

THE VALUE CHAIN OF FARMED AFRICAN CATFISH IN UGANDA

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ABSTRACT

Catfish farming has increased over the past decade in Uganda. In order for this emerging industry to be sustainable, systematic production and marketing are essential. This paper discusses the existing catfish farming industry in Uganda and its value chains. Analysis is done to answer questions on the industry structure, value chains, value distribution and how relationships among actors have influenced profitability. It further draws from the experience of established Icelandic producers to suggest value creation changes that can improve profitability in catfish farming value chains in Uganda. The main findings indicate lack of cooperation in the domestic value chain that has led to vulnerability of farmers though the chain has potential for higher income. Cooperation and governance in the regional export value chain has improved its performance in the industry with farmers having better bargaining power and price control. The paper concludes that, due to size, cooperation among actors in the domestic value chain is a must to improve profitability while consistence in supply of quality and quantity will improve competitiveness of the regional export value chain.

Key words: African catfish, fish farming, value chain, Uganda

TABLE OF CONTENTS

1	Introduction.....	4
2	THEORETICAL DISCUSSION.....	6
2.1	The Industry.....	6
2.2	Industry Supply and Value Chains	8
2.3	The Firm’s Competitive Position	14
2.4	Key Factors For Competitive Success.....	14
2.5	Empirical Studies on Fish Value Chains	15
2.6	Theoretical Model for the Study.....	16
3	Methodology.....	16
3.1	Primary Data Collection	16
3.2	The sample.....	17
3.3	Secondary Data Collection	18
3.4	Analysis	18
4	Analysis of the aquaculture industry in Uganda.....	19
4.1	Recommended Demand for fish and fish products	21
4.2	Determinants of African catfish farming industry profitability in Uganda using the Porter’s five forces model.....	23
4.3	The Fish Supply and Value Chains in Uganda.....	26
4.4	Structure of Farmed African Catfish Value Chains.....	28
4.5	Value added distribution.....	38
4.6	Competitive positioning within the value chain	41
4.7	Key factors for competitive success	42
4.8	Conclusion and recommendations.....	46
	ACKNOWLEDGEMENTS.....	48
	LIST OF References.....	49
	APPENDICES.....	A

LIST OF FIGURES

Figure 1: Map showing location of Uganda and major water bodies.	4
Figure 2: Five forces model for industrial competitive advantage (Porter 1998a).	8
Figure 3: The concept of supply and value chain (Feller et al. 2006).	9
Figure 4: Porter’s value chain.	10
Figure 5: The African catfish (<i>Clarias gariepinus</i>) cultured in Uganda.	19
Figure 6: Aquaculture production in Uganda by species since 1995 (FAO-Fishstat 2009). ..	20
Figure 7: Graph showing supply and demand of fish and fish products on the Ugandan local market (Uganda Bureau of Statistics (UBoS) 2010).	22
Figure 8: Average market prices for animal protein products on the Ugandan market 2001 to 2010 (UBoS, FAO).	24
Figure 9: The marketing chain for Nile perch adapted from Gudmundsson et al. (2006).	26
Figure 10: Picture of traders loading Nile perch bone frames and heads on a pickup truck at a processing plant in Uganda.	27
Figure 11: General farmed African catfish value chain in Uganda.	32
Figure 12: Price range and distribution along the African catfish value chain in Uganda.	38
Figure 13: Price range and distribution along the value chain for African catfish hatchery products in Uganda.	41

LIST OF TABLES

Table 1: Identifying key success factors for a supermarket (adapted from Grant, 2005).	14
Table 2: Regional fish demand and deficits (1000 tonnes) for countries neighbouring Uganda.	21
Table 3: Volumes and sales of live and smoked catfish and live tilapia at WAFICOS coop offices.	22
Table 4: Characterizing farmed fish markets in Uganda.	28
Table 5: Finance, technology, information and legislation relation links between catfish farmers and the other chain actors.	31
Table 6: Screening criteria for farmed catfish by local processors.	34
Table 7: Value addition above farm gate price in USD/kg of live weight catfish at each step in the chain.	39

LIST OF APPENDICES

Appendix I QUESTIONNAIRES	A
Appendix II QUOTED INDIVIDUALS	F
Appendix III ASSUMPTIONS USED IN CALCULATIONS	G

LIST OF ACRONYMS

ARDC	Aquaculture Research Development Centre
EU	European Union
FAO	Food and Agriculture Organisation of the United Nations
FCR	Feed Conversion Ratio
FISH	Fisheries Investment for Sustainable Harvest
GDP	Gross Domestic Product
GoU	Government of Uganda
IMF	International Monetary Fund
MAAIF	Ministry of Agriculture, Animal Industry and Fisheries
NAADS	National Agricultural Advisory Services
NEMA	National Environmental Management Authority
NFCS	National Food Control System
UBoS	Uganda Bureau of Statistics
UIA	Uganda Investment Authority
UNDP	United Nations Development Program
UNEP	United Nations Environment Program
UNU-FTP	United Nations Fisheries Training Program
UPBL	Ugachick Poultry Breeders (U) Ltd
USAID	United States Agency for International Development
WAFICOS	Walimi Fish Farmers Cooperative Society

1 INTRODUCTION

Uganda is a landlocked country twice the size of Iceland located in East Africa at 1°16'48" N, 32°23'24" E with an area of 236,040 km² of which 15% is water (CIA 2011). The country has a population of 34.4 million with average annual growth of 3.27% (World Bank 2010). Only one third of the population is economically active (IMF 2010). The economic backbone of Uganda is agriculture, which employs 80% of the workforce (World Bank 2010). The national gross domestic product (GDP) was 17.70 billion USD in 2010, bringing per capita GDP to 517 USD. The average inflation rate is 10.5% (IMF 2010). Uganda was 42nd in the world GDP growth rate at 5.8% in 2010 but it still ranks in the 11th percentile of the world GDP showing a poor economy (CIA 2011). Economic growth has been attributed to exports to the EU and the regional markets (Hammerle *et al.*, 2010). The contribution of agriculture to the national GDP was 28% (IMF 2010) as a result of exports of coffee, fish and fresh produce in that order (UBoS 2010). The fishing industry has been established on five major freshwater bodies (Figure 1), around the harvest of three most locally available fish species that provide 80% of total landings i.e. Nile perch, tilapia and catfish (FAO-Fishstat 2009). According to the Uganda Bureau of Statistics, the current per capita fish consumption is roughly 10kg/person/year.

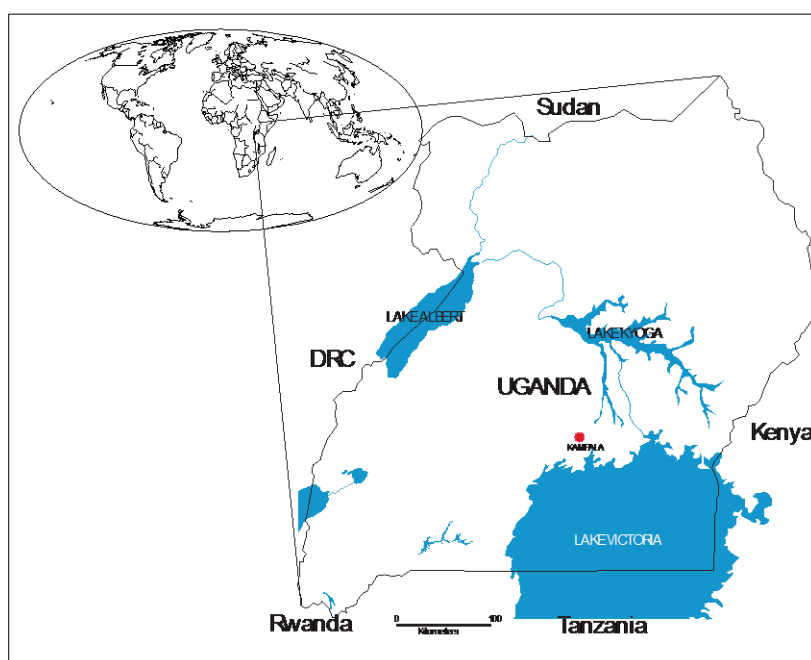


Figure 1: Map showing location of Uganda and major water bodies.

The fisheries sector in Uganda grew from 0.5 million USD to 140 million USD in the period from 1998 to 2008 (ABP 2009). Trade in the fisheries sector accounted for 2.5% of the total national GDP in 2009 and 90% of the fish exports were attributed to Nile perch (Fulgencio 2009). The fisheries sector provides employment directly or indirectly to over 1 million Ugandans (Fulgencio 2009).

However the situation since early 2000s has been changing for the worse in capture fisheries (Kabahenda and Hüsken 2009). Increased fishing pressure, pollution and illegal fishing practises have all contributed to stock reduction from these lakes and several industries have closed due to lack of fish while others operate at low capacity (Marriott *et al.*, 2004). There was a 46% drop in revenues from fish exports in the period 2006 to 2009 from 141 million

USD in 2006 to 75.6 million USD in 2009 due to decreasing export volumes (Hammerle *et al.*, 2010).

There is sufficient supply of fish for close to 75% of the population, attributed mostly to the location of major towns along the lakes with a tradition of eating fish and considerable efforts to increase aquaculture production have been made (Isyagi 2007). Aquaculture has attracted interest and investment from both the private sector and public institutions in the country (UIA 2005). It has grown in the past 10 years from less than 5000 tonnes a year in 2002 to over 50,000 tonnes in 2008 and catfish accounts for two thirds of the production (FAO-Fishstat 2009). However the sector suffers from an uncoordinated marketing system (Hammerle *et al.*, 2010).

The necessity for a value chain study on an important species like the African catfish is evident from the obligations and plans by the Uganda government to the international trade partners and the local population. For example, the UN, of which Uganda is part, clearly states through its FAO constitution Article 1(d) the pertinent need to improve processing, marketing and distribution of food and agricultural products (FAO 1945). This goal is central to both the Strategic Framework 2000-2015 and 2010-2019 of the UN-FAO (FAO 1999; FAO 2010a). Similarly the Uganda National Aquaculture Development Strategy (2008) has four fundamental principles. The third principle is to address aquaculture as a profitable investment and enhanced marketing efforts have been cited to be critical (Wathum and Rutaisire 2008). Farmers and participants along the entire value chain are important actors in all the above efforts.

Several studies have been conducted on fish marketing in Uganda (Reynolds and Kirema-Mukasa 1991; Odongkara 2003; Dhatemwa 2009). However the studies do not address aquaculture products on the Ugandan market with a value chain emphasis similar to studies on farmed fish like salmon in Norway, (Tveterås and Kvaløy 2006), Sea bass in the USA (Wilde 2008) and Chinook salmon in New Zealand (Sankaran and Suchitra Mouly 2006). This study aims at developing the necessary marketing information through a value chain approach using a global perspective. This is of importance to Ugandan fish farmers. A farmer can know which products of catfish are profitable for each market channel and plan their production and marketing accordingly. African catfish is chosen for the study since it accounts for two-thirds of Uganda's aquaculture production (FAO-Fishstat 2009). Its farming technologies are well developed (Isyagi *et al.*, 2009a) and regarded to be of commercial importance in most aquaculture enterprises in Uganda (USAID-FISH 2009). Improvements in production and technology have not been followed by similar efforts to improve the efficiency of the value chain, similar to what has been seen for developed aquaculture producers like Norway (Tveterås and Kvaløy 2006), Vietnam (Loc *et al.*, 2010), and New Zealand (Sankaran and Suchitra Mouly 2006). These aquaculture fish producing countries have realised that with the growing specialisation and globalisation, systemic competitiveness is becoming increasingly important and efficiency in production is a prerequisite to market penetration for sustained income growth. This requires an understanding of the dynamic factors within the chain (Kaplinsky and Morris 2000).

It is therefore necessary to study the catfish farmer's share in the value chain. Most Ugandan commercial fish farmers have been in the business for less than 5 years (USAID-FISH 2009). The viability or profitability for these long term investments and the industry as a whole will to a large extent be determined by the way business activities are carried out.

With this background, the purpose of the study is to answer the question “What value creation changes should African catfish farmers in Uganda adopt to improve sales, cost performance and margins?”

The main aim of the study is to develop structural changes in the African catfish value chain that can improve the profitability of farmed African catfish products in Uganda.

Specifically, the study has the following objectives;

First, determine the main actors, distribution channels and relationships in marketing African catfish products.

Second, analyse the different value chains for African catfish products, their relative value distributions and their effects on farmers.

Third, determine the product needs of value chain customers to suggest key success factors that can improve profitability of African catfish farming in Uganda.

To achieve the objectives above, the following framework is used in this study.

The first part of the project looks at the Ugandan aquaculture industry and gives an overview of the industry and its competitiveness by global standards. The attractiveness of the industry is analysed using Porter’s five forces model.

The second part is a detailed analysis of the value chain that focuses on the supply chain, main actors and roles, relationships, power and trust, governance and value distribution.

Finally there is a brief description of positioning in the industry with emphasis on the key success factors in the industry, addressing the issues of demand and supply among the value chain actors.

2 THEORETICAL DISCUSSION

This chapter looks at previous studies and findings of other researchers on fisheries value chains around the world to draw out the design methodology. First there is a general section of the concept of an industry and the methodologies used by other researchers in industrial analysis. Focus is put on the firm’s external environment detailing the structure, determinants of profitability, i.e. demand and competition, followed by how attractive the business is and the key success factors. Within the industry lies the supply and value chains and focus is put on these concepts respectively looking at methodologies used to analyse the flow of goods and value within the industry. Finally a brief overview of empirical findings of other researchers in the fisheries industries from different countries and a summary of all the literature ending in a framework used to design this study.

2.1 The Industry

The competitive environment must be understood for a successful business strategy. The main aim of any business is to make a profit and the source of this profit is the external environment to the firm. The external environment that a particular firm is working in is the industry. Thus industrial analysis becomes important to a firm if it is to survive in the business sense. Industrial analysis has become essential for the two major roles in business strategy. First at corporate level, choosing which actors to collaborate with and which

resources to allocate where and second at business level, for competitive advantage focusing on consumer needs and preferences (Grant 2005). Understanding the essentials for this industrial analysis can be derived as follows. First the firm must create value for customers for it to make returns and so the customers' needs and preferences need to be assessed and understood. Second the firm needs supplies to make this value and therefore this requires it to understand the suppliers with their business relationships. Third to make a profit the firm must understand the competing actors that are using similar value-creation opportunities in the industry. It is the interaction of the firm with these three players—the customers, suppliers and competitors—that determine its success or failure, and this is the industry environment (Grant 2005).

2.1.1 Factors that determine industry profit: Demand and competition

For a firm to have a proper business strategy that enables it to thrive, it must understand the factors that influence profit in that industry. By transforming inputs into outputs, the producer is making value for customers. If the customer can pay a price above the production costs, then value is created. However, value created is not direct profits since usually the forces of competition between producers and customers distribute it amongst them. Profits made in an industry depend on three factors: i) Value of the products to customers ii) Competition amongst producers and iii) Bargaining power of producers and buyers.

Analysis of the industry provides a single structure to bring all these three factors into examination. This helps in understanding whether the industry is attractive for investment or not (Grant 2005).

2.1.2 Attractiveness of the industry

Whereas some industries regularly earn profits, others struggle to break even. It should therefore be noted that profitability of an industry is not an arbitrary event but a premise with systematic specifics influencing it. Some industries enjoy high margin monopolies with specialised products (e.g. pharmaceuticals) while others are in perfect price competition e.g. the fish supply industry with a lot of substitutes (Grant 2005). A whole spectrum of industrial structures exists with monopolies on one end and perfect completion on the other. In this spectrum, positioning is dependent on mainly four factors in the industry, i.e. number of firms, entry-exit barriers, product differentiation and access to information and knowledge. Analysing the main structural features and relationships within an industry makes it easy to predict competitive behaviour and profitability. In the real world numerous features of an industry determine its level of competitiveness and profitability. However a widely accepted model (Figure 2) for examining these features has been developed by Porter (1998a).

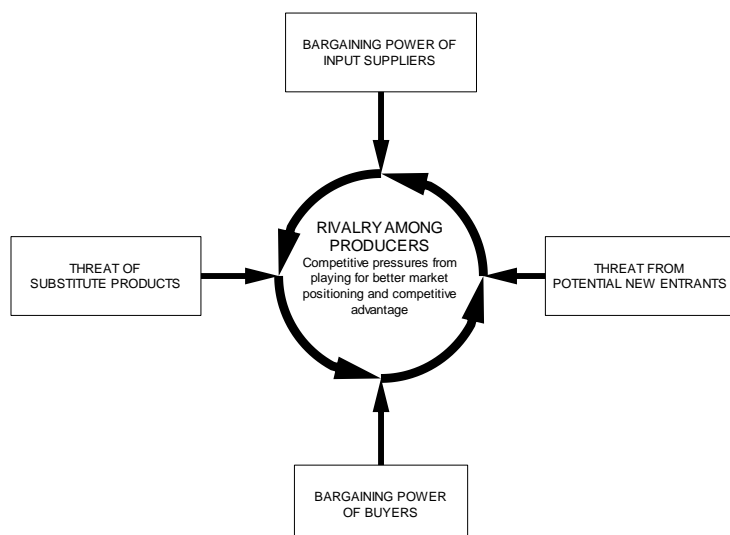


Figure 2: Five forces model for industrial competitive advantage (Porter 1998a).

