

GENDER PARTICIPATION IN THE FISH VALUE CHAIN IN AMOLATAR DISTRICT

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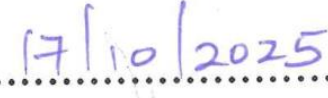
**A DISSERTATION SUBMITTED TO THE DIRECTORATE OF RESEARCH AND
GRADUATE TRAINING IN PARTIAL FULFILMENT OF THE REQUIREMENTS
FOR THE AWARD OF MASTER OF SCIENCE IN AGRI-ENTERPRISES
DEVELOPMENT DEGREE OF GULU UNIVERSITY**

OCTOBER, 2025

DECLARATION

I Laker Viola, declare that this is my original work and has never been submitted for award in any institution of higher learning.

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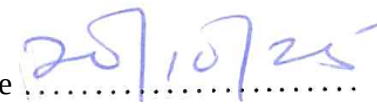
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APPROVAL

This dissertation has been submitted to the Directorate of Research and Graduate Training with our approval as university supervisors.

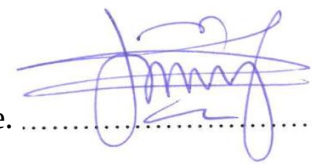
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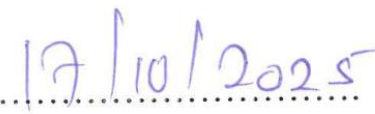
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DEDICATION

With great pleasure, I dedicate this dissertation to my lovely parents Mr. Awich Chouldry and Mrs. Alanyo Gladys Awich and all the fish value chain actors in Uganda.

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ABSTRACT

This study was set out to contribute to an understanding of gender participation in the fish value chain in Amolatar District. Specifically, the study assessed the relationship between socioeconomic factors and gendered participation in the fish value chain, determined the drivers of value shares earned at the various nodes of the fish value chain and determined the factors influencing vertical integration in the fish value chain. Using a cross-sectional survey of 355 randomly selected fish value chain actors. Data was collected using a semi-structured questionnaire, Data was analyzed using descriptive statistics, Tobit regression model and Multinomial regression. Findings revealed that value shares earned at the various nodes of the fish value chain was driven by sex of household head, participation of boys, participation of male spouse, participation of HH member in fish processing, dealing in tilapia, dealing in Nile perch, dealing in silver fish, quantity of fish sold, access to buyer information, distance to market, group membership and education. Vertical integration was influenced by sex of household head, dealing in silver fish, dealing in Nile perch, fish price, tax costs, transport costs, engagement in other farming activities, engagement in trading activities, distance to market and group membership. This study recommends diversification and inclusion in decision-making, strengthening support for value addition, market access, promoting group formation, and strengthening institutional support for value chain actors to overcome barriers to upgrading and enhance the overall efficiency of the fish value chain.

Keywords: *Gender Participation, Fish, Value chain, vertical integration, value shares*

CHAPTER ONE: INTRODUCTION

1.1 Background

Fisheries is an essential component of agriculture and global food security (Olaifa 2015). In Uganda, agriculture remains the backbone of the economy, employing 70% of its population and contributing half of the total Uganda's export earnings and a quarter of the country's gross domestic product [GDP] (World Bank, 2018). The fishery sector in particular is the second largest export earner for Uganda after coffee (MAAIF, 2008).

Gender participation plays an important role in agriculture (Peterman *et al.* 2010). Women in particular are comprising over 40 percent of labor force worldwide (FAO, 2011). Globally, it is estimated that women make up about half of the total workforce in the fisheries sector (Torell *et al.* 2019 ; Mangubhai & Lawless,2021). According to FAO (2013), 12 percent of the 44.9 million fishers and fish farmers (typically considered a male domain) were women. Despite this figure, they are mostly invisible contributors with disenfranchised voices (Bene *et al.* 2016).

Several studies have highlighted that men are mostly involved in fishing activities whereas women mainly concentrate in post-harvest and marketing activities (Béné and Merten, 2008; Nagoli *et al.* 2010; Chiwaula *et al.* 2012). In general, men in Uganda control fisheries inputs (boats, engines, nets) and decisions about when, where, and how to fish. Women, on the other hand, control and make decisions regarding post-harvest activities (where to sell, how to market, how to process, etc). Ugandan women provide substantial value to the fisheries sector and play a vital role in its healthy function.

However, gender disparities in fishing communities are among some of the major constraints affecting equity in fisheries livelihoods and productivity (USAID, 2015). Women who are dependent on fisheries for their livelihoods and families' upkeep are directly impacted by changes in fisheries policies and rules (FAO, 2017). Hence, there is an incentive for women to be active agents of change in the fisheries sector. However, women working in fisheries face many barriers. Women's participation is often constrained by time (the result of household and reproductive responsibilities), education (literacy), access to capital, cultural rules, mobility due to household responsibilities, and discriminatory laws, among other barriers (Matsue *et al.* 2014; FAO 2015).

Cultural norms and traditions perpetuate male-dominated conversations (and shape gender inequities) in which men drive the fisheries sector (Medard *et al.* 2002). The lack of gender disaggregated data and data on fish caught by women gleaners in fisheries globally results in an underestimation of the total fisheries production and of the contribution of fisheries to household income and food security (FAO 2016). This is particularly important because women's fisheries activities disproportionately contribute to household food security, because seafood harvested by women is more likely to be consumed by their household members (Heck *et al.*, 2007; Jahan *et al.*, 2010; Kawarazuka and Béné, 2010).

Despite their importance and contribution to the fish industry, women have received little attention from both the government and nongovernmental organizations. The negligence of women in the fish sector is a matter of priority if the fishery sector is to increase its current level of contribution towards household and national economy. The importance and contribution of women in the fishery sector and their role in production point to the need to identify gender participation in the sector. Gender concerns in the fishery sector can only be identified and addressed by identifying

the participation of male and female in fish value chain as well as the factors hindering their participation. Engendering the fish value chain would provide men, women and youth equal opportunities to participate at the different nodes (Waithanji, Njuki, and Bagalwa 2013). The information provided by this study would help formulate effective interventions to promote the participation of women in fish value chain in the study area and the nation at large.

This study focused on the analysis of the involvement of male and female fish farmers in the study area. The study aimed to unveil the gender gap in the participation of the fish value chain in the study area. Theoretically, in Sub-Saharan Africa, Southern and South-East Asia, women generally have the right to dispose of product and income from their own economic activities. However, “in practice they are often constrained to using them to meet their responsibilities for certain expenditures that are determined by their husbands or by prevailing male-enforced norms” (Dey, 1992). Generally, in Uganda, fishing is an activity that is a male dominated field. Specifically, among the Langi people around Lake Kyoga sub region, women are not allowed to jump over fishing boats or in some instances even come and touch them. Fishing Operations in these communities is mainly done by men. Notably, among the Langi, in Namasale and Muntu fishing villages, the men who do the actual fishing are in most cases not boat owners however, they are the majority of people in these fishing villages.

1.2 Problem Statement

The fish sub-sector in Amolatar and Northern Uganda serves as a vital livelihood activity for local communities, particularly those residing near water bodies like Lake Kyoga. Fishery resources contribute significantly to food security, income generation, and employment opportunities in the region (Mugisha, 2019). Traditionally, men are primarily involved in fishing activities, including the operation of fishing vessels and processing, while women are more commonly engaged in retailing and marketing of fish products (Kabumba & Ntambi, 2017). However, there is evidence of increasing female participation in various nodes of the fish value chain, albeit often facing barriers such as limited access to ownership of fishing equipment and financial resources (Ogola & Egaru, 2020). Although men and women are essential parts of the fish value chains, women have tended to be disadvantaged in terms of participation and benefits reaped from the value chain (Siles *et al.* 2019). For instance, existing reports show that many women in the fish value chain are largely confined to the lowest and less paying nodes of the value chain (Torell *et al.* 2021). Yet again, women's contribution in this lower node of the value chain is often unpaid, part-time, opportunistic, and considered an extension of household duties (Mangubhai & Lawless, 2021).

Previous studies on fish mainly focus on the production sector that is male dominated rather than the processing and marketing sector (female dominated). This has made women contribution to continue being marginalized while male contribution continues to remain the sole focus of attention (FAO, 2005). This study is therefore intended to build on existing work and expand focus on the literature to examine the information gaps and research needs related to gender participation in the fish value chain in Amolatar district to ensure more promotion of pro-poor growth and pro-gender policies.

1.3 Research objectives

1.3.1 General Objective

To contribute to an understanding of gender participation in the fish value chain in Amolatar District.

1.3.2 Specific Objectives

- i. To assess the relationship between socioeconomic factors and gendered participation in the fish value chain
- ii. To determine the drivers of value shares earned at the various nodes of the fish value chain
- iii. To determine the factors influencing vertical integration in the fish value chain

1.4 Research Questions

- i. How are the relationship between socioeconomic factors and gendered participation in the fish value chain?
- ii. What are the drivers of value shares earned at the various nodes of the fish value chain?
- iii. What are the factors influencing vertical integration of the fish value chain?

1.5 Conceptual Framework for gender participation in the fish value chain

In this study, gender participation is anticipated to determine the key roles and responsibilities of household members at the different value chain node, as well as the distribution of benefits along the chain (value shares). Gender participation is operationalized as the roles/activities undertaken by the boys, girls, female and male spouses in the households in the fishing, fish processing and fish retail trading. This study assumes that gender participation is related to the socio-economic structure and characteristics of a household engaging in the fish value chain. For instance, relatively young households in which the male and female spouse fall within the youth age bracket may be more willing to participate together in activities of the value chain than the case where one or more members of the household is/are elderly

The arrows in figure 1 illustrate the factors affecting individual's ability to participate and benefit from the value chain and pinpoint critical segments that require upgrading. Different measures have been used to describe the distribution of benefits along the value chains for instance, Lie *et al.* (2012) used three measures: profit, employment benefits and non-monetary benefits such as knowledge.

The socio-economic, social cultural and institutional factors constraints the participation of men, women and youth at the different nodes of the fish value chain and also have influence on “vertical integration” that is how a firm extends its operations within its supply chain which directly affects the value shares earned by the gender categories at the various nodes. However, price has become an important measure of value since the 1990s because product processing and differentiation significantly add to margins (Manning, 2015). Therefore, this study employs price as a measure of benefit distribution.

