

Marketing of fish passes through various market channels and exchange points before it reach the final consumers (Ali et al., 2008). The value chain is an important instrument in the enforcement of standards with each player ensuring that the product originating from the

previous stage adheres to the standards (UNECA, 2009). On the other hand, improving marketing facilities for fish sector enable farmers to plan to their fish production and supply more in line with market demand, to schedule their harvests at the most profitable times to decide which markets to send their produce to and negotiate on a more even footing with traders. Moreover, a proper fish marketing system is also enables to increase fishermen production and supply as well as further processing and add more value on their fish. Therefore, Value chain analysis is essential to understand relationships and linkages among buyers and suppliers and a range of market actors in between (Wenz and Bokelmann, 2011).

Fish production in Gilgel Gibe dam I reservoir has been started since the dam starts its operation and according to Gashaw and Matthias (2014) estimation model for total fish production of lakes and reservoir based on its surface area the production potential of Gilgel Gibe Dam I reservoir is estimated 371 ton of fish per year. However, people living around this reservoir have engaged in producing fish as income generating activity till the reservoir was constructed; most of them are harvesting the fish in individual basis with poor fish post-harvest management and sell their product to local market.

Even if there are quite large demand of fish in the nearby big towns such as Jimma and the central market at Addis Ababa areas (Jimma ZoA report, 2014) fishermen were not benefited as expected from this product. Their benefit could be attributed to the fact that they were engaged in traditional way of harvesting with less production and poor post-harvest management practice and selling with lower prices. In addition; both buyers and sellers in the study areas usually do not play collective roles towards one another and there were no further fish processing activities rather preliminary processing activities at fishermen level. This was due to lack of knowledge of further fish processing and value addition, lack of access to fish preservation facility, lack of formal fish market channel, lack of linkage between actors in the fish value chain and lack of fishery infrastructure facility in the study area. Under such circumstances, a study that focused on production and marketing problems, roles and responsibilities of actors in the existing fish market chain can play significant role towards the improvements of the existing system. Problems in the fish value chain hinder the potential

gains that could have been attained from the existing opportunities. In this regard, analysis of fish value chain is an interesting process that has not been investigated in the study areas.

However, the study on role of actors in fish value chain, determinants of fish market supply, determinants of fish value addition, and the benefit share of different actors in fish market chain were not done in the study areas. Furthermore, in Ethiopia no study followed fish value chain framework to describe the work process and actors involved in fish value chain analysis so far. Therefore, this study would help to investigating factors affecting fish supply to the market and fish value addition to fill the knowledge and reducing the information gap on the subject matter by contributing to work better understanding on improved strategies for reorienting marketing system for the benefit of small farmer development and traders in the study area

### **1.3. Objectives of the Study**

The general objective of the study was to analyze fish value chain in Gilgel Gibe dam I reservoir with the following specific objectives:-

1. To map fish value chain and identify the major value chain actors in the study area
2. To analyze the performance of chain actors in the fish value chain of the study area
3. To analyze the determinants of fish supply to the market in the study area.
4. To analyze the determinants of value addition on fish by the producers.

### **1.4. Research Questions**

The study tries to answer the following major researchable questions such as:

1. What does fish value chain looks like in respective to the type and number of actors involved and their function in the chain in the study area?
2. What pricing strategy is common in the fish value chain and who is getting more benefit from the sale of fish along the chain in the study area?
3. What are the determinants of fish supply to the market in the study area?
4. What are the determinants of fish value addition along the existing fish value chain in the study area?

### **1.5. Significance of the Study**

This study has analyzed the entire fish value chain from input supplier to the consumer in the study area. Its result is helpful and also provides a holistic picture of the existing opportunities and constraints of fish production and marketing along the value chain. The potential users of the results of this study would be farmers, traders, and policy makers, students, researchers, research centers, universities, governmental and non-governmental organization that want to introduce interventions in fish marketing system. Furthermore, this study could be used as source material for further fishery value chain study and specifically the results of this study can contribute in the following way:

1. The output of this study can help:
  - a. The policy makers in designing a novel value chain in which can be a sustainable production and market from which the fish value chain actors (producers, traders, consumers and others) and the economy of the region can be benefited.
  - b. The development actors in designing their development and outreach programs of fishery to be in line with the existing condition of fish production and marketing as well as fishery management in the study area.
2. The information's that were generated from this study can provides a useful and practical tool for assessing the development status of the fishery sector in analyzing the opportunities and constraints for the future development and provide background information for further study of fish production and marketing through value chain in the study area.

### **1.6. Limitations of the Study**

The main limitation of this study were lack of reliable data about fishery in this study area and the problem of getting ample literatures to review about analysis of fish value chain and market chain in the country and budget constraints.

## **1.7. Organization of the Study**

Subsequent to chapter one that presents the general introduction, chapter two presents literature review on the various aspects such as theoretical and conceptual frameworks related to this study. Chapter three presents the research methodology. Chapter four presents results and discussion and the last chapter (chapter five) presents the summary, conclusions and recommendations. All other supporting documents are attached as annexes.

## 2. LITERATURE REVIEW

In this part of the study the basic concepts and definitions (Definition of terms, Fish production, Fish processing, Value addition, value chain, Fish marketing system, agricultural marketing, marketing margin, supply chain and market chain), fundamental approaches to value chain, and related empirical studies were discussed.

### 2.1. Definition of Terms

**Fish:** Any of the cold-blooded (ectothermic) aquatic vertebrates. Amphibians and aquatic reptiles are not included.

**Fish farm:** An aquaculture production unit (either land- or water-based); usually consisting of holding facilities (tanks, ponds, raceways, cages), plant (buildings, storage, processing), service equipment and stock.

**Fish processing and value-addition activities:** The term fish processing refers to the processes associated with fish and fish products between the time fish are caught or harvested, and the time the final product is delivered to the customer (FAO and WHO, 2009). Fish are highly perishable. The central concern of fish processing is to prevent fish from deteriorating and this remains an underlying concern during other processing operations. Fish processing can be subdivided into fish handling which is the preliminary processing of raw fish and the manufacture of fish products. Another natural subdivision is into primary processing involved in the filleting and freezing of fresh fish for onward distribution to fresh fish retail and catering outlets and the secondary processing that produces chilled, frozen and canned products for the retail and catering trades (FAO, 2014). Freshness of the fish is a mark of high quality and value-added that is rewarded by a price premium. In dedicated fish shops and fish stalls in supermarkets consumers pay a higher price for fresh fish for its hygienic display, quality and associated value-added services, such as gutting, cleaning, filleting, slicing and packaging (Smart Fish, 2012).

**Whole fish:** Fish as captured and un-gutted.

**Filleted fish:** A slice of fish of irregular size and shape removed from the carcass by cuts made parallel to the backbone filleted on a clean table, typically a plastic cutting board. Use of wood in food plants is being discouraged because it is difficult to sanitize and wood splinters can contaminate the product (FAO and WHO, 2009).

**Skimming Fillets** For modest numbers of fish, fillets can be skinned with a flexible fillet knife. Small, hand-operated mechanical skinners are also available that can process up to ten fish per minute. In general, hand skinning yields less than machine skinning. Once skinned, the exposed flesh should not come in contact with ice, water or skin.

**Fresh fish:** Fish products that have received no preserving treatment other than chilling.

**Fish Harvesting:** The operations involving taking of the fish from the water body: ponds, rivers, lakes, reservoirs, oceans ... etc.

**Cleaning:** It is the removal of soil, food residue, dirt, grease or other objectionable matter from fish.

**Washing:** It is the process of washing away blood and water-soluble components from minced fish with cold water; thus increasing the level of myofibrillar proteins thereof.

**Pickling:** The process whereby primary fatty fish is mixed with suitable salt (which may contain vinegar and spices) and stored in watertight containers under the resultant pickle that forms by solution of salt in the water extracted from the fish tissue.

**Retail:** An operation that stores, prepare packages, serve or otherwise provides fish and their products directly to the consumer for preparation by the consumer for human consumption. This may be free-standing seafood markets, seafood sections in grocery or department stores, packaged, chilled or frozen and/ or full service (FAO and WHO, 2009)..

**Fish Package:** Packaging may be defined as the general group of activities in product planning which involves designing and producing the container or wrapper for a product (Ferdous *et al.*, 2012). Fish Package is preparing fish in advance and displayed chilled or frozen for direct consumer pick-up. Processed Fish Packaging involves more than simply

combining ice and fish together in a wet-lock box or a cooler. Plastic or metal tubes that hold 15 to 25 pounds of processed product (without ice) are commercially available. These aesthetically pleasing, simple to employ, and relatively inexpensive processing steps can add significant value to the product before retail sale (FAO and WHO, 2009).

**Value chain:** it is a sequence of related enterprises (operators) conducting activities (functions) so as to add value to a product from its primary production, through its processing and marketing to the final sale of the product to consumers. The functions of each link in the chain involve sourcing inputs, making/producing, and then delivering/selling product to the next link in the chain (Macfadyen *et al.* 2011).

**Value Chain in Fisheries:** The value chain in fisheries is distinguished from traditional industry and service in one major aspect which is that the raw material comes from renewable resources. As the name suggests, value-chains add incremental value to the product in the nodes of a chain either by value addition or value creation. This value is then realized from higher prices and/or the development of new (niche) or expanded markets (De Silva, 2011).

**Supply chain in fisheries:** Supply chains for most of the fish species start from oceans and end up with consumer markets far from thousands of miles. A supply chain is a network of retailers, distributors, transporters, storage facilities and suppliers that participate in the production, delivery and sale of a product to the consumer (Harland, 1996). The supply chain is typically made up of multiple companies who coordinate activities to set themselves apart from the competition. A supply chain has three key parts, these are: Supply focuses on the raw materials supplied to manufacturing units, including how, when and from what location, manufacturing focuses on converting these raw materials into semi-finished or finished products, Distribution focuses on ensuring these products reach the consumers through an organized network of distributors, warehouses and retailers (De Silva, 2011).

## **2.2. The Conceptual Framework of Agricultural Value Chain Analysis**

A value chain encompasses the full range of activities and services required to bring a product or service from its conception to sale in its final markets whether local, national, regional or global (Campbell, 2008). Value chains include process actors such as input suppliers, producers, processors, traders and consumers. At one end are the producers – the farmers who grow the crops and raise the animals. At the other end are consumers who eat, drink and wear the final products. In the middle may be many individuals and firms, each performing one small step in the chain: transporting, processing, storing, selling, buying, packaging, checking, monitoring and making decisions. A value chain also includes a range of services needed including technical support (extension), business enabling and financial services, innovation and communication, and information brokering. The value chain actors and service providers interact in different ways starting from the local to national and international levels.

The value chain concept entails the addition of value as the product progresses from input suppliers to producers and consumers. A value chain, therefore, incorporates productive transformation and value addition at each stage of the value chain. At each stage in the value chain, the product changes hands through chain actors, transaction costs are incurred, and generally, some form of value is added. Value addition results from diverse activities including bulking, cleaning, grading, and packaging, transporting, storing and processing (Anandajayasekeram and Berhanu, 2009) as shown in Figure 1 for the case of a typical agricultural value chain.



Fig. 1: Typical agricultural value chain and associated business development services.

Source: Adapted from Abreham (2013) page 8.

The value chain includes direct actors who are commercially involved in the chain (producers, traders, retailers, consumers) and indirect actors who provide services or support the functioning of value chain. These include financial or non-financial service providers such as bankers and credit agencies, business service providers, government, researchers and extension agents. Figure 2 shows the general framework for value chain actors and supporter.

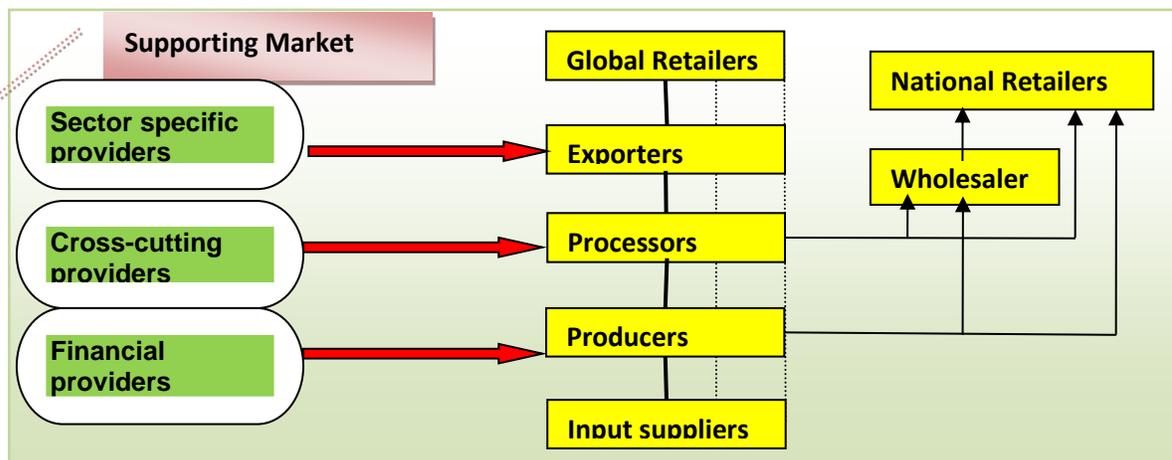


Fig. 2: Value chain actors and support framework

Source: Bezabih and Mengistu (2011): 5.

The chains can be simple, e.g. when producers directly sell to the consumers, or long and complex when other actors play roles in buying, processing, transporting and selling to the end user consumer. The complex chain offers a multitude of choices to farmers. They may choose to supply a specific market segment and produce the crop or animal that is tailored to that segment. They may also try to process their produce to add value to it. Producer farmers need to understand the players in the chain and the requirements of the different branches so they can supply the product which that branch requires. That will increase their bargaining power in the chain and improve the price they get for their product. This in turn increases farmers' comparative advantage by increasing the volume of supply, quality of the product and consistency of supply which is often possible when farmers act as a group (DFID, 2003).

The fishery value chain approach can be useful in developing the strategies to address the main factors which constrain the development and management of the fisheries sector in the country (Aaron, 2014). As opposed to the traditional exclusive focus on production, the concept of value chain stresses the importance of value addition at each stage thereby treating production as just one of several value-adding components of the chain. In its simplest form, a typical seafood Value Chain consists of harvesting (either through fishing or aquaculture, or a combination of both), primary processing, secondary processing, distribution and marketing and finally consumption (Aaron, 2014).Figure 1 below shows a schematic presentation for typical seafood Value Chain.

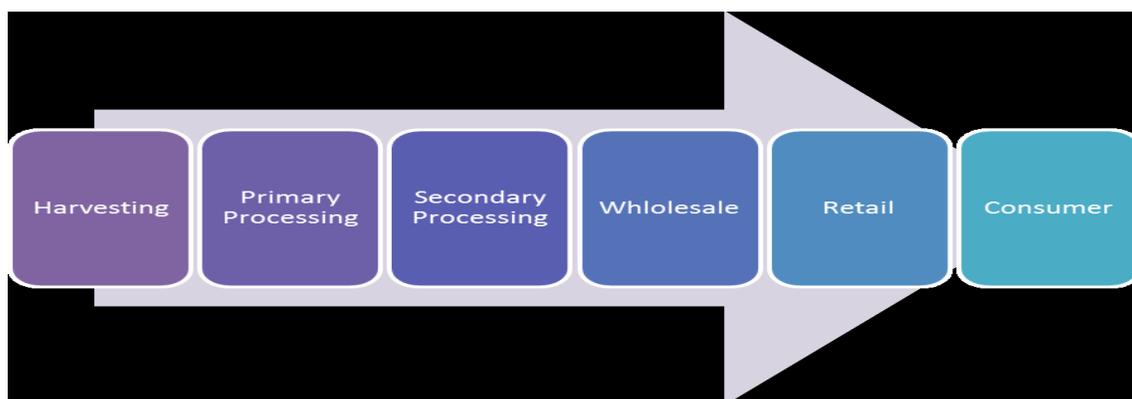


Fig. 3: Schematic presentation for typical seafood Value Chain

Source: adapted from Aaron (2014).

### **2.2.1. Importance of the fish trade**

Indirectly, domestic and international fish trade can increase food security through employment and income generation, which can be utilized to purchase food commodities, including lower cost staple foods. Domestic trade also makes fish much more available and accessible to local populations for consumption. In terms of international trade, it is known that fish exports are a major source of income for developing countries. Indeed, developing countries now represent close to 50% of global fish exports with their annual net export revenues exceeding US\$ 25 billion (FAO, 2012). These exports can generate foreign exchange as well as create employment and income in the primary and secondary sectors (NORAD-FAO, 2013).

### **2.2.2. Production in the value chain.**

In agricultural value chain analysis a stage of production can be referred to as any operating stage capable of producing a saleable product serving as an input to the next stage in the chain or for final consumption or use. Typical value chain linkages include input supply, production, assembly, transport, storage, processing, wholesaling, retailing, and utilization, with exportation included as a major stage for products designed for international markets. A stage of production in a value chain performs a function that makes significant contribution to the effective operation of the value chain and in the process adds value (Anandajayasekeram and Birhanu, 2009).

### **2.2.3. Governance in the Value chain**

Governance is essential to Global Value Chain (GVC) approach because it enable researchers to identify the dominant actors in the chain (Humphery and Schmitz, 2001). It can be exercised in different ways and different parts of the same chain and governed in different ways. Governance of global value chain refers to the ‘inter-firm relationships and institutional mechanisms through which non-market or explicit coordination of activities in the chain is achieved’ (Humphery and Schmitz, 2001). Control of a value chain does not require owning the manufacturing operation nor direct management of all activities instead the leading actors in value chains focused only on a few strategic activities (Knorringa and Pegler, 2006).

According to Humphery and Schmitz (2004), governance has to do with the exercise of coordination and control along the chain. This arises when a dominant actor ‘coordinates the product processes and scheduling/logistics parameters followed by other actors in the chain.

Therefore; applying this to the fishing sector to see as an example, the case of Pangasius production in Vietnam is primarily export oriented hence dominated by processing companies (Loc *et al.*, 2010). Due to this, producers selling to ‘export markets have a direct contact with processing companies thereby avoiding the extra costs incurred by collectors. In contrast to the shrimp farming in Indonesia, the tokeh (middlemen) ‘dominate the buying market in the remote regions’ (Ardjosoediro and Goetz, 2007: 16). This is because the tokeh usually provide micro finance and rental of transportation services to farmers during the production and the harvest periods respectively (*ibid*). However, these often create a ‘non-official contract farmer system’ and also restrict the farmers to sell to the tokeh usually at ‘an unfair prices’ *ibid*). In these two instances, the processing companies and the middlemen are the dominant actors in the Pangasius and shrimp production in Vietnam and Indonesia respectively. This is as a result of the fact that the processing companies and the middlemen control the entire production processes. Identifying the lead actors in the chain is very relevant in the sense that it helps in identifying which of the actors in the chain coordinate and control decisions along the chain.