The horizontal forces include threats from substitute products, new entrants and rivals whereas the vertical forces are due to bargaining power between suppliers and customers. The model is important in assessing the potential profitability of an industry (Thompson and Strickland 2001). The first force determines the power of suppliers to drive up the prices for inputs. The second evaluates the power of customers to drive down sales prices. The third shows the extent to which different products can substitute the product. The fourth is the ease with which new competitors can enter the market and then push prices down.

2.2 Industry Supply and Value Chains

After understanding how the framework of the industry determines competition and profitability, it is possible to predict the future profitability of the industry (Grant 2005). This involves description of the industry and market structures and relationships within that from both supply and value chains. It is from analysing these that it becomes possible to suggest strategies to adjust the industry framework.

2.2.1 From supply chain to value chain

The supply chain denotes a series of activities in which a product or material is transferred from the one point to the final point while in the value chain; instead of just transferring the product, value creation and addition is involved (Feller *et al.* 2006). As an example, suppose the flow of tilapia is from farmers to wholesalers to retailers and finally consumers. If the tilapia just goes through this channel without any grading, sorting or processing then it is a supply chain. If at each stage along the line, we add some value like grading, processing, packaging, cooling and storage, then it becomes a value chain. Value occurs when needs are fulfilled in terms of supply of goods and services in a transaction. Therefore, value flows from the person (or institution) receiving the goods or service i.e. the customer (Feller *et al.*, 2006). This is a key difference between a value chain and a supply chain: They flow in opposite directions (Figure 3).

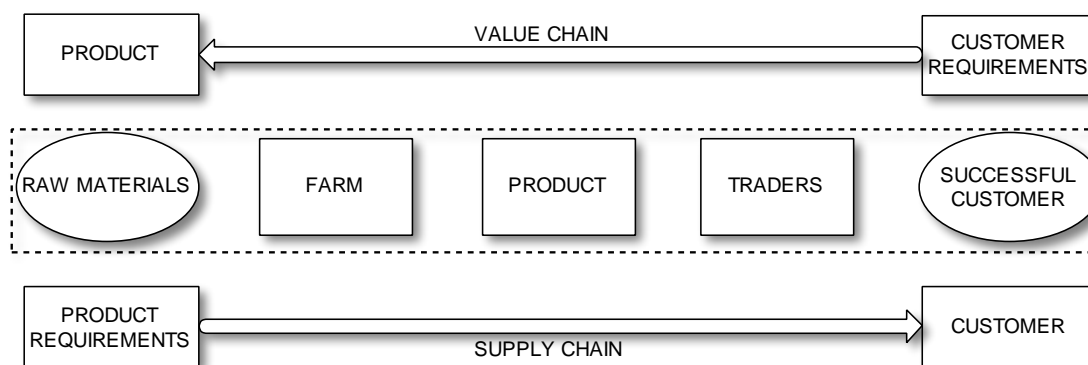


Figure 3: The concept of supply and value chain (Feller *et al.* 2006).

The concept of efficient supply chain management is therefore mostly concerned with the reduction in production costs while value chains take this a step further and look at the effective ways of generating profit. Supply and value chains denote balancing views of the same business process that entail flow of goods and services (demand) in one direction and value (cash flow) in the other. The producer is the source of the supply and the customer of the source of the value (Porter 1998a). Several studies have covered the issues of supply chain management in the food production industry, for example Folkerts and Koehorst (1998) on beef and Thorpe and Bennett (2004) on Nile perch. Thorpe and Bennett (2004) used the supply chain management model of Folkerts and Koehorst (1998) to study how changes in the market and supply chain of Nile perch may have undesirable outcomes for producers at the start of the chain. However, much as supply chain models have been successful, their use is being challenged with increasing interest in the value chain concept. Several factors now drive attention to a more profitability-oriented value chain analysis (Feller *et al.*, 2006).

- Increasing competition and focus on innovation as an element of strategy. Enormous competition has been caused by globalisation and a shift to value chains as a tool to model survival strategies is preferred by most actors.
- Evolving governance models for the extended enterprise. Interest in the value chain has increased as a primary tool for examining new models for business governance.
- Globalisation in outsourcing and purchasing has levelled the ground for value addition and thus the need for a global value chain model as a model of business in many industries.
- Benefits are already squeezed out of production and the supply chain. In order to improve the operational efficiency of other value addition activities in the business, shifting perspective from the supply chain to the value chain is a must.

Supply chains can generate maximum value only if they synchronize the flows of supply with the flows of value from customers addressing rapidly changing tastes, preferences, and demand. It is important to think of supply chains and value chains as integral.

2.2.2 The Value Chain

The concept of a company's value chain looks at "a systematic way of analysing firm's activities and the interactions within that are necessary for competitive advantage" (Porter 1998, p33). The value chain is a complex phenomenon in the real world but abridged illustrations have been used for comprehension of the subject. For example Figure 4 below shows the activities along the value chain according to Porter (1998).

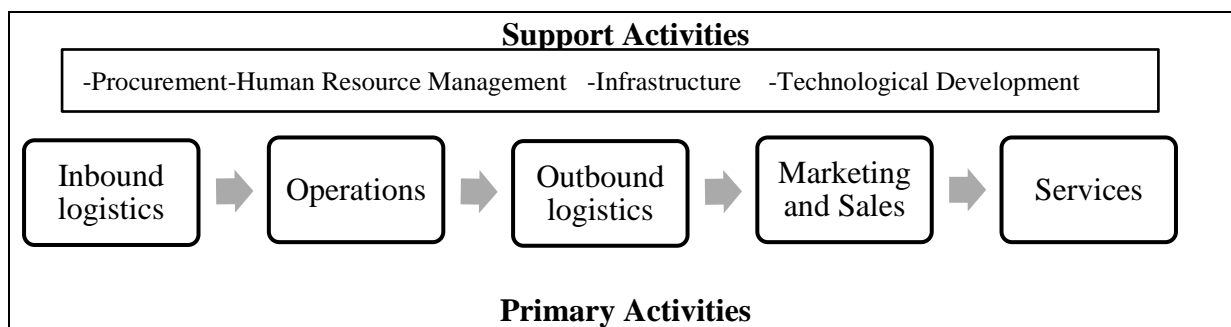


Figure 4: Porter's value chain.

The value chain for an industry looks at the interactions within a chain flowing from a primary harvester to the customer. Value chain in this study will be defined as the sequential set of primary and support activities that the industry performs to turn inputs into value-added outputs for its external customers (ICH 2010).

The chain's primary activities are those that include product creation, marketing, delivery and after sales services. This group of activities is categorised into five distinct stages (Porter 1998a).

- Inbound logistics which are the activities for securing inputs. For example receiving, storing, distributing feeds and equipment, receiving and handling of brood stock or fingerlings, managing inventory, transport scheduling for suppliers.
- Operations which are the activities involved in transforming the inputs into a final product. On a farm they usually include production of fingerlings from brood stock and table fish from fingerlings, other forms of fish grow out, processing and quality management.
- Outbound logistics that are activities associated with fish and fish products distribution to customers may include processing orders, shipping and scheduling deliveries.
- Marketing and sales involve activities that deal with having the fish available for the buyers when they want it and inducing buyers to purchase with incentives like advertising, promotions, price reductions and selection of marketing channels.
- Services boost or obtain value from the fish product after purchase for example replacements, repairs, training farmers and installations.

The chain's support activities reinforce the primary activities as a result of exchanging inputs. These support activities are in four categories.

- Procurement activities associated with buying inputs to use in the firms value chain and not the purchased inputs themselves. This purchasing of inputs includes the growth facilities like tanks and cages, gear and equipment like fishing nets, water pumps, laboratory equipment and administrative infrastructure like buildings.
- Human resource management deals with hiring, firing, training, developing, and compensating personnel.
- Firm infrastructure is associated with general management and planning so as to access fish, financial services, drawing up contracts, and fish quality management.
- Technology development activities are either the efforts to improve fish culture and processing facilities such as harvesting methods or technology symbolised through equipment.

Value reflects the total earnings at a given point in the chain and a firm makes a profit only after the value exceeds production costs (Grant 2005). Scholars argue that the value concept rather than cost concept should be used when looking at competitiveness since firms often raise their costs to improve value of a product or item. Such a product would be priced highly but at the same time the customer will have higher value for money (DFID 2008). The value chain margin is then the difference between total value added and total production cost and sustainable value chains are those with fair distributions of margins amongst actors (Porter 1998a). Each value chain performs differently from the other depending on the actors, how they relate to each other, how information flows and who is in command of the chain (Sturgeon 2000). These will now be discussed in detail.

a) Actors

For any chain to be feasible, actors need to collaborate without a single firm traversing the whole chain operation. All actors work in tandem from deliverance of raw materials to consumption of the finished product (Porter 1998a). Actors fall on two sides of the chain with upstream actors being relevant in the supply and standards of raw materials and downstream actors with roles of marketing the end product from the processors in the middle.

The upstream actors are those who supply the farmer (Loc *et al.*, 2010). These include fish feed millers, fingerling producers, equipment suppliers and technical advisors. The fish farmer is the centre of the activities and he turns these inputs into the final product. Downstream are those that transform and use the products from the farm. These actors include farm gate buyers, fish processors, traders, retailers, supermarkets, and finally consumers. In addition are the support actors that facilitate the smooth running of the chain. These are spread across the chain as groups of support organisations, standards bodies and government (Gestsson *et al.*, 2010). Support groups include farmers' cooperatives, non-governmental organisations, aid agencies, third party certification bodies and government ministries of agriculture and trade. Among these actors, there are three types of flows emerging in an ideal value chain. First supplies flow downstream, second finances flow upstream and third information both ways. Any flow is made possible by interactions between actors and therefore relationships are a vital element in the value chain.

b) Relationships

With increasing globalisation and competition products are becoming similar and relationships with suppliers and customers are becoming increasingly important for competitive advantage. Consequently, businesses have become fixed on relationship management as a strategic capability to achieve market leadership and profits (Kubi and Doku 2010). Relationships in the chain can be *win win* (plus-sum) where actors work together for their mutual value and benefit and in the worst case *predatory* (zero-sum) where an actor uses their bargaining power to gain as much as possible from the chain at the expense of other actors (Gummesson 2002). There is a general trend that most industries and firms are shifting from *zero sum* to *plus sum* relations for long term business survival. Lynch (2006) reports that increased margins by close relationships and collaborations between suppliers and customers create mutual value among the firms in a chain. Porter (1998a) argues that viewing all participants in a chain as one system and thus create higher margin for the whole system can be more beneficial to the whole chain than focusing on the individual links in the chain. Gummesson (2002) further illustrates this using the concept of return on relationships to show the profitability associated with satisfaction between suppliers and

customers. He shows that the external business environment of a firm holds a large fraction of the products cost than the internal environment. The exchange of information within and between these two environments is important to maximise returns in a value chain.

c) Information and learning

Collaboration between trading partners to reduce risks and costs in supply chains has become important for many production companies (Yigitbasioglu 2004). Supply chain partners are increasingly sharing more information with each other on parameters such as product demand, inventory and production schedules. However, the sharing of sensitive information may lead to undesired outcomes such as information leakage and hold-up costs (Yigitbasioglu 2004). Bailey and Francis (2008) showed that inefficiencies could also exist within a highly sophisticated and collaborative value chain with high levels of information transparency and collaborative planning and forecasting. Despite these common trends and risks, little is known about how buyers and suppliers in the supply chain decide what information to share with partners (Yigitbasioglu 2004). According to Drucker (1998) layers of management in organisations work as gatekeepers for information, collecting, evaluating, assessing and channelling it to other units. Information and knowledge should be shared hand in hand for the mutual benefit of participants in a value chain (Porter and Millar 1985). Emphasis should be put on companies working for more than buyer and seller relations, but trade partners with an aim of improving value for the customer (Grunert *et al.*, 2005). This requires a seamless flow of information and knowledge which is key in innovation and performance (Pitta *et al.*, 2004). Some actors hold onto information so that this scarcity of information and knowledge through intentional actions gives the holder an upper hand in business and usually becomes a barrier of entry for other players (Kaplinsky and Morris 2000). This then raises the issue of what Gereffi *et al.*, (2005) term as governance of the value chain.

d) Governance

Governance deals with exerting control in value chains about process and product. This is common in inter-firm relationships within global value chains. For example the way leading European and UK supermarkets exercise control over fresh fish products all the way from Iceland fishing grounds to the final consumer. They have a say on how the fish is caught, handled and delivered. Humphrey and Schmitz (2004) suggest that the questions of what to, how to, and when to produce, define a set of rules that are to be followed in a value chain. Major customers in developed countries set these rules for suppliers when designing products and processes in order to meet a particular target price.

The need for the governance of value chains has been extensively studied (Humphrey and Schmitz 2004; Kaplinsky and Morris 2000). Understanding the chain governance structure helps explain the distribution of gains along the chain. Governance structure refers to the way relationships within a value chain result in a systematic efficiency although, on the other hand, external governance structures may exist in form of standards adherence in order to access markets (Keane 2008).

Gereffi *et al.*, (2005) identified three determinants of global value chains governance and change as the complexity of transactions, ability to systemise transactions, and the capabilities in the supply-base. Their theory generates five types of global value chain governance as hierarchy, captive, relational, modular, and market, depending on the levels of

explicit coordination and power asymmetry. Although Gereffi *et al.*, (2005) identify and discuss these five types, Keane (2008) suggests that these are non-exhaustive and classifying them as quasi-hierarchical and market based governance structure may be better for fresh products. For quasi-hierarchical governance structure, a few lead firms set the rules of production, process and control procedures to be followed. The buyers are in effect bonded to the supplier with fear of risk to lose business if they do not meet the set rules. On the other hand, a market based governance structure can be observed if price controls the chain with many buyers and sellers existing which is common with traditional fish markets (Humphrey and Schmitz 2004).

It can therefore be noted that to remain competitive, some form of governance in a value chain has to exist, someone has to lead and others to follow and this form of control leads to issues of who holds power and how well they are trusted in the value chain.

e) Power and trust

“The effectiveness of a governor’s command of a chain does not only reflect the power of its sanctions, but also the trust which its suppliers or customers have in it.” (Kaplinsky and Morris 2000, p. 73). The quality of a relationship between buyer and seller is a vital construct in the linkages of a value chain. Knútsson *et al.*, (2010) reported that trust in a relationship can create value shared between the firms within the value chain and will determine the effectiveness and longevity of the relationship and thus the value chain itself. Creating value rather than adversaries in the *plus sum* trade considering all actors can be achieved with quality collaborations in terms of trust. Kaplinsky and Morris (2000) suggest the following to evaluate and categorise a chain as high or low trust. Observe the behaviour of actors in relation to length of contracts, nature of ordering procedure, nature of the contractual relationship, modes of inspection used in accepting incoming materials, degree of dependence which firms have on each other, types of technical assistance which flows along the chain, nature and methods of communication along the chain, determination of prices, nature of credit extended along the chain especially to exporting firms, modalities of payment to outsourced informal producers. According to Gestsson *et al.*, (2010) trust and positive attitudes must be built on firm values like willingness to cooperate and not necessarily formal contracts.

Power has been defined as the ability to impose one’s will on another to achieve a goal and as such a pillar of influence (Foucault 1980). It can either be formal in case of legislations or informal as in case of information. Bargaining power is often held by those who possess instruments of power e.g. information on demand and prices of a product or a business protocol necessary to be followed to gain access to specific markets.

The outlined value chain analysis methods have been challenged in detection of market power in a value chain for example by Gudmundsson *et al.*, (2006). They argue that this methodology only represents a snapshot of the activities and revenue distributions along the value chain to estimate the market share level and may not allow detection of market power but value accumulation. On the other hand, they suggest that to solve this issue, data must be collected over a relatively long period of time.

2.3 The Firm's Competitive Position

Another important step in the analysis of an industry's attractiveness and competitiveness is to study the market position of competing actors (Grant 2005). Strategic group mapping is one way used in this regard, where a strategic group is defined as a group of rival firms with similar competitive approaches and positions in the market (Porter 1998a). Groups can range from similar production and prices to similar distribution channels and practises. Through this analysis, it becomes possible to determine whether the industry driving forces and competitive pressures only favour some strategic groups and therefore whether disadvantaged firms can shift positions. Also, valuable information on profit potential of different groups might be explained by the strengths and weaknesses exposed by virtue of the positioning. Closeness in strategic groups is highly indicative of competitive rivalry among producers (Thompson and Strickland 2001).