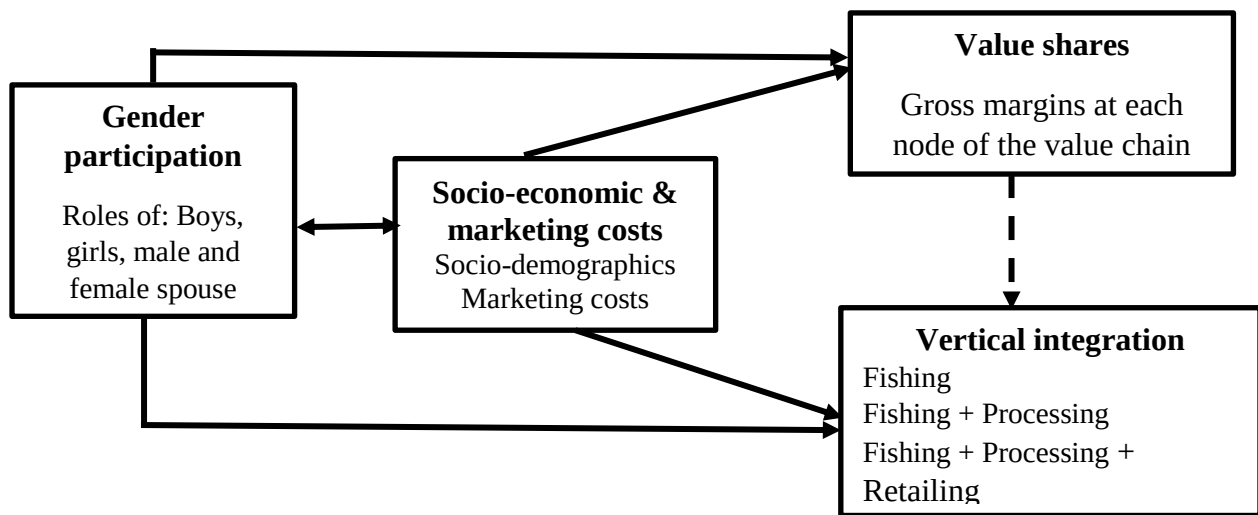


Figure 1: Conceptual framework of gender participation in the fish value chain

Source: Adapted from (Ahmadu & Idisi, 2014; Eriya, 2018)

1.6 Significance of the study

Understanding the gender dynamics within the fish value chain in Amolatar District can contribute to promoting gender equality and social justice by identifying any existing disparities in participation, opportunities, and benefits between men and women. This knowledge can inform policies and interventions aimed at ensuring equitable access and benefits for all gender involved in the fishery sector. Also, investigating gender participation in the fish value chain can shed light on the economic contributions of men and women in the sector. This understanding is crucial for creating economic empowerment programs that target both gender effectively, potentially leading to increased income and livelihood opportunities, especially for women who may be marginalized or underrepresented. Furthermore, analyzing gender roles and participation within the fish value chain can contribute to the development of sustainable practices and policies. By recognizing the diverse contributions of men and women, stakeholders can devise strategies that promote environmental sustainability, improve resource management, and enhance the overall resilience of the fishery sector in Amolatar District.

1.7 Operational Definitions

Gender Participation: In this study, gender participation refers to the specific roles and activities carried out by boys, girls, male spouses, and female spouses within a household across the different nodes of the fish value chain. These nodes include fishing, processing, and retail trading. Participation was measured by whether household members were actively involved in these activities (Yes = 1, No = 0).

Fish Value Chain: The fish value chain is understood as the series of interconnected activities involved in bringing fish from capture to the final consumer. For purposes of this study, the value chain focused on three main nodes: fishing, fish processing, and retail selling.

Value Share: Value share denotes the proportion of gross margins or returns earned by actors at a specific node of the fish value chain. It was expressed as a percentage of the total value created along the chain.

Vertical Integration: Vertical integration describes the extent to which households combine activities across different value chain nodes. In this study, it was categorized into three levels: fishing only; fishing plus processing; and fishing, processing, plus retailing.

CHAPTER TWO: LITERATURE REVIEW

2.1 Overview of the fish sector in Uganda

Fishing is the third most important export activity after Coffee and Tourism, earning an average of U.S dollar 100million per annum (Eduardo *et. al.* 2017). The Fisheries sector in Uganda is one of the sectors that constitute the Ministry of Agriculture, Animal Industry and Fisheries (MAAIF), and it comprises lake fishery and aquaculture subsectors (UBOS, 2014). The Capture fishery makes greater contributions to the national economy and at the household level. The sector employs over three million (3,000,000m) people in Uganda, contributing to 15 percent of the Gross Domestic Product (GDP) and 2.5 percent of the Net Domestic Product (NDP) (FAO, 2010). According to UBOS (2009) and NEMA (2006), fisheries resources contribute to over 12% of the agricultural GDP (Bavinck *et al.* 2005). Ugandans are estimated to harvest about 447,000 tons of fish each year (Katusime *et al.* 2009). The largest component of the catch being of Nile perch and Nile tilapia which come from Lakes Victoria and Kyoga (UBOS, 2008).

Fisheries is the raising or harvesting of wild marine and freshwater fish for food or industrial purposes. It includes the capturing and marketing of aquatic animals such as Nile perch (Lates), Nile tilapia (*Oreochromis niloticus*), catfish, silverfish, spat, and other ornamental fish for food (Wikipedia, 2022). It is estimated that between 1.0 and 1.5 million Ugandans work directly in capture fisheries, with another 5,000 people engaged in industrial processing sector (UNEP, 2020).

Fisheries contribute 12 percent of the agricultural GDP of Uganda with the fisheries sector accounting for 1.6% of Uganda's Gross Domestic Product (GDP) (FAO, 2016b) and supply 50 percent of animal proteins Weight Body Gain consumed in the country (World Bank, 2011; FAO,

2019). Idiku *et al.* (2022) revealed that this sector provides employment opportunities, serves as an income source, supports nutritional well-being, and facilitates the development of industries for the teeming population engaged in fishery production, processing, and marketing (Rutaisire *et al.*, 2017; FAO 2016a; Dirican, 2014; Chikondi *et al.*, 2017; Dagtekin *et al.*, 2007). It equally serves as an effective and efficient supplement to meat protein, more so due to the persistent rise in the cost of meat (Mengesha, 2020).

Lakes and rivers cover 18% of the country's 241,550.7 km² area. There are two long rainy seasons each year with a mean annual rainfall of 1000-1606 mm and mean temperature of 14-31 °C (UBOS, 2015). Uganda has two major sources of fish supply that is aquaculture and fishing from lakes and rivers. The latter makes up the largest and most significant share of all fishing. Open water occupies 15.3 percent of Uganda's surface and comprises five major lakes; Lake Victoria, Lake Albert, Lake Kyoga, Lake Edward and Lake George which are the main sources of fish in the country. Lake Victoria continues to be the most important water body in Uganda both in size and contribution to the total fish catch, followed by Lake Albert and Lake Kyoga (Wikipedia, 2022). The fish products exported include fresh fish (not chilled), chilled, and frozen fish, dry/smoked fish, fish maws, fish meal, fish oil, fish skins and live fish. Fresh fillets are the main fish products exported to Uganda accounting for 76% total quantity and 78% of total value (MAAIF, 2008).

According to Rajiv Gandhi Science and Technology, fish is a rich source of proteins, fats, vitamins, calcium, iron, and essential amino acids. The Fisheries subsector provides a significant source of livelihood for millions of people around the world (Hara, 2022). Both males and females engage in the fish value chain activities essential to household welfare (Akereolu, 2003). Women contribution continues to be marginalized while male contribution continues to remain the sole focus of attention (FAO, 2005). Despite the fact that both male and female contribute in the fish

value chains, their level of participation is not yet known from available empirical evidence (FAO, 2005). It is presumed that male actors participate more into fishing than the female actors.

Participation in fisheries value chain contributes to socio-economic development, improvement of livelihoods and reduction of poverty (Wangila *et al.* 2007). Fisheries value chain is the process of bringing fish from harvesting through different phases of processing and delivery to the consumer. This process involves various economic utilities such as form, place, time and possession, which have attracted various actors and stakeholders such as governments, international agencies and credit institutions as a strategy of mobilizing economic resources to promote small scale traders and improve the household's livelihood.

Although men and women participate in various ventures within the fisheries value chains, women have been restricted to less competitive form utility that has impacted on their level of access and control of fisheries resource. This has been influenced by socio-cultural and economic factors such as gender roles, culture, values, attitudes and norms (Williams, 2002; FAO, 2013). The higher levels of the value chain earn men higher commercial and economic potentials while women at lower levels operate with restricted economic margins. World Bank (2013) thus emphasized the need for development policies, programmes and donor agencies to support women economic activities especially in agricultural value chains.

The fish value chain is a complex network encompassing various functions, actors, and relationships crucial for the production, distribution, and consumption of fish products. At its core, the fish value chain involves several key functions including; fishing, processing, distribution, marketing, and retailing. Each function plays a vital role in ensuring the flow of fish products from the point of capture to the end consumer. Fishing involves the capture of fish from natural water

bodies or aquaculture farms, while processing encompasses activities such as cleaning, cutting, and packaging to enhance product quality and shelf life. Distribution involves transporting fish products to various markets, and marketing and retailing focus on promoting and selling these products to consumers (FAO, 2020).

In the fish value chain, numerous actors contribute to the efficient functioning of each stage. Key actors include fishermen, processors, wholesalers, retailers, and consumers. Fishermen and aquaculture farmers are responsible for the primary production of fish, while processors add value to the raw fish through processing activities. Wholesalers play a crucial role in aggregating fish products from various sources and distributing them to retailers or other intermediaries. Retailers directly interact with consumers, providing them with a variety of fish products to meet their preferences and demands (Kurien, 2017).

The relationships and flow of products within the fish value chain are dynamic and interconnected. Collaboration and coordination among different actors are essential to ensure the smooth flow of products from production to consumption. Relationships between fishermen, processors, wholesalers, and retailers are characterized by supply agreements, contracts, and market dynamics. Additionally, factors such as transportation infrastructure, market demand, government regulations, and consumer preferences influence the flow of products along the value chain. Understanding the intricate relationships and flow of products within the fish value chain is vital for enhancing efficiency, sustainability, and resilience in the seafood industry (Kurien, 2017; FAO, 2020).

2.3 Level of gender participation in the fish value chain

Gender here refers to the socially constructed norms, roles, and behaviors of men and women in a society. Generally, women and men's involvement in different types of agricultural activities depend mainly on the local customs as well as the social, cultural, and religious influence (Kruijssen *et al.* 2018). In sub-Saharan Africa, fishing is considered a man's work and is majorly done by men and male youth. A similar finding in Kenya shows that men undertake most of the production activities (such as fishing), with women and female youth dominating in post-harvest handling of fish, processing and marketing (Kibria & Mowla, 2006; Ndanga *et al.* 2013). However, as time progresses, their roles in the fish value chains are still largely unrecognized.

According to Tejeda *et al.* (2017), there is gender division of labour which has dictated the roles carried out by men, women and youth along the fish value chain. A number of reviewed literatures reveals that, Boys (and young men) are more heavily involved in fishing activities while girls (and young women) are mainly engaged in post-harvest activities like smoking, drying, and marketing (Williams, 2012). This is because fish catching requires a lot of time, energy and it is also very risky for the women.

Waithanji, *et al.* (2013) and Alinyo & Leahy (2012) states that capital and technology have an influence on the participation of people, especially women, in value chains. This limited access to capital and technology minimizes their participation in the higher nodes of the value chain. A similar finding by (FAO, 2016a) also states that women in West African countries like Ghana, Niger, Benin and Gambia, are traditionally engaged in low-paid jobs, such as unloading the day's catch to be carried to the beach or fish-smoking huts; drying and processing the fish; and converting fish waste into useful products.