Scholars have identified five main categories of chain governance. These are markets, modular, relational, captive and hierarchy value chains (Gibbon *et al.*, 2008, Gereffi *et al.*, 2005). According to Gibbon *et al.*, 2008, markets relations are dominant when transactions are easily codified, product specifications are simple and suppliers have the capability to produce without much input from buyers. This implies decisions as to what to produce, how to go about the production process and when to produce are solely dictated by the suppliers. Hence buyers have no control over the production process. With regards to modular value chains, suppliers usually produce products to a customer’s specification which may be more or less detailed (Gereffi *et al.*, 2005). Under this chain governance suppliers take full responsibility for the competences for the full supply of packages and modules thereby lowering the need for buyers to control the design and production processes and monitor closely (Gibbon *et al.*,

2008). Relational value chain is the type whereby product specifications can-not be codified easily this is because products are complex and additionally the capabilities of suppliers are very high (Gibbon et al., 2008). This situation however leads to ‘frequent communication between buyers and suppliers with-in the framework of a certain degree of mutual dependence, which may be regulated through reputation, social ties and/or spatial proximity. Additionally, captive value chains arise when small suppliers are transactional reliant on larger buyers (Gerreffi et al., 2005). According to Altenburg (2006:503) in captive value chains suppliers face high costs of switching to other customers mainly due to relation specific investments. As a result suppliers depend heavily on the lead firm. Furthermore, in this type of chain, suppliers are however assumed to have generally limited capabilities, hence their operations are strongly influenced by lead firms (ibid). Hierarchy value chain on the other hand is a type of governance usually characterized by vertical integration (Gerreffi et al., 2005). Under this type of governance, products are complex, capabilities of suppliers are limited hence buyers develop design and production skills in-house (Gibbon et al., 2008). Moreover, the ‘dominant form of governance is managerial control flowing from managers to subordinates or from headquarters to subsidiaries and affiliates’ (Gerreffi et al., 2005). The consideration of the government type is relevant to the consideration of the relationship between different actors in terms of the role of the state. It helps to differentiate between the types of chain and also to identify factors important to good cluster development.

#### 2.2.4. **Value chain development and tools.**

Value chain efficiency can be improved by means of various mechanisms including enhanced horizontal and vertical integration between the actors to improve overall competitiveness. **Horizontal linkages** (relationships between actors on the same level of the value chain) can be addressed by providing capacity building to farmer associations, producer cooperatives and commodity groups involved in the different stages of the value chain. This capacity building includes support and training to improve understanding of the value chain’s requirements and management. Strategic partnerships or apex organizations within a subsector are part of those horizontal linkages. Capacity development covers enhancement of technical skills (e.g. in

market-oriented production, farming as a business and good manufacturing practices), as well as managerial and business skills.

**Vertical linkages** (relationships between actors along the chain) are supported by linking producers to traders and processing groups or businesses, especially through the facilitation of platforms where they can interact, discuss and set up business arrangements using formal tools, such as memoranda of understanding and contracts, business-to-business linkages, formal and informal contractual arrangements and market information. A variety of strategies are considered for better positioning actors and upgrading value chains in order to increase the efficiency of transactions, ensure steady, increasing supply in terms of quantity and quality and ensure steady production matching market requirements.

Value chain development is based on an approach that examines the interactions and relationships between actors, from production and processing to marketing and distribution of agricultural goods. It seeks to systematically identify the main constraints and bottlenecks as well as the development opportunities in order to increase the competitiveness and inclusiveness of the whole chain. Its objective is to support the generation of added value and shared profits and improve the way value chain actors operate by making the chain more efficient and inclusive(FAO, 2013)

#### **2.2.5. Value chain upgrading**

Upgrading refers to the acquisition of technological capabilities and market linkages that enable firms to improve their competitiveness and move into higher value activities (Kaplinsky and Morris, 2000). Upgrading in firms can take place in the form of process upgrading, product upgrading, functional upgrading and chain upgrading. Upgrading entails not only improvements in products, but also investments in people knowhow, processes, equipment and favorable work conditions. Empirical research in a number of countries and sectors (Humphrey and Schmitz, 2000; Humphrey, 2003; Humphrey and Memedovic, 2006) provide evidence of the importance of upgrading in the agricultural sector.

### 2.3. Market Chains Versus Value Chains

The terms production chain, supply chain, market chain and value chain are often used interchangeably, but in fact there are some important differences. In its simplest definition, the terms production chain, supply chain, market chain are synonymously used to describe all participants involved in an economic activity which uses inputs and services to enable a product to be made and delivered to a final consumer. A value chain is understood as a strategic network between a numbers of independent business organizations. According to Hobbs *et al.* (2000), a value chain is differentiated from a production/supply chain because participants in the value chain have a long term strategic vision, disposed to work together, oriented by demand and not by supply shared commitment to control product quality and have a high level of confidence in one another that allows greater security in business and facilitates the development of common goals and objectives. The goal of value chain is to optimize performance in that industry using the combined expertise and abilities of the members of the chain. Successful chains depend on integration, coordination, communication and cooperation between partners with the traditional measure of success being the return on investment (Dunne, 2001; Bryceson and Kandampully, 2004).

According to KIT *et al.* (2006) farmers who are involved in the supply chain functions have little negotiating power and make little money and have no incentive to improve their products, and the traders face a great deal of risk and can buy only low quality produce. Through their associations farmers can negotiate a deal with a trader who buys a certain amount of a high quality product. The trader in turn has a contract with the end users/consumers. The function through which each actor is prepared to invest and support other actors to maximize the benefit from the chain performance is known as a value chain. This makes the chain to function smoothly and develops the sense of benefiting all actors from having a smooth supply of top quality products in a sustainable manner.

## **2.4. The Concept of Market and Marketing**

### **2.4.1. Market and marketing**

Market can be defined as an area in which one or more sellers of given products/services and their close substitutes exchange with and compete for the patronage of a group of buyers. Originally, the term market stood for the place where buyers and sellers are gathered to exchange their goods, such as village square. A market is a point, or a place or sphere within which price making force operates and in which exchanges of title tend to be accompanied by the actual movement of the goods affected (Backman and Davidson, 1962). The concept of exchange and relationships lead to the concept of market. It is the set of the actual and potential buyers of a product (Kotler and Armstrong, 2003). Conceptually, a market can be visualized as a process in which ownership of goods is transferred from sellers to buyers who may be final consumers or intermediaries.

### **2.4.2. Agricultural marketing**

It is consumers who spend a large amount of income on basic foods; hence, with the growth of urbanization, the agricultural marketing system is expected to play a great role in linking the rural and the urban population. Agricultural marketing covers all the activities associated with the agricultural production and food, feed, and fiber assembly, processing, and distribution to final consumers, including analysis of consumers' needs, motivations, and purchasing and consumption behavior (Branson and Norvell, 1983).

### **2.4.3. Marketing efficiency**

Efficiency in marketing is the most used measure of market performance. Improved marketing efficiency is a common goal of farmers, marketing organizations, consumers and society. It is a common place notation that higher efficiency means better performance whereas declining efficiency denotes poor performance. Most of the changes proposed in marketing are justified on the grounds of improved efficiency (Kohls and Uhl, 1985).

#### 2.4.4. **Marketing channel**

Formally, a marketing channel is a business structure of interdependent organizations that reach from the point of product or origin to the consumer with the purpose of moving products to their final consumption or destination (Kotler and Armstrong, 2003). The channel system creates time, place, possession and form utilities. However, the benefits of the channel system cannot be enjoyed without an element of cost. A product may take many routes on its journey from a producer to buyers and marketers search for the most efficient route from the many alternatives available. The channel may be direct or indirect. In the direct channel a producer and ultimate consumer deal directly with each other. In the indirect channel intermediaries are involved between the producers and final consumers and perform numerous channel functions. To choose appropriate channel environmental factors, consumer characteristics, product type and the firm financial, human and technological capabilities determine (Eric and Kerin, 2000). This channel may be short or long depending on kind and quality of the product marketed, available marketing services, and prevailing social and physical environment (Islam *et al.*, 2001).

#### 2.4.5. **Marketing performance**

Market performance refers to the composite of end results which firms in the market arrive at by pursuing whether lines of conduct they espouse-end results in the dimensions of price, output, production and selling cost, product design, and so forth (Bain and Qualls, 1987; Wolday, 1994), also justified that for firms acting as sellers, these results measure the character of firms' adjustments to the effective demand for their outputs; for firms buying goods, they measure the quantity of adjustments made by firms to the supply conditions of the goods they purchase. And also; Market performance is the impact of structure and conduct as measured in terms of variables such as prices, costs, and volume of output. By analyzing the level of marketing margins and their cost components, it is possible to evaluate the impact of structure and conduct characteristics on market performance. For most countries, it is generally acknowledged that a distribution system displaying acceptable performance is one that (1) allows technological progress, (2) has the ability to adapt, (3) innovates and utilizes resources efficiently, and (4) transmits prices that reflect costs.

**Marketing costs:** Marketing costs refers to those costs, which are incurred to perform various marketing activities in the shipment of goods from producers to consumers. Marketing costs include: handling cost (packing and unpacking, loading and unloading putting inshore and taken out again), transport cost, product loss, storage costs, processing cost, capital cost (interest on loan), market fees, commission and unofficial payments (Heltberg and Tarp, 2001). Different types of marketing costs relating to the latest transaction of fish traders and marketing costs relating to at the last month of business for each actors (fishermen, local trader, wholesalers, retailers and restaurants) will be recorded.

**Marketing margin:** It is a commonly used measure of the performance of a marketing system (Abbot and Makeham, 1981). According to William and Robinson (1990) a marketing margin is defined alternatively as (1) the difference between the price paid by consumers and that obtained by producers (2) the price of a collection of marketing services that is the outcome of the demand for and the supply of such services. The size of market margins is largely dependent upon a combination of the quality and quantity of marketing services provided the cost of providing such services, and the efficiency with which they are undertaken and priced. For instance, a big margin may result in little or no profit or even a loss for the seller involved depending upon the marketing costs as well as on the selling and buying prices (Mendoza, 1995).

## **2.5. Empirical Evidences on Fish Production and Value Chain**

There are scanty of literature on production and value chain of fish in Ethiopia. However, this study attempts to review the available findings. Study conducted by different scholars on fish marketing and value chain analysis identified that an volume of fish produced, education level of the fish producer, access to extension service , distance from nearest market centers, market information, the price of fish and access to credit service were found to have an effect on fish market supply volume. The impacts of these variables on fish market entry decision and marketable surplus of fish were confirmed by them.

According to Dessalegn *et al.* (2013), exploring governance of Lake Tana fishery: interactive perspective on governance which focuses on exploring an overview of the status and

governance problems of Lake Tana fishery sector. He identified that there were no legally binding rules that govern fisher's and other stakeholder's behavior at user level, fishing around Lake Tana and other water bodies in the region is increasing in importance and consumption with an estimated annual off-take of 20 thousand tons. The lake fishery has employed more than 4,500 persons who are directly dependent on the major activities of fishing, marketing, and processing for their livelihood. It is also contributing in giving employment opportunity to women and other landless people like ex-soldiers other than the fishers.

Similarly; Addisu *et al.* (2012) conducted a study on Beef and feed value chain to identify major constraints and opportunities and to test and further refine the VCA tool for wider scale use in the future. The authors used a thematic analysis approach and descriptive statistical analysis techniques to calculate the distribution of costs and margins along the shoat (sheep and goat) value chain.

Gordon *et al.* (2007) Studied the Marketing systems of fish from Lake Tana with the objective of describing and analyzing the opportunities of frozen fish production and marketing system for fish originating from Lake Tana, in particular from Fogera woreda using the rapid market chain analysis identified the various actors and their linkages in the chain and their transactions. The study enables them to reach to the Ethiopian market for frozen fish is small but growing rapidly. The market for frozen fish is heavily concentrated in Addis Ababa and urban areas in the production zones. Day-to-day and seasonal variations are extremely marked, reflecting uneven supply patterns and high demand on Christian fasting days and months. The main products were frozen fillets of tilapia, Nile perch, catfish and barbus. Under relatively conservative assumptions aggregate demand for fish could be expected to grow by around 44% over the next 10 years.

On the other hand Assefa (2013) conducted a study to prioritize the fish products per water bodies and to know the supply potential of the fish products in six different Oromia water bodies using a methodology of PRA to accomplish the experiment and used multistage sampling technique. Different fish specimens was collected and processed in different fish products and demand was analyzed using five (5) point hedonic scales and reached to the

result of demand of fish products was inelastic in Ethiopian fasting season. Demand for fish products is higher in fasting season but supply is lower in comparison with non-fasting season. The price of fish per kg was higher in fasting season than when not fasting; which is not true of "demand law". At different production area the preferred type of fish and fish product is not similar to each other eg. At Ziway Lake and Koka reservoir smoked, filleted and dried was preferred successively but gutted and whole fish was not preferred, Gilgel gibe reservoir filleted, whole fish and dried fish was preferred and smoked and gutted fish was not preferred depending on five point hedonic scale.

Additionally as Several authors have been conducted studies on value chains in both capture fisheries and aquaculture: Disproportional income distribution along the chain has been studied by Loc *et al.*, (2010) while investigating the structure, function and wealth distribution within the *Pangasius hypophthalmus* and *Henicorhynchus* spp. value chains in Vietnam. They wanted to find out whether the framework of each of these value chains in the Mekong Delta in Vietnam was responsible for the livelihood of fish farmers and how effective the support actors were towards sustainability of the industry. The actors in the high value *Pangasius hypophthalmus* export chain had a higher potential income, but faced considerably higher economic vulnerability from global markets competition. While on the other hand *Henicorhynchus* spp. fishers had little bargaining power for higher prices for their fish but were less vulnerable to global economic and environmental change. The study discovered that structural change improves customary institutions and informal market relations can improve the livelihoods of fishers and farmers in both high and low value chains.

Gestsson *et al.* (2010), found two different value chain structures in the Sri Lankan yellow fin tuna fishery. The domestic market value chain and the export market value chain. The domestic value chain activities were highly controlled and depended majorly on price and less on quality. The export value chain was driven by demand for high quality with high prices. They found that structural changes were needed to improve revenues of the fishers. For example the export market in Sri Lanka relied heavily on landings of foreign vessels. Powering the small and poorly equipped local fleet in terms of holding facilities and size was suggested to reduce the outflow of revenues and increase more opportunities for improving

quality and reducing costs. They, however, caution that issues like unimpeded information flow and trust build-up between actors are essential.

It is evident that an industry's value chain is mainly dependent on inter-firm relationships (McCormick and Schmitz 2001). These relationships however always have challenges such as the provision of information for the coordination and optimization of activities across firms (Dekker 2003). It is through value chain analysis that answers to such challenges can be found and thence sources of competitive advantage and performance.

The value chains of the industry were analysed following the principles and methods of Kaplinsky and Morris (2000) and Porter (1998) to develop maps of material and financial flows from input suppliers to market similar to Loc *et al.* (2010) with *Pangasius* in Vietnam. Using the value links approach by GTZ (2007), product flow channels and key functions were determined. Emphasis is put on the value added to the fish products along the chain calculated as the difference between selling price and buying price not putting emphasis on fixed or variable costs of each actor (Loc *et al.*, 2010). Margin on sales of each kilogram of live cat fish was calculated as the difference between the selling price and the average unit cost of production by the farmer. For homogeneity, the sales value for each final product (whole gutted, smoked, fillet), was calculated in terms of live weight equivalent using the average yield.

## **2.6. Conceptual Frame Work of the Study**

The conceptual frame work defines the variables of research and shows how independent variable influences on the dependent variables. In this study based on the above empirical evidences from different authors on fish production and value chain and additional concepts the conceptual frame work of the study is depicted the most important variables expected to influence the fishermen fish supply to the market and value addition on their fish as the following. It show how factors such as demographic factors (age, education level, marital status and family size), socio-economic factors (fish production experience, terms of production per week, income other than fishing and other assets), institutional factors (access to extension service, access to credit service and access to fishery cooperative membership) and communication and infrastructure facility (access to road, access to market information and distance from market place) and the others like cultural practices such as eating habits and

source of income and management skills affects fish supply to the market and fish processing and value addition in the study area.

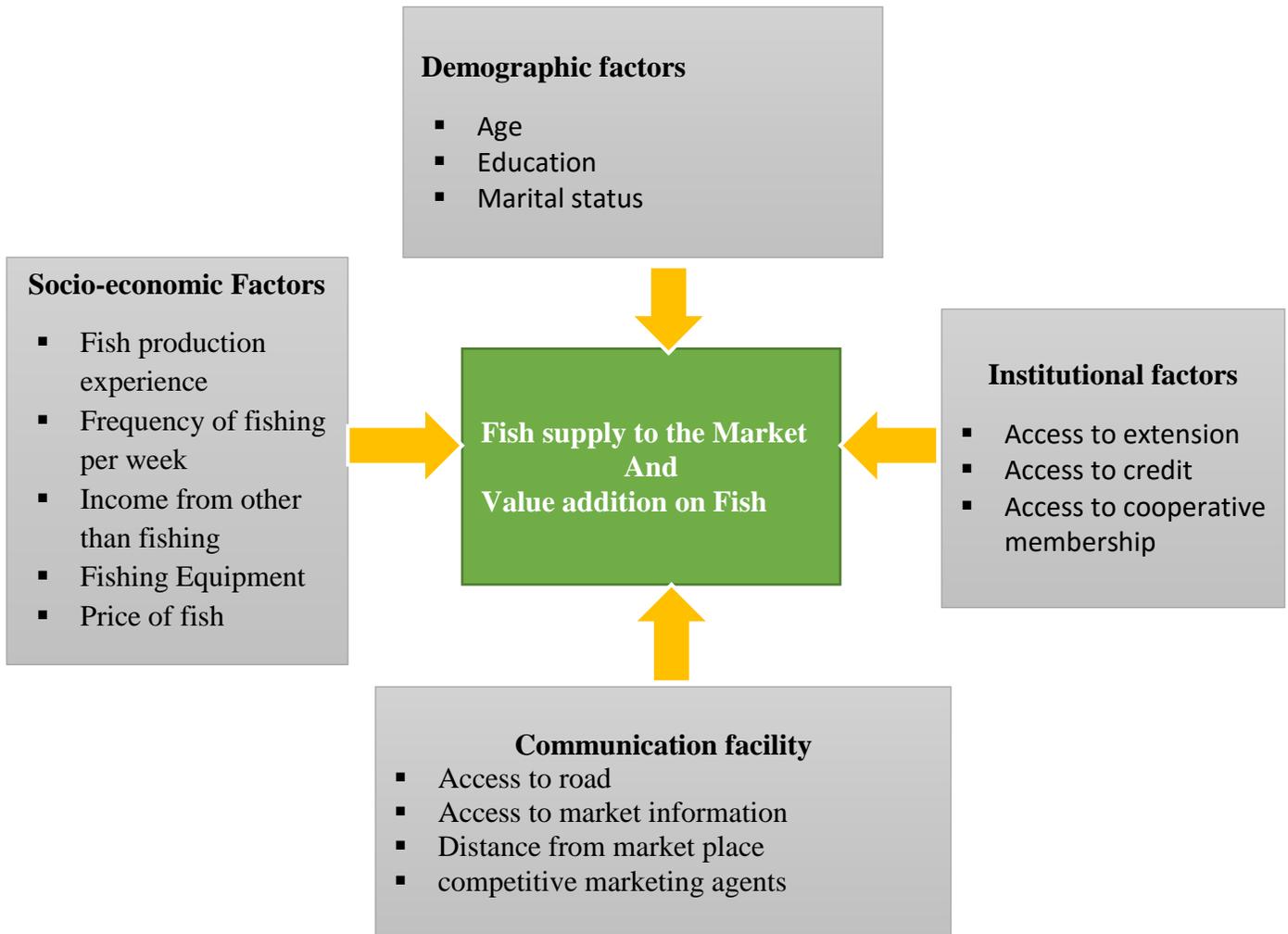


Fig. 4: Conceptual framework (self-sketched)