2.4 Key Factors For Competitive Success

It is the key success factors of a firm in a market environment that enables it to survive and prosper (Grant 2005). In order to do that, it has to meet two criteria. It has to supply what the customers want and it must survive competition (Feller *et al.*, 2006). To supply what customers want calls for identifying the customers, their needs and what determines their choice of a product or preference. For example in Sri Lanka Gestsson *et al.*, (2010) found that much as local customer's choice of fish was driven by price, foreign customers were driven by quality. Key success factors are functions, activities or business practices, defined by the market and as viewed by the customers that are critical to the vendor/customer relationship and ultimately determine competitive success or failure (profit or loss). An example would be the identification of the key success factors for establishing a supermarket. The process is outlined in Table 1 below.

Table 1: Identifying key success factors for a supermarket (adapted from Grant, 2005).

What do customers want? (Analysis of demand)	How do firms survive competition? (Analysis of competition)	Key success factors
<ul style="list-style-type: none"> • Low prices. • Convenient location. • Wide range of products adapted to local preferences. • Fresh/quality produce; good service; ease of parking. 	<ul style="list-style-type: none"> • Markets localized. • Intensity of price competition depends on number and proximity of competitors. • Bargaining power a critical determinant of costs 	<ul style="list-style-type: none"> • Low-cost operation requires operational efficiency, scale efficient stores, • Differentiation requires large stores, convenient location, easy parking.

Key success factors can be broadly put into six categories relating to technology, production, distribution, marketing, skills and organisational capability (Thompson and Strickland 2001).

2.5 Empirical Studies on Fish Value Chains

Several authors have 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 revealed that structural changes that improve customary institutions and informal market relations can improve the livelihoods of fishers and farmers in both high and low value chains.

The issues of structural changes in fisheries value chains have also been studied in Iceland (Knútsson *et al.*, 2010) and Sri Lanka (Gestsson *et al.*, 2010). Knútsson *et al.*, (2010) investigated changes in strategic positioning in the Icelandic cod fish industry's value chain. They studied the substantial changes in the structure of harvesting, production and processing, export activities and marketing emphasising the main forces that cause changes. The characteristics of the Icelandic fisheries sector had changed from being a centralised, regulated and an alliance based structure to a deregulated, diversified and vertically integrated structure. Their study revealed that this change strengthened the industry competitive status and agility. They attributed this to the high degree of vertical integration of the industry. They concluded that better control of the value chain and use of sophisticated technology enables companies to increase value creation in production.

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. 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.

2.6 Theoretical Model for the Study

Using the literature as a framework for the study of the industry and value chains, the following is used as a structure for this study.

- 1) Overview of the aquaculture industry in Uganda
- 2) Demand of fish and fish products in Uganda
- 3) Determinants of African catfish farming industry profitability in Uganda
- 4) Fish supply and value chains in Uganda
- 5) The structure of farmed African catfish value chains in Uganda
 - a) Actors
 - b) Flow of farmed African catfish products
 - c) Relationships
 - Information and learning
 - Power and trust
 - Governance
- 6) Value added distribution of farmed catfish
- 7) Competitive positioning
- 8) Key factors for competitive success in farming African catfish in Uganda

The first topic looks at the important fish species in Uganda, the production trends in the industry, the related earnings, and the overall contribution of the aquaculture sector to Uganda's economy. The second topic discusses the recommended demand for fish and fish products in both the Ugandan and regional markets. The third topic looks at the competition that catfish products face from other meat sources on the Ugandan market and the pricing trends over the years. This is followed by a close look at the competitive forces within the industry itself that determine profitability. Topics four to six detail the value chain of the farmed African catfish in Uganda. Topics seven and eight look at the customer's needs and how they can be satisfied for a company to survive competition. This gives a summation of how the catfish farming industry is presently structured in Uganda and suggestions on how it can be improved to meet the growing demands from customers and pressure from competitors and still be a profitable business to all actors that serve in it.

3 METHODOLOGY

The study required collection of both primary and secondary data that were both qualitative and quantitative. Primary data was used in the analysis of the value chain of farmed catfish while secondary data was for both value chains and industrial analysis.

3.1 Primary Data Collection

The study area used in the collection of data was the central and eastern Uganda in the districts of Kampala, Wakiso, Mukono, Jinja, Iganga and Kamuli. Semi-structured interviews were conducted in these areas from June to July 2010. This approach is opted for in recognition of the complexity in smallholder agriculture (Isyagi 2007). Semi-structured interviews were preferred because they guide the respondent to the topic and also leave room for them to discuss issues that are most appropriate (Stenius *et al.*, 2007).

Interviews were carried out by a team of five individuals. Prior to carrying out the interviews, the interviewers were trained on how to handle the data collection process in relation to the aim of the study and pre-tests of questionnaires were done in Kampala to get *a priori* feedback on how well the questions would be received in the field. Several revisions were made and the team set off for the four week data collection period.

Access to all interviewees was gained through authorities by a written request. These were district officials responsible for farmers, markets and marketing. The chairman/leader of the community well known to the interviewees was used to introduce each of the interviewers to the respective respondent. This method was chosen to build trust during the interviews as well as to generate in-depth individual data about the respondents and to lower their inhibitions in discussing personal material as they know and trust the community leader (Highet 2003). Formal letters of introduction and emails for booking interview dates were issued to six factories, 11 supermarkets and 10 local markets. Positive responses were received from three factories, 8 supermarkets and 10 local markets.

Regular meetings were held every evening after the interview sessions to reflect on the developments and adjustments were made to the questions as needed, as was observed as well by Amos *et al.*, (2004). The interviews explored the role and meaning of fish and aquaculture in the businesses and livelihoods of actors (Appendix I). For example, farmers were interviewed about their production, management, constraints, sourcing of materials and support plus their collaboration with other members in the industry. Traders gave details of the factors that determine the choice of fish to trade, the preferred markets and marketing systems, the technology in maintaining fish quality and volumes traded, packaging and constraints in the business among other issues. On the other hand consumers were interviewed about the factors that determine what, how, where and when they buy fish or other competitive products on the market.

Two focus groups were also conducted in Jinja and Kamuli at Masese and Kibuye landing sites respectively. This was done to collect views of the fishing communities about the status of the wild fisheries and their views on aquaculture as an alternative to the supplies from the lake. Information was also gathered on the use of catfish as bait for fishing Nile perch.

3.2 The sample

The sample used included 90 farmers (81 male, 9 female), 13 restaurants, 51 traders and 12 processors and 150 consumers. The fish farmers interviewed in Uganda were those who had at least stocked their culture units, managed and harvested fish and their existence was registered at the district and community farmers' associations. The total number of farmers on the lists was estimated to be close to 250 though it was clear less than 50% were functional at the time.

The traders in this study fell into two categories; those who sell fresh fish and those who processed fish before selling. The latter group had about six traders. Factories included Nile fishing company, Marine and Agro Ltd., and Victoria fishing company. The fish marketing outlets that were visited included the open space fish markets in Iganga, Kamuli and Jinja and supermarkets in Jinja and Kampala. The consumers were randomly selected from Kampala and Jinja with a precondition of having eaten fish at least once in the last six months and being decision makers in their households. The consumers were interviewed in markets, restaurants, shops and households. Interviewing consumers during the act of fish purchasing

or consumption is useful in verification of data given by the traders/sellers (Isyagi 2007). It is easier for the consumer to respond as the activity is still fresh in their memory. The two focus groups had 23 individuals for Masese and 18 in Kibuye.

Four Icelandic farmers cum processors were also interviewed (Appendix II). This sample was chosen out of convenience and prior knowledge of their activities in selling farmed fish for export. Their activities are vertically integrated from production, processing and exporting and their number represent a broad sample of aquaculture processors and exporters.

3.3 Secondary Data Collection

Secondary data was retrieved from the Uganda Bureau of Statistics and Ministry of Finance Economic Planning and Development. The data on imports, exports and total production in tonnes of different lakes for the different species was collected from the annually issued national statistical abstracts; data on prices was collected from the monthly consumer price indices entries for all animal protein products on the Ugandan markets (UBoS 2010). These sets were collected for the period 2001 to 2010. Other statistics and figures were obtained from vetted international online databases like the Food and Agricultural Organisation, World Bank and the International Monetary Fund (FAO-Fishstat 2009; IMF 2010). Reports, working papers and peer reviewed literature available on the various aspects of the aquaculture sector in Uganda were used.

3.4 Analysis

Interview data was hand recorded on the open-ended questionnaires that were used during the process. Questionnaires were designed for specific groups i.e. for farmers, processors, traders and consumers. Data from the two focus groups was hand recorded on sheets of paper and later indexed for similarities and differences in content. Only part of the collected data was necessary to answer the objectives of this study. Quotations in results of qualitative research were used to illustrate some key issues from communities (Amos *et al.*, 2004). These quotes are coded MF and KF for Masese focus group and Kibuye focus group respectively. Quoted individuals are listed in Appendix II.

The methodology by Grant (2005) and Porter (1998) was used to conduct the general industrial analysis. Supply was calculated as total fishery production and imports minus exports and re-exports. Recommended demand was calculated as the amount of fish required for the current population so as to attain a per capita consumption of 15.8 kilograms target as outlined by the FAO (2010b) and (Delgado *et al.*, 2003). Using the whole population helps account for zero consumption which provides richer information and minimises methodological problems (Dey 2000). For example, Jagger and Pender (2000) reported that fish is consumed by 75% of Ugandans but the demand here is projected for 100% of the Ugandan population.

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 catfish 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 figures obtained from interviews (Appendix III). All prices used for the study are converted to US dollars at the exchange rates on 31st of December for the appropriate year (Thordarson 2008).

The data retrieved was used to structure the study in the following stages. Secondary data was used to generate the overview of the aquaculture industry in Uganda. Analysis involved the regional demand of fish, the competition in catfish farming using Porter's five forces model. This is followed by examining the existing value chains through which the farmed catfish products are channelled documenting the main actors and their relationships, the strategic positioning of actors, and finally key success factors of the Ugandan aquaculture industry. Data from the Icelandic fish farmers was used for key success factors to discuss and determine possible solutions and suggestions to problem in the Ugandan farmed catfish value chain.

4 ANALYSIS OF THE AQUACULTURE INDUSTRY IN UGANDA

Aquaculture has been practised in Uganda since the 1950s (FAO-Fishstat 2009). During the first five decades aquaculture was mostly practiced on a subsistence scale with little or no aim of sales and revenue (Jagger and Pender 2000). In 2005, the efforts for aquaculture development intensified mostly for two reasons: i) a drop in capture fish volumes and a decrease in exports, ii) the goal of the Nutrition Policy and Fisheries Strategy for every Ugandan to be able access cheap fish protein with a target of >15 kg/person/year in accordance to the FAO world average, up from 10 kg/person/year (FAO 2010a).

African catfish (*Clarias gariepinus*) and Nile tilapia (*Oreochromis niloticus*) are the two main species farmed in Uganda (FAO-Fishstat 2009). The production of catfish is more than twice that of tilapia. *Clarias gariepinus* is a subtropical fish with a growth temperature range of 8°C to 35°C. The species is found in most African inland freshwater bodies with a pH of 6.5 to 8.0 (Binohlan 2010). It is a bottom dwelling fish but only reported to occupy up to a depth of 80 m. *Clarias gariepinus* (Figure 5) has been reported to grow to 90 cm in length, weighing a maximum of 60 kg and living up 8 years with first maturity attained at 30 cm (Binohlan 2010).



Figure 5: The African catfish (*Clarias gariepinus*) cultured in Uganda.

Clarias gariepinus has been popular in African and Ugandan aquaculture in particular, mainly due to its wide tolerance to environmental conditions (Isyagi *et al.*, 2009a). It can survive low oxygen levels (less than 3 mg/l) as a result of the presence of an accessory breathing organ for capturing atmosphere oxygen. It is a bottom feeder but occasionally feeds at the water surface and requires high protein feed (Binohlan 2010).

Earthenpond production accounts for most of the catfish aquaculture production units. In 2006, cage farming of catfish and tilapia in lakes and reservoirs using low volume (8 m³) high density cages was started and is continuing to grow (USAID-FISH 2009). The industry produces mostly fry, fingerlings/bait and table-size fish. The major bottlenecks requiring attention in the industry are quality of seed, feed, water management, farm management and marketing (USAID-FISH 2009). Several of these have and are still being addressed in order of building up a full-fledged private sector driven aquaculture industry in Uganda. Uganda's aquaculture production has increased from 5,000 to 50,000 tonnes per year with a surge in catfish and tilapia production in the past six years (Figure 6).

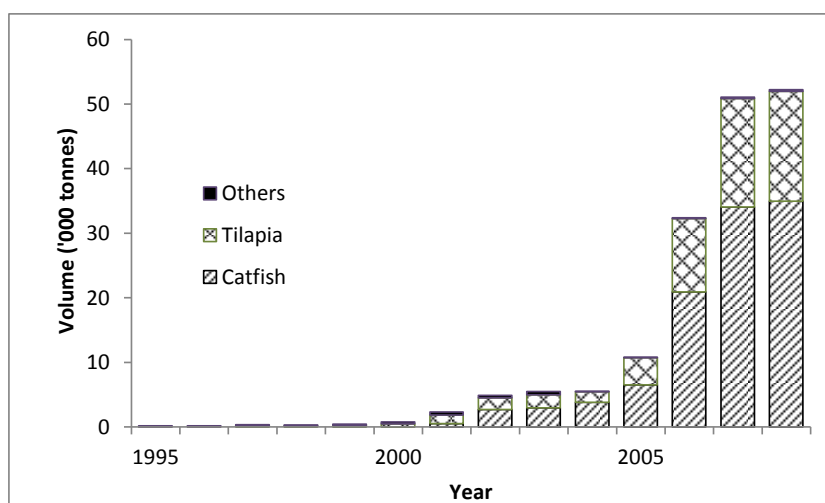


Figure 6: Aquaculture production in Uganda by species since 1995 (FAO-Fishstat 2009).

Thirty five thousand tonnes of catfish were produced in 2008 compared to 17,000 tonnes of tilapia in the same year (Figure 6). However it is worth noting that these officially available FAO data on aquaculture growth are estimates from the Ministry of Agriculture, Animal Industry and Fisheries (MAAIF) possibly showing the production potential and not necessarily the actual volumes produced and sold or consumed.

The contribution of Ugandan aquaculture to global production and national economy has been negligible but is growing. By 2008, Uganda was accounting for 0.05% of the world aquaculture production and was third in African aquaculture production after Egypt and Nigeria (FAO-Fishstat 2009) though its contribution to the national GDP is negligible. Available figures for 2005, when production was less than 10,000 tonnes, estimated that about 32,000 individuals were involved directly or indirectly in aquaculture (FAO 2005).

Over the years, the catfish farming industry in Uganda has grown in value from approximately 0.12 million USD in 2000 to about 70 million USD in 2008 (FAO-Fishstat 2009). With this growth in the sector and the need for responsible aquaculture development comes several challenges along the supply chain including issues of production, marketing and governance (FAO 2010a). Then again, the lack of necessary information (Dorosh and

Thurlow 2009; Gudmundsson *et al.*, 2006) and technologies (Petra 2010; Isyagi *et al.*, 2009a) to tackle these challenges could put the industry at risk.

Several products of farmed catfish on the market are sold through different methods of marketing. Farmers and middlemen buy catfish fingerlings from hatcheries (USAID-FISH 2009). Table-size fish is sold live, frozen, smoked, or filleted to consumers by farmers, restaurants, processors and farmers' cooperatives (USAID-FISH 2009). Regionally most of the fish is exported to Congo, Sudan and Kenya (Dhatemwa 2009).

4.1 Recommended Demand for fish and fish products

Fish and fish products are traded both within Uganda and across the region. The following sections provide details on regional and local demand for all fish species and the demand for catfish fingerlings and bait.

4.1.1 Demand for fish and fish products in surrounding countries

Overall the total demand for fish products in the nations surrounding Uganda has increased. From 2000 to 2008 the total demand increased from 2.2 to 2.9 million tonnes while the total supply decreased from 0.82 to 0.78 million tonnes (Table 2).

Table 2: Regional fish demand and deficits (1000 tonnes) for countries neighbouring Uganda.

Fish and fish products volumes ('000 tonnes)				
Year	Country	Demand	Supply	Deficit
2000	DRC	726.3	303.2	-423.0
	Kenya	440.6	157.9	-282.6
	Rwanda	96.2	6.3	-89.9
	Sudan	448.0	49.8	-397.1
	Tanzania	501.9	303.4	-198.5
Total		2211.9	820.7	-1391.2
2008	DRC	963.9	341.9	-622.0
	Kenya	581.6	134.9	-446.6
	Rwanda	145.8	19.6	-126.2
	Sudan	620.3	70.7	-549.6
	Tanzania	637.2	217.6	-419.6
Total		2948.7	784.7	-2164.0

FAO Regional Fisheries and Aquaculture Statistics 2010

The fish supply deficit roughly doubled during this period and was highest in Congo followed by Sudan, Kenya, Tanzania and Rwanda in that order. Apart from Rwanda, these nations have fish supplied from both freshwater and marine sources.