Cheffo *et al.* (2021) argues that women perform many vital roles in fish production which include both pre-harvest and post-harvest tasks like mending nets, collecting bait, preparing food for fishers, keeping accounts, smoking fish, drying fish and marketing of fish which are unacknowledged or undercounted as employment. They provide labour force and contribute to household well-being through their income generating activities.

According to Hakim (2016), gender considerations is fundamental in ensuring that women and men undertake diverse or same activities. Both men and women have dissimilar resources, experiences, as well as diverse decision-making responsibilities in fisheries value chain. On the other hand, lack of recognition of women's responsibilities in fisheries practices limits women's participation in fish value chains (Koralagama *et al.*, 2017).

Bronnmann & Asche (2017), argued that there are several literatures indicating the serious disadvantage among women to access fisheries and its resources. Women are not equally represented in equipment and storage ownership (Lynch *et al.*, 2016). Likewise; they are disadvantaged in finding market. A study conducted by Thilsted *et al.*, (2016) established that women play a significant role in fishery industry. In addition, through women participation in fishery value chain, there is promotion in families' welfare in terms of reduced post-harvest losses and increased value addition.

Nunan & Cepic (2020), stipulated that men were found to have a significantly higher level of education than women. This was because women were forced to marry at an early age which has led to their negligence in this sector because they were considered ignorant (have no skills) and thus, their contribution continues to be marginalized while male contribution continues to remain the sole focus of attention.

It was also revealed that despite the importance and contribution of women and youth to the fishery sector, they have received little attention from both the government and non-governmental organizations (Umunna *et al.*, 2020). Youth often abandon school to take up lucrative options that the fishing industry offers (USAID, 2015), but still, their role in the fish value chain is still poorly understood. This was seen by the limited access to productive resources like inputs, capital, trainings and extension services. Similarly, an investigation by Ajiboye *et al.* (2018) concluded that educational level, age of farmers, accessibility to credit facility directly affects their level of participation.

2.4 Gender disaggregation of activities in the fish value chain

Medard *et al* (2001) and Nunan & Cepic (2020) reveals that men fish near-shore and off-shore while women concentrate on inshore activities collecting different activities from reef and other inshore areas and also collecting mollusks as an activity though very invisible in most fisheries studies and statistics. Furthermore, in some situations, such as in Cape Coast, Ghana, and on Lake Victoria, Uganda, women are able to use their income from fish sales to invest in boats and gear to sell or rent to men for their harvesting activities. In Kenya, fish supply chain production is dominated by men and, although women are not permitted to go fishing due to cultural taboos, they would own fishing vessels (Williams, 2012).

Women predominantly occupy the fish drying node of the value chain, because the activities associated with this node are considered female tasks (Hossain *et al.* 2015). For example, sorting, gutting, cleaning, salting, and drying (on mats or drying racks) are tasks typically performed by women (Hossain *et al.* 2015; Samanta *et al.* 2016).

Women also participate in dried fish trade in local and domestic markets and in nearby villages (selling on-foot). For example, women in Tanzania, Congo, and Malawi, play prominent roles as dried fish traders, including cross-border trade (Manyungwa-Pasani *et al.* 2017; Medard *et al.* 2019). In contrast, fish harvesting, hanging fish to dry on tall scaffoldings, weighing and bagging, and trading in distant markets are generally perceived as masculine tasks and thus, are performed by men (Belton *et al.* 2018). Sometimes, the roles women perform overlap. For example, they process and also trade dried fish or they harvest some of the fish they process. In most households, women also perform pre-harvesting activities such as net cleaning, mending, and bait preparation (Samanta *et al.* 2016).

According to Mayala and Kristófersson (2018) in Tanzania found that Dagaa processing is largely a women's reserve at several landing sites. The vendors in Tanzania are made up of both sexes, but mostly the work is dominated by women. Wet Dagaa, however, is transported by male bicycle vendors to various estates where it is easily purchased by customers who choose to handle the fish themselves (Allegretti, 2019).

Limbu *et al.*, (2017), established that fisheries around Lake Victoria are characterized by gender imbalance. In reality, the majority of men in Dagaa fisheries are engaged in processing and trading. Many of the operators in Dagaa business also belong to middle-aged people who probably must have accrued savings that could be invested in Dagaa trade. Odhiambo, (2019) indicated that gender distribution in Dagaa fishery is averagely 55 per cent males and 45 per cent females. Generally, women are the lowest proportion in Kenya.

2.5 Factors influencing value shares earned at the various nodes of the fish value chain

Value shares earned by men and women in the fish value chain differs. Women often receive lower returns and are disproportionately represented in less-profitable nodes of the fish value chains (Kruijsen *et al.*, 2013) or where jobs are regarded as especially insecure (Veliu *et al.*, 2009). For example, a study in Vietnam and Nigeria concludes that in processing, women often hold the lowest paying jobs, while men hold the jobs that are more secure, responsible and senior, therefore dominating the management roles (Veliu *et al.*, 2009), while women are more likely to dominate in the administrative jobs (Hishamunda *et al.*, 2014).

Globally there is absence of women in intermediate and high leading positions in the seafood industry (Monfort, 2015). Even when performing the same tasks in the same node, women are often (but not always) paid less than their male counterparts. Coles and Mitchell (2011) asserts that, women are represented disproportionately in lower value products and the lower value nodes within the value chains which according to them, is a strong characteristic of globalized export chains, which are usually more lucrative than the traditionally feminized domestic markets.

Boodhna (2011) states that there is variation in the income levels of men and women which directly affects their participation in the fish value chain since majority of women in most cases are found having low income and cannot afford to invest in the fish value chain.

Akite *et al* (2018) argued that education plays a big role in gender participation since it is a key component in shaping a person's ability to meet and enjoy opportunities. Education (both formal and informal) in the fish value chain would enhance the profit margins and also improve the cost-benefit analyses of the different segments thus encouraging active participation of both men and

women. However, this is not the case in the fish value chain because women are not given the opportunity to attend such education sessions and thus remain less educated than men (Combaz 2013).

Ahlers *et al.* (2009) also argues that women have limited access to and control over productive resources like access to credit, extension advices and adopting new technologies which could have a negative impact on their participation in the fish value chain and thus affecting the value shares earned at each segment of the value chain. Dolan (2002) and Combaz (2013) agreed that women's reproductive roles (the unpaid economy of domestic work and childcare) played at the different households coupled with an absence of improved domestic technology (piped water and cooking stoves), significantly compromises women's ability to expand and/or diversify production and thus reducing the profit margins.

A study by Coles & Mitchell (2011) reveals that the distribution of benefits from value chains by the different gender categories varies depending on location. Waithanji *et al.* (2013) stated that the benefits obtained from the different value chain nodes vary amongst men and women since women tend to occupy the lower nodes and men the higher nodes with relatively high barriers to entry and correspondingly greater returns.

Cheffo *et al.* (2021), asserts that the extent and ways women and men are involved in the fisheries sector and the benefits reaped from the fish value chain differ between them. This is seen from the fisheries products that men and women trade in. Men trade in smoked fish products like Nile perch and tilapia which is more profitable while women trade in sun-dried fish products like 'Mukene' which is less profitable (Richard & Ed, 2022). This is because men are physically stronger, have transport and access to loan facilities. These could be the reasons women do not deal so much with

smoked fish products as men do. Sun-dried fish products often require a lot of patience, involve low capital and require little transportation which has favored the women.

Amartey *et al.* (2013) added that women and men may work together to bring wealth and resources into the family, but this does not determine the division of wealth between them. This is often because of the cultural factors that influence the control women have over their earned income and the extent to which this income is reinvested in their business or contributes to household expenses (Farnworth 2011; Sebstad & Manfre 2011). This was observed at one site in Kenya, men used their wives' earnings for personal expenditure, leaving the women little to reinvest in their fish processing businesses until the introduction of a mobile money platform reduced the husbands' access to their wives' income.

2.6 Factors influencing Vertical Integration in the fish value chain

Vertical integration is when a firm in the fishery industry engage in multiple levels of the supply chain. It can also be defined as the economic entity's possession of successive stages in the input-throughput-output paradigm (Isaksen, n.d.). In Agribusiness, it is highly and widely considered to be a promising venture for value creation in rural economies and agri-food industry (Barney and Hesterly, 2011). Also, it was believed that this opportunity could support farmers to uplift them up from the limited commodities through retaining bigger share of the value chain (Caracciolo & Lombardi, 2012).

Supply chain integration is considered as a realistic strategy to improve and optimize production system, which will help to improve the agri-food industry to face the global competition. A suitable question that one could ask is why adjacent stages of production, which could have been

undertaken by separate firms, are governed within the boundaries of one firm. There are two types of business integration, vertical and horizontal integration. Vertical integration at fishermen level is formed of two types, forward and backward integration.

According to B.Wicaksana *et al.*, (2021), The backward vertical integration relationship occurs between fishers and traders. Furthermore, they stated that this vertical integration of fishers and collectors is in the form of fishing capital loans for fishers. For the collectors, backward vertical integration occurs in the business relationship between the collectors and fisher and this was in form of the existing fishing capital loan agreements from collectors to fishers. Another form of backward vertical integration is where the retailers guarantee the collectors to sell the fish only to the retailers. Lastly, vertical forward business integration occurs between fishers and collectors in sorting fishers' catches by the fish type.

Coase (1937), stated that firms vertically integrate to reduce transaction costs, which is the cost of using the market. Coase defined transaction costs as the deciding factor for a firm's expansion. The cost of using the market includes the costs incurred by collecting information, writing contracts, policing and enforcing those contracts. Coase said that if a firm finds that it can internalize the production of one of its inputs at a lower cost than buying that input on the market (including transaction costs), the firm will vertically integrate that part of its production process. Gordon (1994), further reveals that fishery management plan (FMP) as formulated, will lead to a fewer vertically integrated enterprises being able to control every aspect of the industry from harvesting through marketing.

In fisheries, as compared to other industries, there are some factors that affects transaction costs and these may include the following; Uncertainty over the quality of the input. The greater the

uncertainty over quality, the greater the industry has to incentivize internally and better control the production of the input. uncertainty about the availability of supply. This is as a result of lack of substitute available for a particular input in the industry's production process therefore, integrating the production of that intermediate good can alleviate fears of insufficient supply. The industry likewise can be concerned over whether they will have a buyer for their (intermediate) product or not. Therefore, advance contracting can guarantee a buyer for future production. A third concern is when either the downstream or upstream firm has a specific asset that has little or no value in its next best use. In the fisheries literature this is often referred to as capital malleability. In this case there is a possibility of hold-up by either party in the transaction. To illustrate using an example, for the upstream firm to hold-up the downstream firm simply means that it takes advantage of the fact that the downstream firm has no other way to earn revenue from its specific asset, so when bargaining, is able to capture more rent than it would otherwise be able to capture. Contracting to avoid hold-up can lead to higher transaction costs. Search costs are the final component of transaction costs. The longer one must search for a trading partner the higher are transaction costs. When a firm decides to vertically integrate to reduce transaction costs, this increases efficiency in the market. On the other hand, there is the case of market foreclosure, where a firm vertically integrates in order to gain monopoly power in one or even both markets.