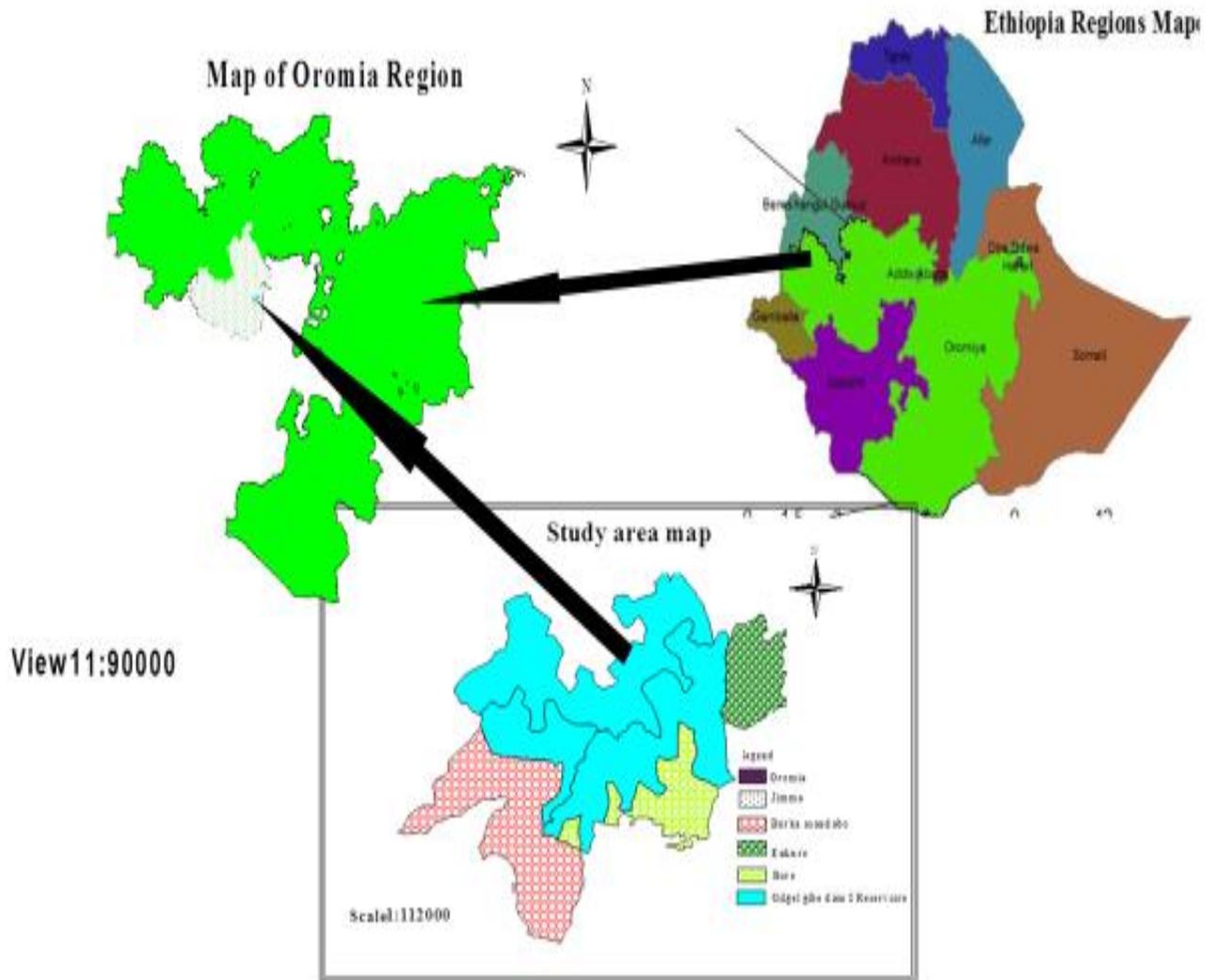
### **3. RESEARCH METHODOLOGY**

This chapter discusses the research methodology used in the study including location and description of the study areas, data types and data sources, sampling procedure and sample size, methods of data collection and analysis.

#### **3.1. Location of the Study Area**

The study area is located in Oromia regional state, Jimma Zone about 260 km south west of Addis Ababa and 60 km north-east of Jimma town. The reservoir is enclosed with four Woredas namely Sekoru, Omo Nada, Kersa and Tiro Afeta; with the area coverage of the reservoir 62 square kilometers (Gashaw and Mathias, 2014) and it has been operational since February 2004 (CEE Bank watches Network, 2008). Astronomically the study area is found within 7°3' to 8°3' and 36°7'to 37°6' with an average altitude of 1,650 m.a.s.l, annual rainfall is about 1,479 mm (Bahiru, 2010) and it is the reservoir of Gilgel Gibe Hydroelectric dam I. with-in these four woredas there are Eight kebele's and about 12 small scale fish producer cooperatives who are organized from these each kebeles and engaged on fish production from reservoir and gain benefit; the total beneficiaries (fishermen) are about 510 individuals (From the four Woreda's office of Agriculture and WSSMEO, 2014 report).

The dominant economic base of the people in this study area is subsistence farming and livestock production. The most cultivated cereal crops include maize, Teff and Sorghum Pulses, onions, cabbage, banana, 'enset' as well as coffee are grown in rare case in some parts of the study area.



**Fig. 5: Map of the study area.**

Source: self-sketched.

### **3.2. Type, Source and Methods of Data Collection**

Both primary and secondary data were needed for this study. The primary data required for this study was the information on different variables such as data on the general socio-economic information, fish production; fish processing and value addition, fish marketing and supply, about infrastructure and services facility and the overall other related information were collected using formal and informal surveys from key informants.

The primary data required for this study was collected from the key informants selected in this study area. Secondary data were collected from literature review and from related government organization such as: Jimma zone and woreda offices of agriculture, woreda office of small scale cooperative and micro enterprise organization of the four woredas:- such as Sekoru, Omo Nada, Tiro Afeta and Kersa office of livestock production health and development agency and office of small scale micro enterprise organization on fish production, marketing, cooperatives and other information related to this study.

The formal survey was done using structured questionnaire and checklist prepared for each group (i.e. fish producers, fishery cooperatives, local collector, wholesalers, retailers, and restaurants/hotels). The group included all individuals participating in the value chain of fish in the study area. The informal surveys were done using Rapid Market Appraisal (RMA) technique using checklists.

### **3.3. Sampling Technique, Sampling Procedure and Sample Size**

Appropriate sample size depends on various factors relating to the subject under investigation like the time aspect, the cost aspect, the degree of accuracy desired, etc (Rangaswamy, 1995; Gupta and Gupta, 2002). If sample size is too small, we may fail to achieve the objectives of our analysis. However, if it is too large, we waste resources when we deal with the sample. Therefore, appropriate sample size has to be applied in order to get good representative data. In the case of this study the total beneficiaries (those who engaged in fish production) of the Gilgel gibe dam I reservoirs were about 510 individuals (source: each four woreda's office of agriculture and WSSMEO, 2014) (i.e. 103 from Sekoru, 136 from Omo Nada 173 from Tiro Afeta and 98 from Kersa woreda)

A three stage sampling procedure has been applied to select sample respondents from the total of 510 producers in the reservoir. In the first stage, two weredas namely Omo Nada and Sokoru were purposively selected based on their production potential. In the second stage, one kebele from Omo Nada (Burka Assendabo) and two kebeles from Sokoru (Hunkure and Bore) were purposively selected based on their intensity of fishing activities. In the third stage, a total of 128 producers were selected using proportionate random sampling from a total of 189 fish producer from the three selected kebeles. Finally; 4 local collectors, 4 fishery cooperatives, 3 wholesalers, 4 retailers, 4 restaurant and hotels and 10 fish consumer individual were purposively selected after specifying their name based on the information collected from the target respondents that for whom they sell their fish. Therefore; the ratio of each woreda's and kebeles producer respondent is briefly discussed in the following table.

The sample size determination was resolved by means of Yamane (1967) sampling formula with 95% confidence level.

$$n = \frac{N}{1 + N(e)^2}$$

Where: - **n** is sample size,

**N** is population and

*e* is the desired level of precision which is 0.05.

**Table 1: Sample distribution of each woereda's and kebeles fisher respondents**

Name of Woreda	Total no of fishermen from each the two woreda	Total No fishermen from each three Kebeles		Sample size
Omo Nada	86	Burka Assendabo	86	58
Sekoru	103	hunkure	54	37
		Bore	49	33
Total producer	189	Total	189	128

**Table 2: Summary of total sample size**

Fishermen	Local collector	Fishery Cooperatives	Whole sellers	Retailer	Restaurant & Hotels	Consumers	Total
128	4	4	3	4	4	10	157

### **3.4. Methods of Data Collection**

During the survey of this study development agents who are working in kebele level were recruited as enumerators and trained to implement data collection using the prepared questionnaire. Then before data collection was applied the questionnaire was pre-tested on five farmers with similar characteristics to the final sample individual to evaluate: the appropriateness of the design, the clarity and interpretation of the questionnaire by the development agents and relevance of the questions and time to be taken for an interview. Finally, the appropriate modifications were made on the questionnaire and the data were collected.

### **3.5. Methods of Data Analysis**

Two types of data analysis were applied in this study, namely descriptive statistics and econometric analysis were used. For both descriptive statistics and econometric models analysis statistical package for social science (SPSS version 20) and statistical software (STATA version 12) were employed.

#### **3.5.1. Descriptive analysis**

These methods of data analysis refer to the use of percentages, mean, tabulation, frequency distribution in the process of describing the individual fish producer characteristics in the study area.

##### **3.5.1.1. Value chain analysis**

As products move successively through the various stages, transactions take place between multiple chain actors, money and information were exchanged and value was progressively added. The analysis of fish value chains highlights the need for enterprise development, enhancement of product quality, and quantitative measurement of value addition along the chain, promotion of coordinated linkages among producers and improvement of the competitive position of individual enterprises in the marketplace. Moreover, individual fishermen may feed into numerous chains; hence, which chain (or chains) was/were targeted depends largely on the point of entry for the research inquiries (Kaplinsky and Morris, 2001). The following four steps of value chain analysis were applied to this study:

1. **Mapping the value chain** to understand the characteristics of the chain actors and the relationships among them, including the study of all actors in the chain, of the flow of fish product through the chain and its destination and volumes of domestic sales. This information can be obtained by conducting surveys and interviews as well as by collecting secondary data from various sources.
2. **Identifying the distribution of benefits in the chain:** This involves analyzing the margins and profits within the chain and therefore determined who benefits from participating in the chain and who would need support to improve performance and gains. In the prevailed context of market liberalization this step is particularly important since the poor involved in value chain promotion were the most vulnerable.
3. **Defining upgrading needed within the chain:** By assessing profitability within the chain and identifying chain constraints, upgrading solutions could be defined. These may include interventions to: (i) improve product design and quality and move into more sophisticated product lines to gain higher value and/or diversify production; (ii) reorganize the production system or invest in new technology to upgrade the process and enhance chain efficiencies; (iii) introduce new functions where in the chain to increase the overall skill content of activities; and (iv) adapt the knowledge gained in particular chain functions in order to redeploy it.
4. **Emphasizing the governance role:** Within the concept of value chain, governance defines the structure of relationships and coordination mechanisms that exist among chain actors. By focusing on governance, the analysis identified actors that may require support to improve capabilities in the value chain, increase value added in the sector and correct distributional distortions. Thus, governance constituted a key factor in defining how the upgrading objectives could be achieved.

Following the above procedure, the main aspects of fish value chain analysis was done by applying some quantitative and qualitative analysis. First, an initial map was drawn which depicts the structure and flow of the chain in logical clusters. This exercise was carried out in qualitative and quantitative terms through presenting the various actors of the chain, their linkages and all operations of the chain from pre-production (supply of inputs) to consumption. After having developed the general conceptual map of the fish value chain, the next step is analyzing the chain's economic performance and benefit share of actors.

### 3.5.1.2. Analysis of fish market performance

Estimates of the marketing margins are the best tools to analyze performance of market. Margin analysis was used to evaluate the performance of actors in fish market chain. Marketing margin was calculated by taking the difference between producers and retail prices. The producers' share is the commonly employed ratio calculated mathematically as the ratio of producers' price to consumers' price.

Mathematically, producers' share can be expressed as:

$$PS = \frac{Cp - Pp}{Cp} \dots\dots\dots 1$$

**Where;** PS = producer share

Cp = consumer price

Pp = producer price (calculated as producers selling price per unit less producer's marketing cost)

#### **Traders marketing costs:**

Different types of marketing costs relating to the latest transaction of fish traders and marketing costs for each actor (fishermen, local collector, fishery cooperative, wholesalers, retailers and restaurants) were recorded and calculated based on the following formula.

$$AMCi = \frac{XiQi}{Qi} \dots\dots\dots 2$$

**Where:** - AMCi = Average marketing cost for each different kind of traders.

- Qi = Quantity handled during the latest transaction for each *fish* trader; used as a weighing coefficient.
- Xi = Different types of marketing costs of the latest transaction incurred by each fish trader.

Then, calculating the total marketing margin was done by using the following formula. Computing the Total Gross Marketing Margin (TGMM) is always related to the final price paid by the end buyer and is expressed as a percentage (Mendoza, 1995)

$$TGMM = \frac{Cp - Pp}{Cp} \times 100 \dots\dots\dots 3$$

Where: TGMM = Total Gross Marketing Margin

From this measure, it is possible to see the allocative efficiency of markets. Higher NMM or profit of the marketing intermediaries reflects reduced downward and unfair income distribution, which depresses market participation of smallholders. An efficient marketing system is where the net margin is near to reasonable profit.

To find the benefit share of each actor the same concept was applied with some adjustments. In analyzing margins, first the Total Gross Marketing Margin (TGMM) was calculated. This is the difference between producer's (farmer's) price and consumer's price (price paid by final consumer) i.e.

$$\text{TGMM} = \text{Consumer's price} - \text{Farmer's price} \dots\dots\dots 4$$

Then, marketing margin at a given stage 'i' (GMMi) was computed as:

$$\text{GMMi} = \frac{SPi - Ppi}{TGMM} \times 100 \dots\dots\dots 5$$

Where, SPi is selling price at i<sup>th</sup> link and PPi is purchase price at i<sup>th</sup> link.

$$\text{Total gross profit margin also computed as: TGPM} = \text{TGMM} - \text{TOE} \dots\dots\dots 6$$

Where, TGPM is total gross profit margin, TGMM is total gross marketing margin and TOE is total operating expense.

Similar concept of profit margin that deducts operating expense from marketing margin was done by Dawit (2010) and Marshal (2011)

Then profit margin at stage "i" is given as:

$$\text{GPMi} = \frac{\text{GMMi} - \text{OEi}}{\text{TGPM}} \times 100 \dots\dots\dots 7$$

Where, GPMi = Gross profit margin at i<sup>th</sup> link

GMMi = Gross marketing margin at i<sup>th</sup> link

OEi = Operating expense at i<sup>th</sup> link

TGPM=Total gross profit margin

The net marketing margin (NMM) is the percentage of the final price earned by the intermediaries as their net income after their marketing costs are deducted. The percentage of

net income that can be classified as profit (i.e. return on capital), is depends on the extension to such factors as the intermediaries' own (working capital) costs.

$$\text{NMM} = \frac{\text{Gross marketing margin} - \text{Marketing costs}}{\text{End buyer price}} \times 100 \dots\dots\dots 8$$

**Where:-** NMM = Net marketing margin

### 3.5.2. Econometric analysis

Several studies indicate that econometric models have the power to generate essential information on causal relationship between dependent and independent variables. In reality the data especially the survey data, often have limitations and may not even include all the necessary variables, which could impose restrictions on the methods to be applied. An econometric model consists of a dependent variable and independent variables, also called explanatory variable and an error terms, or to be more precise stochastic disturbance terms, which stand for unobservable random variables not explicitly included in the model (Gujarati, 1998). To analyze objective three and four; the determinants of fish value addition and fish supply to the market: binary logit model and multiple linear regression models were employed respectively.

#### **Regression models for categorical dependent variables**

In categorical dependent variable models, the left-hand side (LHS) variable or dependent variable is neither interval nor ratio, but rather categorical. The level of measurement and data generation process (DGP) of a dependent variable determine a proper model for data analysis. Binary responses (0 or 1) are modeled with binary logit and probit regressions

**Logit models versus probit models:** how do logit models differ from probit models? The core difference lies in the distribution of errors (disturbances). In the logit model, errors are assumed to follow the standard logistic distribution with mean 0 and variance  $\frac{\pi^2}{3}$ ,  $(\epsilon) = \frac{e^\epsilon}{(1+e^\epsilon)^2}$ . The errors of the probit model are assumed to follow the standard normal distribution  $\phi(\epsilon) = \frac{1}{\sqrt{2\pi}} e^{-\frac{\epsilon^2}{2}}$ , with variance 1.

The two models, of course, produce different parameter estimates. In binary response models, the estimates of a logit model are roughly  $\frac{\pi}{3}$  times larger than those of the probit model. These estimators, however, end up with almost the same standardized impacts of independent variables (Long 1997). The choice between logit and probit models is more closely related to estimation and familiarity than to theoretical or interpretive aspects. In general, logit models reach convergence fairly well. For this study by using the logistic regression the probability of a result being in one of the two response groups (binary response) is modeled as a function of the level of explanatory variables. Thus, the probability of whether or not the fishermen do fish value addition activity may be modeled as a function of the level of one or more independent variables.

Therefore; for this study, the response variable is 1 when the fishermen do value addition activity and 0 otherwise. Therefore, to identify the determinants of value addition on fish in the study area the binary logit model was used.

The binary logit model function used in this model was:

$$\text{Logit}(P) = \ln\left(\frac{P}{1-P}\right) = \beta_0 + \beta_1 x_i + \epsilon$$

$$y = \begin{cases} 1 & \text{if } y > 0 \\ 0 & \text{if } y \leq 0 \end{cases}$$

**Where:** Logit (P) = is the log odds of the dependent variable = the log of the odds ratio

$\beta_1$  = the slope coefficient, measures the change in L for a unit change in x,

$\beta_0$  = the intercept value of the log odds

P = the probability of value addition,

(1- P) = the probability of not adding value on fish

$\epsilon$  = error/disturbance term.

### Multiple linear regression models

Multiple linear regressions are the most common form of linear regression analysis. As a predictive analysis, the multiple linear regressions are used to explain the relationship between one continuous dependent variable from two or more independent variables. The independent variables can be continuous or categorical (dummy coded as appropriate). It is also considered as the most commonly used statistical analysis techniques to describe the functional relationships between a dependent variable (either continuous or categorical) and a set of independent variables based on samples from a particular population (Fatah, 2013). In this study, multiple linear regression models were used to identify determinants of volume of fish supply to the market. The model specification of supply function in matrix notation is the following: The empirical model for this study was specified as follows:

$$y = \beta_0 + \beta_1 x_{12} + \beta_2 x_{22} + \dots + \beta_p x_m$$

for  $i = 1 \dots n$

**Where:** Y = quantity of fish supplied to market (a continuous dependent variable)

$\beta_0$  = the intercept value

X = a vector of explanatory variables x

$\beta_i$  = a vector of parameter to be estimated

$\hat{u}_i$  = disturbance term u

### 3.6. Hypothesis and Definition of Variables

In the case of this study identifying factors influencing the fish supply to the market and the determinants of fish value addition; the main tasks are to analyze which factors influence the supply of fish to the market through the value chain and the determinants of fish value addition. Therefore, potential variables, which are hypothesized to influence fish production and supply to the market through value chain and determinants of fish value addition in the study area, are explained below.