4.1.2 Demand for fish and fish products in Uganda

The demand for fish products was calculated as the volume of fish that the growing Uganda population needs to be able to access the global average of 15.8 kilograms of fish/person per year (Delgado *et al.*, 2003; NEMA/UNEP 2004). With this assumption, this demand has been increasing over the years and currently approximately 460,000 tonnes. With declining catches, the supply deficit has also been increasing (Figure 7).

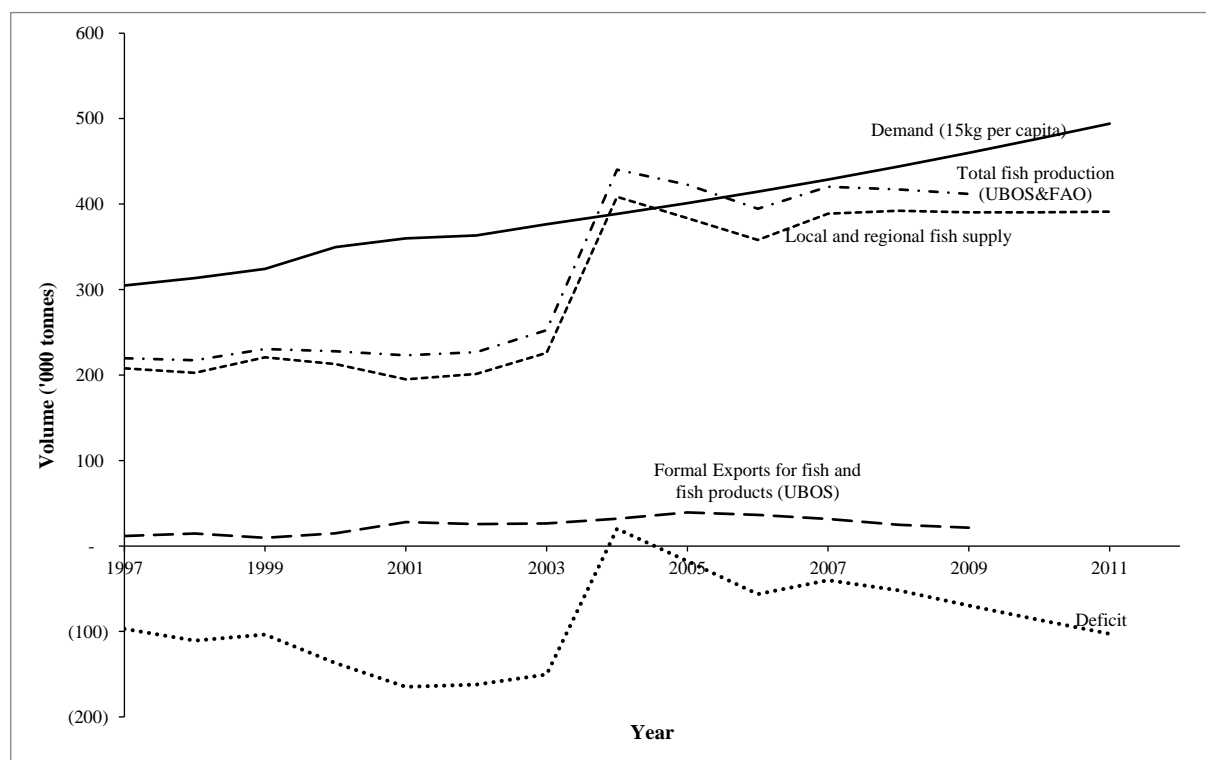


Figure 7: Graph showing supply and demand of fish and fish products on the Ugandan local market (Uganda Bureau of Statistics (UBoS) 2010).

Even though increased fishing efforts reduced the deficit between 2003 and 2004 demand continued to increase. Increased aquaculture output can explain the small recovery between 2006 and 2007 (Figure 7) but, as shown, demand for fish continues to increase with the current population projections. By the year 2008, the supply of 51,000 tonnes from aquaculture could only reduce by half the total deficit of 104,000 tonnes.

This situation was confirmed by farmers interviewed, 77% reported that there is high demand for catfish from their customers. Only 23% were struggling to sell their products. However 45% of the farmers were satisfied with the price paid for their catfish. The farm gate price was between 1.5 to 3.0 USD per kilogram. Each trader with a market stall on average sold between 30 to 300 kilograms of fish per day and it was noted that sales were high during the dry season, mainly attributed to fewer food alternatives in the local market. Further evidence for the existing demand of farmed catfish was also obtained from interviews and data from a fish farmer's cooperative in Kampala (Table 3).

Table 3: Volumes and sales of live and smoked catfish and live tilapia at WAFICOS coop offices.

Species	Weight (kg)	Total Sales (USD)	Average price (USD)
Catfish	11,718	29,350	2.50
Smoked catfish (live weight)	1,000	2,000	2.00
Tilapia	6,736	18,265	2.71
Total	19,454	49,615	

Generated from WAFICOS sales and inventory records for 2009.

The coop sold over 20 tonnes of live weight fish for the year 2009 with 83% of sales being catfish. According to the coop's secretary, "The demand for farmed catfish of the right quality and quantity is high but farmers usually fail to supply these consistently and we lose the market."

These products were sold directly to consumers, processors and other traders. The 150 consumers interviewed were spending between 0.9 and 5 USD per kilogram of fish products purchased.

4.1.3 Demand for catfish as bait

Catfish, tilapia, mormyrus, and haplochromines are the major baits used in the longline fishery of Nile perch (Dhatemwa 2009). Increased demand for quality raw material fish from factories has increased the use of long lining as usually fish caught this way is considered of superior quality than that from gillnets. About 54% of all the boats dealing in Nile perch fishery are using baited hooks and the demand for bait has been increasing since the year 2000 (Mkumbo and Mlaponi 2007) and is likely to continue. The use of hooks is seen as the best with respect to quality. However there is need for a sustainable source of bait.

Harvesting live baits from the wild is illegal and difficult and the best alternative could be obtaining them from hatcheries; and this presents a ready market for aquaculture products (Isyagi, 2007). The East African countries sharing Lake Victoria (Tanzania, Uganda, and Kenya) are proposing closed seasons and quota systems as a way of conserving the fishery of this lake. By doing this, the demand for live baits from aquaculture particularly for African catfish fingerlings which stay alive for long (Isyagi 2007) is likely to increase.

An estimation of three million baits per day is required in the Lake Victoria fishery and Uganda's requirements are estimated at 13% of this figure (Isyagi 2007).

Farmed bait is good because it shines and attracts mpuuta (Nile perch) and in this group seven of us use long lines and need bait for these lines. However, the farmed bait is expensive and if you do not catch enough mpuuta you lose your money (MF respondent).

In relation to the regional bait market, there is limited use of long lining fishing in DRC and Rwanda and therefore, the demand for bait is relatively lower than it is in Uganda, Kenya and Tanzania (Dhatemwa 2009).

4.2 Determinants of African catfish farming industry profitability in Uganda using the Porter's five forces model

This section considers the active forces in the African catfish farming industry in Uganda that determine competitiveness and profitability of the sector using the five forces model.

4.2.1 Rivalry among competing producers and sellers

Catfish farmers and sellers use more or less similar channels of distribution. Amongst farmers, internal rivalry is rather low as they are scattered throughout the country serving different local markets. However the following forces could cause farmers to compete internally. The costs of getting out of an aquaculture enterprise in Uganda are rather high.

Most farms have a break even period of 3 to 5 years (USAID-FISH 2009). This is a high exit barrier forcing the farmer to stay in business and compete if he/she is to gain returns on investment (Thompson and Strickland 2001). The lack of new product innovation by processors to attract different markets increases internal pressure on producers competing for the same market. Developing new products can in the short term reduce competition (Kim and Mauborgne 2005). On the other hand, Uganda's population and projected demand for fish is increasing, presenting a lack in projected internal rivalry.

4.2.2 Competition from substitute products on the market

There are several products listed by the Uganda Bureau of Statistics that directly compete for the same market with aquaculture products. These include products of chicken, Nile perch, Nile tilapia, *Rastrineobola argentea*, beef and pork (Figure 8).

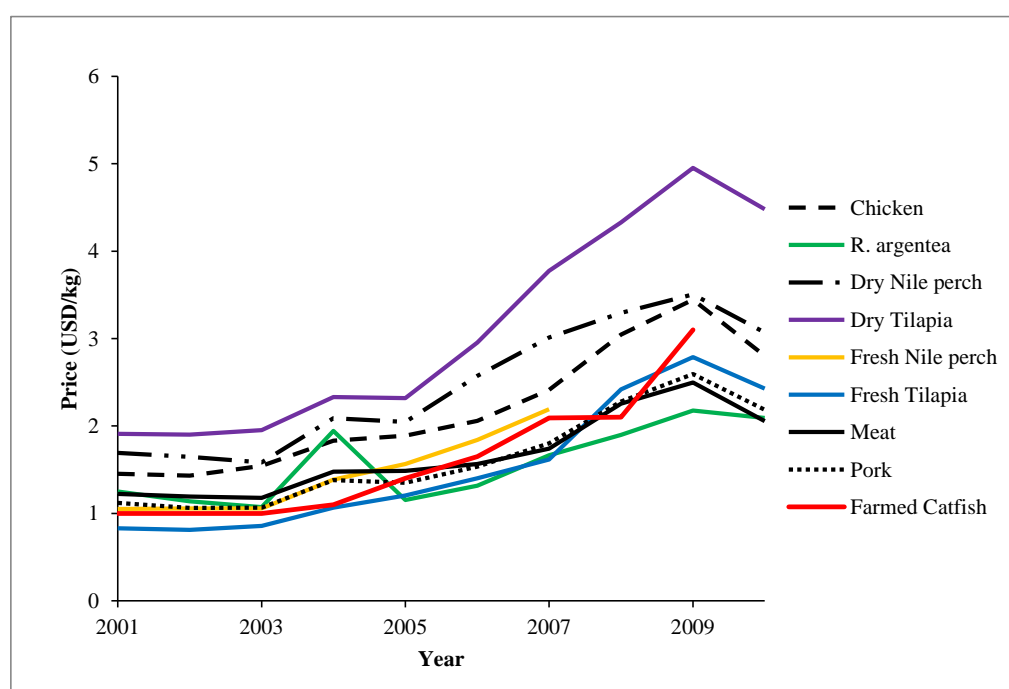


Figure 8: Average market prices for animal protein products on the Ugandan market 2001 to 2010 (UBoS, FAO).

The farmers noted that catfish products are facing competition from Tilapia and low quality Nile perch products on the local market as a result of catfish being of inconsistent supply (32%), small in size (39%) and less tasty (20%), among other reasons. Indeed the same view was held by fishermen in Kibuye.

Nile tilapia is a lean fish and has no particular taste so it can be consumed frequently but Nile perch and catfish are fatty fish and customers do not like to consume them frequently. However when they are smoked they are more highly marketable than tilapia (KF discussant)

The prices of these products averaged over the whole country have been increasing for the past ten years. The price per kilogram of farmed catfish also increased and by 2009 it averaged at three US dollars. Traders attributed this to lack of demand for quality differentiation from consumers. This makes it rather easy to switch between fish products

(Bada 2010). Most consumers are driven by the price of the fish and would buy easily or switch to products that are considered cheap (Garrett and Brown 2009). The low prices offered locally for fresh fish also presents a barrier for importers to sell fresh fish on the same market but some import substitution may occur for processed products especially for the affluent communities (Vallejo *et al.*, 2009). Therefore the threat from substitutes is high, putting downward pressure on prices.

4.2.3 Buyer power

The strength of this force is determined by whether buyers have sufficient bargaining power and the extent of importance of buyer-seller strategic partnerships in the industry (Knútsson 2001). In Uganda, it is mainly a result of lack of national cold chains and only a few large chain supermarkets situated in the capital city. However, no single fish farm in Uganda has been able to produce the required quantities consistently to justify bargaining¹. Farmers usually get large orders from industrial processors who in turn export regionally. The inability of producers to fill orders consistently leaves them with low bargaining power (Engle and Quagraine 2006). To solve this farmers in the central region have an active cooperative that has about 250 famers² through which members sell their products. This is lacking in other parts of the country leaving them little room to bargain. Being a commodity product ('fish') fresh catfish faces stiff competition from other 'fishes' on the market since buyers consider them more or less the same. Therefore a situation of extreme price sensitivity occurs making it hard to raise the product prices and stay in business (Asche *et al.*, 2001). The strong buyer power implies a downward pressure on prices (Grant 2005).

4.2.4 Threat of new entry

The threat of new entry into the aquaculture industry in Uganda is very low. This comes from the greater weight of entry barriers in comparison to incentives (Porter 1998b). The business requires high level of experience and is known to be risky (Leonard and Blow 2007). It is expensive to enter the aquaculture industry. Interviews revealed that with low financial support, farms have been established on farmer's savings and donor agencies' grants. This is coupled with long breakeven periods (USAID-FISH 2009). For example a 1000 m² pond requires 2500 USD to set up and produce two tonnes per year. The cost is expensive in relation to the average annual income of a Ugandan being 517 USD (IMF 2010). Another barrier is in the form of establishment permits (GoU 2003). Legal entry requirement permits include water extraction permit, environment permit, fish marketing permit, transport permit plus several quality permits in the case of high end sales. Also there is lack of technology protection from government unless the farm strategically makes a move to do so privately. This is a disincentive to innovation that drives industrial growth (Keane 2008). However some positives exist in the industry. Experience in fish farming can be obtained locally through institutions of learning and available on farm training at a fee. With farmer cohesion, some economies of scale mostly through reduced costs of access to inputs (Kelling *et al.*, 2010) e.g. equipments, advise and marketing. There are also some cost benefits if one has been in business for some time such as hiring out equipment, trainings to new farmers and other forms of collaboration.

¹ Interview with chairman of WAFICOS, a fish farmer's cooperative society in Kampala Uganda.

² -do-

4.2.5 Supplier power

There is high supplier power as the industry is growing. This has been a result of few suppliers, for example Uganda has one fish net and one extruded fish feed manufacturer and supplier presenting a monopoly situation (USAID-FISH 2010). There are also few large suppliers of inputs as most aquaculture inputs are specialised and import is crippled by taxes. This, however, can be rectified with high volume import orders (UIA 2005). There is also lack of quality substitutes for inputs in the industry. This inability to substitute leaves the farmer with less bargaining power for inputs (Lynch 2006).

In summary, the aquaculture industry faces low competition from within (internal rivalry) but high competition from external competitive forces. Suppliers and buyers hold high bargaining power making the overall effect from vertical competitive forces negative to the profitability of the industry. However the horizontal forces are moderate as there is low threat of new entrants in the industry and mild competition from substitute products. The model indicates low profitability of the industry.

4.3 The Fish Supply and Value Chains in Uganda

The fish marketing chain in Uganda is characteristic of most value chains in the East African region. The Nile perch fishery has a well-documented supply chain in the region (Thorpe and Bennett 2004; Gudmundsson *et al.*, 2006; Schuurhuizen *et al.*, 2006). The existing marketing chain for Nile perch as outlined by Gudmundsson *et al.*, (2006) is shown in Figure 9 and can be applied to most fishery products for Uganda.

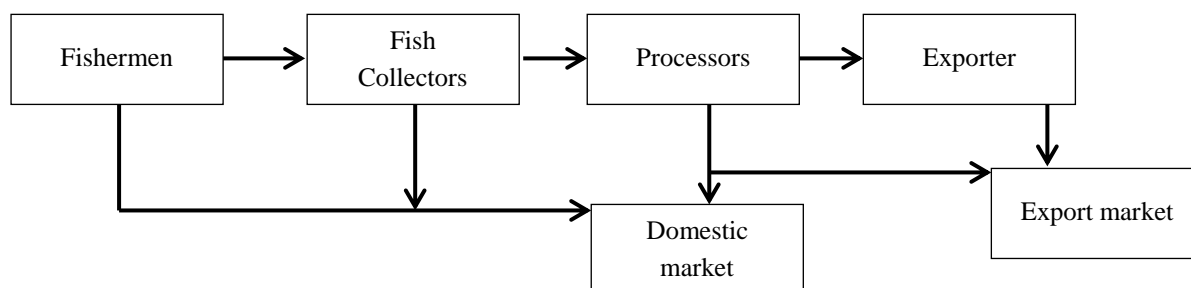


Figure 9: The marketing chain for Nile perch adapted from Gudmundsson *et al.* (2006).

Marketing fish in Uganda has been reported to be complex by several authors (Reynolds and Kirema-Mukasa 1991; Jagger and Pender 2001). Fresh or processed fish products are transported over a wide geographic range by a large number of traders and processors through both formal and informal channels (Jagger and Pender 2001). Wild caught fish in Uganda is delivered to consumers through different channels including the direct sale of fish to households at landing points on lakes or rivers, sale to households by head load carriers or bicycle traders that buy fish from fishers at landing sites, wholesalers that collect fish with pickup trucks in fairly large quantities delivering to retailers, and processors that salt, dry or smoke and then sell their products to traders or directly to consumers (Jagger and Pender 2001).