2.7 Summary of literature reviewed

The literature review provided a comprehensive overview of gender participation, value shares, and vertical integration within the fish value chain in Uganda. It highlighted the significant contributions of both men and women to various aspects of the fishery sector, emphasizing the roles they play in different nodes of the value chain. While men are often associated with fishing and higher-profit activities, such as trading smoked fish products, women tend to engage more in post-harvest activities, such as processing and trading sun-dried fish. However, despite their active involvement, women generally receive lower returns and face barriers to accessing productive resources and education, limiting their participation in higher-value nodes of the value chain. Furthermore, there is a gender gap in terms of representation in leadership positions and access to credit and technology, further exacerbating the disparities in value shares earned between men and women.

Despite the extensive literature available on gender participation, value shares, and vertical integration in the fish value chain, several research gaps remain to be addressed. Firstly, there is a need for more empirical research to quantitatively assess the relationship between socioeconomic factors and gendered participation in the fish value chain in Uganda. This would involve conducting surveys or field studies to collect data on factors such as education, access to resources, and income levels, and analyzing how these variables influence men and women's roles within the value chain. Secondly, further investigation is required to identify the specific drivers of value shares earned at different nodes of the fish value chain. This could involve examining factors such as market dynamics, technological advancements, and government policies to understand their impact on the distribution of benefits among different gender categories. Lastly, there is a need to

explore the factors influencing vertical integration in the fish value chain, particularly in the context of transaction costs and market dynamics. Understanding the motivations behind vertical integration can provide valuable insights into strategies for promoting efficiency and sustainability within the fishery sector while ensuring equitable participation and distribution of benefits among all stakeholders. Addressing these research gaps can contribute to the development of evidence-based policies and interventions aimed at fostering gender equality, improving value chain efficiency, and promoting sustainable economic development in the fishery sector in Uganda.

CHAPTER THREE: METHODOLOGY

3.1 Study Area

The study site is located on the shores of lake kyoga in Amolatar District. This district is bordered by Apac District to the north, Dokolo District to the northeast, Kaberamaido District to the east, Buyende District to the southeast, Kayunga District to the south and Nakasongola District to the west. The administrative headquarters of the district at Amolatar, are located 85 kilometres (53 mi), by road, south of Lira, the largest city in the sub-region. This location lies about 185 kilometres (115 mi), by road, northeast of Kampala, the capital of Uganda and the largest city in that country. The coordinates of the district are: 01 38N, 32 50E. A key livelihood activity in the area is fishing. However, many people in this study area also practice cultivation of crops and rearing of livestock. Common crops grown include: Cotton, Cassava, Sunflower, Soybeans, Oranges, Bananas, Matooke, Simsim, Rice, Maize, Beans, Millet, Sweet potatoes. The livestock raised in the district includes: cattle, goats, chicken and turkeys. Although men and women are involved in numerous value chain activities and play essential roles in the fish value chains, women have tended to be disadvantaged in terms of participation and benefits reaped from the value chain.

3.2 Study Design

A cross-sectional survey was conducted between March 2023 and May 2023 to collect primary data from fish value chain actors. A structured, researcher administered questionnaire was used to collect data on socio-economic characteristics of fish value chain actors, institutional factors, fish value chain activities (fishing activities, fish processing activities, fish selling). Cross-sectional design gives insights into an existing situation through data collection and are useful for assessing

characteristics within a population at a given point in time. The design was relevant for this study since it helped in exploring different interests and characteristics among fishing communities in the study area.

3.3 Sample size determination and sampling procedure

3.3.1 Sample size determination

In the process of developing this thesis, the determination of an appropriate sample size played a pivotal role in ensuring the robustness and reliability of the research outcomes. To achieve this, the Morgan table (Appendix X), as proposed by Krejcie and Morgan (1970), was employed as a valuable tool for estimating the required sample size. This method was chosen for its ability to systematically calculate a sample size that aligns with the desired level of confidence, margin of error, and the size of the target population. According to Krejcie and Morgan's seminal work, it is essential to ensure that a sample size is sufficiently large to yield results that can be generalized to the broader population accurately.

The Morgan table, in this particular study, yielded an estimated sample size of 335 respondents. However, to account for potential non-responses, a further 20 respondents were included in the sample. This additional number is consistent with the recommendations by Krejcie and Morgan (1970), who emphasize the importance of considering potential non-responses or incomplete data when determining sample size. In total 355 respondents were considered for this study. By adhering to their guidelines, this research aimed to enhance the credibility and representativeness of its findings while maintaining methodological rigor and a comprehensive approach to sample size determination (Krejcie & Morgan, 1970).

3.3.2 Sampling Procedure

The target population of the study are the fish value chain actors which include the producers, processors and the marketers who are the major participants along the fish value chain. The study employed a multistage sampling technique to select of a representative sample. In the first stage, Amolatar district was selected based on the diversity of coverage of the area and the large number of individuals involved in fisheries activity. In the second stage, two sub counties (Namasale and Muntu Subcounty) were sampled because of the predominance of fishing activities in the area. In the final stage, the fish value chain actors (producers, processors and traders) were stratified into three strata and finally selected using systematic sampling procedure where every 5th respondent was selected from the sampling frame. A total of 355 fish value chain actors was drawn from the sub counties based on the sampling frames obtained from the Amolatar District Production and Marketing Offices. The systematic sampling procedure was chosen because it allows all potential respondents equal chances of participating in the study. The respondents were above the age of 18 years since they are responsible for making decisions at their fisheries activity.

Table 3.1: Distribution of fish value chain actors sampled in Amolatar District

District Subcounty	Amolatar	
	Namasale	Muntu
Producers	60	40
Processors	70	50
Marketers	80	55
Total	210	145

3.4 Data Collection

3.4.1 Data collection instruments

Data was collected through the administration of semi-structured questionnaires to collect data in face-to-face interviews with fish value chain actors. Prior to the primary data collection exercise, the questionnaire was pre-tested on selected respondents on Kabermaido District to evaluate the appropriateness of the design, coherence and relevance of the questions. Kabermaido was chosen because just like Amolatar, there are numerous men and women who are involved in fish value chain activities. The necessary modifications were made on the questionnaires after pretesting in order to capture the relevant information related to the study objectives of the study. The questionnaires comprised of both close-ended and open-ended questions to collect data. Open-ended questions were appropriate for prompting the respondents to answer questions that required numerical value, for instance quantity of fish stocked by the trader for a given period, while close-ended questions enabled respondents to choose a response from a given list of options.

The questionnaire was organized to capture data as follows; the first section of the questionnaire focused on the socio-demographic factors including age of the respondents in complete years, the level of education of the respondents in the number of years spent in school, other sources of income and household composition. The second section captured information on institutional factors particularly information was collected on access to fishing information services, borrowing history, group membership and distance the market in kilometers (km). The third section focused on the fish value chain activities including participation in the fish value chain activities, type of fish traded, quantity of fish (kg) sold, price of fish sold (ugx), cost incurred (ugx), and frequency of trading (count).

3.5 Data Quality Control

3.5.1 Content validity and reliability

In order to ensure content validity, questionnaire items were formulated around the aspects of the problem being investigated with guidance from the supervisor. A pre-test of the questionnaire was conducted on 10 respondents who are not inhabitants of the study area. During the exercise, the flow of questions and responses were examined to see if they satisfactorily tackle the specific objectives. After the pre-tests, modifications were made to the questionnaire to improve the reliability of the content (Mugenda, 2003). There was a keen supervision of research assistants who were well trained on skills for conducting ethical research and the study and had an excellent command of the local language during the data collection process. To establish reliability of the information collected, the Cronbach Alpha value was computed to be 0.797. In alignment with the established benchmarks, a Cronbach's alpha of 0.797 falls within the category of "good" reliability. Consequently, this implied that the measurements utilized in the study exhibit a commendable level of internal consistency.

3.6 Data Analysis

The data collected was edited, coded, and cleaned to ensure consistency, uniformity, and accuracy. Data was entered into the statistical package for social scientists (SPSS V₂₀) for analysis, and STATA V₁₅. The statistical packages chosen made the analysis neat and precise (Boudjeka Guemkam *et al.*, 2018). Descriptive statistics such as means, standard deviations, percentages and frequencies were performed as a way of exploring the data. Econometric analysis was later performed following the research objectives.

3.6.1 Relationship between socio-economic characteristics and participation in the fish value chain

To address this objective, descriptive statistic including the mean, frequency, percentages and standard deviations was used. t-test was used to compare the means of the socio-economic characteristics of the value chain actors across the nodes of the fish value chain. The variables for which one-way Anova was conducted in this study include education, experience, household size, distance to market, fish price, quantity of fish sold, tax cost, transport cost and storage costs. The Chi-square test was used test for association between participation in the fish value chain and socio-economic characteristics of the fish value chain actors including gender, participation of household members in the fish value chain (male spouse, boys), participation in non-fishing activity, access to credit, access to fish information, group membership, fish type (tilapia, silverfish, and Nile Perch).

3.6.2 Drivers of value shares earned at each node of the values chain

In determining the drivers of value shares at the various nodes of the fish value chain, a Tobit regression of the proportion of the value share earned at each node on a set of independent variables was used. The choice of the Tobit regression model was informed by the fact that the dependent variable is a proportion that takes on values from zero to one. According to Wooldridge (2016), consistent estimates of such zero-centered dependent variables are obtained by the method of maximum likelihood estimation (MLE) of the Tobit regression model. The Tobit model uses MLE procedures to estimate errors in the presence of non-normal distribution (Cameron and Trivedi 2005). According to Wooldridge (2016), MLE is considered the most efficient estimator for asymptotically distributed dependent variable. The Tobit model has been used for several studies

(Yoo 2005; Yue and Hong 2012; Okello *et al.* 2019; Amore and Murtinu 2019). Following Wooldridge (2016), the Tobit regression model was specified as in Eq. (1):

$$Y^* = X_i\beta + \mu_i \quad 1$$

where Y^* is the dependent latent variable that takes on values with both lower and upper bounds, X_i is a vector of independent variables, β is a vector of parameters to be estimated, while μ_i is an error term which is assumed to be independent and identically distributed. The analytical model specified in Eq. (1) was modified for analysis of drivers of value shares earned at each node of the fish values chain (fishing, processing, retail trade) separately as in Eq. (2):

$$ValueShare_Earned_j^* = X_i\beta + \mu_i \quad 2$$

Where;

$$ValueShare_Earned_j = \frac{ValueAdded_j}{Total\ Valueadded} \quad 3$$

$$Value\ Added_j = Selling\ price\ of\ fish - Cost\ of\ producing\ the\ fish \quad 4$$

$$Total\ Valueadded = \sum_1^n Value\ Added_j \quad 5$$

Where; $ValueShare_Earned_{ij}^*$ is a latent variable representing proportion of value shares earned X_i represents a vector of explanatory variables which included: Sex of HH, education, participation of boys, participation of male spouse, quantity sold, group membership, distance to market, access to buyer information, fish type. The hypothesized effects of the explanatory variables are presented in Table 3.1