#### 3.6.1. Dependent variables

**The value addition on fish (VAF):** It is a dummy variable which takes a value of 1 if the respondent do for fish value addition activities (grading, plastic packing, smoking, sun drying, salting, pickling, storage and refrigeration, icing and/or canning) and 0 otherwise and

**Volume of Fish products supplied to market (VFPSM):** It is continuous dependent variable measured in Kg.

#### 3.6.2. Independent variables

Fish producer individual's determinants of value addition activity on their fish and volume of fish supply to the market through the value chain in this study area were hypothesized to be influenced by a combined effect of various factors, such as demographic, socio-economic, institutional and communication factors.

1. **Education level (EdLev):** It is a continuous variable and refers to the number of grades of formal schooling of the individual fishermen attended. The higher the education level, the better would be the knowledge of the farmer towards the value addition on their fish and quantity supply to the market. Hence; searching for market information and acquire news and education about the benefits of marketing through the value chain easily. So this variable is expected to influence the value addition of fish and quantity supply of fish to the market positively. As cited by Muhammed (2011), Holloway *et.al*, (1999) argued that education had positive significant effect on quantity of milk marketed in Ethiopian highlands.

2. **Age of individual producer (Age):** It is a continuous variable and measured in years. Age is a proxy measure of farming experience of individuals. Aged individuals are believed to be wise in resource use, and it is expected to have a positive effect on market participation and marketed surplus. Tshiunza *et al.* (2001) identified age as the major farmers' characteristics that significantly affected the proportion of cooking banana planted for market. He found that younger farmers tended to produce and sale more cooking banana than older farmers did. Therefore; this variable is expected to influence the value addition of fish and quantity supply of fish to the market positively.
3. **Availability of competitive marketing agents which offer competitive price (ACoMktA):** This is a dummy variable taking a value 1 if there are other marketing agents in the area of production to compete each other and benefit the producer, and 0, otherwise. Farmers will get alternative market outlet and then supply more fish to the market and accomplish more value addition processes if there are competitive marketing agents in their area. Therefore, this variable is expected to influence the value addition and quantity supply of fish positively.
4. **Access to Credit (AC):** This is a dummy variable taking the value one if an individual producer get access to takes loan and zero otherwise, which indicates credit taken for fish production. Access to credit would enhance the financial capacity of the farmer to purchase the inputs and equipment's thereby increasing fish production and market share size and more value addition. Therefore, it is hypothesized that access to credit would have positive influence on level of production and quantity supply of fish to market and fish value addition activity.
5. **Distance to the nearest market places (DistMkt):** It is a continuous variable measured in km. It refers to the distance of the reservoir where fish is produced and transported to the market places, where local trader and fish semi processors buy from the fisher men and undertake some processes/value addition on their fish. The closer the fish market to fish producer, the lesser would be the transportation charges, less loss of fish due to spoilage, reduced walking time, and reduced other marketing costs, better access to market information and facilities. This improves return to labour and capital; increases

farm gate price and the incentives to participate in economic transaction. Therefore, in this study, the distance of fishermen residence from the nearest market places is expected to influence the quantity supply of fish and value addition activity of the fishermen on their fish negatively.

6. **Access to Extension Service (ExtServ):** A dummy variable taking a value of one if an individual fish producer has access on fish production, marketing and value addition extension service within last two year and zero otherwise; and representing extension services as a source of information on technology. It is expected that extension service widens the individual's fish producer knowledge with regard to the use of improved technologies and has positive impact on fish and fish products sale volume and undertake fish processes. Different studies conducted by different scholars revealed that extension visit has direct relationship with market entry decision and marketable output. Study conducted by Ayelech (2011) found that if fruit producer gets extension service, the amount of fruits supplied to the market increases. Therefore, this variable is hypothesized to influence volume of fish supply to the market and fish value addition activity positively.
7. **Price of Fish in 2015 G.C. (PricF2015):** It is a continuous variable and is measured in Birr per kilogram of fish. This variable is expected to influence marketable supply positively. When the price of the product is promising; individual fish producer farmers are motivated to produce more fish and supply to the market and access to purchase fish processing equipment. This makes the quantity supply to be directly related to the current year market price. Therefore; this variable is hypothesized to influence the volume of fish supply to the market in the year 2015 G.C. and fish value addition activity positively. The study of Assefa(2009), on determinants honey quantity supply to the market found a positive relationship between price and honey quantity supply.
8. **Membership to fish Cooperative (MemCoop):** It is dummy variable and takes the value of one if an individual fish producer is membership of fish cooperatives engaged in any fishery business, and zero otherwise. Thus cooperatives improve understanding of members about market and strengthen the relationship among the members. It is expected

to be associated with market outlet choice decision of fish producers to whom to supply their fish continuously (Abraham, 2013). Therefore, this variable is hypothesized to influence volume of fish supply to the market positively.

9. **Fish Production Experience (ProdExp):** It is a continuous variable that shows the total number of years an individual producer farmer stays in production of fish. An individual fisherman with better experience in fish production is expected to produce more volume of fish and as a result they are expected to supply more volume of fish to the market and know more fish processing value addition activity. Farmers with longer farming experience are expected to be more knowledgeable and skillful (Ayelech, 2011). Therefore, this variable is hypothesized to positively influence fish value addition activity and fish quantity supply to the market in the study area.
  
10. **Additional Source of income other than fishing (AmICoF):** It is a dummy variable that shows income obtained from non-farm activities by the individual fishermen. As study by Alemnew (2010) income from non-farm activities is expected to have inverse relationship with market supply because farmers will have alternative sources of income to cover tax, loan and other social requirements and then decrease the supply. On the other hand an individual fishermen who have additional source of income other than fishing expected to access fish processing equipment. Therefore; this variable is expected to negatively affect the production and supply of the fishermen and positively affect individual fishermen value addition on their fish.
  
11. **Access to Fishing and Processing Equipment (AcFE):** It is a dummy variable that measured in terms of whether the individual producers have their own fish production equipment or not. Individual fishermen who have fish production and processing equipment such as fishing boat, nets, fileting blades, packing equipment, refrigerator, roasting equipment's... etc are expected to more produce and supply to the market and further process and add more value on their fish. Therefore; this variable was assumed to be positively affects the production and quantity supply of fish and value addition activity on their fish.

12. **Frequency of Fish Production per Week (FFP):** This is continuous variable and refers to the average fish production day per week. It is assumed that the marketing of fish by the producer is positively related the average days the participation on fish production in the week. The higher the days they participate in fish production, the higher would be they participate in the market through the value chain. Therefore, this variable is expected to influence positively quantity supply of fish to the market.
13. **Access to Market information (ACMIF):** It is a dummy variable that is measured in terms of whether the individual producers access to fish market information or not. And assigned one if a farmer got information and zero otherwise. Farmers marketing decisions are based on market price information, and poorly integrated markets may convey inaccurate price information, leading to inefficient product movement (Abreham, 2013). Again, business decisions are based on dynamic information such as consumer needs and market trends (CIAT, 2004). In addition; producers can get information on what type and products to be needed on the market and undertake further processing to satisfy their customer. Therefore, it is hypothesized that market information is positively related to volume of fish supply to market and value addition activity.
14. **Access to all weather road (ACCROAD):** It is a dummy variable measured in terms of whether the individual producers access to all weather road or not. It is assigned one if an individual fishermen access all weather road or zero otherwise. Availability and adequacy of road is an important prerequisite to link producers with fish markets and also reduced the time to reach and process the fish before it gets spoilage. Therefore, it is hypothesized that accessing all weather road is positively related to fish value addition and processing activity in the study area.

**Table 3: Description of the dependent and independent variables used in the model**

Variables	Description	Hypothesis		Types	Values
		VFPSM	DVAF		
	<b>Dependent variables</b>				
VFPSM	Volume of Fish products supplied to market			Continuous	
DVAF	Value addition on fish			Dummy	
	<b>Independent variables</b>				
EdLev	Education level	+	+	Continuous	No of schooling
AGE	Age of Household Head	+	+	Continuous	Year
ACoMktA	Availability of competitive marketing agents	+	+	Dummy	Yes =1, not = 0
AC	Access to Credit	+	+	Dummy	no= 0,yes= 1
DistMkt	Distance from the nearest market places	-	-	Continuous	Km
ExtServ	Access to Extension Service	+	+	Dummy	No=0, yes=1
ProdExp	Fish production Experience	+	+	Continuous	No of years
ACCMKINF	Access to Market information	+	+	Dummy	No= 0,yes= 1
PRODAY	Frequency of production days per week	+	<b>X</b>	Continuous	Days/week
FISHEQP	Access to fishing and processing equipment	+	+	Dummy	Yes = 1, no = 0
AmICoF	Additional means of income other than fishing	-	+	Dummy	No=0, yes=1
MemCoop	Membership to fish Cooperative	+	<b>X</b>	Dummy	Yes =1, no = 0
ACCROAD	Access to all weather road	+	+	Dummy	Yes =1, no = 0
PriF2007	Price of Fish in 2015	+	+	Continuous	ETB/kg

Source: own sketched from the hypothesis.

## **4. RESULTS AND DISCUSSION**

This chapter presents the major findings of this study. It has four sub sections. The first section deals with descriptive and inferential statistics of the sample individual fish producer. The second section presents value chain analysis of fish which includes value chain map, actors and their roles. The third section presents marketing channel and performance analysis of the actors which includes marketing channels, marketing costs and margins, and benefit shares of actors in the fish value chain of the study area and finally the fourth section presents the results of econometric analysis which contains the determinants of fish value addition of producers by using binary logit model and the determinants of volume of fish market supply of fish by using multiple linear regression model.

### **4.1. Descriptive Results**

#### **4.1.1. Demographic characteristics of sample fish producers**

Table 4 presents demographic and socioeconomic characteristics of the individual sample respondents. Totally all the respondents are male, an average individual respondent's age was 26 and with the minimum and maximum age of 16 and 45 years respectively; this average age of the targeted respondents indicates that most of the producers in this study area are found in the young age group.

The average years of fish production experience of targeted respondents in this study area was 4.5 years with the minimum and maximum of 1 and 10 years respectively. With regards to educational status 22.7%, 26.6% 29.7 % 14.1 % and 7 % of the respondents was literate, read and write, grade 1- 4, grade 5-8 and grade 9-12 and above respectively. The average marital status of the total sample respondents was found to be 46.9% and 53.1% are married and unmarried respectively.

With regarding to small scale fishery cooperative 41.4 % of the respondent individual fish producer farmers were members of fishery cooperatives and 58.6 % were non- member in this study area.

**Table 4: Demographic and socioeconomic characteristics of fishermen (N = 128)**

Variables	Item	Categorical Variables		Continuous Variables		
		Frequency	%	Average	Min	Max
Sex	Male	128	100			
	Illiterate	29	22.7			
Education	Read and write	34	26.6			
	Grade (1-4)	38	29.7			
	Grade (5-8)	18	14.1			
	Grade (9-12) and above	9	7			
Marital Status	Married	60	46.9			
	Unmarried	68	53.1			
Cooperative member ship	Yes	53	41.4			
Non-Fishing income	Yes	76	59.4			
Age	N <sub>o</sub> of Year			26	16	45
Family Size	N <sub>o</sub>			3	1	10
Fishing Experience	N <sub>o</sub> of Year			4.5	1	10

Source: Own computation from survey result, 2015.

#### 4.1.2. Means of livelihood

Farming was the main occupation and source of livelihood for all sample individual farmers in this study area. They led their life depend on different means of income generating agricultural activities such as coffee production, staple food crop cultivation, spices such as pepper production, animal rearing and apiary production were major sources of income and used for home consumption. For the majority of fishermen fish production is also considered as the second major means of livelihood in this area. However; 59.4 % of the respondents engaged in both fishing and other agricultural activities while 40.6% were engaged only on fishing activity. (Table 5 shows fishermen additional means of income other than fishing)

**Table 5: Additional means of income of individual fishermen of the study area**

Income sources	Frequency	Percent
Coffee production	23	18
Crop production	68	53
Animal rearing	44	34.4
Apiary	27	21
Other trade	2	1.6

Source: Own computation from survey result, 2015

#### 4.1.3. Fish production overview

##### Fish species

In the study area there are three fish species such as: *Tillapia*, *Barbus* and Cat fish. Based on the information gathered from the target respondent, mostly *Tillapia* is produced and more preferred fish species. It is preferred because it was more available, has more flesh, more sweet and can be easily fileted than the other species.



**Picture 1: Fish species in the study area**

Source: own captured during survey, 2015

##### Fishing equipment and fishing methods

The fishing equipment that the producer used in the study area was: Drift-nets, fishing boats, locally made boat (“*Bidiru*”) which is made of local materials, fishing hooks; fileting blades were the main fish production equipment in the study area. The majority of the sample producers used the fishing equipment which was previously offered by support provider (supporting agents such as NGO: World vision Ethiopia Omo Nada branch). The equipment’s are timber made boat, fishing net, freezer and motorized boat, additionally some of the individual fish producer uses locally constructed boat. Fish seed is applied on the reservoir by Oromia Bureau of Agriculture in collaboration with Ziway fishery research center.

The fishermen set drift nets in the evening and drag them early next morning by which time the nets have gilled different types of fish. The problems mostly encountered was the net gilled out both target and non-target fish. Though; the non-target fishes were thrown back into

the water because there are no buyers or any other means to utilize them. The nets also accidentally catch endangered/died fishes.



**Picture 2: Sample fishermen harvesting fish in the study area**

Source: own captured during survey, 2015

**Fishing frequency**

From the total 128 target respondents 10.9% of the respondents were fishing daily and 10.2 % were engaged for the minimum 3 days per week and the rest fishermen were engaged only occasionally. The average fishing day’s frequencies per week of individual fish producer were 5 days per week with the minimum and maximum of 3 and 7 days per week respectively (shown on Table 6 below).

**Table 6: Fishing frequency of the respondent fishermen per week**

<b>Production Days/week</b>	<b>Frequency</b>	<b>Percent</b>	<b>Min</b>	<b>Max</b>	<b>Mean</b>
<b>3</b>	13	10.2			
<b>4</b>	33	25.8			
<b>5</b>	41	32.0	3	7	4.97
<b>6</b>	27	21.1			
<b>7</b>	14	10.9			
<b>Total</b>	128	100.0			

Source: own survey result, 2015

**Fish Production, consumption and income**

Fish production in Gilgel Gibe Dam I reservoir takes place all year round from the start of the dam constructed; however the peak period when the best harvesting is between February and

June. Based on the survey result the daily average fish production of an individual fish producer is 5.92kg and the average annual volume of production of the respondent fishermen in the study year was 33,124kg/year and 163,761kg/year for whole and semi-processed (fileted) fish respectively. Some fishermen produces a combinations of the two types of fish products; whole and fileted fish and very few fishermen produce only one type i.e. whole or fileted fish only. Accordingly the total volume of fish produced in the study area in this year was estimated as 196,885kg/year which is 16.4% were used by fishermen for home consumption, 4.5% were lost in different ways and the remaining 79.13% was supplied to the market through different channels.

**Table 7: Annual production, consumption, loss and sale of fish in the study area**

Type of fish produced	Av. daily prod/per son	Av. Annual Production	Annual consumption	Average Sale	Average loss	Av. Sale price (ETB/kg)	
						Fasting Season	Non-fasting season
Whole fish	0.995	33,124				9.36	8.78
Semi-processed	4.92	163,761				26.31	15.89
Total	5.92	196,885	32,282	155,799	8797		

Source: Own computation from survey result, 2015

There were high postharvest losses due to improper harvesting, poor post-harvest handling, lack of fish storage facility and due to the nature of the product being easily deteriorate. According to the survey result shown on table 7 above because of those reasons 4.5 % of fish produced can be deteriorating per year before it reaches to market. An average fish price in 2015 was 9.36 and 26.31 ETB/Kg in Christian fasting season and 8.78 Birr and 15.89 ETB/Kg in non-fasting season for whole fish and semi-processed/fileted fish respectively. Based on this information the average annual income for individual fishermen from fish production in this study area was 26,925.35ETB/person/year which is 103.56 ETB/day/person.

#### 4.1.4. Fish Processing and post-harvest handling

Fish which is produced in the study area was supplied to the market either as gutted whole fish or filleted fish. As the survey result indicated there were no further fish processing activity undertaken but mostly the fish producer accomplish only the preliminary fish processing activity such as: washing, fileting, gutting, cleaning and sorting and very few of

them add some processing and preservation activity such as plastic packing and storage facility. Picture.3 shows the high light of the processes at different actors' level (picture A&B shows process at fishermen level, picture “C” at cooperatives and picture D&E shows processes at fish wholesalers level) as follow.



**Picture 3: Fish processes at cooperatives and wholesaler level**

Source: own captured during survey, 2015

Survey result shows that the different types of fish processing and value addition in primary and secondary processing level. In primary processing: 82 %, 80.5%, 46%, 41% and 45% of sample respondents conduct washing, cleaning, gutting, fileting and sorting respectively. This means in average 69% of the respondents do for preliminary fish processing. Most of the fishers do not have fish preservation facilities such as cooling systems. Once the fish is caught they do only for preliminary processing (i.e. washing, gutting, cleaning) and taken straight to the market for selling without any further processing and value addition. The situation therefore impact on the next actors in the chain to find ways of preventing the fish from going bad.

In secondary fish processing where more of fish processing and value addition is done: only 43%, 6%, 9.4% and 8.6% of the target sample respondents conduct grading, plastic packing, salting and storage and refrigeration activity respectively. In average only 17% of the respondents do for secondary fish processing and value addition. They do not process and preserve their fish by the process of smoking, icing and sun drying and therefore their fish is easily got bad; because these processes and preservation methods needs knowledge and understanding of fish handling and post-harvest management. Therefore the cumulative result of this study shows they do only for preliminary processing and value addition on fish. Table 8 shows the existing ways of fish processing and value addition in the study area.

**Table 8: The existing ways of fish processing and value addition in the study area**

Type of processing and value addition	Respondent (N=128)		Remark
	Frequency	%	
Washing	105	82	These are the preliminary or primary processing stage
Cleaning	103	80.5	
Gutting	59	46	
Fileting	52	41	
Sorting	58	45	
Grading	55	43	Secondary Processing where value addition in fishery is accomplished
Plastic Packing	8	6	
Smoking	0	0	
Icing	0	0	
Salting	12	9.4	
Sun drying	0	0	
Storage and Refrigeration	11	8.6	

Source: Own computation from survey result, 2015.