Well-developed commercial export channels also exist and these have been extensively studied for Nile perch in Kenya (Schuurhuizen *et al.*, 2006) and Tanzania (Gudmundsson *et al.*, 2006). The demand for improved quality products in accordance to standards in international markets has a great influence on the local supply chain organisation (Thorpe and

Bennett 2004). Fresh fish, preferably long-line fish, is delivered by contract fishermen to gazetted landing sites where iced trucks (5 to 10 tonnes) owned by sub agents await for transportation to the factory. At the processing plant, the fish is unloaded, washed, graded, filleted, skinned, packed and frozen in order to have it ready for the international market (Schuurhuizen *et al.*, 2006). Usually through agents this fish enters the same marketing channels with fish from other parts of the world in Europe and US markets for retail shops and then consumers (Engle and Quagraine 2006). The processing industry has thus successfully linked the small-scale domestic fishers to compete favourably on the international market for white fish.

Another chain of trade emanates from the by-products of fillet processing. There has been a growing demand for the off-cuts, skins, trimmings, bone frames, and heads of the Nile perch (Figure 10).



Figure 10: Picture of traders loading Nile perch bone frames and heads on a pickup truck at a processing plant in Uganda.

These are sold fresh (without further curing) or processed (smoked, dried or salted) usually at landing sites (Dhatemwa 2009). The curing industry trades the processed products locally or regionally to Congo, Kenya and Sudan (Dhatemwa 2009). These established patterns of wild fish chains are important in the orientation of the farmed fish supply and value chain (Loc *et al.*, 2010).

4.3.1 Characteristics of the farmed fish market in Uganda

The Tveterås and Kvaløy (2006) method of determining the structure of a market (traditional vs. demand market) was used to classify the African catfish market in Uganda. The table below is a summary of the findings from interviews with the different actors and literature.

Table 4: Characterizing farmed fish markets in Uganda.

Characteristic	Findings
Traditional products	Due to lack of cold chains in the country most catfish is sold the day it is harvested. However there are privately owned cold stores by industrial processors.
Few value added products	Catfish products that enter factories ³ get further processing into hot and cold smoked catfish, fillets, and catfish sausages. Artisanal processing also occurs at a small scale ⁴ .
No formal documents	All the respondents had no formal contract documentation for transactions between suppliers and customers. Only the fish farmers' coop is implementing documentation for accountability and traceability.
Independent retailers	No retailers (100%) had formal relationship with fish suppliers and could easily switch supplier depending on supply price, quality and availability. Only the farmers' coop is obliged to retail the members' produce.
Low requirements	Marketing farmed fish technically requires documentation by law but none of the respondents had applied these in their previous transactions.
Low demand for freshness	Traditionally there is low demand for fish 'freshness' from consumers but farmers acknowledge that live fish sell faster than dead fish. Fresh fish here means fish kept close to its original state of quality at harvest.

Generated from interviews with stakeholders

The farmed catfish market in Uganda can be in general terms referred to as a 'traditional' market characterised by low demands of quality. Indeed a study by Bagumire *et al.* (2009) revealed that Uganda's NFCS was still short of the requirements to allow aquaculture entrepreneurs to access markets in the EU and other developed countries. The market is mostly driven by price of fish. However with increased globalisation, improvement in technology and competitiveness, and awareness the market is shifting towards a 'demand' market (Lindkvist *et al.*, 2008). Several 'high-end' markets exist today i.e. supermarkets, hotels, fast food restaurants and fresh food stores. These markets serve the affluent consumers who prioritise quality over price in fresh whole fish, fish fillets, and other fish products.

4.4 Structure of Farmed African Catfish Value Chains

The value chain of the African catfish farming industry in Uganda has several direct and indirect actors at different levels interacting together to form a functional system. The actors, their relationships and governance issues in this chain are discussed below.

³ Greenfields Uganda Ltd. Pearl Uganda Ltd (2008). UPBL. Sausage King Ltd.

⁴Edhron enterprises Ltd.

4.4.1 Actors

Aquaculture as a growing industry Uganda has been supported by a number of stakeholders. These actors along the entire value chain carry out both primary and support activities and can be categorised as actors in inputs suppliers, production, marketing, research, finance and legislation.

a) Primary actors

Input suppliers. These include feed producers, seed producers, and equipment suppliers. In 2010 a local company (UPBL) installed the first extruder for floating fish feeds in Uganda. There are 11 commercial seed producers in the country who produce quality catfish fingerlings (Appendix IV). Uganda Fishnet Manufacturer makes nets for cages and pond seines (USAID-FISH 2010). Other companies⁵ directly or indirectly procure fish handling equipment for farmers.

The farmers are the most important actors in the industry. These are both grow-out farmers and hatchery producers. Interviews revealed that 80% of them started fish farming after the year 2000. Most of the farms (90%) use earthen ponds to culture catfish. All hatcheries practise tank-based fingerling production. Monoculture and polyculture are practised by approximately equal proportions of farmers i.e. 46% and 56% respectively. Polyculture with catfish maximises tilapia production for these farmers as it controls the prolific breeding of tilapia in ponds (Isyagi 2007). Most farms have a production cycle of six to eight months in which period the catfish under good management is expected to weigh approximately 0.8 to 1 kilogram (Isyagi *et al.*, 2009a). The produced fish goes through the intermediary channels of marketing involving other actors or farmers themselves.

The processing and marketing section of the industry involves middlemen (local collectors, wholesalers), and fish farmers' groups whose chief aim is sales to the best bargain buyer. The middlemen collect the live catfish from farms and distribute it. Live fish is pooled from different farms in case one farmer cannot raise the required volume. Processors and local market retailers get farmed catfish from these middlemen. There are both artisanal processors; processing less than 100 kilograms of live catfish per day; and industrial processors with the capacity to process over one ton of farmed catfish per day. Processed products of catfish on market are fillets, smoked whole fish and in 2009 a local food company started producing catfish sausages. Lastly, the grow-out catfish ends with the local and regional consumer while the hatchery products are utilised for stocking ponds and bait for Nile perch.

b) Support actors

Collaborations between farmers and support actors can be divided into four major categories i.e. financial, technical support, information and knowledge, and legislation.

Over the years financing aquaculture has been generally by farmer's savings and in-kind support from government and donor agencies (SEATINI 2008). However, with increasing information on the financial viability of the aquaculture projects, several banking institutions

⁵ An example is Balton (U) ltd which imports hatchery feeds for farmers on order and Wagtech (U) ltd for water testing equipment (USAID-FISH 2010).

are showing interest in providing loans to farmers for capital and management finance (Nafula 2010). None of the farmers had access to financial information from credit institutions; however this information was found to be available⁶. Technologies and innovations like fish handling equipment, techniques of feeding fish and smoking fish were attributed to training by the USAID funded FISH project, which is in agreement with Atukunda (2010). Farmers in Kamuli revealed that most of the information on production methods employed on their farms was from both a UNDP funded project and government officials from the ARDC in Kampala (Table 5).

⁶ Proceedings of the third annual fish farmers' symposium contain presentations on credit access from both Stanbic Bank ltd and Centenary Rural Development Bank Ltd.

Table 5: Finance, technology, information and legislation relation links between catfish farmers and the other chain actors.

	Financial Support	Technology and Innovations	Information and Knowledge	Legislation/rules
<i>Support Actor</i>				
Donor funded Projects Research and Academic Institutions	Yes	Yes Yes	Yes Yes	
Government of Uganda	Yes	Yes	Yes	Yes

Generated from interviews: 'Yes' indicates at least one farmer acknowledges the relationship.

The government is the sole actor in the aquaculture legislative instrument most of which has been a subsidiary of the fisheries instrument since 1967 (GoU 1967). Over the years technologies and economies have changed rendering most of these laws almost obsolete and in need of revision. This trend is changing as it is now clear that both aquaculture and fisheries much as they may serve the same purpose, have different production procedures and therefore cannot as such be treated alike. The government developed a fisheries policy (GoU 2004) and later drafted the national aquaculture development strategy (Wathum and Rutaisire 2008) as a precursor to developing an aquaculture policy for the country. None of the farmers acknowledged implementing legislation from the government (GoU 2003) as they can become an entry barrier (Herr 2007). However farmer groups have set rules that govern production and troubleshooting. Also quality standards and certification procedures for aquaculture products are yet to be set.

For over 30 years, research institutions have been mostly involved in selective breeding to enhance profitable biological features like improved growth rates and tolerance to extreme environments (Balarin 1985). The ARDC has been a pivotal actor in this regard. However as the industry progressed several public and private institutions (universities, companies and NGOs) have carried out several studies on catfish. Examples include the catfish growth studies and fisheries clusters studies by USAID funded projects (USAID-FISH 2009; Hammerle *et al.*, 2010).

4.4.2 Flow of farmed African catfish products

The value chain of farmed African catfish in Uganda is rather complex in detail, however for simplicity a rather general scheme can be traced out to illustrate the general flow of products and value from one stage and actor to another (Figure 11).

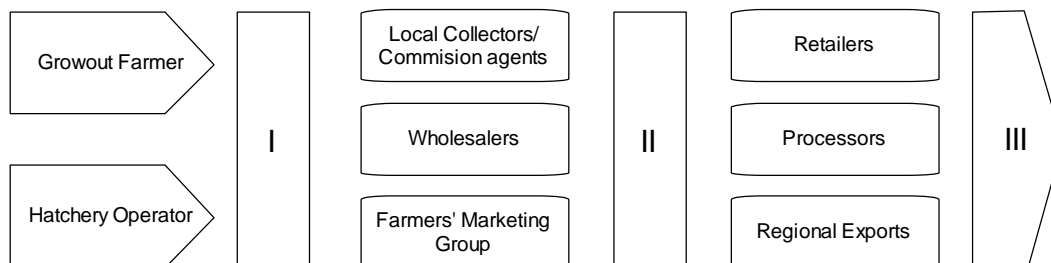


Figure 11: General farmed African catfish value chain in Uganda.

- I) Total volume of farmed catfish exiting production in upstream part of the value chain
- II) Total volume of farmed catfish entering and exiting intermediary actors
- III) Volume of catfish from intermediary actors to the downstream part of the chain for consumption and utilisation

a) *Flows from producers to primary intermediaries (I)*

An estimated production of 35,000 tonnes of catfish was reported by FAO-Fishstat (2009). The catfish grown by commercial producers (43%) goes through the chain as follows. The grow-out farmers harvest live catfish for orders placed by customers. Due to lack of cold chains transactions are done with live fish within the shortest time (less than 10 hrs). Interviews with a farmers' marketing group revealed that registered members took turns to sell their fish which they have to transport to the head office in tanks with oxygen. Farmers' products can also shunt level I into II (Figure 11a) where they retail the fish or sell to other retailers, "I take the fish to Iganga market and give it to a fish seller and collect my money later," reported Mr. Waigulo, a catfish farmer in the town of Iganga.

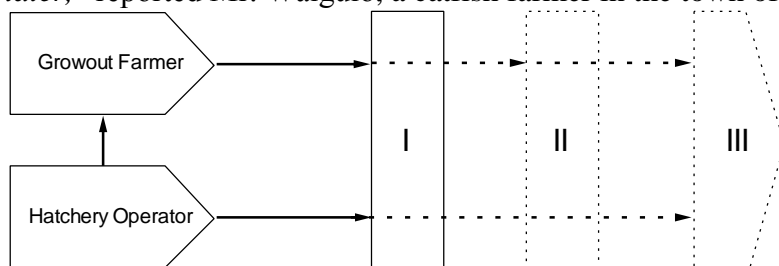


Figure 11a: Flow of live catfish from producers.

Some farmers, like Edhron enterprises, process both the fish they farm and also collect fish from other farmers to fill customer orders for smoked farmed African catfish. Lastly, this flow goes directly upstream (III) when households purchase fish and the farmer makes a direct sale common with farmers situated far from main access roads.

Market size fingerlings are those with a total length of 5 to 10 cm. Hatcheries serve both farmers (fingerling market) and fishermen (bait market). They sell to agents (middlemen), or get connected to potential buyers through the farmers' marketing group (coop). This is the

main channel of flow for fingerlings and bait. However connections between I and III are existent where individual farmers and fishermen purchase directly from hatcheries. Fish is packaged in oxygen filled bags for transport during long distances while open water tanks at the back of pickups are mainly used for short distances.

b) Flows from primary intermediaries (I) to secondary intermediaries (II)

The total volume of catfish from farms held at primary intermediaries gets distributed to secondary intermediaries. Wholesalers and agents collect fish from farmers while members deliver live catfish to the coop. It is then distributed to secondary intermediaries (Figure 11b).

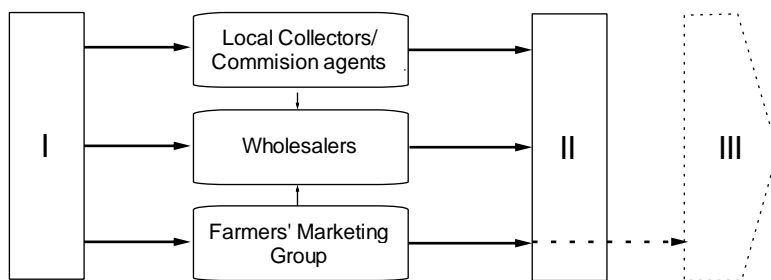


Figure 11b: Flow of catfish products from primary intermediaries to secondary intermediaries.

Wholesalers purchase fish and bear the risks thereafter while agents get paid a commission for selling on behalf of the farmer.

“I prefer selling directly to the men who come to buy the whole pond [wholesaler] since they purchase in bulk and by weight not number of fish. In doing so I do not lose a lot of fish due to mortalities during harvesting and unsold fish,” reported Mrs. Mbabazi, whose statement was reflected generally amongst all farmers.

Wholesalers can sell to processors and retailers for further value creation. The fish farmers’ coop also makes bulk sales to wholesalers and processing plants. Also direct retailing of live fish, fillets and other products to consumers (III) is done by this coop.

c) Flows from secondary intermediaries (II) to upstream actors (III)

Much of the processing and value creation takes place in this section of the chain. Farmed fish is retailed as fresh or processed. Processors have criteria for accepting or rejecting farmed fish from primary intermediaries (Table 6).

Table 6: Screening criteria for farmed catfish by local processors.

Accepted catfish	Rejected catfish
Uniform size fish	Non uniform size fish
Proper acknowledgement of fish source	Supplier does not reveal source of fish
Live fish	Dead fish
Exact quantity requested	Less or greater quantity than requested
Good quality fish	Damaged fish e.g. bruised, sick, etc.
Delivered on time	Delivery outside required time

Compiled from records of WAFICOS

The accepted catfish of good quality is processed into different products such as whole gutted catfish, smoked catfish, and catfish fillets. Within this section, processors sell to retailers like supermarkets, restaurants and affluent consumers (Figure 11c).

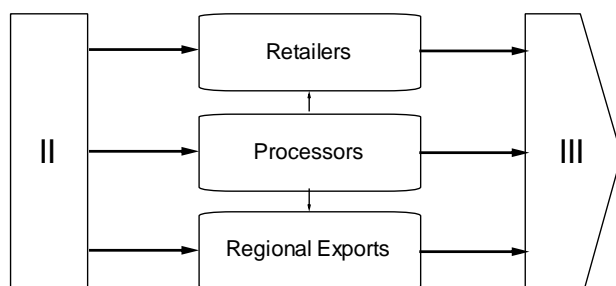


Figure 11c: Flow of value added catfish products from secondary intermediaries to final consumer or user.

Smoked farmed catfish from processing plants is documented to be sold to the Congo, Sudan and Kenya as regional market destinations (Dhatemwa 2009). Within the respective regional countries, the fish is then retailed to the final consumer. Examples of local companies that have had a great contribution to farmed catfish processing in Uganda include Greenfields (U) Ltd with sales of smoked products to Congo (WAFICOS sales data) while Pearl (U) Ltd dealt in cold smoked catfish (USAID-FISH 2009). UPBL processes farmed catfish fillets for local supermarkets. Catfish rejected by these processing plants is sold in local community markets.

From the above flows, two relevant value chains can be defined for Uganda's grow-out farmed African catfish. The regional export market chain: grow-out farmer → coop → processor → regional exports; and the domestic market chain: grow-out farmer → middleman → processors and retailers → consumer.

The functions in the chains can be grouped as those of farmers, traders, processors and retailers. The two chains differ in composition depending on whether they extend to domestic or regional export markets, but the function of the actors across the channels remains relatively similar. The regional export value chain is vertically integrated from farmers to processors and export. This extends into the Congo, Sudan and Kenya markets.

Results show that farmers through the coop sold fish to the regional export market and are in direct contact with processing companies, thereby avoiding middlemen. This has resulted in a shift towards vertical integration similar to Vietnam where processing industries maintained greater control over farming practices of *Pangasius* (Loc *et al.*, 2010).