Table 3.2: Variables used in the Tobit regression

Variable	Description/Measurement of variable	Apriori sign
Age	Age of respondent(years)	+
Sex_HHH	Sex of household head (Female =1, Male = 0)	-
Education	Number of years spent in school	-
HHmember_boys	Dummy 1 = Yes, No = 0	+/-
HHmember_male	Dummy 1 = Yes, No = 0	+/-
HHmember_fishprocessing	Dummy 1 = Yes, No = 0	-
Quantity_sold	Quantity sold (Kg)	+/-
Fishtype_Nileperch	Dummy 1 = Yes, No = 0	+
Fishtype_tilapia	Dummy 1 = Yes, No = 0	+
Fishtype_silverfish	Dummy 1 = Yes, No = 0	+/-
Buy_inform	Access to buyer information (1 = Yes, 0 = No)	-
Hygiene_inform	Information access on good hygiene (Yes = 1, 0 = No)	+/-
HHsize	Number of people in dwelling	+/-
Borrowing	Borrowed money (1 = Yes, 0 = No)	+
Group membership	Dummy 1 = Yes, 0 = No	+
Experience	Years of fishing experience	-

3.6.3 Factors influencing vertical integration in the fish value chain

To examine the factors influencing integration in the fish value chain, the dependent variable was arranged categorically into three classes of the value chain nodes actors engage in the fish value chain. These were; Fishing (reference category), combination of fishing processing, and combination of fishing processing retail selling. Given the fact that the dependent variable was categorical and based on three classes, the multinomial logit (ML) regression model was preferred for the analysis as shown in equation (3)

The model is specified as;

$$Y_i^* = \beta_0 + \beta_i X_i + \dots + \beta_n X_n + \mu_i \quad 3$$

Where Y_i^* is the variable that captures vertical integration and it comprised of the classes of value chain actors: 1) Fishing (reference category); 2) combination of Fishing and processing; and 3) combination of Fishing, processing, and retail selling. β_0 – regression intercept estimates, β_i –

coefficient of regression model estimates, X_i – vectors of factors influencing vertical integration such as sex of HH, distance to market, group membership, tax costs, transport costs among others and μ_i – error term

The apriori sign for the regression in equation (3) above are as presented in Table 3.2

Table 3.3: Variables used in multinomial regression model

Variable	Description/Measurement of variable	Apriori sign
Sex_HHH	Sex of household head (Female =1, Male = 0)	-
Education	Number of years spent in school	+/-
Fishprice	Price of fish (Ugandan Shillings)	-
Taxcost	Tax cost (Ugandan Shillings)	-
Trasportcost	Transport cost (Ugandan Shillings)	+
Storagecost	Stroage cost (Ugandan Shillings)	+/-
Distance	Distance to nearest market (Km)	-
Fishtype_Nileperch	Dummy 1 = Yes, No = 0	+
Fishtype_tilapia	Dummy 1 = Yes, No = 0	+
Fishtype_silverfish	Dummy 1 = Yes, No = 0	+/-
Nonfishact_farming	Dummy 1 = Yes, 0 = No	-
Nonfishact_trading	Dummy Yes = 1, 0 = No	+
Group membership	Dummy 1 = Yes, 0 = No	+
Experience	Years of fishing experience	-

3.7 Ethical Consideration

The study observed all the laws of the country and demonstrated high level of integrity without any form of compromise. The researcher sought ethical clearance from the Gulu University Research and Ethics Committee (GUREC) (Appendix II). The study also sought authorization from relevant offices such as Chief Administration Officer and Landing Site leaders as well as informed consent from the research participants. The respondents were asked before interviewing them and further be requested to agree to participate by signing the consent form and be interviewed. To achieve privacy, and confidentiality, the researcher abided by the principle of voluntarism and maintained the highest level of confidentiality of the respondent's details. The

researcher observed the COVID-19 prevention guidelines by ensuring that at all times there was hand sanitizing, wearing of face masks and social distancing while conducting interviews with the respondents.

3.8 Limitation and Delimitation of the study

The researcher faced the challenge of the lack of willingness of respondents to participate in the study. This was mitigated through prior community engagement to create awareness about the study and its likely benefits to the community.

CHAPTER FOUR: PRESENTATION OF RESULTS

4.2 Relationship between socio-economic characteristics and participation in the fish value chain.

The descriptive statistics presented in Table 4.1 indicate with regards to gender that four out of five of actors engaging in fishing were male. Slightly more than half (55.6%) of the actors engaging in processing were male while three out five of the actors engaging in retail selling were female. Close to two thirds (64.8%) of the actors engaging in fishing and processing were male and nearly three quarters (71.4%) of the actors engaging in fishing, processing and retail selling were male. The chi-square test results for gender were significant for fishing, processing and retail selling at ($p<0.01$), ($p<0.1$) and ($p<0.01$) respectively implying that there was a statistically significant association between gender and fishing, processing and retail selling respectively.

Regarding borrowing, majority of the actors engaging in the fishing, processing, retail selling, fishing_ processing, and fishing_ processing_ retail selling did not borrow money in the past 12 months. The chi-square test results for borrowing were significant at ($p<0.01$) and ($p<0.1$) for retail selling and fishing_ processing_ retail selling respectively implying that there was a statistically significant association between borrowing and retail selling, and fishing_ processing_ retail selling respectively.

With reference to group membership, slightly more than half (56.1%), (51.4%), (55.9%), and (53.4%) of the actors engaging in fishing, processing, retail selling, and the combination of fishing +processing were not members of any group. However, all actors engaging in the vertical integration, combining activities of fishing, processing, and retail selling had membership with

groups. The chi-square test results for group member were significant ($p < 0.05$) for value chain integration of fishing+processing+retail selling indicating that there is a statistically significant association between group membership and vertical integration in the fish value chain.

In terms of access to fishing information, close to three quarters (73.0%) and (73.9%) of the actors engaged in fishing and fishing+processing respectively had access to fishing information, nearly two thirds of the actors engaging in processing had access to fishing information, slightly more than half (55.9) of the actors engaging in retail selling had access to fishing information. None of the actors engaging in fishing+processing+retail selling reported access to fishing information. The chi-square test results for access to market information were significant at $p < 0.01$, $p < 0.1$, $p < 0.1$ and $p < 0.1$ for value chain activities of fishing, retail selling, fishing+processing, and fishing+retail selling respectively. This implies that there is a statistically significant association between access to fishing information and fishing, retail selling, fishing+processing and fishing+retail selling respectively.

Referring to fish type (tilapia), slightly more than two thirds (68.7%) of the actors engaging in fishing were dealing in the tilapia fish, slightly more than half (56.3%) of the actors engaging in processing were dealing in tilapia fish, slightly more than two out five of the actors engaging in fishing_ processing was dealing in tilapia fish and nearly seven out of eight of the actors engaging in fishing_ processing_ retail selling were dealing in tilapia. The chi-square test results for fish type (tilapia) are significant ($p < 0.01$) for fishing, processing, retail selling, fishing+processing combination and fishing+processing+retail selling. This implies that there is a statistically significant association between fish type (tilapia) and fishing, processing, retail selling, fishing+retail selling and fishing+processing+retail selling respectively.

Regarding to fish type (silver fish), four out of five (80.0%) of the actors engaging in fishing were dealing in the silver fish, more than two out of five (41.5%) of the actors engaging in processing were dealing in silver fish, most of the actors engaging in retail selling were not dealing in silver fish and slightly more than half (52.3%) of the actors engaging in fishing processing were dealing in silver fish whereas none of the actors engaging in fishing_ processing_ retail selling were dealing in silver fish. The chi-square test results for fish type (silver) were significant ($p < 0.01$) for fishing, processing, retail selling, and fishing_ processing. This implies that there is a statistically significant association between fish type (silver fish) and fishing, processing, retail selling, and fishing_ retail selling respectively.

Referring to fish type (Nile perch), more than two out of five (44.8%) of the actors engaging in fishing were dealing in the Nile perch, nearly a third of (31.0%) of the actors engaging in processing were dealing in Nile perch, close to two thirds (65.7%) of the actors engaging in retail selling were dealing in Nile perch and more than one out of two (22.7%) of the actors engaging in fishing_ processing were dealing in Nile perch and close to seven out of eight (85.7%) of the actors engaging in fishing_ processing_ retail selling were dealing in Nile perch. The chi-square test results for fish type (Nile perch) were significant ($p < 0.01$) for fishing, processing, retail selling, fishing_processing and fishing_processing_retail selling. This implies that there was a statistically significant association between fish type (Nile perch) and fishing, processing, retail selling, fishing_retail selling and fishing_processing_retail selling respectively.

Table 4.1: Chi-square test for association between socio-economic factors and fish value chain activities

Variables	Fishing (n=230)		Processing (n=142)		Retail Selling (n=102)		Fishing Processing (n=88)		Fishing Processing Retail Selling (n=7)	
	Percent	χ^2	Percent	χ^2	Percent	χ^2	Percent	χ^2	Percent	χ^2
Gender										
Female HH	20.0	90.084***	44.4	4.034*	60.8	31.449***	35.2	0.389	28.6	0.271
Male HH	80.0		55.6		39.2		64.8		71.4	
HH member Male	68.3	152.984***	77.5	52.755***	25.5	69.587***	21.6	51.657***	0.0	
Spouse										
HH member Boys	37.0	60.739 ***	18.3	42.082***	10.8	28.157***	11.4	22.832***	0.0	
HH member non-fishing activity	71.3	0.019	70.4	0.148	70.6	0.065	67.0	1.166	85.7	0.704
Borrowed money	23.9	5.847	28.9	0.058	42.2	13.840***	28.4	0.003	57.1	2.963*
Group membership	43.9	0.075	48.6	2.617	44.1	0.032	46.6	0.491	100.0	9.320**
Access to fish information services	73.0	24.851***	66.2	0.658	55.9	3.744*	73.9	5.264*	0.0	4.076*
Fish type (tilapia)	68.7	154.740***	56.3	154.909***	87.3	294.617***	42.0	87.773***	85.7	259.070***
Fish type (silverfish)	20.0	28.722***	41.5	106.140***	9.8	25.523***	52.3	160.345***	0.0	
Fish type (Nile perch)	44.8	78.858***	31.0	75.338***	65.7	204.848***	22.7	38.073 ***	85.7	303.414***

The findings in Table 4.2 presents results on comparison of socio-economic factors affecting the gender categories at each node of the value chain. The results showed that the education level of the fish value chain actors at fishing-processing-retail selling node was more than the education level of the fish value chain actors involved at fishing-processing fish retail selling, processing and fishing. The t-test results showed that education level was statistically significant ($P < 0.1$). Regarding distance to the market by the fish value chain actors, the results indicated that the distance moved by the actors was more at the processing node as compared to the distance moved by the fish value chain actors involved at fishing-processing, fishing, fishing-processing-retail selling and retail selling. The t-test results indicated that distance to the market was statistically significant ($p < 0.01$) and ($p < 0.05$).