### **Fish Demand and Supply relation in the study area**

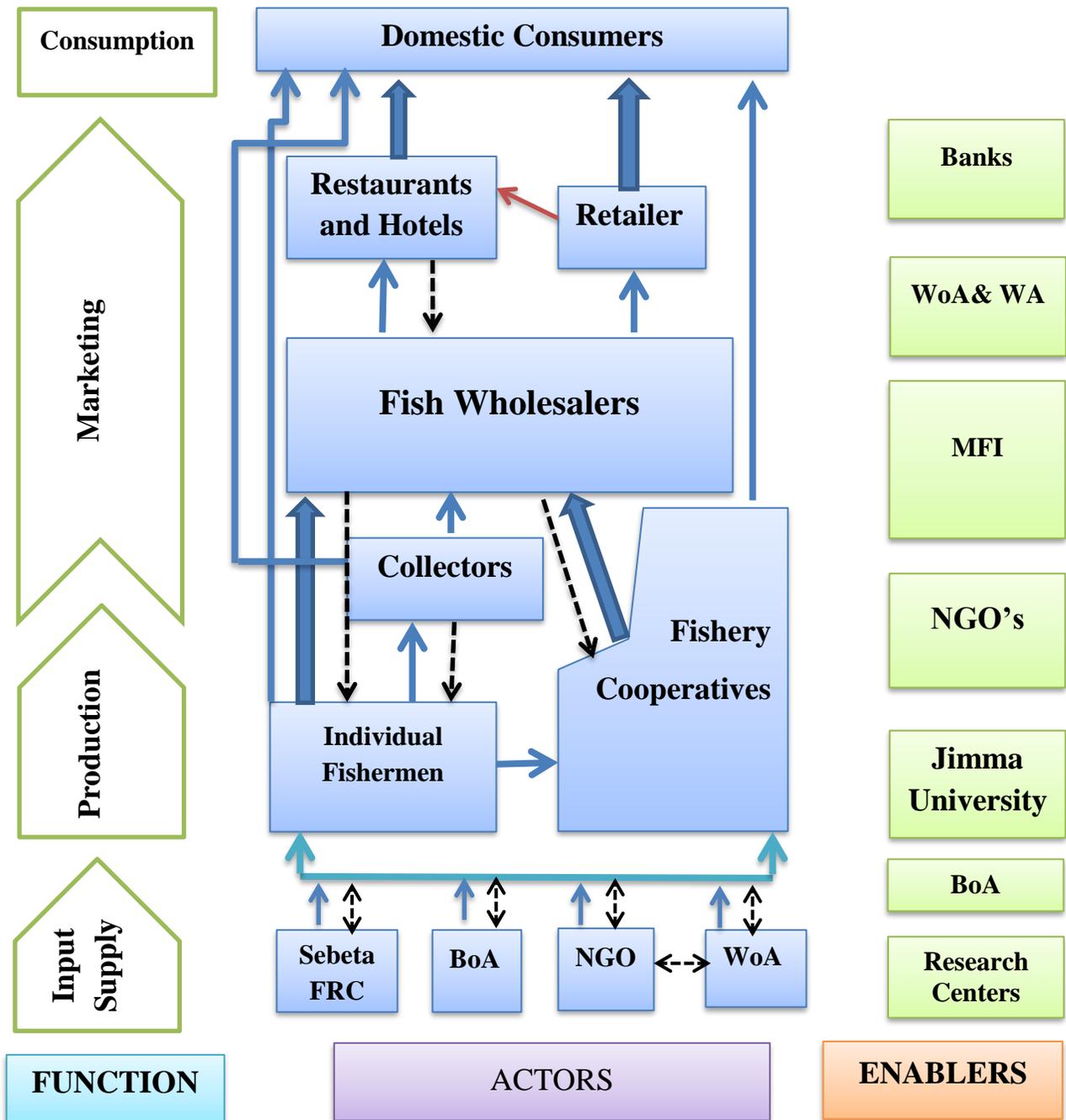
The result of this study shows that demand of fish is higher than supply especially in Christian fasting season and when it is not fasting season supply is higher. The price of fish per kg was higher in fasting season and lower when non- fasting. As the rule of demand law: when price increase the demand decreases and vice versa but, in the case of this commodity it is not supported by the demand law because in fasting season the only allowed meat type is fish and Christians consume fish as a substitute food even if the price is higher the supply is not enough for consumers in the region.

## **4.2. Value Chain Analysis**

The value chain in the fisheries sector can be defined as the movement of fish from the landing beach, through the supply chain, to the final consumer taking into the consideration the whole range of activities and the subsequent value addition undertaken by different stakeholders at various levels of the chain in lieu of a profit accruing to them from their operations (A. J. Kulmiyei, 2010). Value chain may be long or short for a particular commodity depending on the qualities of products, size and nature of consumers and producers and the prevailing social and physical environment (Ferdous et al., 2012). Value chains for capture and culture fisheries differ from fish to fish and from country to country and frequently within regions (De Silva, 2011). Value chain describe a high-level model of how fishery businesses receive raw materials as input (captures and culture fisheries) add value to the raw materials through various processes and sell finished products to customers. Moreover, fishery value chain can be defined as interlinked value-adding activities that convert inputs into outputs which in turn add to the bottom line and help to create competitive advantage. Therefore, an attempt was made to analyze the current domestic marketing channels and key actors involved in fish value chain in the study area.

### **4.2.1. Value chain map of fish in the study area**

According to Mc Cormick and Schmitz (2001), value chain mapping enables to visualize the flow of the product from conception to end consumer through various actors. It also helps to identify the different actors involved in the fish value chain, and to understand their roles and linkages. The value chain isn't necessarily straight it has vertical relationships as the product moves through different processing stages and it has various horizontal relationships as the product passes to multiple markets (Hempel, 2010). An important concept is that no matter its direction, all decisions made at one step have consequences thereafter. Value chains can be mapped and analyzed further using a value chain analysis framework. Consequently, the current value chain map of fish in study area is depicted in Figure 5 below.



**Fig. 6: Value chain map of Gilgel Gibe dam I reservoir's fish**

**Key:** → Represent Flow of fish products  
 ↔ Represents two way flow of information and technology  
 → One way flow of information  
 → Represents much flow of fish product

**Source:** Own sketch from survey result, 2015.

#### **4.2.2. Actors and their role in fish value chain**

There are several actors in fish value chains in the study area who engaged in various activities from fishing up to retailing. These actors have defined roles specific to the activities they perform and/or services they provide within the chains. The value chain map highlighted the involvement of diverse actors who are participated directly or indirectly in the value chain. According to KIT *et al.* (2006), the direct actors are those involved in commercial activities in the chain (producers, traders, consumers) and indirect actors are those that provide financial or non-financial support services such as input suppliers, credit agencies, business service providers, government, NGOs, researchers and extension agents.

In the case of this study area fisheries sector, however, a full value chain analysis cannot be done due to the fact that fish marketing is not well developed and that producers and customers in most cases deal with each other without involving other intermediaries. Despite this limitation an attempt had been made to analyze the current fish marketing channels and key actors involved in these chains and other relevant issues. Based on their roles and responsibilities the actors participating in this chain are discussed as follows.

##### **4.2.2.1. Primary actors**

The primary actors in fish value chain in this study area were input supplier, individual fish producers', fish producer cooperatives, traders and consumers. Each of these actors adds value in the process of changing product title. Some functions or roles are performed by more than one actor and some actors perform more than one role.

##### **Input supplier**

At this stage of the value chain, there are many actors who are involved directly or indirectly in fish input supply in the study area. Currently the Woreda Office of Agriculture, Sebeta research center and NGO's such as world vision Ethiopia are the main fish input supplier in this study area. The World Vision Ethiopia is also participating in funding facilitation for training and purchasing fishing equipment for the fish producer on the reservoir. All these actors are responsible to supply fish seeds and fishing equipment which are essential inputs at the production stage.

### **Producers/Fishermen**

Fishermen are people who earn their living by exploiting fish resources. Individual fish producers are the major actors who perform the work of fish production in the study area's fish value chain. They are the first link in the fish marketing channels and the supplier of fish to the market. Their major value chain functions of fishermen in this study area are mainly processing of fish at preliminary stage such as: fish harvesting, washing, cleaning, gutting, filleting and transport by head load and bajaj motor. As the survey result indicated they were responsible for the supply of 155,799kg of fish to the market in the study year.

### **Local Collectors/Assemblers**

These are traders in assembly markets who collect fish from individual producer farmers at their production/landing area for the purpose of reselling. They sell it to wholesalers, retailers and consumers. They use their financial resources and their local knowledge to handle and transport their fish to their customer area. They play an important role in fish value chain in linking producer with traders and responsible for the trading of 12,152kg or 7.8% of fish from production area to wholesaler, retailers and consumer markets in the study areas. The other function of these actors is doing for time and place utility. The trading activities of fish collectors include buying and assembling, sorting, transporting and selling to the next actors in the chain.

### **Wholesalers**

In case of this study area most of fish whole sellers are found 5 km far from the reservoir in Assendabo village and they are who buys whole and filleted fish from the fisher men, local collector and fish producer cooperative. They are the main assembly centers for fish in their respective surrounding areas and play an important role in linking fish producer with the other actors in the chain and doing for value addition as time and place utility. As this study indicated they are responsible for trading of 81,482kg of fish. They were involved in collecting a large volume of fish from their supplier and supply it to fish retailers, fish traders who came from abroad (from Addis Ababa, Wolkite and Wolisso) and restaurants and hotels at Jimma town. They can store fish usually for a maximum of three days and perform rewashing, sorting, grading, plastic packing, refrigeration and transporting to their customer.

Their mode of transportation is mainly bajaj motor to collect from their supplier and passenger minibus to transport to Jimma town. They have better storage facility, transport and communication access than other actors in the chain.

### **Retailers**

Retailer involvement in the chain includes buying of fish from whole sellers and transport to their retail shops and store it under refrigerated temperature condition, displaying and selling to their customer i.e. sometimes they sell to Restaurants/Hotels and mostly to final consumers. Retailers are key actors in fish value chain in the study area. They are mostly the last link between producers and consumers. They mostly buy from wholesalers and sell to consumers and responsible for 24,445kg of fish. Consumers usually buy the product from retailers as they offer according to requirement and purchasing power of them.

### **Primary fishery Cooperatives**

Fishery cooperatives are one of the fish value chain actors in this study area. They have a great role in this value chain. They are the second fish collector from fish producer in this study area. Cooperatives involvement in the fish value chain includes buying of fish from the individual producer at their store house, store it in refrigeration, plastic packing and selling for their customer such as for wholesaler and consumer. Some of the fisher cooperatives in Sekoru woreda supply their fish product to voyager at their shop on the main road of Jimma to Addis Ababa.

### **Restaurants and hotels**

The restaurants and hotels are where the consumers consume value added fish. Restaurants and hotels once they buy fresh fish from wholesalers; they process their fish by roasting and semi pickling/addition of spice and vegetable and called “*d ujimf*“, “*አሳ ጥገስ*” and “*አሳ ከተሌቻ*” to satisfy their customer need. They are more responsible for time, place and form utility for their customer. In rare case when there was shortage of supply from their customer whole seller they collect fish from retailers. They incur additional costs during processing and also they preserve the fish for some days with no deterioration. At this level of marketing more value is added to the fish product.

### **Fish consumers**

Consumers are those who purchasing the fish products from different sources of fish supplier for consumption. Consumers consume fish as a substitute protein food especially at Christian fasting season the preference of consumer to fish is highly increases. Consumers prefer fresh, quality and plastic packed fish for consumption. As this study area they are consumers who buy fish basically for home consumption. They particularly buy from the retailers and restaurants and hotels at the markets often in small quantities. Those located near the reservoir also buy from the fishermen themselves at landing place.

#### **4.2.2.2. Supporting actors**

Supporting actors are those who provide supportive services including fish seed and other inputs, training and extension, information, financial and credit services and legality concern services. According to Martin *et al.* (2007), access to information or knowledge, technology and finance determines the state of success of value chain actors.

BoA, Sebeta Fishery research institute, Gilgel gibe hydroelectric power station, micro finance and Jimma University are the main supporting actors who play a central role in the provision of such services. Different NGO's who are performing their work on natural resource conservation henceforth for the sustainability of the reservoir provides economic support to fishermen. They are a high interest group and have low political influence.

#### **Training and Extension Service provider**

DAs and woreda office of agriculture were the main sources of fish production and marketing training provider in the study area. The survey result revealed that 45.3% of sample respondents participated in fish training and extension service that were organized in the last two years (Table 9). The result shows that most of the trainings were given on formation of different small scale cooperative organization fish production and marketing, fish management, fish harvesting and post-harvest handling fishing equipment repairing and making like fishing net.

### **Credit services**

In the study area, Oromia Credit and Saving Institution (OCSI) and individual lenders (i.e. whole sellers) have been identified as a potential source for credit on a cash basis. The survey result showed that only 42.2% of sample respondents took credit service (Table 9). Sources of credit for local collector and whole sellers are also the same as producers except for some whole sellers who get credit from banks (commercial bank of Ethiopia Assendabo Branch).

### **Market information**

Market information is a facilitative function required for efficiently operating marketing system. In the study area, personal contact and market visit and using telephone/mobile phones are the most common methods to collect market information for all value chain actors. The result of the survey shows among the total sample individual fish producer only 52.3% of the respondents access market information by personal search and directly contacting with their customer, they get information particularly about the price of their fish.

**Table 9: Access to services by sample respondents**

<b>Variables</b>	<b>Item</b>	<b>N</b>	<b>%</b>
<b>ExtServ</b>	Yes	58	45.3
	No	70	54.7
<b>Credit</b>	Yes	54	42.2
	No	74	57.8
<b>MktInf</b>	Yes	67	52.3
	No	61	47.7

Source: Own computation from survey result, 2015.

### **4.3. Marketing Channels and Performance Analysis**

#### **4.3.1. Marketing channels**

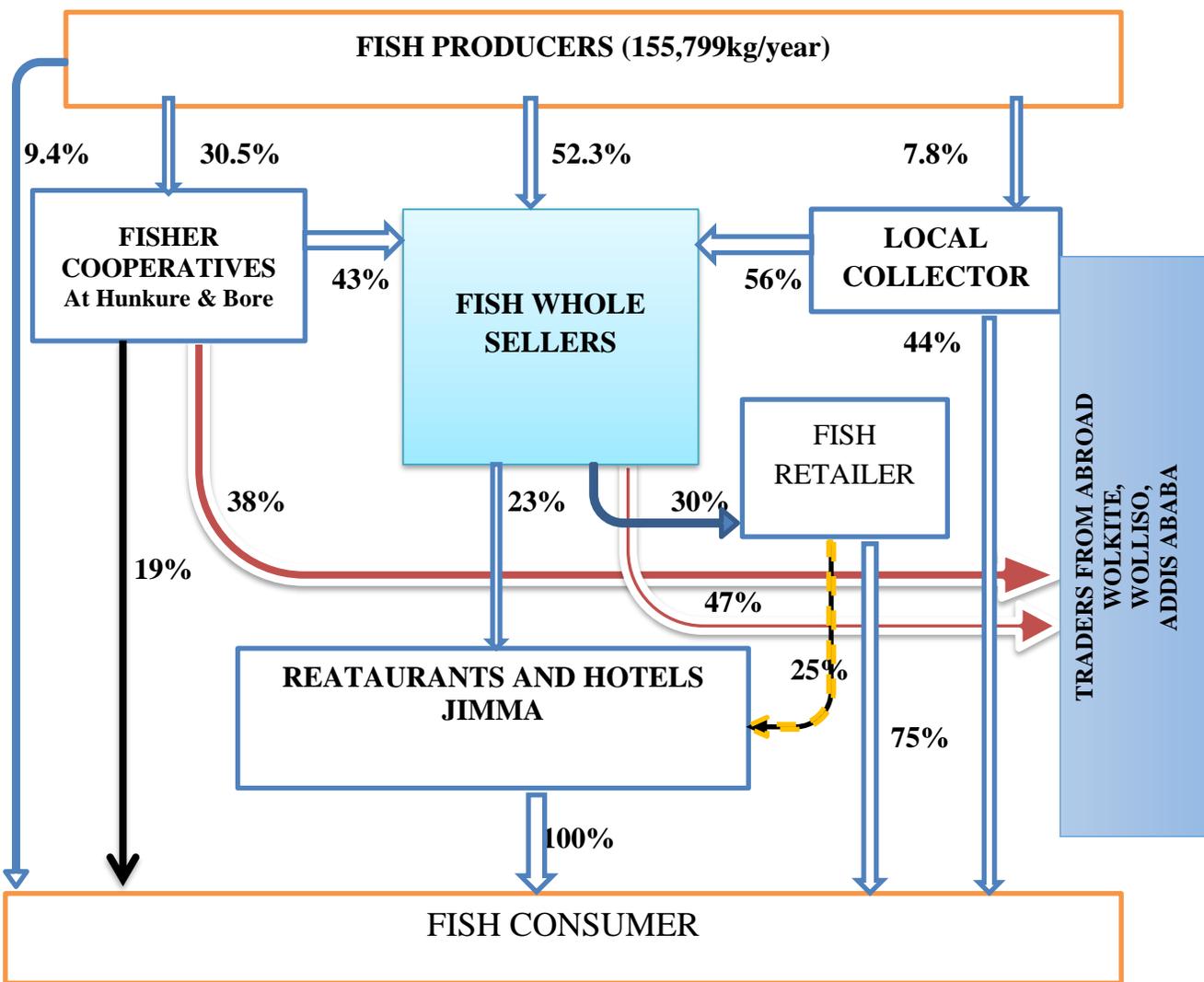
A marketing channel is a business structure of interdependent organizations that reach from the point of product origin to the consumer with the purpose of moving products to their final consumption destination. The analysis of marketing channels is intended to provide a systematic knowledge of the flow of the goods and services from their origin (producer) to the final destination (consumer).

##### **4.3.1.1. Fish marketing channel**

Twelve main alternative fish marketing channels were identified in the study area. The survey result shows that 196,885kg of fish were produced by the respondent fishermen in the study year and 79% or 155,799 kg of the produced fish were marketed in and around the study area in 2015. The main marketing channels identified from the point of production until the product reaches to the final consumer through different intermediaries were depicted in Figure 6 below. As can be understood from Figure 6, the main receivers from the fish producers were fish whole sellers and fisher cooperatives with an estimated percentage share of 52.3%, 30.5 % respectively. Channel comparison was made based on volume that fish produced was passed through each channel.

Accordingly, the channel of Producer – wholesaler–Restaurant & Hotels to Consumer carry on the largest fish volume followed by Producer– Wholesaler – Retailers to Consumer that carry a volume of 18,740kg and 18,334kg of fish respectively. Very small volume of fish were passed through the channel of Producer- Local Collector – Wholesalers – Retailer – Restaurant & Hotels to Consumer (i.e. only 510kg). The reasons for this small volume of fish passing through this channel were local collectors buy small amount of fish from producer because of lack of fish storage facility and fearing of deterioration. As a result mostly restaurants and hotels consume fish from wholesaler because of wholesalers can supply fresh fish on time as much as possible and they do have access to storage but in rare case when there is shortage of fish supply restaurants and hotels buy fish from the retailers from Jimma town.

These two main channels and the other ten are the channels which show the distribution of fish from this reservoir within Jimma region. In addition to these fish market channel there were channels which ends up with the traders from abroad i.e from Addis Ababa, Woliso and Wolkite and carry the volume of 44.32% or 69,050kg of fish. The result of this marketing channel indicates 55.62% of the fish produced from this reservoir was consumed within Jimma zone and the remaining 44.32% were traded towards the center of the country i.e. Addis Ababa.



**Fig. 7: Gilgel Gibe Dam I reservoir fish market channel**

Source: Own sketch from survey result, 2015.

**Based on figure 6 above the twelve Fish Marketing Channels were as follows**

- I. **Producers → Consumers (14,645 Kg)**
- II. Producer → Cooperatives → Consumers (9,028kg)
- III. Producers → Cooperatives → Whole Seller → Restaurant & Hotels → Consumers (4,699kg)
- IV. Producers → Cooperatives → Whole Seller → Retailer → Consumers (4,597Kg)
- V. Producers → Cooperatives → Wholesaler → Retailer → Rest/T & Hotels → Consumer (1,532kg)
- VI. **Producers → Whole Seller → Restaurant & Hotels → Consumers (18,740kg)**
- VII. **Producers → Whole Seller → Retailer → Consumers (18,334kg)**
- VIII. Producers → Whole Seller → Retailers → Restaurant & Hotels → Consumers (6,120kg)
- IX. Producers → Collectors → Wholesalers → Restaurant & Hotels → Consumers (1,565 kg)
- X. **Producers → Collectors → Wholesalers → Retailers → Res/t & Hotels → Consumers (510kg)**
- XI. Producers → Collectors → Wholesalers → Retailers → Consumers (1,532kg)
- XII. Producers → Collectors → Consumers (5,347kg)

#### **4.3.1.2. Performance of fish market**

The performance of fish market was evaluated by considering associated costs, returns, marketing margins and channel comparison. The analysis of marketing channels was intended to provide a systematic knowledge of the flow of goods and services from its origin of production to final destination consumers.