The domestic value chain flows from farmers, to traders, processors and retailers in the local open markets and supermarkets. The domestic chain is also a secondary market for those farmers who do not meet the quality or safety requirements of processors similar to findings in Kenya by Schuurhuizen *et al.*, (2006).

4.4.3 Information and learning within the chain

Farmers require information about production management and marketing of their farm products to have a *plus sum* relationship with other actors. The two value chains observed results from individual farmer's lack of knowledge on quality and quantity of catfish required by processors. Uganda's aquaculture industry is characterised by a large number of small-sized fish farms with low individual production volumes (Muir and Aurell 2009). With commercial aquaculture being a relatively new practise, this brings a challenge to information flow and subsequent learning. This has presented situations of *zero-sum* relationships in the domestic value chain (Kim and Mauborgne 2005). For example 57% of the interviewed

farmers had no knowledge of better markets, relying on middlemen for information. This situation was found mostly for farmers in Kamuli, Iganga, Jinja, and Mukono. Farmers (58%) obtained price information from traders, 23% asked fellow farmers what their last selling price was and the rest (9%) had no option but to sell their fish to whomever was willing to buy. Depending on traders to get information increases the bargaining power of the middlemen since they provide the only way out to sell products (Knútsson 2001).

In the regional export chain, farmers obtain information through the coop. Information about market prices and demand is obtained through bargaining directly with the bulk processors. Market information is then relayed back to the farmers in terms of guidelines on the way of harvesting and handling to improve quality of fish as it should be supplied live. The association further retails small volumes of products from the domestic chain directly to consumers thereby gaining knowledge of how much can be paid for the product on the local market. This gives the producer the ability to bypass intermediaries and get information and feedback about farmed fish directly from the end consumer (Knútsson 2001). This connection reduces the information barrier that could be created by intermediaries and improves bargaining power (Yigitbasioglu 2004). There is also the added advantage of information sharing between the farmers themselves for example sharing information about the best supplier of fingerlings and advice and value for money in purchasing inputs from suppliers. The coop organises a yearly forum held in Kampala as an avenue to exchange ideas and share experiences about challenges and solutions.

4.4.4 Power and trust

The main control tool in the African catfish value chain in Uganda is information and knowledge. Information about markets gives power to middlemen to set prices (Gestsson *et al.* 2010). Dr. Kazungu, a fish farmer in Butansi, Kamuli district, acknowledged that: “It is good to process my fish and sell directly in the local market as the middlemen would take a bigger part of the revenues when they come for the fish from the farm.”

Farmers lack power due to the small farm sizes and low production volumes (Herr 2007). They acknowledge that middlemen are a ‘necessary evil’ since they collect the fish in bulk and pay promptly, “We do not have enough fish in our individual ponds to take to better paying markets so they come with a pickup or motorcycle and collect from each of us,” said Mr. Kalizimbawa with a group of five fish farmers in Nabitambala, Jinja District.

Knowing the prevailing quality requirements and attached market prices for catfish could help farmers bargain for a ‘fair’ price for catfish whilst allowing middlemen to recover their operational costs and a margin. This information (about processors, farms needing stocking seed from hatcheries) is mostly known by middlemen, giving them bargaining power.

For the regional export chain, through forming a coop, farmers in central Uganda bypass middlemen. However, there are few bulk purchasers creating a market monopoly and high bargaining power (Knútsson 2001). Much as this is true, they help the fish farmers with an assured market channel. At times the price offered for the fish by these customers is too low to justify a transaction. To combat this problem, the coop advised farmers to condition fish prior to supply to improve stress resistance when supplied live (Engle and Quagraine 2006). If a customer is not willing to purchase, fish is returned to the holding tank or pond. Without this alternative the situation ends in a *zero sum* game and lack of power (Gummesson 2002). For example Mr. Kadi reported that:

“I stopped fish farming because I could take the fish in the market in the afternoon and the customers wait until they see it’s getting dark and they know I have to sell the fish by all means so they could offer me a very low price because I didn’t want the fish to get spoiled and I made losses.”

This highlights a similar situation to Thordarson (2008) in the Sri Lankan fishery where vessel owners neglected suppliers for several days to push down prices. In all cases, power is held by actors closer to the downstream part of the chain. Trust decreases and suspicion increases as one proceeds downstream the value chain (Grunert *et al.*, 2010).

4.4.5 Governance

Commercial catfish farmers are scattered throughout the country (FAO 2005). Being responsible for an estimated 43% of farmed catfish produced annually, some form of governance has to exist so as to be competitive (Gereffi *et al.*, 2005). Prior to 2006 the African catfish value chain in Uganda lacked cooperation. There was a supply driven (push) system of production, where catfish is produced and farmers wait for a willing buyer (Wilkinson 2006). In such a system there is no clear form of governance. Any form of governance in the chain can be described as that driven by price (Keane 2008). Interviewed farmers reported that there existed high demand for fish including catfish in their localities. However this local demand is usually only for less than 100 kilograms of fish at a time. In the case of large volumes of catfish, the need for a bulk purchaser is indispensable and hence the need for some form of coordination.

Since 2006, with regional exports there have been considerable efforts for some form of coordination that would see catfish production market (pull) driven (Wilkinson 2006). Several fish farmers groups were formed, most notably WAFICOS in central Uganda, Kabeiura Fish Farmers Association in western Uganda and Iganga Zonal Fish Farmers’ Association in eastern Uganda among others (Isyagi *et al.*, 2009b). These associations govern the activities of member farmers and they are responsible for ensuring that farmers get the required inputs and at the end of the production cycle be able to sell their fish. WAFICOS in particular receives orders from processors and retailers for catfish which is pooled from members’ farms to fill orders. These customers have requirements that the farmer has to meet and abide by if they are to make sales. For example, processing plants require live fish that is between 0.8 and 1.5 kilograms⁷ while local smokers require fish that is less fatty so as to improve yields after smoking. A farmer targeting the processing plant would therefore culture the fish with target weight and fish condition as the main requirement while one whose customer is a smoker would need to produce less fatty fish. Mrs. Buwule, the proprietor of Edrhon enterprises for production of smoked farmed catfish noted:

“I don’t accept female catfish and fatty catfish in general simply because you require almost three one kilogram pieces to get one kilogram of smoked catfish whereas usually it is two kilograms to give one kilogram of finished product.”

A vertically integrated value chain is emerging where catfish quality requirements the farmer has to meet are demanded by customers as a result of product expectations (Nguyen 2007; Loc *et al.*, 2010). This is an example of fish quality as driving force for governance.

⁷according to WAFICOS sales data

Coordination of activities from customers to farmer has also indirectly improved sales and record keeping on members' farms for traceability. In all these cases, any form of governance that exists is a result of the required final quantity and quality of product for the target market.

4.5 Value added distribution

The value added of farmed catfish was determined for different links in the value chain by the difference in average sales price data collected from different actors. All average prices per kilogram were calculated to live weight equivalent. Tracing volumes of catfish from farm to shelf was practically impossible due to absence of records in that regard.

Overall the value added between the actors is positive. However, much as these values are positive, in agreement with *Loc et al.*, (2010), they have a high degree of variation. According to the authors this is an indicator of risk and could be a precursor to failure cases of catfish farmers in Uganda. In Nigeria, *Velu et al.*, (2009) reported similar variations in value of table size catfish farm gate prices (2.39 to 3.33 USD/kg) being related to the size of the fish at harvest. The average total value added for live catfish flowing through the actors is approximately 2 USD/kg. Results show that added value between actors in the domestic and export chain are relatively similar at 2.1 and 1.8 USD/kg. Accumulators contribute the lowest value added, about 15% of the average retail value (Figure 12). A similar situation in Nigeria was attributed to lack of cold storage (*Velu et al.*, 2009).

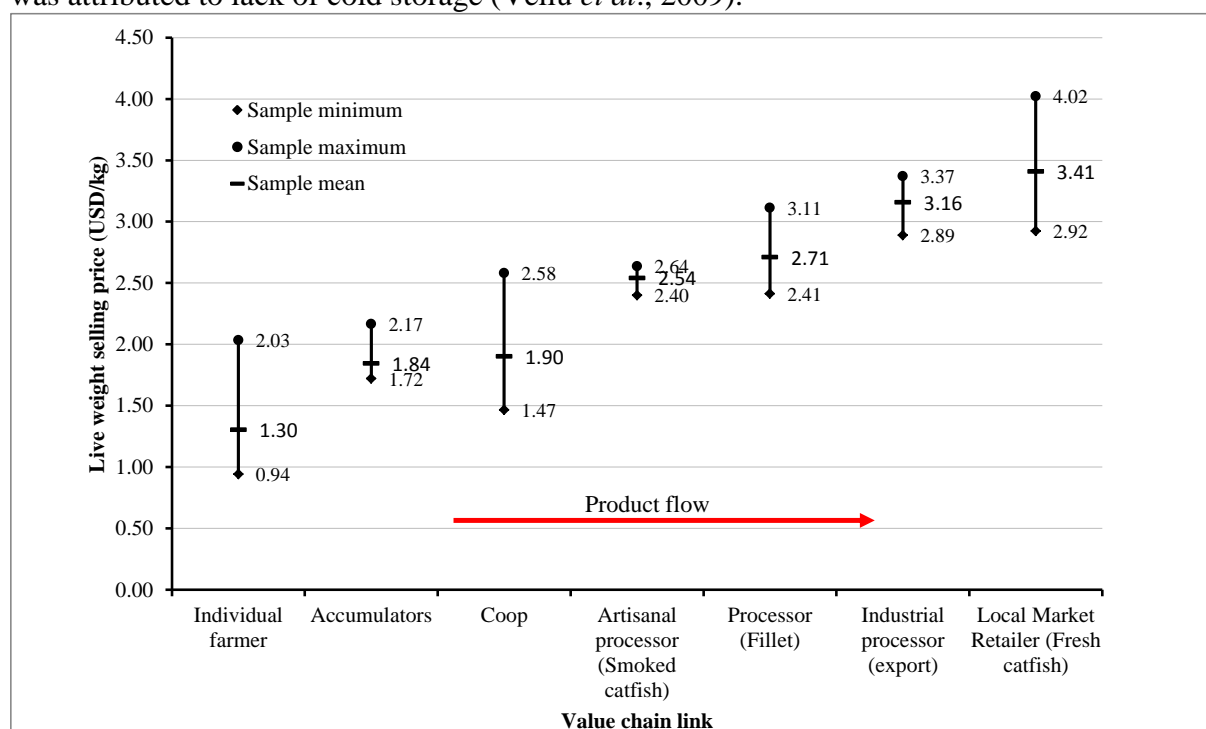


Figure 12: Price range and distribution along the African catfish value chain in Uganda.

Processors add twice the value added by accumulators. Overall selling catfish through either the coop or the accumulators yielded close to similar added value (15%) i.e. 0.5 and 0.6 USD/kg (Table 7). The processor also adds about twice the value that the individual farmer obtains for catfish but one and a half times the value if the fish is procured through the coop. The average price received by retailing catfish is 260% of the farm gate price (3.4 to 1.3 USD/kg).

Table 7: Value addition above farm gate price in USD/kg of live weight catfish at each step in the chain.

Buyer Seller	Accumulators	Coop	Artisanal processor and retailer of smoked catfish	Processor of fillets	Industrial processor	Local market retailer (fresh catfish)
Individual farmer	0.54	0.60	1.24	1.41		2.10
Accumulators		0.06	0.70	0.87		1.56
Coop			0.64	0.81	1.25	1.51

The domestic value chain yields a higher final value within Uganda than the export value chain; however, the price variation is higher in the former.

Overall farmers' average added value is offset as a result of many small-sized farms with varying levels of production (FAO 2005). Production levels and ultimately the selling price becomes a function of the level of inputs (GTZ 2007). For example some farmers use on-farm made feeds while others use commercially produced industrial fish feeds from UPBL. The difference is that commercial feed lowers FCR and production time and improves final product quality (USAID-FISH 2009). The average cost of production is estimated at about 1.4 USD per kilogram. When compared to the average selling price for catfish the individual farmer gets (1.3 USD/kg), poor quality fish could indicate negative returns. However consolidation through coops can improve the situation. The role of strategic alliances on large number of small enterprises has been extensively covered by Knútsson (2001). The study demonstrated how the alliance of Icelandic small scale producers resulted in a successful vertically integrated industry.

In Uganda, the value added by the coop in this example is not directly translated into farmer's profits much as the coop is borne by the farmers, similar to findings of Knútsson (2001). This scenario is illustrated by the coop as follows. When the farmer harvests farmed catfish, it is sorted into three sizes. Both large (>1.5 kg per fish) and small (<0.8 kg per fish) catfish cannot enter the processing channels as they are associated with low yields (Velu *et al.*, 2009). Catfish between 0.8 and 1.5 kilograms is collected to the coop office and then channelled to processing factories. This action has several transaction costs. First the fish has to be collected and delivered live for checking and record keeping prior to delivery to the processor. The farmer has to bear the costs of transport (0.4 USD/km) and hire of harvesting equipment. Therefore, long trips are costly to the farmer. Also the losses that accrue from fish rejected at the factory are borne by the farmer. Much as this channel would ensure large volume sales, consistent price and above average farm gate price (0.60 USD/kg), the transaction costs reduce the margin realised by the farmer with reports of losses. The processor sells the catfish at an average price of 1.85 USD/kg above farm gate. From these observations, selling directly to the industrial processor would improve the individual farmers' value added. However, the processor requires certification of the fish from the coop. This implies the coop is a gate to this link. Using findings of Knútsson (2001) and having the coop acting not as a link (GTZ 2007) but a channel facilitator between links could improve value added since there is no particular lead farm among catfish producers in Uganda.

Similarly artisanal processors require high quality farmed catfish. In this chain the farmer sells directly to the processor for a higher value than obtained through the coop. However, this requires the farmer to deliver the fish and bare the transaction costs before sales yet through the coop these costs would be deducted after sales. Also farmers have to be in position to provide regular supplies. Therefore predictability of returns from these channels is dependent on supply and quality assurance.

There are farmers who have farmed catfish that does not meet the raw material requirements for processors. For example catfish of mixed sizes, low volumes that do not justify transportation and small remote farms. Such catfish is collected by middlemen or sold locally fetching low prices. This is a probable explanation for the high price range for the individual farmer in agreement with Loc *et al.*, (2010) for *Pangasius* in Vietnam. Usually, catfish ponds are drained prior to harvesting. When the fish is harvested and the farmer lacks holding facilities to keep the fish live, he is at the mercy of the middleman who either pays low prices or leaves the fish to the loss of the farmer.

The farmer has the option of retailing directly to the consumer fetching between 2.9 to 4 USD per kilogram (retailer price range Figure 12). However, there are also barriers and costs attached to this. The farmer needs to access a stall to sell the fish. This requires payment of transport, stall rent fees, and market permit plus daily produce tax. Generally it is observed the further away from the town centres the markets are, the lower the expected price. Thus, the option is costly to the farmer and cannot be feasible with inconsistent production output. Retailing also puts all the risks of transaction to the farmer.

Therefore the low value added for catfish farmers in Uganda is not necessarily a function of actions of the middleman but a combination of factors such as the small farm size, low production volumes and poor coordination and governance to overcome these challenges. The findings are therefore in agreement with Velu *et al.*, (2009) and contrasting those of Loc *et al.*, (2010) and Wamukota (2009), whose studies on small scale producers attributed low producers' returns to middlemen.

The fingerling value chain is a short chain from the producer to the fisherman or grow-out farmer. Selling undifferentiated products makes the farms follow a common value chain from farmer to middlemen and finally user. Generally price fluctuations are similar at all levels (Figure 13).

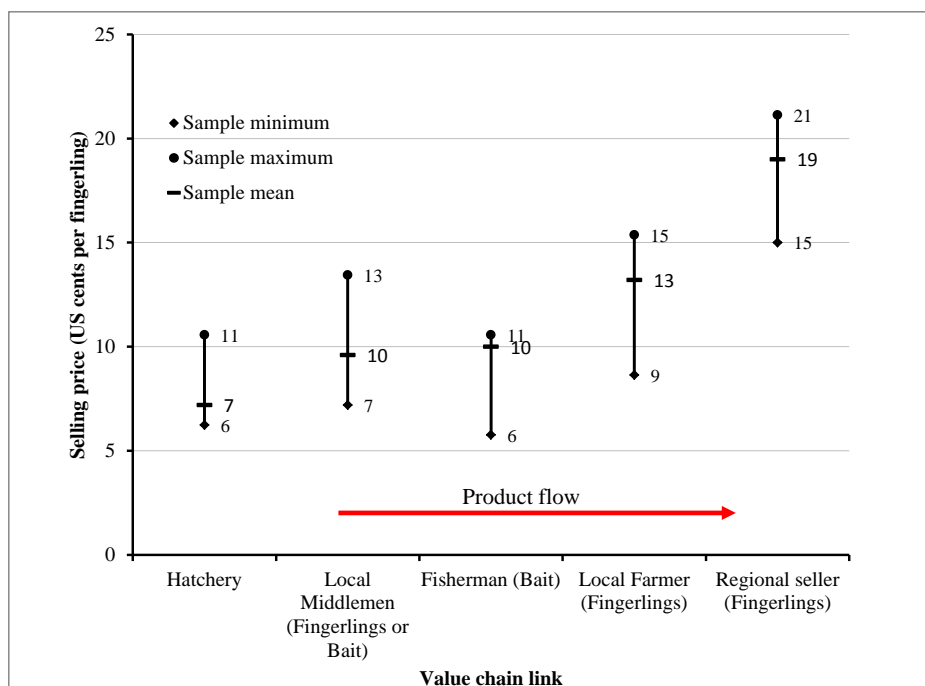


Figure 13: Price range and distribution along the value chain for African catfish hatchery products in Uganda.