With regards to fish price, the findings showed that the fish price of the value chain actors involved at the three nodes (fishing processing and retail selling node) was more than the fish prices of the value chain actors involved at fishing-processing, processing, retail selling and fishing. The t-test results revealed that the fish price was statistically significant ($P < 0.01$) and ($p < 0.1$) respectively. In terms of the quantity of fish, the results revealed that the quantity of fish the value chain actor handle at the two nodes of fishing-processing was more than the quantity of fish handled by the fish value chain actors at processing, retail selling, fishing and fishing-processing-retail selling. The t-test results revealed that the quantity of fish was statistically significant ($p < 0.05$) and ($p < 0.1$). Tax cost incurred by the fish value chain actors at fishing-processing was more than the tax cost incurred by actors involved at the three nodes (fishing-processing-retail selling), fishing, processing and retail selling. The t-test results revealed that the tax incurred was statistically significant ($P < 0.01$).

Table 4.2: T-test for association between socio-economic factors and fish value chain activities

Variables	Fishing (n=230)		Processing (n=142)		Retail Selling (n=102)		Fishing+processing (n=88)		Fishing+processing+retail selling (n=7)	
	Mean	F-ratio	Mean	F-ratio	Mean	F-ratio	Mean	F-ratio	Mean	F-ratio
Education	7.63	6.41*	7.23	0.13	7.62	1.24	7.72	1.77	9.14	2.20
Experience	7.57	2.24	6.85	0.44	6.68	0.64	7.20	0.01	6.71	0.03
HH Size	6.81	0.001	6.74	0.10	6.75	0.05	6.52	0.76	6.43	0.08
Distance	137.63	0.04	237.95	26.82***	96.09	2.18	226.60	10.03**	118.14	0.02
Fish Price	1833.70	0.04	2509.16	52.11***	2104.80	4.24*	2898.86	67.34***	3200.00	5.80*
Quantity	30.93	3.94*	35.01	4.89*	32.48	1.50	41.94	7.72**	27.39	0.003
Tax Cost	10673.91	21.19***	9839.20	2.65	9181.37	0.37	12446.97	12.61***	11333.33	0.38
Transport	19840.58	0.19	27578.64	3.48*	24901.96	0.76	22303.03	0.038	13142.86	0.13
Storage	4868.84	2.30	3322.77	0.72	7116.01	7.43**	4212.12	0.01	6976.19	0.33
Source: Field Data (2023); Number of respondents = 355, ***, ** & * implies $p < 0.01$, $p < 0.05$ and $p < 0.1$										

Also transport cost incurred by the fish value chain actors at processing was more than the transport cost incurred by actors at retail selling, fishing-processing, fishing and fishing-processing-retail selling. The results showed that transport cost incurred was statistically significant ($P < 0.1$). Furthermore, storage cost incurred by the fish value chain actors at retail selling was more than the storage cost incurred by actors at fishing-processing-retail selling, fishing, fishing-processing and processing. The results revealed that storage cost incurred was statistically significant ($P < 0.05$). The other variables which were not significantly associated with the participation of the fish value chain actors in the various nodes of the chain included experience and household size.

4.2 Value shares in the fish value chain

4.2.1 Summary statistics for value shares in the fish value chain

Table 4.3: Value shares earned at each node of the value chain

(Percentage)			
	Value share_fishing	Value share_processing	Value share_retail
Mean	33.7	40.2	25.3
Std. Deviation	44.6	46.1	42.8
Source: Field Data (2023); Number of respondents = 355			

Table 4.3 shows that the mean value share earned at the processing node (40.2) was more than those earned at the fishing node (33.7) and retail selling node (25.3).

4.2.2 Factors driving value shares

The results of Tobit regression concerning the drivers of value shares earned at each node of the fish value chain are presented in Table 4.4. The results show a significant log likelihood ratio for the three empirical models on value shares at: 1) fishing (-860.68), 2) processing (-671.64) and 3) retail selling (-504.34) suggesting that the empirical data fitted well the estimation models. The R^2

for the model on fishing (0.23), processing (0.30) and retail selling (0.31) suggests that specified factors in each separate model were explaining 23%, 30% and 31% respectively of the total variation in the value shares earned at such node of the fish value chain. On the basis of the R^2 and log likelihood, the assumption that empirical data fitted well the estimation model was confirmed.

Table 4.4: Drivers of value shares in the fish value chain

Variables	Fishing		Processing		Retail Selling	
	Coefficient	SE	Coefficient	SE	Coefficient	SE
Sex HH (female = 1)	-54.73	10.38***	-2.26	10.63	55.56	12.76***
HH member (boys)	13.69	5.97**	17.42	6.06***	-46.17	13.95***
HH member (male)	26.13	5.85***	8.85	5.93	-29.28	14.00**
HH member (processing)	-51.24	6.13***			-63.58	12.20***
Fish type(tilapia)	19.83	6.75***	83.61	7.43***	150.67	18.18***
Fish type(silverfish)	-28.64	12.18**	130.38	7.21***	190.06	31.95***
Fish type (Nile perch)	10.81	5.05**	35.35	7.21***	37.55	12.28***
Quantity Sold	12.39	1.99***	-15.14	3.63***	1.78	3.15
Female sex X Tilapia	48.01	11.79***	40.20	12.99***	-71.80	21.9***
Female sex X Silverfish	-5.74	34.24	-0.06	12.46	-125.48	35.66***
Female sex X Nile perch	45.14	11.70***	-28.26	11.12**	-0.12.36	15.86
Buyer information	-19.97	7.28***	-1.61	6.50	-5.27	11.24
Information accessed (good hygiene)	-1.50	4.41	6.24	4.45	6.25	7.09
Borrowed money	-7.21	5.60	6.38	4.86	18.87	7.40**
Distance to market(km)	-5.03	1.06***	1.91	0.91**	1.19	1.76
Group membership	-1.41	5.08	-1.68	4.72***	-11.02	7.18
Household size	0.33	0.58	-0.73	0.59	0.20	0.93
Experience	-3.26	2.31	-1.92	2.05	-3.61	3.65
Education	-5.48	3.57	-6.73	3.14*	1.60	5.75
Constant	29.07	10.87***	-21.82	9.75**	-66.00	17.49***
Log-likelihood	-860.68		-671.64		-504.34	
LR chi2(19)	521.70		582.16		448.07	
Prob>chi2	0.00		0.00		0.00	
Pseudo R2	0.23		0.30		0.31	
Number of observations	355		355		355	

Source: Field Data (2023); ***, ** & * implies $p < 0.01$, $p < 0.05$ and $p < 0.1$

Results in Table 4.4 further reveal that boys in the household ($p < 0.05$), male spouse ($p < 0.01$), fish type- Tilapia ($p < 0.01$), fish type-Nile perch ($p < 0.05$), quantity sold ($p < 0.01$), Female sex interaction with Tilapia fish ($p < 0.01$) and Female sex interaction with Nile perch fish ($p < 0.01$) significantly and positively influence value shares earned at fishing node of the value chain. These

co-efficient findings suggest that households with boys, male spouse, relying on Tilapia fish, and relying on Nile perch have a chance of earning higher value shares at fishing node of the value chain by a probability of 13.7%, 26.1, 20.0 and 11.0% respectively. For the interaction variables, the results implied that households that had female members dealing in Tilapia and Nile perch at fishing nodes are associated with a likelihood of earning higher value shares by a probability of 48.0% and 45.1% respectively. On the hand, results reveal a negative and significant influence on value shares at the fishing node of the value chain for the variables of female-headed households ($p<0.01$), participation in fish processing ($p<0.01$), fish type-silver fish ($p<0.01$) and access to buyer information ($p<0.01$). These co-efficient findings suggest that female headed households, participation in fish processing, relying on silver fish and access to buyer information lowers the chance of earning higher values at the fish node by 54.7%, 52.24%, 28.6% and 20.0% respectively.

Turning to processing, household member(boys) ($p<0.01$), fish type (tilapia) ($p<0.01$), fish type (silver fish) ($p<0.01$), fish type (Nile perch) ($p<0.01$) interaction of sex of household head and fish type (tilapia) ($p<0.05$), distance to market ($p<0.05$), and education ($p<0.1$) posted a positive and significant influence on value shares earned at the processing node however group membership ($p<0.01$), interaction of sex of household head and fish type (Nile perch) ($p<0.05$) and quantity sold ($p<0.01$) negatively and significantly influenced value shares earned at processing node. These coefficient findings suggest that participation of boys, relying on tilapia, relying on silver fish, relying on Nile perch were associated with a likelihood of earning higher value shares at the processing node by 17.4%, 83.4%, 130%, 35.4% respectively. For the interaction variables, the results implied that households that had female members dealing in tilapia were associated with a likelihood of earning a higher value share at the processing node by a probability of 40.2%. However, results suggest that belonging to a group, higher quantity of fish sold were associated

with a likelihood of earning lower value shares at the processing node by a probability of 1.7% and 15.1% respectively. For the interaction variables, results implied that households with female members dealing in Nile perch was associated with a likelihood of earning lower value shares at the processing node by 28.3%. For retail selling, sex of household head ($p<0.01$), fish type (tilapia) ($p<0.01$), fish type (silver fish) ($p<0.01$), fish type (Nile Perch) ($p<0.01$) and access to credit ($p<0.05$) significantly and positively influence value shares earned at the retail selling node surprisingly household member (boys) ($p<0.01$), household member (male spouse) ($p<0.05$), household member (processing) ($p<0.01$), interaction of sex of household head and fish type (tilapia) ($p<0.01$) and interaction of sex of household head and fish type (silver fish) ($p<0.01$) posted a negative significant influence on value share earned at retail selling node. The coefficient results suggest that female headed households, relying on tilapia, silverfish, Nile perch, and having access to credit is associated with a likelihood of earning higher value shares at the retail trading node by a probability of 12.8%, 150.7%, 190.1%, 37.5% and 18.9% respectively. However, participation of boys, participation of male spouse was associated with a likelihood of earning lower value shares at the fishing node by a probability of 46.2%, 29.3%. For the interaction variables, results suggest that household with female members dealing in Tilapia and households with female members dealing in Nile perch were associated with likelihood of earning lower value shares by a probability of 71.8% and 125.5% respectively.

4.3 Vertical integration in the fish value chain.

4.3.1 Distribution of value chain actors by level of integration

Findings in Table 4.5 indicate that slightly more than half (55.1%) of the actors didn't not engage in vertical integration.

Table 4.5: Participation in Vertical integration in the fish value chains

Vertical Integration	Frequency	Percentage
Fishing	120	55.1
Fishing + Processing	89	40.8
Fishing + Processing + Retail selling	9	4.1
Total	218	100

This was followed by those who engaged in fishing + processing (40.8%) and those involved in Fishing + Processing + Retail selling accounting for (4.1%).

4.3.2 Determinants of vertical integration in the fish value chain

The results of multinomial logit regression concerning the factors influencing vertical integration in the fish value chain presented in Table 4.6. The category of “fishing” was considered as the base outcome (reference category) for comparison of the decision to undertake vertical value chain upgrading among the fish value chain actors. The results showed a significant log likelihood ratio for the empirical models for fishing and processing (-75.94), and fishing, processing and retail selling (-75.94) suggesting that the empirical data fitted well the estimation model. The R^2 for the model on fishing and processing (0.578), and fishing, processing and retail selling (0.58) suggests that the specification factors in each separate model were explaining 58%, and 58% respectively of the total variation in the decision to undertake upgrading in the fish value chain. On the basis of the R^2 and log likelihood, the assumption that empirical data fitted well the estimation model was confirmed.