The distribution of costs and gross income at different levels is important in the business of fishery. Being highly perishable nature of the product, fresh fish require greater attention during harvesting, transporting, processing and packaging from the point of production to the final market. The marketing cost of the fish mainly involves the cost of post-harvest activities incurred before reaching the consumer. This includes cost of harvesting and packaging (material and labor costs), handling and processing (sorting, cleaning, washing, grading, fileting, gutting, smoking, salting), transportation (loading and unloading) and tax costs. Generally, these components constitute a large share in the total margin between the final retailer price and the cost of production.

#### **4.3.1.3. Marketing costs and benefit shares of actors in fish market chain**

Table 9 indicates different types of marketing cost related to the transaction of fish by local collectors, cooperatives, wholesalers, restaurants and hotels, retailers and the benefit share of each marketing actors. The arrangement of marketing cost revealed that perishability loss is the highest cost for fish producer and local collector. This is due to the highly perishable nature of fish and it is easily deteriorate during harvesting and carrying to market place. On the other hand packaging material cost followed by transport and labour cost is highest for Cooperative, Wholesalers and retailers in this study area. For Restaurant and Hotels the processing/operation cost is the highest because when they prepare fish for customer they need to add some additional food materials to do more value addition on their fish during processing and they collect Value Added Tax.

**Table 10: Marketing costs and benefit shares of actors per kg of fish**

Item(Birr/kg)	Producer	Collector	Cooperatives	Whole seller	Retailer	Rest/Hotels	Horizontal sum
Purchase Cost	-	15.89	17.17	21.25	36.33	40	
Production Cost							
Fishing Material and Equip	1.73						
Marketing cost							
Labor and processing	0.37	0.16	0.24	1.08	0.25	6.38	
Transport	0.27	0.14	0.30	1.17	0.15	-	
Loss	0.71	0.25	0.17	0.19	0.20	-	
Overhead cost	-	-	0.25	0.50	0.25	10	
Added food material	-	-	-	-	-	15	
Packing material	0.10	0.16	0.60	1.23	0.60	2	
Storage Cost	-	-	0.13	0.25	0.42	1.88	
Loading Unloading	-	-	-	0.22	0.12	-	
Tax/VAT	-	-	-	-	-	25.58	
Total marketing cost	1.45	0.86	1.69	4.64	1.97	60.83	
Total cost	3.18	16.75	18.86	25.89	38.3	100.83	
Sale Prices	15.89	17.17	21.25	36.33	40	170.5	
Market Margin	14.16	1.28	4.08	15.08	3.67	130.5	168.77
% share of margin	8.40	0.76	2.42	8.94	2.2	77.32	100
Profit margin	12.71	0.42	2.39	10.44	1.7	69.67	97.35
% share of profit	13	0.78	2.5	10.72	1.75	71.57	100

Source: Own computation from survey result, 2015

Each of the fish value chain actors adds value to the product as the product passes from one actor to another. In a way the actors change the form of the product through by cleaning, gutting, fileting or create space and time utility.

Compared to fish producer, except collectors the other traders' (Cooperatives, wholesalers, retailers) marketing cost/operating expense are a little higher than the producer, but for restaurant and hotels operating expense is much higher than that of individual fish producer. Except for restaurant and hotels the profit margin of actors in the channels is lower than that of individual fish producer farmers (i.e. relatively Restaurants and Hotels do for more fish processing and pay more for operating expense than the other actors, and finally share more than 69.67 % of the total profit margin followed by producers and wholesalers who share 12.71% and 10.44 % of profit respectively. While the collector, cooperatives and retailers

took only 0.42%, 2.39% and 1.7% of the profit margin respectively. This disproportionate share of benefits is the reflection of power relationship among actors.

Fish producers added 8.4% of the total value added for fish in the study area. Local collectors, cooperatives, wholesalers, retailers, restaurants and hotels are responsible for 0.76%, 2.42%, 8.94%, 2.2% and 77.32% respectively. The price change from producer's price to consumer price is 60.3 % on the channel finalized by retailer to Consumer and 90.7% change on the channel finalized through restaurant and hotels to consumer. This price change was due to adding more value on operating expense and adds more utility for customer satisfaction.

#### **4.3.1.4. Marketing margins of actors in different channels**

The margin calculation was done to show the distribution of share throughout the various actors as fish move from Producer, Local Collector, Wholesalers, Retailer, Restaurant and Hotels and finally reach to Consumer. Marketing margin can be used to measure the share of the final selling price that is captured by a particular agent in the value chain. The relative size of various market participants' gross margins can indicate where in the marketing chain value was added and/or profits were made.

In order to calculate the marketing margin of an agent, the average price of fish sale for that particular agent was taken. For instance, the buying price of consumers was obtained by taking the average purchasing price of consumers. In order to measure the market share of each agent, the marketing channel where all agents have participated was selected.

Marketing margins of fish in the twelve channels for each group of market players are given below in Table 10 GMM<sub>p</sub>, GMM<sub>c</sub>, GMM<sub>coop</sub>, GMM<sub>ret</sub>, GMM<sub>w</sub> and GMM<sub>res&hot</sub> are gross marketing margins of producers, local collectors, cooperatives, retailers, wholesalers and restaurants and hotels, respectively. NMM<sub>col</sub>, NMM<sub>coop</sub>, NMM<sub>ret</sub>, NMM<sub>w</sub>, NMM<sub>res&hot</sub> are net marketing margins of local collectors, wholesalers', restaurants and hotels and retailers, respectively. Marketing margins, associated costs and benefit share of value chain actors and marketing margins through different main channels was presented below.

**Table 11: Marketing margins of actors in different marketing channel of fish (in %)**

Marketing Margin	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII
TGMM	0	25	90.5	58.8	90.3	91.2	62.5	91.2	91.8	91.8	65	26.3
GMM p	100	75	9.5	41.2	9.7	8.8	37.5	8.8	8.2	8.2	35	73.7
GMM col	-	-	-	-	-	-	-	-	2.2	2.2	3	19
GMM coop	-	22	2.2	3.4	2.2	-	-	-	-	-	-	-
GMM ret	-	-	-	8.5	5.5	-	8	5.5	-	5.5	7.7	-
GMM w	-	-	21.6	28	18	25	32	22	24	20.7	29	-
GMM res&hot	-	-	146	-	145	145	-	143	144	142	-	-
NMM col	-	-	-	-	-	-	-	-	0.8	0.8	5.4	95.5
NMM coop	-	92.3	0.3	4.3	0.3	-	-	-	-	-	-	-
NMM ret	-	-	-	16.3	2.1	-	15	2.1	-	2.1	14.3	-
NMM w	-	-	9.95	58.4	7.8	11.9	68.4	10.2	11.4	9.4	60.9	-
NMM res&hot	-	-	50	-	49.4	49.4	-	48	48.8	47.6	-	-

Source: Own computation from survey result, 2015.

The total gross marketing margin (TGMM) is the highest in channel III, V, VI, VIII, IX and X which is about greater than 90% and in this channels Restaurants and hotels have got the highest gross marketing margin (i.e. 142-146%). On the other channels cooperatives, wholesalers and local collectors have got 22%, 32% and 19% which is their highest gross marketing margin in channels II, VII and XII respectively. In average retailers got the lowest marketing margin through overall marketing channels (i.e.5.5 and 8.5% in channel V and IV). Without considering channel I (where producers sell their fish directly to consumer) producer's share (GMMp) was highest at channels II and XII which were they sell to cooperatives and collectors respectively and then reach to consumer (which were 75% and 73.7%) from the total consumers' price and lowest in channel III, V, VI, VIII, IX and X where the consumer purchase from Restaurants and Hotels because of the involvement of Restaurants and Hotels through these channels and they purchase relatively at a lower price from their customer and finally sell at higher price for consumer.

The NMM were highest in channel II and XII for cooperatives and local collector as they directly purchase from producer and sell it to the end buyers of fish, average at channels IV, VII and XI for wholesalers and channels III, V, VI, VIII, IX and X for restaurant and hotels; while the lowest III, V, VIII, IX and X where Cooperative's and local collectors bought and sell their fish with

very few price difference and retailers at channel V, VIII and X bought from wholesalers and sell to the customers.

#### **4.4. Econometric Results**

In the preceding section, variables characterizing the individual fish producer and their differences among different actors in fish value chain in the study area were identified. However, in the econometrics model analysis similar variables were hypothesized to influence value addition and fish supply to the market. The determinants of fish value addition and determinants of fish supply to the market were analysed using binary logit model and linear regression model respectively.

##### **4.4.1. Determinants of fish value addition**

Twelve variables were hypothesized to explain the determinants of fish value addition of individual fish producer in the study area; such as Age, Education level, fishing experience, fishing equipment, additional means of income other than fishing, access to competitive marketing agents, access to extension service, selling price of fish in 2015, distance from the nearest market center, access to all weather road, access to market information and access to credit service. Out of these six of the variables were found to be significant, while the remaining six were less significant in explaining the variations in the dependent variable.

The maximum likelihood estimates of the logistic regression model show that education level (EDLEV), fishing equipment (FISHEQP), accessing competitive marketing agents (AcoMktA), Extension service (ExtServ), access to market information (ACCMKINF), and Access to credit service (AC) were important factors influencing individual fishermen processing and value addition on their fish in the study area. The Pseudo  $R^2$  shows approximately 0.67. Indicating that variations in probabilities of processing and value addition of fish by individual fish producer in the sample surveyed was explained by about 67 percent of the logistic model.

All of the other demographic variables such as: Age, fishing experience, additional means of income other than fishing, price of fish in 2015, distance from the nearest market area and

access to all weather roads were less powerful in explaining the determinants of fish producer's value addition on their fish.

**Table 12: Maximum likelihood estimates of logit model and the effects of explanatory variables on the probability of fish value addition**

Variables	Coefficient	Odds ratio	Std.Err.	Signf. level
Age	.032	1.03	0.09	0.711
Education Level	.704	2.02	0.40	0.075*
Fishing Experience	.041	1.04	0.23	0.860
Fishing and processing Equipment	4.067	58.38	1.07	0.000***
Means of income other than fishing	.736	2.09	0.92	0.425
Access to Competitive Market Agent	2.938	18.87	1.11	0.008**
Extension Service	3.822	45.68	1.21	0.002**
Price of Fish in 2015	.179	1.20	0.24	0.458
Distance to the nearest Market	-.398	1.49	0.39	0.312
Access to all Weather Road	.488	1.63	0.89	0.584
Access to Market Information	1.726	0.18	0.89	0.052*
Access to credit	1.802	0.17	0.97	0.062*

N	128
LR chi2(12)	114.87
Prob > chi <sup>2</sup>	0.0000
Pseudo R <sup>2</sup>	0.67
Log likelihood	-28.63

\*\*\*, \*\* and \* represent level of significant at 1%, 5% and 10% respectively

Source: Computed from the field survey data, 2015.

**Education Level (EDULEV)** was found to be an important variable in fish processing and value addition of individual fish producer on their fish and affects positively and significant at 10% probability level. The odds ratio shows the probability of processing and value addition of fish is found to be increased by a factor of 2.021 when the level of education increases by 10 % of who learnt formal education. Therefore, if individual fish producers' gets formal education and learn more, there is a possibility to apply more fish processing and value addition. This is in-line with (Odebiyi et al., 2013) who found that education is an important factor which can determine level of awareness on the value addition in fish.

**Fishing and processing Equipment (FISHEQP):** is another factor which is significantly related to the dependent variable and that it affects positively and significant at 1% probability

level. The odds ratio shows the probability of fish processing and value addition of an individual fish producer increases by a factor of 58.38 when an individual producers having more fishing equipment increases by 1%. The reason behind this is that an individual fish producer farmers accessing more fish processing and handling equipment's have more opportunity to do more processing and value addition for their fishes; because when the fishermen own more fishing equipment they can further process and add more value on their fish.

**Access to Competitive Marketing Agents (ACoMktA):** In addition, accessing to competitive marketing agents was also affects the value addition of fish positively and significantly at 5% probability level. The odds ratio shows that whenever accessing of competitive marketing agents for individual fishermen increases by 5% in the study area; the probability of processing and value addition on their fish increases by a factor of 0.1779. This means the processing and fish value addition is influenced by participation and accessing competitive marketing agents who can pay more prices for being value added fish products for individual fish producer. It supports the idea of (Feller *et al.*, 2006) who said to supply what customers want; calls for identifying the customers, their needs and what determines their choice of a product or preference and in Sri Lanka Gestsson *et al.*, (2010) found that as much as local customer's choice of fish was driven by price, foreign customers were driven by quality.

**Extension service (ExtServ):** Access to extension services was found to be an important variable in fish value addition and it affected the individual fish producer capacity to value addition on their fish products positively and significant at 5% probability level. The odds ratio shows that accessing extension services increases the probability of value addition of individual fish producers by a factor of 45.677 whenever the fishermen access to extension increases by 5%. This means as the individual fish producer contact to extension service increase the probability to add value on their fish increases; because through provision of extension service farmers' knowledge and capacity to apply modern activity can be upgraded.

**Access to Market information (ACCMKINF):** It affected the process of value addition of individual fish producer on their fish positively and significantly at 10% significance level. This is the binary logit estimate for a one unit increase in market information; given the other

variables in the model are held constant, increases the value addition on the fish by a given factor. The odds ratio shows that if individual fish producers access to market information is increased by 10% probability level; the level of processing and value addition on fish at individual fish producer level increases by a factor of 0.178. This means whenever fishermen try to get market information they collect about the type of product the customers want,

**Access to credit service (AC):** The results of the logit model show that this variable affects the value addition of individual fish producer on their fish product is positively and significant at 10% probability level. The odds ratio shows that whenever the producers' access to credit service increases by 10% the processing and value addition on their fish product increases by a factor of 0.165. This means accessing credit of individual fish producers increases the capacity to purchase fishing and processing equipment of the fishermen to accomplish further processing and value addition on their fish.

#### **4.4.2. Determinants of fish supply to the market**

In the study area fish were produced for market and home consumption. It is the important source of income for individual producers. According to the result of this study, all sample individual fish producer are good suppliers of fish to the market. Analysis of factors affecting fish production level and marketable supply of fish was found to be important to identify determinants of fish supply to market. The numbers of targeted fish producing individual farmers were 128. Multiple linear regression models were employed to identify the determinants that affect fish supply to the market. For the parameter estimates to be efficient, unbiased and consistent assumptions of classical linear regression (CLR) model should hold true. Hence, multicollinearity and Heteroscedasticity detection test were performed using appropriate test statistics.

Test for Multicollinearity: the variance inflation factor (VIF) was employed to test the existence of multicollinearity problem among explanatory variables. VIF shows how the variance of an estimator is inflated by the presence of multicollinearity (Gujarati, 2003). All values are less than 10. This indicates absence of serious multicollinearity problem among independent variables (Appendix Table 1). Test for Heteroscedasticity: the **imtest** was

employed to test the existence of Heteroscedasticity problem. The result of Imtest shows absence of Heteroscedasticity problem (Appendix Table 2).

Fourteen explanatory variables were hypothesized to determine the individual level fish supply to the market such as: age of the individual fish producer (Age), Education level (EDLEV), fish production experience (EXPRCE), fishing equipment (FISHEQP), number of production day per week (PRODAY), additional means of income other than fishing (AmICoF), access to competitive marketing agent (ACoMktA), access to extension service (ExtServ), individual fish producer membership with any fishery cooperative (MeCoop), price of fish in 2015 (PriF2015), distance from the nearest market (DistMkt), access to all weather road (ACCROAD), access to market information (ACCMKINF) and access to credit services (AC). Table 13 shows the analysis results of those variables.

**Table 13: Factors affecting fish supply to the market**

Variables	Coefficient	St. Error	t	P>/t/
Age	.093	.059	1.56	0.121
Education Level	.364	.260	1.40	0.164
Fishing Experience	.694	.177	3.92	0.000***
Fishing and processing Equipment	.072	.810	0.09	0.930
Production day per week	.482	.248	1.94	0.055*
Means of income other than fishing	-.983	.639	-1.54	0.127
Access to competitive marketing agent	.164	.811	0.20	0.840
Extension service	.447	.653	0.68	0.496
Membership to fishery cooperatives	1.093	.580	1.88	0.062*
Price of fish in 2015	.863	.174	4.96	0.000***
Distance from the nearest market	-.242	.301	-0.80	0.424
Access to all weather road	.661	.686	0.96	0.337
Access to market information	.067	.591	0.11	0.911
Access to credit	1.336	.636	2.10	0.038**
Constant	-13.421	3.530	-3.80	0.000***
R <sup>2</sup>		0.5600		
Adjusted R <sup>2</sup>		0.5328		
N		128		

**Note:** Dependent variable is volume of fish supplied in Kg. \*\*\*, \*\* and \* are statistically significant at 1%, 5% and 10%, respectively.

Source: Own computation from survey result, 2015.

Out of fourteen explanatory variables only Five of them such as: fish production experience (EXPRCE), number of production day per week (PRODAY), price of fish in 2015(PriF2015), individual fish producer membership to fishery cooperative (MeCoop) and access to credit services (AC) are significantly affects the production and supply of fish to the market in the study area.

**Fish Production Experience (EXPRCE):** It affects fish market supply positively and significantly at less than 1% significance level. The result suggests that as farmers get high fish production experience the amount of fish supplied to the market increased through its effect on fish production. Thus, the result implied that as fish producer individual fishing experience increases by a year; the supply of fish to the market increases by 0.694 kg. This is in line with Abay (2007) who illustrated as farmer's experience increased the volume of tomato supplied to the market increased and Abraham (2013) as farmer's experience increased by a year, potato supplied to market increased by a unit.

**Number of production day per week (PRODAY):** The result of multiple linear regression models for this study shows the number of fish production days per week affects fish supply to the market positively and significantly at less than 10% significance level. The result suggests that as the number of fish production day per week increases by one unit, the amount of fish supplied to the market increases by 0.482 kg.

**Individual fish producer membership to fishery cooperative (MeCoop):** Membership to fishery cooperative affects fish supply to market positively and significantly at 10% significance level. The result shows that as the individual fish producer getting the opportunity to be a membership of fishery cooperative increase by one unit; the quantity of fish supplied to the market increases by 1.09 kg; because of an individual fish producers worry to whom they sell their fish product after produced. It means, if they get the opportunity to be a member of fishery cooperative, their fish production and supply to the market through their cooperative increases. This is in-line with (Olaoye et al., 2011); who found that membership of cooperatives influences the adoption of improved fisheries technologies resulting in higher productivity and supply to market.

**Price of fish in 2015 (PriF2015):** It affects fish supply to market positively and significantly at less than 1% significance level. The result suggests that the unit variation of fish price affects the daily production and supply of fish to the market in the study area. Thus, the result implied that as the price of fish on the market increases by one unit, the supply of fish to the market by individual fish producer increase by 0.863 kg. This is in line with (Anthony *et al.*, 2012); who found that the price of fish is positively and significantly related to the probability of selling fish.