The maximum value added is for the regional dealer (12 US cents) and minimum when middlemen sell bait. The hatchery incurs an average of 6 US cents in production costs to produce a marketable fingerling (6 to 10 cm) that can be used as seed for stocking grow-out units or as bait in capturing Nile perch. The value is in exact agreement with Velu *et al.*, (2009) for Nigeria catfish hatcheries (6.5 US cents/fingerling). However, the average value added for Uganda hatcheries is 1 US cent (Figure 13) compared to 5 US cents in Nigeria. Selling bait or fingerlings yields similar average value addition. It is about 3 US cents when middlemen sell either fingerlings or baits.

The low margins the hatcheries get from selling through middlemen are compensated by making high volumes of sales. Several issues ensure survival in this chain. First the hatchery has to be able to provide graded fingerlings, good quality, high survival plus adding an extra 10% of fingerlings for mortality compensation. These actions ensure that the customer returns for future purchases.

The major transaction costs for the hatchery operator are packing, oxygen and water. Usually the farmer or fisherman incurs the transportation costs.

4.6 Competitive positioning within the value chain

Competitive positioning determines the competitive advantage of a firm in an industry i.e. a position a firm can take to outperform rivals in the industry if it can establish a difference (Porter 1996). One way this is done is through strategic group mapping (Porter 1998a). Developing credible strategic group maps would require production data and sales from producers over a long period of time (Lynch 2006) which could not be accomplished under this study. However as seen earlier there are notable driving forces within the industry. There is an emerging market for high quality catfish products like fillets and sausages⁸. This has led

⁸ A local company Sausage King Ltd. is the first known to produce sausages from high quality farmed catfish.

farmers to unite into strategic groups that can aid them meet production objectives and maintain these markets. Another aspect is the emerging regional markets⁹ with consistence in prices and demand for catfish better than the local market. This is price acting as a driving force for the regional value chain (Marriott *et al.*, 2004). Maintaining these markets requires proper coordination, cohesion, cooperation among the farmers themselves and the other actors in the industry. The major problem is that majority of the farmers are small producers who are emerging into a fully fledged industry. To beat these driving forces of competition from other producers will require unity and synchronisation of production scheduling for consistence in supply of quantity and quality at a good price (Vallejo *et al.*, 2009).

4.7 Key factors for competitive success

In this study it is prudent to determine the key factors that will help the catfish farmer survive the competition in both value chains. These factors are a combination of how and what the catfish farmer and processor in Uganda does in order to satisfy the customer (Grant 2005). A reflection on the Icelandic farmers' experiences helps to draw suggestions for probable improvement.

4.7.1 Who are the customers and what do they want?

Analysing the needs of the final consumer is the first step towards determining key success factors (Lynch 2006) for the African catfish farmer. This builds up knowledge, good customer relations and bargaining power (Kubi and Doku 2010). The catfish farmer has two types of customers, those in the domestic value chain and the regional value chain. Since value is created by the consumer (Feller *et al.*, 2006) their needs will be discussed. In addition, processors' key success factors will be discussed for the regional value chain. Fulfilling customers' needs starts right from the fish farm.

In the domestic chain, the following results from interviews with consumers could give highlights of the consumer perceptions about fish and farmed fish and what they expect from the fish seller and thus producer at the beginning of the value chain.

It was noted that commercially farmed fish is still new and has not penetrated the market to a large extent. Only 36% of the consumers interviewed acknowledged having consumed farmed fish. However much as the the rest answered no to this question, they had no clear knowledge of the source of fish they have consumed in the past. Those who consumed farmed fish had obtained the fish mainly from fish farms (56%) and the rest from markets and visits. Majority of the consumers (76%) reported that the prevailing prices of fish are high and affected their access to fish. This was a general comment on all species of fish found in the local markets in Iganga, Jinja and Kampala. Consumers are supplied by local traders, market vendors, bicycle traders, while others buy the fish from supermarkets, restaurants and hotels. There are four main reasons why the consumers bought fish in the first place. They buy because the price is comparatively low to other food products in the market (25%), fish is readily available (35%), it has a good taste (33%) and the rest is a matter of preference.

Three out of every four sampled consumers prefer 'fresh' fish which is fish less than 10 hours from harvest to buying. Due to lack of cold chains in the markets visited, the buyers have few

⁹ According to Ms. Claire, UPBL, a promising catfish fillet market is emerging in Juba, southern Sudan.

other options of fish products. Another reason for this preference is probably the fact that by weight the smoked or processed fish is viewed as expensive.

Consumers advised that if they are to buy fish, it should be brought closer to their homes as usually it is the people at home that buy fish for dinner preparation. This is coupled with the fact that by the time most heads of family leave work for home in the evening, the fish at the market stalls is starting to spoil and not good for consumption.

The size most liked by the consumers (89%) is fish above 500 g with lots of flesh, fewer bones and easy to serve a big family (an average of 5 members per household).

They noted that fish has become scarce (70%) and very expensive and therefore 80% looked at farmed fish as an alternative to wild caught fish.

For the regional value chain, emphasis is on consistency in supply of farmed catfish of the right quantity and quality.

From the above, it is clear that consumers are looking for a relatively low price product, consistent supply, a quality product, closer to homesteads, and relatively big in size.

4.7.2 *What are the competitors doing?*

Since internal rivalry in the catfish farming industry is low, focus will be put on the competing products. These competitors have the following characteristics: they offer their products consistently in time and space. There are no erratic increases in prices, a fact that farmers usually face when they have to recover their costs and push up prices. Demand for other meat products is higher during the festive seasons and therefore could cut into demand for fish (Dhatemwa 2009). Competitors sell similar products with little differentiation. For example most customers knew fish only as whole fish on market stalls and not fillets etc. Traders of fresh Nile perch frames and heads move it in iced pick-up trucks through villages and communities thus bringing the product to the consumer (Erik 2010).

4.7.3 *Key success factors for African catfish farming industry in Uganda*

In analysing the above issues answers can be drawn from the Icelandic small scale fish farmers and processors. To avoid repetition, issues of competitive price and consistent supply are discussed for both the domestic and regional value chains while quality assurance is discussed for producers and processors aiming for the regional value chain.

To compete on price: the producer should have low production costs. This requires being able to operate and sell at low costs. At the beginning of the chain, the farmer has to be good at aquaculture with the need to balance skills, technique and knowledge. For a constant flow of products, the end of the chain has to be certain. This requires marketing skills and knowledge of customers (business contacts) who will consistently buy the products.

One way to lower catfish production costs is by increasing the farmers' bargaining power over supply of inputs like feed (Olagunju *et al.*, 2007). Feeds account for close to 70% of catfish production costs (Isyagi *et al.*, 2009a). According to an interview held with the

proprietor of Hólalax¹⁰, Mr. Friðrik, it is important the farmers keep a close working relationship with the feed producers giving valuable feedback on the performance of feeds and suggestions for improvement. This creates mutual trust between the two parties but mostly improves the bargaining power of the buyer especially when dealing with a monopoly supplier (Gummeson 2002). Furthermore, farmers can make sure they get steady supply of inputs through contracts with local suppliers of feeds (Pomeroy 2003). For Hólalax this is done with Laxá feed company in Akureyri, Iceland. For hatchery operators it is important to have more than one source of feed supply to improve your bargaining power. For example the farm had Arctic charr hatchery feed imports from both Norway and Scotland depending on price.

Avoiding middlemen could also improve pricing (Vallejo *et al.*, 2009). Fiskeldisstöðin Hlíð¹¹ has all the value creation happening under one roof. The company deals directly with the customers, shunting the middleman. This way prices have stabilised for over the past ten years. Where middlemen cannot be avoided, collaboration in the whole chain is important if one is to have competitive prices (Knútsson 2001). This was confirmed by Norlandia¹² managing director Mr. Ásgeir:

“We hold meetings with the middlemen and distributors for discussions about prices, no contracts only trust. In this relationship, feedback and response is important.”

If the product price cannot outcompete substitutes, new product development might be a solution to consumer acceptability (Kasapis 2009) and competitiveness (Asche *et al.*, 2001). A quote from Mr. Ásgeir highlights this;

“...we discuss strategies of testing new products on the Nigerian market like how we started the bales of blue whiting which is now fetching more price...like my buyer; when he was introducing my products in the beginning, these belly cuts and stuff, he had to give a discount on that product and say to people ...well if you buy ...eh...five bags of heads you get one bag of this to try...you know...and that is how it started...and you know what after a while instead of pushing the product out; the market started to pull it out...you need to start competitively, if you are not competitive in the beginning...go somewhere else with it...you have to be competitive with other production methods...if you are not you are just on borrowed time and it is only a matter of time when you will fall out...”

Another view of reduction of production costs was held by Mr. Gunnar, proprietor of Fiskeldisstöðin Hlíð.

“Our aquaculture has been successful because of the strategic siting of the farm, natural spring water from the mountain provides gravity flow of water to and from the farm and therefore cutting out the cost of pumping water.”

¹⁰Hólalax hf. is a small scale fish farm in northern Iceland producing high quality Arctic char (high price fish) products for export market. They have both hatchery and grow-out operations. Produce 100 tonnes of 800 g whole fish for the European market and 250 g fillets plus 200,000 to 400,000 fingerlings per year.

¹¹Fiskeldisstöðin Hlíð is a small scale family aquaculture and processor business owned by Mr. Gunnar.

¹²Norlandia processes dry products for the Nigerian fish market.

For Norlandia, having competitive prices comes from the access to cheap energy from hot water, good climate, good dry air, no pollution and no humidity, thus producing dry processed fish cheaply. *“Business continuity is important; there is no need to start the enterprise and then close,”* Mr. Ásgeir. Therefore being competitive would require proper business agility (Bostock *et al.*, 2009). The catfish farmers should think of variable costs, volume they can supply, understand who their customers are and finally know if alternative markets exist for the produced fish. This also highlights the importance of record keeping (Atukunda 2010). Another option given was to keep the number of employees on the farm to a minimum. For example Hólalax had 3 employees to produce the 100 tonnes per year. This cut down the amount of wages that would be spent on unproductive labour (Lynch 2006).

For consistent supply: stability in supply is usually a result of financially strong growers in the industry or having cooperation among small scale growers. Smallholders with good market access and the ability to supply fresh fish of consistent quantity and quality are likely to command the highest prices and net returns (Jagger and Pender 2001). For example Mr. Gunnar regularly smokes salmon fillets yet at times would not get raw materials. The proprietor solves this by having supply from his indoor fish farm so that the customer could still access the product anytime for the past twenty years. Furthermore, it is important to produce what the customers can consume, then plan and build demand gradually (Subhash 2000). Hólalax produces 100 tonnes of arctic charr per year and would gradually get to the permitted 500 tonnes of arctic charr, revealed Mr. Friðrik. It is not advisable to have big investments into fish farming prior to determining the market demand for your products, according to Mr. Friðrik. This would usually result in underutilisation of farm capacity and huge overheads that will run a farmer out of business (Isyagi 2007). It is better to have small culture unit volumes with high density than big volumes with wasted water space.

For the fingerling business, the Hólalax proprietor advises that *“..when you are producing small fish you have to be sure that you can sell it.”* This very important to avoid costs of maintaining unsold fish. Having both a hatchery and grow-out operation ensured that fingerlings not sold could be channelled to full grow-out operations. In this kind of system, if sales went down in one operation, the other operation could sustain the farm operating costs.

Also commercial fish farmers should know that fish farming is a technically risky business (Leonard and Blow 2007) and that they should put all their effort where their investment is and not expect free assistance. However, Hólalax acknowledges that issues like breed purification may be done with farmers collaborating with government.

“The government helps in building the right stocks and produce eggs for farmers. Then the farmers give back the best performing stock to the government research station and the cycle of selective breeding continues.”

For quality products: *“...if you have a good quality raw material...sure you can turn it into a good product, but how to do it..that is the question,”* Mr. Ásgeir. Quality for farmed fish starts deteriorating during harvest and price is reduced (De Silva *et al.*, 2006). Therefore, farmers need to harvest the fish with minimum stress (Mr. Friðrik) and deliver it to the next actor in the value chain in as much the same condition as it was harvested (Petra 2010). This rapid deterioration requires the raw material should be either kept live or degutted and cooled (Marriott *et al.*, 2004). For fatty fish, for example catfish, during gutting there is need to completely remove the liver out of the fish such that it does not spoil the smoked or dried products through oxidation (Mr. Ásgeir). There is also need to keep the processed product in

cool dry ventilated place with minimum moisture less than 11% for a good dry product (Shamsuddoha 2007).

For high quality products like fillets, the processing environment has to be hygienic (Keane 2008). Mr. Kristján, managing director of Egilssíld¹³ puts it that “...*Here there are three rules: number one, two, three are hygiene, hygiene and hygiene....this very important, everything has to be extremely clean*”. Therefore catfish processors ought to first understand the meaning and then the importance of quality for the products.

Icelandic firms have realised the need for product presentation in recommended ways (Engle and Quagraine 2006). “*You buy food with the eyes and product presentation is so important,*” Mr. Gunnar. “*The fish not only needs to be fresh but needs to look good,*” Mr. Kristján. There is need to have consistence in form, texture, shape and colour to build loyalty from customers and improve sales over time (Kinnunen and Pistis 2007). For example Egilssíld processes smoked herring and salmon fillets. These are cold smoked, sliced and vacuum sealed attaining a shelf life of one year. The shelf life is a function of a high quality raw material. Much as the fish is fatty, keeping the temperature low with good hygiene improves shelf-life (Bostock *et al.*, 2009).

Product identity is also important (Engle and Quagraine 2006). Customers associate brand to the quality of a product (Balabanis 2006). For example, the case of Egilssíld and Fiskeldisstöðin Hlíð firms. Both companies have small scale production of smoked salmon fillets but distinct product identities that give them separate market lines. Egilssíld uses fast salting, fast smoking, a grid powered oven and fast packaging for its products. On the other hand, Fiskeldisstöðin Hlíð offers manual traditional salting that takes time, uses wood oven, and produces drier spiced fish. The focus is on maintaining the quality the customer wants. This way their product identity and innovation is distinct (Engle and Quagraine 2006).

On Other Issues: Farmers need to have good production technologies to produce harvest size fish in a short time. For Hólalax, collaborating with the government hatchery has helped reduce production time of Arctic charr from over 30 months to 18 months. In terms of product distribution, the producers should have enough volumes to justify the transportation costs (Erik 2010). To remedy the inadequate size of producers, horizontal cooperation should be supported at different stages of the value chain to benefit from the economies of scale that could exist in the service delivery (Pietrobelli 2008).

4.8 Conclusion and recommendations

The study has provided the first detailed account of aquaculture value chains in Uganda particularly on African catfish. Analysis of the aquaculture industry and the determinants of profitability have revealed low internal rivalry and low bargaining power of the catfish farmer thus low profitability. Value chains and the participants reveal a multi-faceted value chain that is emerging into vertical integration. The key drivers are price and fish quality. Relationships are mainly zero-sum but the improvements in cooperation are aimed at yielding plus sum relationships. Contrary to several findings in aquaculture value chains, the African catfish value chain in Uganda is to a large extent not governed by middlemen, rather lost value and bargaining power are a result of size and scale of production. Actors in the regional

¹³Egilssíld is a small scale processing company for herring and salmon fillets.

value chain have a potential for higher income and global market penetration. Therefore governance in the regional export value chain is more likely to be effective than the domestic value chain. The key success factors thereto are also most likely to have a positive impact in this emerging value chain. The Uganda government has been successful in promoting environmentally friendly aquaculture as a poverty reduction tool as reiterated in the strategy thereof. However these efforts have not been effective in supporting fair distribution of benefits along value chains and reducing the vulnerability of farmers. By regulating and facilitating the smooth operation of these value chains, the government would make the most important intervention. Farmers note that increased certainty over their variable costs and revenue will clear their investment climate.

What value creation changes should African catfish farmers in Uganda adopt to improve sales, cost performance and margins?

Due to small-sized farms, production and uncoordinated structure, cooperation among actors in the domestic value is a must to improve profitability. On the other hand, consistence in supply of quality and quantity will improve competitiveness of the regional export value chain.