Further, results in Table 4.6 indicate that dealing in Nile perch ($p < 0.001$), engagement in trading ($p < 0.1$), distance to market ($p < 0.01$), Transport cost ($p < 0.1$) have a positive and significant influence on the decision to integrate fishing+ processing in the fish value chain.

Table 4.6: Factors influencing vertical integration in the fish value chain

Variables	Fishing + Processing		Fishing + Processing + Retail Selling	
	Coefficient (SE)	Marginal Effect (SE)	Coefficient (SE)	Marginal Effect (SE)
Sex_HH	0.048(2.153)	0.050(0.022)	-32.873(2.513) *	-0.0005(0.0009)
Fish type (tilapia)	1.172(0.808)	0.109(0.079)	1.033(0.962)	0.0008(0.0011)
Fish type (silverfish)	22.507(1.196)	0.859(0.044)	4.233(1.416) ***	-0.0054(0.0045)
Fish type (Nile perch)	1.951(0.723) ***	0.095(0.044)	3.512(1.141) ***	0.0026(0.0017)
Female sex X tilapia Interact	1.675(1.777)		19.327(1.909) ***	
Female sex X silverfish Interact	-0.019(2.492)		3.654(3.302)	
Female sex X Nile perch Interact	0.262(1.569)		15.681(2.053) ***	
Fish price	-0.257(0.109) **	-0.012(0.006)	-0.134(0.148)	0.0002(0.0002)
Tax cost	-0.861(0.352) **	-0.043(0.019)	-1.145(0.447) ***	-0.0003(0.0004)
Transport cost	1.128(0.655) *	0.059(0.036)	1.262(0.905)	0.0004(0.0011)
Storage cost	-0.668(0.793)	-0.031(0.048)	-0.762(1.0598)	0.0002(0.0002)
Non fishing activity (farming)	-1.023(0.604) *	-0.043(0.031)	-2.430(1.003) **	-0.0012(0.0015)
Non fishing activity (trading)	1.026(0.589) *	0.041(0.0196)	1.401(0.977)	0.0001(0.0015)
Distance to market(km)	0.632(0.154) ***	0.326(0.011)	0.500(0.172) ***	-0.0000(0.0002)
Group membership	0.606(0.5795)	0.022(0.031)	2.795(1.129) **	0.0026(0.0026)
Experience	-0.391(0.271)	-0.018(0.014)	0.094(0.577)	0.0004(0.0005)
Education	0.0325(0.465)	-0.002(0.024)	1.657(1.181)	0.0017(0.0012)
Constant	4.378(2.995)		-1.406(4.860)	
Log Pseudolikelihood	-75.938886		-75.938886	
Wald chi2(34)	3854.32		3854.32	
Prob>chi2	0.0000		0.0000	
Pseudo R2	0.5783		0.5783	
Number of observations	218		218	

Source: Field Data (2023); ***, ** & * implies $p < 0.01$, $p < 0.05$ and $p < 0.1$

Surprisingly, fish price ($p < 0.05$), tax cost ($p < 0.05$), engagement in farming ($p < 0.1$) post a negative and significant influence on the decision for fishing + processing integration in the fish value chain. For the three-level integration of fishing + processing + retail selling, the factors that positively and significantly influence actor decisions include: distance to the market ($p < 0.01$), group membership ($p < 0.05$), interaction of female sex with Nile perch fish ($p < 0.01$), female sex interaction with Tilapia fish ($p < 0.01$), dealing in Nile perch fish ($p < 0.01$) and dealing in silver fish

($p < 0.01$). Surprisingly, only sex of HH ($p < 0.1$) tax cost ($p < 0.01$) and engaging in other farming ($p < 0.05$) posted a negative and significant influence on the decision to undertake Fishing Processing Retail Selling upgrade.

In terms of the marginal effects, the participation of fish actors at fishing-processing reveals a probability (85.9%) of silverfish handled compared to the reference category “fishing” node of the fish value chain. On the other hand, fishing-processing-retail selling has the lowest likelihood (0.5%) of silverfish handled compared to the reference category. In addition to that, the participation of fish actors at “fishing” reveals a higher likelihood of Nile perch handled as compared to fishing-processing which had a probability of less amount of Nile perch handled (9.5%). The alternative category of fishing-processing-retail selling had a probability (0.3%) of Nile perch handled. Results further show that participation of the fish actors at fishing-processing had a probability of incurring less tax (4.3%) and transport (5.8%) compared to the reference category. On non-fishing activity like farming and trading, the marginal effects reveal the participation of fish value chain actors at fishing-processing to be associated with a probability (4.3%) decrease participation at farming and trading (4.0%) as compared to the reference category. On the contrary, fishing-processing-retail selling had marginal effects with a probability (0.1%) decrease participation at farming and trading (0.1%) as compared to the reference category. For distance to the market, the marginal effects reveal that the fish value chain actors participating at fishing-processing had a probability (3.3%) of more likely to increase distance in kilometers to the market when compared to the reference category. On the actors’ fish price, the marginal effects reveal that those participating at fishing-processing had a probability (1.2%) of more likely to increase fish price has compared to the reference category. Similarly, group membership had marginal effects of the actors participating at fishing-processing is associated with a probability

(2.1%) decrease in chain actors' participation as compared to the reference category. On the other hand, group membership at fishing-processing-retail selling is associated with a probability (0.3%) decrease in chain actors' participation as compared to the reference category.

CHAPTER FIVE: DISCUSSION OF RESULTS

5.1 Socio-economic characteristics of the fish value chain actors

The results reveal that men dominate the fishing and processing nodes of the fish value chain whereas women dominated the retail selling node of the fish value chain. This could be attributed to the fact that access to fishing resources such as boats, gear, and fishing licenses has historically been controlled by men due to societal structures and legal frameworks. This has limited women's participation in the fishing and processing nodes, as they may face barriers to accessing these resources or lack the necessary support networks to enter these sectors. Conversely, women may have better access to retail selling opportunities, which often require fewer resources to start, such as setting up a market stall or selling fish locally. This finding is in agreement with the findings of Allison & Ellis (2001) and Kwarazuka (2010) who reported that men engage in fishing activities like boat operation and fishing gear handling and fish processing activities where male dominated.

The study findings show that male household members were also found carrying out processing. This could be attributed to the fact that processed fish attract a higher price and as such men engage in processing to reap more money from their engagement. This finding is in agreement with Allison & Ellis (2001) who found out that Male engagement in fish processing diversifies household livelihoods and reduces dependency on fishing activities alone, contributing to increased resilience. Male household members participate in processing because they believe that the processing node is more profitable and thus displacing the women which is in line with the finding of Dolan (2001) who observed a trend in appropriation of benefits by men in agri-food chains that become more profitable and this was seen in the case of fish processing in Kenya where men entered fish processing, displacing women Ndanga *et al.*, (2013).

Female household members were found dominating the fish retail selling business. This is because fish retail selling is a source of employment and helps them to provide for the needs of their household members. Fish trade plays significant roles in the fishery sector by acting as a source of income generation, employment, food security and foreign exchange (FAO 2016). Also, retail selling is a major occupation of the women in the study area besides rearing animals, farming and operating small businesses. This is similar to the finding of FAO (2005) which revealed that fish trading is a major occupation among many fishing communities, including women in Malawi.

Furthermore, study findings indicated that most of the women carrying out retail selling in this study area were doing it within their homesteads because they were restricted by household chores and taking care of their family members. This is in agreement with the finding of Kabeer (2011) and Dolan (2002) who stated that women roles are limited to domestic and care duties, which takes place mainly within the confines of their homestead.

The findings showed that male spouse were involved at two nodes of fishing and processing was significant. This could be attributed to the fact that male spouse participation at the two nodes enables one to get higher returns to take care of the family than when one is participating at only one node. This finding is in agreement with that of Allison & Ellis (2001) who asserted who that Male spouses contribute to household income through their engagement in fishing and processing and their earnings support family livelihoods and contribute to economic stability.

The boy's involvement at fishing node of the value chain was statistically significant. This could be attributed to the fact that most of the boys in the study area had fathers, uncles and brothers who were fishermen and could move with their boys to fish to enable them to attain the fishing skills and thus this prepares these boys in a way that even when their fathers are away, they are able to

cope up with the fishing activities. This is in line with the finding of Pasani and Chiasson (2007) who stated that the boys help in mending nets and sometimes fishing. Also, this finding is in agreement with Béné *et al.*, (2009) who stated that boys' engagement in fishing at a young age allows them develop skills related to fish harvesting, equipment handling and resource management and thus passing of knowledge to the upcoming generations. The boys involved at processing was statistically significant. The boys in many occasions were seen helping their father to carry the fish from the landing sites to the processing racks and with processing.

Also in some instances, boys participate in processing to be able to provide for their personal needs like food, clothing, medical care etc. This is because in most cases, these boys come from families that cannot provide them with these necessities. This could be in agreement with the findings of Koralagama *et al.*, (2021) and Weeratunge *et al.*, (2021) who stated that In Sri Lanka, many people participating in DFVCs belonged to marginalized and disadvantaged groups, such as casual wage laborer's, people with lower levels of formal education, and people living in rural areas with less options for livelihoods. The participation of boys at retail selling was also statistically significant. This could be attributed to the fact that fish in this study area is cheap and there is ready market so, the boys buy fish directly from the fishermen and then sell these fish to other retailers, hotel owners, visitors and exporters and thus able to provide for their family members as well as pay for their own school fees. This is in agreement with findings of Béné *et al.*, (2015) who stated that Boys' participation in retail selling can provide additional income for their families.

Additionally, the participation of boys at both fishing and processing was statistically significant. This could be attributed to the fact that majority of the boys participating at fishing are not boat owners and thus after a day's catch, the boat owner sells the fish and pays off the workers their wages and some fish. These workers can decide whether to sell their share or process it to get more

money. This is in line with the findings of Abila (2002) and Odongkara (2003) on remuneration systems around Lake Victoria who indicated boat owners remunerate fishing crew using one of the main methods where the boat owner takes 50% of the income from fish sales, and the crewmember share out the remaining half amongst themselves.

The study also found out that the fish value chain actors who borrowed money at retail selling was statistically significant. This is probably because the retailers may want to increase on their fish stocks to get higher returns. Borrowing money allows retail sellers to invest in their businesses by purchasing more inventory, improving infrastructure, or diversifying their product offerings. This expansion can lead to increased sales and profitability World Bank (2020). Also, fish actors who borrowed money at the three nodes of fishing, processing and retail selling was statistically significant. This can be explained by the fact that these actors need money to meet the operational costs along the production chains of the three nodes. This finding is comparable to that of Patterson & Englin (2006) who stated that Borrowed funds can be used to acquire fishing gear, processing equipment, or retail facilities which enhances efficiency, quality, and overall business operations.