**Access to credit services (AC):** Credit is an important element starting from buying of fishing equipment up to the marketing of the fish product at the market place. It affects fish supply to market positively and significantly at less than 5% significance level. The result shows that a unit increase of an individual fish producers accessing to credit service; increases the fish supply to the market by 1.34 kg. This is in line with Muhammed(2011) who illustrated that those farmers who have access to formal credit, are more probable to supply marketable wheat than those who have no access to formal credit.

**Finally,** The  $R^2$  value of the model is 0.56 and adjusted  $R^2$  value is 0.53 (Table 13). It was observed that the adjusted coefficient of determination was more than 53 percent in the marketable supply function, implying that more than 53 percent of the variations in marketable supply were explained by the explanatory variables.

#### **4.5. Major Fish Production and Marketing Constraints and Opportunities**

According to the result of this survey a number of constraints and opportunities for fish production and marketing in the study area were identified by fish producer farmers. In this subsection, the major constraints and opportunities are briefly discussed below.

##### **4.5.1. The major production constraints**

There are a number of factors that hinder the production and marketing of fish products in the study area. According to the sample respondents, limited access to inputs, lack of capital, lack of knowledge, lack of fishing equipment, the presence of illegal fish producer, the perishability nature of the product and the absence of strong fish cooperative were problems which affect from both production and marketing side of sample individual fish producers. Based on this, the production problems have been discussed on table 14 below.

**Table 14: The major production constraints of fish producer No (128)**

Major production constraints	%
Limited access to inputs	57
Lack of capital	48
Lack of knowledge	59
lack of fishing equipment	70
Illegal Fish Producer and ways of their Production	65
Lack of Strong fish producer Cooperatives	66

Source: computed from own survey result 2015

#### **4.5.2. The major production opportunities**

The different important fish production opportunities around the study area are:

- ✚ The existence of this reservoir is the first and essential opportunity for the community and also at the right now this reservoir fish were not over exploited,
- ✚ The existence of encouraging policy framework of the country in the fishery sector development manifested by assigning fishery team and experts at WoA level.
- ✚ The current government attention towards small scale cooperative society development to identify and solve their common problem and use the resource effectively and efficiently,
- ✚ The existence of some rural development projects around the reservoir like giz/SLMP who doing for the conservation of natural resource (i.e. its impact is to prolong the reservoir life for long periods of time, World vision Ethiopia who help the groups by material and equipment support and provision of extension service and training, Sebeta Fishery Science research center for fish seed supply, Gilgel gibe hydro-electric supply project in control and facilitating for beneficial relationship with the society and make sustainable benefit and Jimma University in researching about the biology of fish and aquaculture

#### **4.5.3. The major marketing constraints**

Almost all fish producer individual responded that there were market problems in their area. The major fish marketing constraints are related with non-availability of competitive market agents who pays fair price for the producers, unfair price quotation, lack of storage facility, lack of transport, low quality product that cannot meet consumers demand and the perishability nature of the products to stay long, insufficient product handling.

**Table 15: The major fish marketing problem of the fishermen No (128)**

Major marketing constraints	%
Lack of competitive fish trader	57
Lack of fish storage facility	65
Lack of fish transportation facility	48
Low fish product quality at the central market	59
Information gap	45
Financial constraints	59
Lack of Strong Fish Receiver Cooperative	56

Source: computed from own survey result 2015

Out of the above discussed on table 15 above according to the respondent farmers responded Lack of fish storage facility to store and stay long for market, compared to the other fish source area low fish quality at the central market and Financial constraints to purchase the required equipment for transportation to the market place are the three major fish marketing constraints which accounts 65%, 59% and 58% respectively. This indicates less access of credit service in the study area.

#### **4.5.4. The major marketing opportunities**

The different important fish marketing opportunities around the study area are:

- ✚ Availability of fish market throughout the year, growing number of buyers, highly increasing the experience in fish trade and growing price were some of the opportunities of fish marketing by most of the producers.
- ✚ The proximity to Jimma town and the main road Jimma to Addis Ababa is the other opportunities that enhance the benefit of fishermen from fish market.
- ✚ The increasing demand of the people for fish consumption and feeding habit; and the timely increasing price of fish were the other opportunity in the future for this study area.
- ✚ The right now government attention towards fishery resource can make a great opportunity for this study area's community. In the future time when Ethiopian government will promote the homestead pond fish development; the reservoir can serve for fish seed source as well as fish seed breeding area.

## **5. SUMMARY, CONCLUSION AND RECOMMENDATIONS**

### **5.1. Summary and Conclusion**

This study was conducted with the aim to analyze fish value chain in the case of Gilgel gibe dam I reservoir southwest of Ethiopia. The specific objectives of the study include mapping of fish value chain and identify the major value chain actors, investigating the fish market channels and performance, analyzing the determinants of fish supply to the market and to assess the determinants of value addition on fish by the producers in the study area.

The data were generated from both primary and secondary sources. The primary data were collected from individual interview using pre-tested semi-structured questionnaire and a rapid market appraisal technique. This was supplemented by secondary data collected from different published and unpublished sources. The primary data for this study were collected from 128 randomly selected individual fishermen from the three selected kebeles of Burka Assendabo kebele from Omo Nada woreda and Hunkure and Bore kebeles from Sekoru Woreda. Based on the information gained from the respondents' 4 local collectors, 4 wholesalers, 3 fishery cooperatives, 4 retailers, 4 Restaurants and Hotels and 10 individual fish consumer have been contacted from Deneba and Assendabo village and Jimma town. The analysis was done using descriptive statistics and econometric models using SPSS version 20 and STATA version-12 software. All the sampled individuals were fish producers.

From the 128-interviewed fish producing individuals all of them were male. The average ages of the sampled respondent individuals were 26 years old and the average family size was 3. The overall Education level of the respondents were 22.7% illiterate, 26.6% read and write, 29.7% grade 1-4, 14% grade 5-8 and 7% were grade 10 and above. The average fishing experience of the individual fish producers was 4.5 year.

The result of descriptive analysis of individual fish producer data point out that, the average daily fish production per individual producer during the survey year was 5.92 kg/day and the average fish production per year of the targeted respondent were 196,885kg/year in the study area. About 79% of the fish produced were supplied to the market, 16.4% was used for home consumption which is in average about 0.92kg per day for individual fishermen and 4.5 % of

fish was lost by deteriorating before it reaches to market. As the survey result indicated the average annual income from fish production for individual fishermen in this study area was 26,925.35 ETB/person/year in 2015 which is 103.56 ETB/ day/person.

The analysis of fish value chain in the study areas revealed that the main value chain actors are input suppliers, fishermen, fish producer cooperatives, local fish collectors, wholesalers, retailers, restaurants and hotels and finally consumers. Currently the woreda office of agriculture, Sebeta fishery research center, Bureau of agriculture, micro financial institution, Jimma University, Jimma research centers and NGO's such as world vision Ethiopia are the main support provider actors in this study area. The value chain supporters or enablers provide facilitation tasks like awareness creation, facilitating joint strategy building and action and the coordination of support. Therefore; based on analysis results mapping of fish value chain were developed. The result indicates that the fish traders are the key value chain governors; they have the power in setting the price of the fish on market and the fishermen were the price taker because of lack of storage facility and the nature of the fish after produced i.e. it can be easily deteriorate.

The fish market channels and performance analysis result revealed twelve main alternative fish marketing channels were identified in the study area. The main marketing channels which receive fish directly from the producer are fish whole sellers and fisher cooperatives with an estimated percentage share of 52.3% and 30.5 respectively. Channel comparison was made based on volume that fish produced and passed through each channel. Accordingly, the channel of Producer – wholesaler–Restaurant & Hotels to Consumer carry on the largest fish volume followed by Producer– Wholesaler – Retailers to Consumer that carry a volume of 18,740 kg and 18,334kg of fish respectively and the very small volume of fish were pass through the channel of Producer- Local Collector – Wholesalers – Retailer – Restaurant & Hotels to Consumer (i.e. only 510kg).

The performance of fish market was evaluated by considering associated costs, returns and marketing margins i.e. the methods employed were channel comparison and marketing margin. Compared to fish producer, except collectors the other traders' (Cooperatives, wholesalers, retailers) marketing cost/ operating expense are a little higher than the producer and restaurant and hotels operating expense is much higher than that of individual fish

producer. But their profit margin is lower than that of individual fish producer farmers except for restaurant and hotels (i.e. Restaurants and hotels pay more operating expense and shares more than 69.67 % of the total profit margin. Without considering channel I (where producers sell their fish directly to consumer) producer's share (GMMp) was highest at channels II and XII at where they sell their fish to cooperatives and collectors respectively (which were 75% and 73.7%) from the total consumers' price and in general restaurants and hotels have got the highest GMM. This disproportionate share of benefits is the reflection of power relationship among actors.

With regard to econometrics results determinants of fish value addition and factors affecting fish supply to the market were found to be important elements in the study of fish value chain. Twelve variables were hypothesized to explain the determinants of fish value addition of individual fish producer. Finally; the result of binary logit model shows that only six variables such as education level (EDLEV), fishing equipment(FISHEQP), accessing competitive marketing agents (AcoMktA), access to extension service (ExtServ), access to market information (ACCMKINF), and Access to credit service (AC) were important factors influencing positively individual fish producers value addition on their fish in this study area.

In identifying the determinants of fish supply to the market fourteen explanatory variables were hypothesized to determine the individual fishermen supply to the market. From the fourteen explanatory variables only five of them such as: fish production experience (EXPRCE), number of production day per week (PRODAY), price of fish in 2015(PriF2015), individual fish producer membership with fishery cooperative (MeCoop) and access to credit services (AC) were significantly affects the supply of fish to the market in the study area.

Finally according to the information revealed by this study a number of factors that hinder the production and marketing of fish were identified. Those are: lack of the right type of transportation facility, less product quality at central market (A.A.) and illegal fish producer on the reservoir were the most important problems from both production and marketing side of the fish and with regard to opportunity the government's attention to the fishery resource, the current increasing fish market in the country, the proximity of the reservoir to Jimma to Addis Ababa main road are some of the opportunities raised by fishermen in the study area.

## **5.2. Recommendation**

Based on the findings of this study, the following policy measures could be recommended, because there is a need for the promotion of fish processing and value addition activity and volume of fish supply. The recommendations or policy implications to be drawn from this study are based on the significant variables from the analysis of this study.

To start with descriptive result, regarding to the characteristics of fish producer most of them engaged on production of fish as individual basis, only 41.4 % of them were organized under small scale fishery cooperative. Because of this they have no power to access modern fishing and fish processing equipment. Therefore; effort should be made to strengthen fishermen cooperative and encourage collective action of stakeholders to make the fishermen benefited.

Secondly, the result of market channel and performance analysis the marketing costs and benefit shares of actors in fish market chain the arrangement of marketing cost revealed that perishability loss is the highest cost for fish producer. This is due to the highly perishable nature of fish and easily deteriorates during harvesting and carrying to market place and lack of modern fishing and processing equipment. Hence; fish producers are price taker and the chain is governed by fish trader. Therefore; it needs strong government intervention on the support of modern input technologies such as production and processing equipment, fish storage facility, cold transportation facilities are essential in increasing the production and productivity of fish and the produce stay long as well as increase the benefit of the fishermen.

Thirdly, the result of binary logit model indicated that the determinants of fish value addition activity were positively and significantly affected by individual's fishermen education level, fishing and processing equipment, access to competitive marketing agents, extension service, access to market information and access to credit service. Therefore; to promote fish value addition in a sustainable way some policy implications are suggested to be addressed by stakeholders. Supporting the fishermen in providing a continuous awareness creation and training, providing market information and encourage the producer to participate in competitive market and strengthening of market extension (linking fishermen with competitive fish markets, building marketing capacity of fishermen, etc.) and promote the

financial service providers and accordingly extension workers should give attention to encourage them. Hence, it improves their skill to fish value addition.

Fourthly, the results of multiple linear regression model analysis indicated that the determinants of volume of fish supply to the market in the study area were positively and significantly affected by fish production experience, frequency of production day per week, price of fish in 2015, access to credit services and membership to fishery cooperatives. Therefore, these factors must be promoted in order to increase the volume of fish marketable supply. Supporting the fishermen in upgrading their knowledge through experience sharing and awareness creation on sustainable way of fish production and supply to market. Facilitating for access of information to get the daily price change and facilitating for financial service provider to strengthen their purchasing power to buy the modern fishing equipment. Strengthening the supportive activities such as information centers and input supply systems and building the asset base of the farmers and developing the skills what farmers have through experience increases fish supply to the market. In addition to that, the government should encourage the fish producer farmers to be organized under strong fish producer cooperatives and promote different types of fishery cooperatives such as fish processors at rural area around the reservoir and fish produce receiver cooperatives at urban level to increases fish supply to the market.

Fifthly, According to the sample respondents: lack of the right type of fish transportation facility, less product quality at central market and illegal fish producer on the reservoir were the most important problems from both production and marketing side of fish in the study area. Therefore, this all need to be focused by stakeholders to facilitate for fish transportation, strengthen the community's know how to control fish product quality and the government should control the illegal producers by supporting the legal producers and the fishery sector should support the development agents by giving continuous capacity building and separating them from non-extension work (especially the fishery experts) can solve those constraints.

Finally, the future research need to be conducted on production, value addition and marketing of fish to identify the existing limitation on market based fish production and encouraging them for commercial fishing system by using of modern fishing equipment to make the fish producer benefited.

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## 7. APPENDIXES

### Appendix A. Tables

**Appendix table 1: Multicollinearity test with VIF**

Variables	VIF	1/VIF
AGE	2.36	0.424210
FISHEQP	2.26	0.442645
EXPRCE	2.10	0.476453
ACoMktA	2.05	0.488606
ExtServ	1.46	0.685018
DistMkt	1.38	0.723622
AC	1.36	0.733516
AmICoF	1.36	0.736111
EDLEV	1.31	0.765485
PriF2007	1.23	0.811966
ACCRoad	1.22	0.821352
ACCMKINF	1.20	0.832068
MeCoop	1.13	0.887640
PRODAY	1.12	0.895614
Mean VIF	1.54	

**Appendix table 2: Heteroscedasticity test with imtest**

Source	Chi2	df	p
Heteroscedasticity	123.45	111	0.1975
Skewness	27.51	14	0.0165
Kurtosis	2.01	1	0.1559
Total	152.97	126	0.0513

**Appendix table 3: Price setting strategy of fish in the study area**

Price setting strategy	Number respondent	Percent
Producers set	10	8
Traders set	56	44
Through negotiation	25	19
Based on market demand	37	29

Source: own computation from survey, 2015.

## Appendix B. Survey Questionnaires

### Instructions for Interviewer

- a) Make brief introduction before starting any question at any actor level, introduce yourself to the farmers, greet them in local ways and make clear the objective of the study.
- b) Please fill the interview schedule according to their reply (do not put your own feeling).
- c) Please ask each question clearly and patiently until the respondent gets your points.
- d) Please do not use technical terms and do not forget local units.
- e) During the process write answers on the space provided.
- f) Prove that all the questions are asked and the interview schedule format is properly completed.
- g) Finally thank the respondents.

### I. Questionnaires For Fish Producer

#### i. Producer's / Fishermen's socioeconomic/demographic characteristics

1. Name of fish producer \_\_\_\_\_
2. Zone \_\_\_\_\_ Wereda \_\_\_\_\_ Kebele \_\_\_\_\_
3. Sex male [ ] Female [ ]
4. Age \_\_\_\_\_
5. Marital status (√): 1. Married [ ] 2. Unmarried [ ] 3. Divorce [ ] 4. Widowed [ ]
6. Education level of the respondent (in grade)(√)
  - a. Illiterate \_\_\_\_\_
  - b. Read and write \_\_\_\_\_
  - c. Grade (1-4) \_\_\_\_\_
  - d. Grade (5-8) \_\_\_\_\_
  - e. Grade (9-12) and above \_\_\_\_\_
7. Family size including his/her partner (Wife/husband) Male \_\_\_\_ Female \_\_\_\_ total \_\_\_\_
8. How long have you been fishing? (in year) \_\_\_\_\_
9. Have you additional means of income other than fishing? 1. Yes [ ] 2. No [ ]
10. If your answer for Q. 9 is yes what are they? Other farming activity
  - a. Coffee production 1. Yes [ ] 2. No [ ]
  - b. Crop production 1. Yes [ ] 2. No [ ]
  - c. Animal rearing 1. Yes [ ] 2. No [ ]
  - d. Apiary 1. Yes [ ] 2. No [ ]
  - e. Trading 1. Yes [ ] 2. No [ ]
  - f. Employed 1. Yes [ ] 2. No [ ]
11. What are the major crops cultivated in your area?
  - a. Maize 1. Yes [ ] 2. No [ ]
  - b. Wheat 1. Yes [ ] 2. No [ ]
  - c. Teff 1. Yes [ ] 2. No [ ]
  - d. Barley 1. Yes [ ] 2. No [ ]

- e. Sorghum 1. Yes [ ] 2. No [ ]  
 f. Pepper 1. Yes [ ] 2. No [ ]

**ii. Fish Production**

12. How many kilogram of fish do you harvest in a normal fishing day?( Kg/day)  
 Whole fish (Kg/day) \_\_\_\_\_Semi processed fish (Kg/day) \_\_\_\_\_
13. For what purpose do you produce Fish?  
 1. For home consumption [ ] 2. For sale [ ]. 3. For recreation [ ]
14. How much do you use for home consumption and for selling? (In kg/day)  
 1. For consumption (Kg) \_\_\_\_\_ 2. For sale (Kg) \_\_\_\_\_
15. Have you your own fishing and processing equipment such as fishing boat, nets, fileting blades, packing equipment, refrigerator, roasting equipment's?  
 1. Yes [ ] 2. No [ ]
16. What are the major fishing equipment in this area \_\_\_\_\_
17. How many days in a week do you harvest? \_\_\_\_\_
18. What is your Product type?  
 1. Whole fish [ ] 2. Semi-processed fish [ ] 3. Both [ ]
19. How many species of fish do you know in the reservoir? \_\_\_\_\_
20. Their species name 1. \_\_\_\_\_ 2. \_\_\_\_\_ 3. \_\_\_\_\_ 4. \_\_\_\_\_
21. Which species of your fish is more preferable in the market? (Put it in rank)  
 1<sup>st</sup>. \_\_\_\_\_ 2<sup>rd</sup> \_\_\_\_\_ 3<sup>nd</sup>. \_\_\_\_\_ 4<sup>th</sup> \_\_\_\_\_

**iii. Processing and Value Addition**

22. Do you do primary processing for your fish? 1. Yes [ ] 2. No [ ]
23. If your answer for Q no 23 is yes what type of primary processing have you done?  
 a. Washing [ ] c. Cleaning [ ] e. Sorting [ ]  
 b. Gutting [ ] d. Filleting [ ]
24. Do you do for secondary/further processing and preservation for your fish product?  
 1. Yes [ ] 2. No [ ]
25. If your answer for Q 25 is yes what type of secondary processing and preservation methods do you apply?

No	Activity	Response	
		Yes	No
1	Grading		
2	Plastic Packing		
3	Smoking		
4	Sun drying		
5	Salting		
6	Pickling		
7	Storage and Refrigeration		
8	Icing		
9	Canning		

26. If you do not add values for your product what are the factors that affect the value addition activities on your fish?