Cooperation is needed in the domestic chain to improve the bargaining power of individual famers. Existing fish farmers' cooperatives should be supported to reinforce the regional export value chain for global competitiveness. Further research is needed to elaborate the structure and function of farmed fish value chains. This could be done through tracking of fish volumes through the chain. Another important issue that would require addressing is the input costs at each link to determine the exact added margin instead of value. This requires data on inputs and outputs at each link. It would also be recommended to trace the regional export value chain into the neighbouring countries to estimate exactly the final value added in this channel. The reason for this is that live weight catfish to regional markets like Congo goes for less than 4 US dollars yet a report by Velu *et al.*, (2009) indicated prices of over 12 USD per kilogram for the same catfish from Nigeria. There is also need to determine the specific support different chain actors need to comply with emerging environmental and social regulations and standards; and finally, what new public-private partnerships can be adopted to regulate production using private sector led value chain governance.

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APPENDICES

Appendix I QUESTIONNAIRES

AI-1: Farmer Questionnaire

Name of enumerator.....

Name of farmer.....

Telephone contact.....

1.0 LOCATION CHARACTERISTICS

District.....

Sub-county.....

Parish.....

Village.....

SOURCES OF INCOME

1. What are the sources of income in this household?
2. Rank the above mentioned sources of income starting with the one, which brings in most income

Source	Rank

FISH PRODUCTION

3. When did you start fish farming?
1. What types of fish do you farm?
2. What system of production do you use?
3. Rank the types of fish farmed and attach the percentages?

Type (Specie)	Rank	%	Production System	Rank	%	Reason for its culture

4. What criteria do you base on to select the type of fish you farm?
5. Which month's do you produce the highest and lowest volumes? (Can obtain annual trend if possible)
6. Fill in the below for the types and volumes harvested.

Pond Number	Size of pond (sq. m / ft.) measure if possible.	Year constructed	Type of fish farmed	Amount Harvested in 2009 Specify Unit (Pieces / Kgs)	
				First Harvest	Second Harvest
1					
Observations and comments on pond construction quality, on next page					
Observations and comments on pond construction quality					

Enumerator should be able to observe and make some remarks on whether the pond meets the minimum recommended standards

7. How has been your production over the past three years / since you started farming?/Decreasing, Increasing, Constant (If possible give annual production volumes and reasons for your answer)
8. Which type of fish do buyers prefer and why?

FARM RECORDS

1. Do you keep records?
2. What type of records do you keep?
3. Observations about the quality of record kept (If none, poor quality, give reason)

FISH FRY/ FINGERLINGS

1. What is your main source of fry? (On farm made, Fellow farmers, Ugachick, SoN) Specify.
2. How far is the source of fry? (Kilometres)
3. Is the fry always available when you need it?
4. What problems do you encounter while accessing the fry?
5. When did you last purchase fingerlings to stock in your ponds?

4. FISH FEED

5. What types of feeds do you give to the fish?
1. What is your main source of feed? (Research station, Own farm, Fellow farmers, NGOs (specify)
2. How far is the source of feed? (Kilometres)
3. Are the feeds always available when you need them?
4. What problems do you encounter while accessing the feeds?

- (a) What problems do you face in fish production?

(Pests and diseases, Low production, High cost of fish fry, Lack of market, Low prices, Poor quality advice, High post harvest losses due to lack of storage facilities)

Problem	Rank starting with most serious one.	Suggested solution

- (b) Give suggestions on how best the above problems can be solved

FISH MARKETING

1. Do you sell fish? Yes ----1, No-----2./If no, give reasons /If yes, which types and how do you sell your fish? (Group, Individually, Both)
2. Which months do you sell the highest and lowest volumes? (Can obtain annual trend if possible).
3. What is the maximum amount of fish that you can sell in a day?
4. Which system of sale do you prefer and why?
5. Fill in the table below for the volume and unit price you sold at in 2009?

Species	Product	Wholesale/Retail	Avg. Size	Quantity sold	Units (kg or pieces)	Unit Price

6. Where do you sell your fish? Rank the main market outlets for your fish?
7. Is your production usually enough to satisfy customer demand? If no, what other sources do you use to maintain customer demand?
8. Are you satisfied with the price offered?
9. What is your source of market and price information?
10. Do you know of a better market outlet where you would rather sell your fish? If yes, why are you not able to access these market outlets?
11. What do you think can be done to access these market outlets?
12. What problems do you face in fish marketing? (Lack of market, Low prices, Inadquate production, High cost of transport, High post-harvest losses due to lack of storage facilities).
13. Please rank them starting with the most serious one
14. Give suggestions on how best the above problems can be solved.

Problem	Rank start with most serious one	Suggested Solution

15. Do you package your fish?
16. How do your customers prefer the fish you sell. Fill table below

Type of fish	Preffered product (Live, smoked, salted, fillet, whole gutted, whole ungutted)	Preffered size

GRADING OF FISH/FISH PRODUCTS FOR SALE

1. Do you grade your fish before selling?
2. If yes, what do you base on while grading?
3. What problems do you face while grading?
4. How are you coping with the above mentioned problems?
5. Give suggestions on how best the above problems can be solved

POST-HARVEST LOSSES

1. Do you experience any post-harvest losses
2. What kind of post-harvest losses do you experience in fish farming?
3. Give suggestions on how best the above losses can be reduced (by type of fish and product sold)

PROCESSING

1. Do you process your fish before marketing? If no, why not?
2. If yes, explain how you process your fish products.
3. How much does it cost you to process you fish?
4. How much raw fish do you process and how much product do you get?
5. What is the quantity you process daily / weekly / monthly?
6. Who are the main buyers of the processed fish?
7. What is incurred during processing (include transportation and its costs).
8. What is the price of the final product?
9. Is what you process adequate?
10. Fill in the table below for 2009.

Species	Quantity processed	Cost of processing	Price

11. What problems do you face during processing?
12. Do the constraints affect your levels of production? (Yes or No), If yes in what way?
13. Give suggestions on how best the above problems can be solved

TRANSPORTATION

1. Do you transport your fish to market outlets?
2. If yes, what mode of transport do you use? Bicycle, vehicles)
3. What is the distance to this market outlet? (Kilometres)

Mode of Transport	Distance to market (km)	Cost (Shs)	Price at market

4. What problems do you face during transportation?
5. Give suggestions on how best the above problems can be solved

AI-2: Processors' Questionnaire

Name of enumerator.....
 Name of Processor
 Telephone contact.....

1.0 LOCATION CHARACTERISTICS

- 1.1 District.....
- 1.2 Sub-county.....
- 1.3 Parish.....
- 1.4 Village.....

2.0 Processing

- 1. When did you start processing?
- 2. What type of fish do you process?
- 3. What products do you process?
- 4. What is the quantity you process daily / weekly / monthly?
- 5. Who are the main buyers of the processed fish?
- 6. What type processed products have got the highest demand and why?
- 7. What type processed products have got the lowest demand and why?
- 8. Where do you obtain the fish you process?
- 9. Which fish is supplied from the lake and estimate the percentage?
- 10. Is there shortage of fish from the lake? And when is this shortage greatest?
- 12. Where do you sell your processed products? Rank the main buyers
- 13. Which months do you process the highest and lowest volumes? (can obtain annual trends if possible)
- 14. Fill in the table below for the volume and unit price you sold the processed fish in 2009?

Type of fish	First Season		Second Season	
	Quantity Processed	Unit Price	Quantity Processed	Unit Price

- 15. Do you always have enough processed fish to satisfy customer demand? If no, what other sources do you use to maintain customer demand?
 - 16. Do you know of a better market outlet where you would rather sell your processed fish? If yes, why are you not able to access these market outlets?
 - 17. What do you think can be done to access these market outlets?
 - 18. Comment on the volumes processed over the past three years/ since you started.
 - 19. What problems do you face in fish processing? (Lack of market, Low prices, High post-harvest losses due to lack of storage facilities)
 - 20. Please rank them starting with the most serious one
 - 21. Give suggestions on how best the above problems can be solved
 - 22. When you run out of the preferred fish what do your customers opt for?
 - 23. When are fish prices highest/ lowest? Give reasons for your answer.
- GRADING FOR SALE**
- 24. Do you grade your fish after processing?If yes, what do you base on while grading (size, species, product)?
 - 25. What problems do you face while grading?
 - 26. How are you coping with the above mentioned problems?
 - 27. Give suggestions on how best the above problems can be solved
 - 28. Do you experience any post-harvest losses?
 - 29. What kind of post-harvest losses do you experience in fish processing?
 - 30. Give suggestions on how best the above losses can be reduced
 - 31. Do you process any of the fish you buy whole yourself?
 - 32. Do you sell farmed fish? If not, why not? If yes which species and size?
 - 33. What would be preferred products, size, and species?

AI-3: Traders' (Retailers / Wholesalers) Questionnaire

Name of enumerator.....

Name of Trader.....

Gender

Telephone Contact.....

Category of Trader (Retailer / Wholesaler).....

1.0 LOCATION CHARACTERISTICS

1.1 District.....

1.2 Sub-county.....

1.3 Parish.....

1.4 Village.....

1.5 Name of market.....

1.6 Location of your Outlets (e.g. Town, mobile, rural, etc.)

2.0 MARKETING

What type of fish and products do you sell?

What type of fish and products has got the highest demand and why?

What type of fish and products has got the lowest demand and why?

Where do you obtain the fish you market?

Where do you sell your fish? Rank the main buyers

Which months do you sell the highest and lowest volumes? (Can get annual trends if possible).

What is the highest amount of fish that you can sell (for each of the species, products)?

Fill in the table below for the volume and unit price you sold at in 2009?

Species	Product	Rank	Size	Type of Customer	Quantity sold Specify unit (pieces or kg)	Unit Price

Do you always have enough supply to satisfy customer demand? If no, what other sources do you use to maintain customer demand?

Do you know of a better market outlet where you would rather sell your fish? If yes, why are you not able to access these market outlets?

What do you think can be done to access these market outlets?

What problems do you face in fish marketing? (Lack of market, Low prices, High cost of transport, High post harvest losses due to lack of storage facilities)

Please rank them starting with the most serious one

Give suggestions on how best the above problems can be solved.

3.0 GRADING for sale

Do you grade your fish before selling?

If yes, what do you base on while grading?

What problems do you face while grading?

How are you coping with the above mentioned problems?

Give suggestions on how best the above problems can be solved

4.0 PACKAGING

Do you package your fish?

If yes, how?

What constraints do you face in packaging?

What are the consumer preferences?

5.0 POST-HARVEST LOSSES

Do you experience any post-harvest losses of the products you sell?

What kind of post-harvest losses do you experience, for which products most?

Give suggestions on how best the above losses can be reduced?

6.0 PROCESSING

Do you sell processed fish?

Give reason for the above response.

Do you purchase processed fish or you process your own fish before marketing? If no, why not?

If yes, explain how you process your fish

What is the quantity you process daily / weekly / monthly?

What is the dry season cost price from your supplier?

What is the wet season cost price from your supplier?

Who are the main buyers of the processed fish?

What problems do you face during processing?

Give suggestions on how best the above problems can be solved

AI-4: Consumers' Questionnaire

Name of Enumerator.....
 Name of Respondent.....
 Telephone contact.....
 Sex.....

1.0 LOCATION CHARACTERISTICS

1.1 District.....
 1.2 Sub-county.....
 1.3 Parish.....
 1.4 Village.....

1.5 Name of Market

1.6. Is this a weekly/daily market?

A] CONSUMERS' PREFERENCES

What type of consumer are you? (Restaurant, family, hotel..)

How many people live you in this house hold?

How often do you buy fish? Daily/Weekly/Month

How much fish (pieces or kg) do you usually buy when you purchase?

When was the last time you bought fish/ products?

Where do you purchase the fish from?

Rank the sources?

How much did you pay for it by species and product?

Which species and product is preferred by your household and why?

Specify the number of times in the last month you ate fish?

Where did you consume this fish? Friends/restaurant/home (may list several and find out where most of the fish was consumed)

Was the fish you consumed fresh/processed?

Please rank the constraints of obtaining fish starting with the most serious one?

Constraint	Rank	Suggested solution

B] FARMED FISH

Have you ever eaten farmed fish?

Which type of fish was the farmed fish you ate?

What are your comments on the farmed fish

Where do you get the farmed fish you consume(d)?

Which do you prefer? Farmed fish or lake fish?

C] GENERAL FISH SUPPLY

Who are the suppliers of the fish products you consume?

In your opinion, what type of fish has got the highest demand and why?

Which months of the year is the fish you prefer scarce or expensive? (mention the fish type and product)

Do you consider the various fish products you buy affordable? (mention product and its source to eg. Smoked fish from so and so is most affordable)

From which market do you purchase most of your fish and why? (eg. near home, near work, cheaper, products/quality of fish sold, etc.)

What is your most preferred form (processed) of fish?

What sizes of fish do you prefer and why?

Do you find problems accessing fish for your household? If no, why not; if yes, why?

Give suggestions on how best the above problems affecting supply, your access to fish, or affordability of fish can be solved?

Appendix II QUOTED INDIVIDUALS

Title and Company	Name of Interviewee	Contact	Products
Managing director Hólalax	Friðrik Steinsson	Tel: +354 892 7706	Arctic charr: aquaculture and processing (head on gutted and filleted – fresh and frozen)
Managing director Egilssíld	Kristján Haraldsson	Tel: +354 467 1690	Smoked herring and smoked salmon
Managing director Norlandia	Ásgeir Logi Ásgeirsson	Múlavegur 3, Iceland Tel: +354 4662788 Mobile: +354 6603959 asgeir@norlandia.is	Dry cod head, and several bi-products
Proprietor Fiskeldisstöðin Hlíð	Gunnar L Jóhannsson	Svanfríður Halldórsdóttir Tel: +354 4662461	Smoked salmon. Spiced salmon fillets
Chairman/Secretary Walimi Fish Co-operative Society (WAFICOS)	Paul Ssebinyansi (Chairman) Lovin Kobusingye (Secretary)	Wandegeya, Kampala District P.O Box 6213, Kampala Tel: +256 312 265896 +256 772 405460 waficos08@yahoo.co.uk	Live catfish, fingerlings, frozen tilapia and catfish, fish farming inputs
Proprietor Edrhon Enterprises and Fish Farm	Buwule Rhona fish farmer and marketer	Busega, Kampala District Tel: +256 772 882006 +256 772 440221 edwinpaulb@yahoo.co.uk	Smoke farmed catfish products
Catfish Farmer	Waigulo Karim	Tel: +256 752 549304 Iganga T/C	Catfish
Fish Farmer	Dr. Kazungu David	Tel: +256 772 721233, Kamuli	Catfish, tilapia
Fish Farmer	Mbabazi Rose	Tel: +256 752 668002, Jinja	Catfish, tilapia
Fish farmer	Kalizimbawa Godfrey	Tel: +256 779 871552, Jinja	Catfish, tilapia

Appendix III ASSUMPTIONS USED IN CALCULATIONS

All values are calculated for live weight equivalent. Average yields obtained for farmed catfish were; whole gutted=0.7, fillets=0.5, cold smoked=0.65, hot smoked=0.4. Variable costs were estimated at an average of 2500 Ush per kg (FCR=1.5; Feeds cost 1100 Ush/kg; Overhead costs including stocking=850 Ush/kg) for grow-out while for hatchery unit cost of production was 130 Ush per fingerling. All figures were generated from interviews.

Appendix IV CATFISH HATCHERIES IN UGANDA

Name and Location	Contact name	Address
Kigezi Fish Farm Kizigizi (Kabale)	Mr.Kahababo Valentine	
Sun Fish Farm Kajjansi (Wakiso)	Mr.Tugumisirize Digo	
TIFTC Garuga (Wakiso)	Mr. Phillip Borel	Entebbe (Wakiso District) Greenfields (U) Ltd. Plot 15/17 Mirza road, Entebbe-Uganda Tel: +256 414-321141/320716 Mob: +256 752-764764 Fax: +256 414-312386 Email: iil@infocom.co.ug
Umoja Fish Farm Kakiri (Wakiso)	Mrs.Rugunda Jocylene	
Aquafarm Consults Ltd. (Wakiso)	Dr. Justus Rutaisire	Plot 14-18 Nakivubo Place P.O Box 72406 Kampala Tel: +256 312-102859 +256 772-501227 +256 772-634077 Email: aquafarmconsults@yahoo.com
Kabeiura Fish Farm (Bushenyi)	Mr.Muhozi Eriab	P.O. Box 47 Bushenyi Tel: +256 485 43456 +256 772 496989 +256 772 430201 Email: igara@infocom.co.ug
Tochi Heights (Gulu)	Mr. Dick Nyeko	
Mpigi Fish Farm (Mpigi)	Mr. Ssebinyansi Paul	waficos08@yahoo.co.uk
MUSO4 Fish Farm Busalaamu (Iganga)	Mr. Musomerwa Mutalib	
Interglobe Services Ltd Makindye (Kampala)	Mrs. Rumanyika Mary	Makindye, Kampala. Tel: +256 772 416237
Salaama Integrated Fish farm	Vincent	Busia Uganda