- 1. Knowledge gap [ ]
- 2. Cultural practice [ ]
- 3. Lack of equipment [ ]
- 4. Lack of capital to purchase equipment [ ]
- 5. Distance from market place [ ]
- 6. Lack of training support [ ]

**iv. Market and Supply**

27. Are there competitive marketing agents who offer competitive price to your fish?

- 1. Yes [ ]
- 2. No [ ]

28. Do you gain good price to sell your fish on the market?

- 1. Yes [ ]
- 2. No [ ]

29. How do you set the price of your fish?

- a. Solely by the will of you [ ]
- b. By negotiation with the buyer [ ]
- 3. Solely by the will of the buyer [ ]
- 4. Based on market demand [ ]

30. What factors affects your fish price?

- a. The number of illegal fish producer [ ]
- b. The lack of fish storage equipment [ ]
- c. The absence of competitive fish collector [ ]
- d. The quality of the product [ ]

31. For whom do you sale your fish product?

- 1. Local collector [ ]
- 2. Whole seller [ ]
- 3. Retailer [ ]
- 4. Cooperative [ ]
- 5. Restaurants and hotels [ ]
- 6. Consumer [ ]

\* Their name and location \_\_\_\_\_

32. Are you networked with your customer? 1. Yes [ ], 2. No [ ].

33. If your answer for Q 33 is no how do you communicate and sell your product?

Specify \_\_\_\_\_

34. Is there fish producer cooperative in this area? 1. Yes [ ] 2. No [ ]

35. If your answer for Q 35 is yes are you its member? 1. Yes [ ] 2. No [ ]

36. At what price do you sell fish presently? (Birr/kg for each type of fish products)

Type of product	Selling Price(ETB/kg) for different customer				
	L/collector	Wholesalers	Cooperatives	Retailer	Consumer
Whole fish					
Processed fish					

37. Have you incur additional cost during production and marketing of your fish?

- 1. Yes [ ]
- 2. No [ ]

38. If your answer for Q No 38 is yes what and how much cost do you incur during production and marketing of your fish?

No	Description of the cost	Value	
		Birr	Cents
1	Labor/production cost		
2	Harvesting		
3	Storage cost		
4	Transport cost		
5	Loading unloading cost		
6	Equipment hiring cost (eg. boat)		
7	Levy		
8	Others		
	Total cost		
	Average cost per Kg		

39. Have you faced fish product loss during production and marketing of it?

1. Yes [ ] 2. No [ ]

40. If your answer for Q 40 is yes at what stage do you incur more?

1. At production stage [ ] 2. At marketing stage [ ]

41. If your answer for Q 37 is yes what kind of loss and its values do you incur?

No	Description of the loss	Approximate value in birr		Frequency of occurrence per month
		Birr	Cents	
1	Adulteration during production/harvesting			
2	Spoilage			
3	Theft			
4	Others			
	Total			

**v. Infrastructure facility**

42. Distance from the nearest market center (in km) \_\_\_\_\_

43. Have you access to all weather road 1. Yes [ ] 2. No [ ]

44. Do you have an access for market information? 1. Yes [ ], 2. No [ ].

45. If your answer for No 45 is yes; how do you get it?

- a. Through media [ ]
- b. Personally searching [ ]
- c. Directly from customer [ ]

46. Do you get continuous market opportunity for your fish product? 1. Yes [ ] 2. No [ ]

47. Is there seasonal market variation on your product (fish)? 1. Yes [ ] 2. No [ ]

48. If your answer for Q 48 is yes when is it?

- a. When is its maximum and minimum demand? (In month) \_\_\_\_\_
- b. What is the reason for fish market variation? \_\_\_\_\_

49. What are the major factors/determinants that affect your fish supply to the market?

- a. Lack of fishing equipment [ ]

- b. Lack of market information [ ]
- c. Lack of well-organized whole seller [ ]
- d. The less quality of our fish on central market level [ ]
- e. A number of illegal fish harvester and small scale collector [ ]
- f. Lack of fish product transportation facility [ ]

**vi. Services**

50. Do you have access to credit? (1) Yes [ ], (2) No [ ].
51. If your answer for Q 51 is yes from whom do you acquire credit?
- a. Family and friends [ ]
  - b. Informal saving and credit groups [ ]
  - c. Microfinance institutions [ ]
  - d. Commercial Banks [ ]
52. Do you access any extension service on fish production, marketing and value addition activity from different supporting agency with in last 2 year? 1. Yes [ ] 2. No [ ]
53. If your answer for Q 53 is yes what is it?

No	Activity/support	Response(√)		Frequency within a year
		Yes	No	
1	Fish seed supply			
2	Training/extension service			
3	Logistics support			
4	Fishing equipment support			
5	Transportation support			
6	If others(specify)			

54. Who are those organizations who support you?
- a. Government organization(specify) \_\_\_\_\_
  - b. NGO's (specify) \_\_\_\_\_
55. What is your source of labor used for fish production?(multiple response is possible)
- 1. Family labor [ ]
  - 2. Hired labor [ ]
  - 3. Personally engaged [ ]
56. What are the opportunity and constraints related to fish production and marketing in your area?
- a. Opportunity
    - i. \_\_\_\_\_
    - ii. \_\_\_\_\_
  - b. Constraints
    - i. \_\_\_\_\_
    - ii. \_\_\_\_\_ .
57. In general what is to be done to use this resource in efficient and effective ways?  
(List them)
- a. \_\_\_\_\_
  - b. \_\_\_\_\_
  - c. \_\_\_\_\_
  - d. \_\_\_\_\_.

**I. Local collector/ Whole Sellers/Retailers Interviews Questionnaire**

1. Name of Respondent\_\_\_\_\_
2. Zone\_\_\_\_\_ Wereda \_\_\_\_\_ Kebele/Town \_\_\_\_\_
3. Sex (√): 1.  Male 2.  Female
4. Age\_\_\_\_\_
5. Place of interview (market place) 1. Local trader  , 2. Whole seller  , 3. retailer
6. Education level of the respondent \_\_\_\_\_
7. How long have you been in fish trade? (in year) \_\_\_\_\_
8. Distance from fish production area(km) \_\_\_\_\_
9. How many days in a week are you involved in fish trade? (in days) \_\_\_\_\_
10. How much of fish do you handle and sell in a normal working day? (in Kg)\_\_\_\_\_
11. Who is the source of your fish product?
  1. Fishermen  2. Cooperative  3. Local collector
  4. Wholesalers  5. If other (specify) \_\_\_\_\_
12. At what price do you buy fish or fish product? (Birr per Kg)\_\_\_\_\_
13. Have you networked with your supplier? 1. Yes  2. No
14. How do you set the buying price?
  1. By agreement with your customer
  2. Solely by the will of the sellers  . 3. Solely by your will  .
15. Do you consider the buying price affordable? 1. Yes  2. No
16. Do you transport your own produce? 1. Yes  2. No
17. To where do you transport your fish?
  1. To local market around the source of fish
  2. To Jimma market  3. To central (A.A.) market 4. Specify if others\_\_\_\_\_
18. If your answer for Q 17 is yes what mode of transport do you use?
  - a. By head  c. Public transport
  - b. Handcart  d. Refrigerated truck  e. If other (specify) \_\_\_\_\_
19. For whom do you sell your fish produce?
  - a. Local collector  c. Retailers  e. Wholesalers
  - b. Consumers  d. Cooperatives
20. Do you undertake secondary fish processing and value addition on your fish?
  1. Yes  2. No
21. If your answer for Q 20 is yes do you undertake any of the following activities?
  1. Drying 1. Yes  2. No  4. Preservation 1. Yes  2. No
  2. Grading 1. Yes  2. No  5. Sorting 1. Yes  2. No
  3. Storage 1. Yes  2. No  6 Packing 1. Yes  2. No
22. At what price do you sell your produce presently? (In Birr Per Kg) \_\_\_\_\_ -
23. How do you determine the selling price of fish?
  1. In advance  . 3. If others (specify)\_\_\_\_\_
  2. At the market place

24. Is your product marketable throughout the year? 1. Yes [ ] 2. No [ ]
25. Have you access to daily market information? 1. Yes [ ] 2. No [ ]
26. If yes how do you get?
1. Through media [ ] 3. From customer contact [ ]
2. Through phone search [ ] 4. Specify If others \_\_\_\_\_
27. Have you incur additional cost during marketing of your fish? 1. Yes [ ] 2. No [ ]
28. If your answer for Q No 27 is yes what and how much cost do you incur during production and marketing of your fish?

No	Description of the cost	Unit	Value	
			Birr	Cents
1	Labor cost			
2	Storage cost			
3	Transport cost			
4	Loading unloading cost			
5	Equipment hiring cost (eg. Refrigerator )			
6	Levy			
7	If Others			
	Total cost			

29. Do you incur fish loss during your market activity? 1. Yes [ ] 2. No [ ]
30. If your answer for Q 29 is yes what kinds of loss do you incur?

No	Description of the loss	Approximate value in birr	
		Birr	Cents
1	Adulteration during processing		
2	Spoilage		
3	Others		
	Total		

31. Generally, how do you view fish marketing relating to the opportunity and constraints
1. Opportunity \_\_\_\_\_
2. Constraints \_\_\_\_\_

## II. Questionnaires For Fish Producer Cooperatives

### i. Socio-economic/demographic characteristics

- 1) Name of respondent \_\_\_\_\_
  2. Zone \_\_\_\_\_ Wereda \_\_\_\_\_ Kebele \_\_\_\_\_
  3. Level of the cooperative \_\_\_\_\_
  4. Member characteristics male \_\_\_\_\_ Female \_\_\_\_\_ total \_\_\_\_\_
  5. How long have this cooperative been fishing? (in year) \_\_\_\_\_
  6. Have the member additional means of income other than fishing? 1. Yes [ ] 2. No [ ]
  7. If your answer for Q. 6 is yes What are they?(Rank in order of importance)
- 1<sup>st</sup> \_\_\_\_\_ 4<sup>th</sup> \_\_\_\_\_
- 2<sup>nd</sup> \_\_\_\_\_ 5<sup>th</sup> \_\_\_\_\_

3<sup>rd</sup> \_\_\_\_\_ 6<sup>th</sup> \_\_\_\_\_

**ii. Gender**

8. Is there female participation in your cooperative? 1. Yes [ ] 2.No [ ]
9. If your answer for Q 8 is no what is the reason to be not participates in fishery cooperative?
- a. Lack of knowledge [ ]                      c. The hardness of the work [ ]
- b. Tradition/cultural practices [ ]            d. Economic factor[ ] e. Religion factor[ ]

**iii. Fish Production**

10. How many kg of fish your cooperative harvest in a normal fishing day?( kg/day)\_\_\_\_\_
11. For what purpose do you produce Fish?
- a. For home consumption [ ], b. For sale [ ]. c. For recreation[ ]
12. How your cooperative engaged on fish production and supply to the market?
- a. Direct production and supply to the market [ ]
- b. Collecting from individual fishermen and supply to the market [ ]
- c. If other (specify) \_\_\_\_\_
13. What are your major fishing equipment in \_\_\_\_\_
14. How many days in a week your cooperative engaged on fishery work? \_\_\_\_\_
15. What is your Product type: 1. Whole fish \_\_\_\_\_ 2. Processed fish \_\_\_\_\_

**iv. Processing and Value Addition**

16. Is your product processed? 1. Yes [ ] 2. No [ ]
17. If your product is processed what type of processing have you done?
- a. Filleting [ ] c. Gutting [ ] e. Cleaning [ ] g. packing [ ]
- b. Salting [ ] d. smoking [ ] f. Washing [ ]
18. Do you preserve your product? 1. Yes [ ] 2. No [ ]
19. If your answer for Q 18 is yes what type of preservation methods do you apply?
- a. Refrigeration and Storage [ ] e. Pickling [ ]
- b. Icing [ ] f. Packing [ ]
- c. Salting [ ] g. Drying [ ]
- d. Grading [ ] h. Sorting [ ]

**v. Market and Supply**

20. How do you set the selling price of your fish?
- a. Solely by the will of you [ ] c. solely by the will of the buyer [ ]
- b. By negotiation with the buyer [ ]
21. What factors affects your product price?
- a. \_\_\_\_\_ c. \_\_\_\_\_
- b. \_\_\_\_\_ d. \_\_\_\_\_
22. For whom your cooperative sale fish product?
1. Local collector [ ], 2. Whole seller [ ] 3. Retailer [ ]

4. Restaurants [ ] 5. Consumer [ ]

Their name \_\_\_\_\_ Location \_\_\_\_\_

23. At what price do you sell your products presently? Birr per Kg for each type

Type of product	Selling Price (ETB/kg)	
	Consumer	Other customer
Whole fish		
Processed fish		

24. Have you incur additional cost during production and marketing of your fish?

1. Yes [ ]. 2. No [ ]

25. If your answer for Q No 24 is yes what and how much cost does you incur during production and marketing of your fish?

No	Description of the cost	Unit	Value	
			Birr	Cents
1	Labor/production cost			
2	Harvesting			
3	Storage cost			
4	Transport cost			
5	Loading unloading cost			
6	Equipment hiring cost (eg. boat)			
7	Levy			
8	Others			
	Total cost			

26. Have you faced fish loss during production and marketing of it?

1. Yes [ ] 2. No [ ]

27. If your answer for Q 26 is yes at what stage do you incur more?

1. At production stage [ ] 2. At marketing stage [ ]

28. If your answer for Q 26 is yes what kind of loss and its values do you incur?

No	Description of the loss	Approximate value in birr		Remarks
		Birr	Cents	
1	Adulteration during production			
2	Spoilage			
3	Theft			
4	Others			
	Total			

#### vi. Infrastructure facility

29. Distance from the nearest market center (in km) \_\_\_\_\_

30. Is your cooperative access to all weather road 1. Yes [ ] 2. No [ ]

31. Do it has access for market information? 1. Yes [ ], 2. No [ ].

32. If your answer for No 31 is yes; how do you get it?

a. Through media [ ] b. personally searching [ ] c. From customer [ ]

33. Do you get continuous market opportunity for your fish product? 1. Yes [ ] 2. No [ ]

34. What are the major factors that affect your fish supply to the market?

- a. \_\_\_\_\_ c. \_\_\_\_\_  
 b. \_\_\_\_\_ d. \_\_\_\_\_

**iii. Services**

35. Does your cooperative have access to credit? (1) Yes [ ], (2) No [ ].

36. If your answer for Q 35 is yes; from whom do it acquire credit?

- a. Individuals [ ] d. Commercial Banks [ ]  
 b. Informal saving and credit groups [ ] e. Specify if others \_\_\_\_\_  
 c. Microfinance institutions [ ]

37. Do your cooperative get any support on fish production and marketing activity from different supporting agency? 1. Yes [ ] 2. No [ ]

38. If your answer for Q 37 is yes what is it?

No	Activity/support	Response(√)		Frequency within a year
		Yes	No	
1	Fish seed supply			
2	Training/extension service			
3	Logistics support			
4	Fishing equipment support			
5	Transportation support			
6	If others(specify)			

39. Who are those organizations who support you?

- a. Government organization(specify) \_\_\_\_\_  
 b. NGO's (specify) \_\_\_\_\_

40. What is your source of labor used for fish production?(Multiple response is possible)

1. Daily laborer [ ] 2. Cooperative member [ ] 3. If others [ ]

41. What are the opportunity and constraints you faced during fish production and marketing activity?

- a. Opportunity  
 1. \_\_\_\_\_  
 2. \_\_\_\_\_  
 b. Constraints  
 1. \_\_\_\_\_  
 2. \_\_\_\_\_

42. In general as you think what is to be done to use this resource in efficient and effective ways?

- a. \_\_\_\_\_  
 b. \_\_\_\_\_

**III. Restaurant Owners Interviews Questionnaire**

1. Place of the organization(village, town, or city)\_\_\_\_\_
2. Name of organization(restaurants/hotels) \_\_\_\_\_
3. Name of respondent \_\_\_\_\_ Age \_\_\_\_\_
4. Occupation in the organization \_\_\_\_\_
5. How long does s/he in his/her job in the restaurant \_\_\_\_\_
6. Where do you get fish?
  1. From Fishermen [ ]
  2. From local collector [ ]
  3. Wholesalers [ ]
  4. From retailers [ ]
7. Do you get fresh fish on the time you need? 1. Yes [ ] 2. No[ ]
8. What type of fish product do you get? 1. Whole fish [ ] 2. Semi processed fish [ ]
9. At what price do you buy fish? (Birr per Kg)
  1. Whole fish \_\_\_\_\_
  2. Processed fish \_\_\_\_\_
10. Have you networked with your supplier? 1. Yes [ ], 2. No[ ]
11. At what time do you get the fish(before noon/after noon ) \_\_\_\_\_
12. Do you have enough market for fish \_\_\_\_\_
13. If yes how many Kg do you sale per day \_\_\_\_\_
14. Which part of community eats fish more/ Who is your customer?
  1. Young [ ]
  2. Adult/middle aged [ ]
  3. Old [ ]
15. How is the frequency of your customer? \_\_\_\_\_
16. What value addition have you done for your fish to satisfy your customer need?

No	Activity	Response	
		Yes	No
1	Refrigeration		
2	Sun drying		
3	Smoking		
4	Icing		
5	Salting		
6	Pickling		
7	Storage		
8	Sorting		
9	Grading		
10	Plastic Packing		

17. What are the costs you incur during value addition (processing) of per Kg of fish?

No	Description	Qty per Kg	Cost per Kg	
1				
2				

18. At what Price do you sell fish at your organization (selling price)?

No	Product Type	Selling Price
1		
3		

19. Do you get any training about fish handling and processing? 1. Yes [ ] 2. No [ ]
20. If yes who did deliver the training (organization)? \_\_\_\_\_
21. If yes for how many terms did you get the training (within one year) \_\_\_\_\_.
22. What do you suggest about over all activity on fish \_\_\_\_\_
  - a. Opportunities \_\_\_\_\_
  - b. Constraints \_\_\_\_\_

#### IV. Fish Consumer's Interview Questionnaire

1. Name of interviewer \_\_\_\_\_
2. Name of Respondent: \_\_\_\_\_
3. Zone: \_\_\_\_\_ Woreda: \_\_\_\_\_ Kebele: \_\_\_\_\_ Village: \_\_\_\_\_
4. Age of the respondent: \_\_\_\_\_
5. Sex of the respondent (√): 1. [ ] Male 2. [ ] Female
6. Are you a regular Buyer of fish? 1. Yes [ ] 2. No [ ]
7. From whom do you usually buy fish?
  1. Retailers [ ]
  2. Wholesalers [ ]
  3. Small-scale processors [ ]
  4. Fishermen [ ]
  5. If others (specify) \_\_\_\_\_
8. How many times in a month do you buy fish? (Frequency per month) \_\_\_\_\_
9. What quantities of fish do you buy in a month? (in kg per month) \_\_\_\_\_
10. At what price do you buy fish? (Birr per Kg) \_\_\_\_\_
11. Do you consider this price affordable? 1. Yes [ ] 2. No [ ]
12. Have you satisfied with the way in which fish processed and supplied to the market?
  1. Yes [ ]
  2. No [ ]
13. As you have seen; is the supply of fish enough for the market demand?
  - (1) Yes [ ]
  - (2) No [ ]
14. How do you think about the quality of fish that you buy? 1. Poor [ ]
  2. Average [ ]
  3. Good [ ]
15. Can you determine the price of fish on the market based on its quality?
  1. Yes [ ]
  2. No [ ]
16. Are you satisfied with the way in which fish is supplied to the market?
  1. Yes [ ]
  2. No [ ]
17. What would you like to suggest to improving the quality of fish being sold for human consumption? \_\_\_\_\_