Group membership was statistically significant at the three nodes of the value chain that is fishing, processing and retail selling. This can be explained by the fact that these groups provide the chain actors with access to credits, extension services and also supports the actor in case of emergencies like sickness, death or loss of fishing equipment. This finding is in line with that of Béné *et al.*, (2015) who asserted that Groups can access loans, grants, or resources that might not be available to individuals which aids in investment, technology adoption, and business expansion. Also, all the actors participating at the three nodes of the chain belonged to group, implying that they have higher access to quality inputs at lower prices because of the collective bargaining power and also higher output prices. This is in agreement with the finding of Allison and Seeley (2004) who stated

that group membership increases the bargaining power of individuals in negotiating prices, accessing resources, or dealing with buyers. This collective strength improves their ability to secure favorable terms.

Majority of the fish actors had access to fish information services and was statistically significant at fishing, retail selling, fishing and processing, fishing, processing and retail selling. At fishing could be attributed to the government regulations of banning fishermen from fishing amidst the covid 19 lockdown and imposing laws that prohibits the fishermen from catching undersize fish, using inappropriate fishing equipment and many others. This could have made the fishermen and the boat owners to have access to this information in order not to fall a victim of circumstance. This is in line with the finding of Béné *et al.*, (2009) who stated that access to information about fishing regulations, quotas, and seasonal closures helps fishermen comply with legal requirements which fosters sustainable fishing practices and supports long-term industry viability.

Dealing in Tilapia was statistically significant at fishing. This could be attributed to the low skills and technologies required of using a fishing net to catch the fish type. Furthermore, the availability of tilapia at lake Kyoga could have attributed to this. Tilapia was statistically significant at processing. This could be attributed to the various technologies use to increase the shelf life of this fish by the processors which includes; smoking, deep frying, salting and sun drying. This is in line with the finding of Aragon *et al.*, (2014) who stated that tilapia can be processed into a number of products such as fillets, nuggets, fish cakes, sausages and many others because of its texture and flavor that makes suitable for various processing techniques. Tilapia was statistically significant at retail selling. This could be attributed to the fact that the price of tilapia was lower than the price of Nile perch in the study area. This is similar to the findings of Quagraine *et al.* (2011) who drew conclusion from the experiences from Kenya that the marketing of tilapia is different from that of

Nile Perch. (Hickling *et al.*, 2017) also agreed that Tilapia is often more purchasable as compared to other fish types and thus attracting a number of consumers and this raises the profit margins of the retailers.

Dealing in silver fish was statistically significant at fishing. This could be attributed to the relatively low skills requirements needed to participate in the silver fish business. Silver fish was also statistically significant at processing. This is attributed due to the low-key technology (like drying *mukene* on the ground) that creates opportunities to employ most of the uneducated youth. Silver fish was statistically significant at retail selling. This is attributed to the fact that there are no regulations that stops the retail selling of silver fish as compared to Nile perch and tilapia. Also, silverfish is often more affordable compared to other fish species, making it accessible to a wide range of consumers, including those with budget constraints. Its affordability enhances its market demand (Liao *et al.*, 2017). Silver fish was also statistically significant at the two nodes of fishing and processing. This is also attributed to the fact that silver fish cannot be sold fresh so one had to first process it before it can be sold to the customers.

Dealing in Nile perch fish type was found to be statistically significant at fishing. This is attributed to Nile perch being a commercially valuable fish species with a high market demand. Its large size and quality fillets make it an economically important catch for fishermen and fishing communities (Pérez-Ruzafa *et al.*, 2004). Nile perch was statistically significant at processing. The processing of Nile perch supports local economies by generating employment opportunities in processing plants and related industries. It contributes to income generation and economic development (FAO, 2021). Nile perch is statistically significant at retail selling. Nile perch is a sought-after fish species with large market demand, particularly in regions where it is native. Its popularity is

driven by its large size, quality fillets, and mild flavor that appeals to consumers (Pérez-Ruzafa et al., 2004).

Nile perch was statistically significant at the two nodes of fishing and processing. Nile perch can be processed into a wide range of products, including fresh fillets, frozen fillets, smoked fish, fish steaks, fish fingers, and more. Its versatility allows processors to cater to different consumer preferences (Boglione *et al.*, 2013). Nile perch was statistically significant at the three nodes of fishing, processing and retail selling. This could be attributed to the fact that participating at the three nodes could mean higher gross margins of the actors.

5.2 Drivers of value shares in the fish value chain

Findings reveal that female-headed households are associated with increased value shares earned at retail trading but decreased value shares earned at fishing. The increase in the value shares at the retail selling node could be attributed to the fact that female household heads might effectively target and cater to these segments, resulting in higher value shares within those specific market segments. Male household heads may have better access to market information, networks, and channels for selling fish, leading to greater market reach and higher value shares compared to female household heads. This discrepancy in access to market opportunities can contribute to a negative relationship between the sex of the household head and value shares earned at the fishing. This finding mirrors the findings of Ancharaz, (2017) and FAO, (2013) that revealed that the sex of the household head greatly impacts on the businesses.

Study findings also show that engagement of household members who are boys in the fishing, processing and retail selling nodes increased the value shares earned in the fishing, processing and

retail selling nodes of the fish value chain respectively. This could be attributed to the fact that in many fishing communities, traditional gender roles assign specific tasks and responsibilities to boys and girls within households. Boys are often expected to engage in fishing-related activities from a young age, which can translate into valuable experience and expertise that positively influence value shares across different nodes of the fish value chain. This finding corroborates with the findings of Béné *et al.*, (2003) that argued that engagement of boys leads to preferential allocation of resources and opportunities that enhance their participation and contribution to value creation within the fish value chain

It was equally observed that engagement of household members who are male spouses in fishing activities increased the values shares earned in the fishing node but reduced the value shares earned in the retail selling node of the fish value chain. The increase in the value share earned at the fishing node is explained by the fact that male spouses may hold decision-making power within fishing households, influencing resource allocation and investment decisions related to fishing activities. Their strategic allocation of resources towards productive fishing endeavors enhances the profitability and value shares earned at the fishing node. Male spouses may lack the interpersonal and customer interaction skills typically associated with successful retail selling. The findings agree with the findings of Béné *et al.*, (2003) and Ancharaz, (2017) that revealed that women often excel in building rapport with customers and providing personalized service, which can lead to increased sales and higher value shares in retail settings

Furthermore, study findings revealed that dealing in Tilapia fish is associated with increase in value shares in the fishing, process and retail selling node. This implies that dealing in Tilapia fish type increases the value shares earned at the fishing, processing and retail selling node of the fish value chain respectively. Tilapia is a popular and widely consumed fish species with a growing

demand in domestic and international markets due to its mild flavor, versatility, and nutritional value. As a result, dealing in tilapia can lead to higher market prices and increased value shares across the fish value chain. The study finding is in line with the findings of (Béné *et al.*, 2015; Delgado *et al.*, 2003) who found out that tilapia fish attract premium price across the fish value chain thus higher value share.

Dealing in silverfish was found to have a positive influence on the value shares earned at the processing and retailing selling nodes but a negative influence on the value shares earned in the fishing node of the fish value chain. The positive influence of dealing in silver fish on the value shares earned in the processing and retail selling node could be attributed to the fact Silverfish may be in high demand due to their popularity in local cuisines, medicinal properties, or use in specialty products such as cosmetics or supplements. High demand can create opportunities for businesses to capitalize on selling silverfish at higher prices, thus increasing their value shares. The perceived health benefits of silver fish products drive demand and increase value shares in the retail selling node. The reduction in the value share attributed to dealing in silver fish is explained by the fact that silver fish, such as small pelagic species, are often considered low-value fish compared to larger and more commercially valuable species. Fishers targeting silver fish may fetch lower prices for their catch, resulting in reduced value shares at the fishing node. The findings corroborate with the findings of (Okechi & Mlaponi, 2019; Gordon *et al.*, 2015).

Findings also revealed that dealing in Nile perch is associated with an increase value share earned in the fishing, processing and retail selling node of the fish value chain. This is attributed to the fact that Nile perch is known for its high yield and profitability in commercial fisheries, making it a lucrative target species for fishers. The large size and high market value of Nile perch contribute

to increased revenue and value shares at the fishing node. The study finding is in agreement with the findings of (Okello *et al.*, 2015).

Similarly, study findings revealed that quantity of fish had a positive and significant influence on value shares earned at fishing node but quantity of fish had a negative and significant influence on value shares earned at processing node of the fish value chain. This implies that a unit increase in quantity of fish increases the value shares earned at fishing but reduces the value share earned at the processing node. The increase in value share is attributed to the fact that fishing operations often benefit from economies of scale, where larger quantities of fish caught result in lower average costs per unit of fish. This can increase the overall profitability of fishing activities and contribute to higher value shares for fishers. The decrease in the value shares with increase in quantity of fish could be attributed to the fact that processing facilities may face challenges in finding markets for processed fish products when dealing with large quantities of fish. Oversupply in the market can drive down prices, leading to lower revenues and value shares for processed fish products. This finding aligns with the findings of (Thorpe *et al.*, 2015). The finding of Asche *et al.* (2015) and Aboagye *et al.*, (2018) found that while an increase in fish quantity led to higher revenue for fishers, it did not necessarily translate into higher profitability due to associated costs such as fuel, labor, and maintenance.

Study findings show that an interaction of engagement of female actors and dealing in tilapia fish had a positive and significant influence on value share earned in the fishing and processing nodes of the fish value chain. However, interaction of engagement of female actors and dealing in the tilapia fish had a negative and significant influence on the value shares earned in the retail selling node of the fish value chain. Research has shown that women tend to be meticulous and detail-oriented, which can lead to improved productivity and higher-quality fish products. This attention

to detail in handling, processing, and packaging can enhance the overall value of tilapia fish in the market. The negative influence of interaction of engagement of female actors and dealing in the tilapia fish on the value shares earned at the retail selling node could be attributed to the fact gender norms and discrimination may limit women's ability to negotiate prices, access market opportunities, or participate in decision-making processes within retail networks. This can lead to unequal treatment and lower returns on their investments, ultimately affecting value shares. The finding is aligned with the findings of (Williams *et al.*, 2016).

Furthermore, the studying findings also indicate that the interaction of engagement of female actors and dealing in silver fish had a negative and significant influence on the value shares earned at the retail selling node of the fish value chain. Women often face constraints in accessing and controlling productive resources, which can limit their ability to engage in profitable economic activities. Therefore, in contexts where female actors are primarily engaged in dealing with lower-value fish such as silver fish, their overall contribution to the value chain may be limited compared to male counterparts who deal with higher-value fish species. The study finding agrees with the findings of (Kabeer, 2005; Cramer & Johnston, 2018).

Similarly, findings reveal that the interaction of engagement of female actors and dealing in Nile perch have a positive and significant influence on value shares earned in the fishing node but a negative and significant influence on the value share earned in the processing node of the fish value chain. The involvement of female actors in fish value chains can lead to improved market access and increased profits. In the context of dealing in Nile perch, which is a valuable commercial fish species in many regions, female engagement may contribute to more efficient and diversified value chains, leading to higher value shares for all actors involved. The finding on the positive influence of the interaction of female actors and dealing in Nile perch correlates with the

findings of (Ojha *et al.* 2018). Conversely, the negative influence of the interaction between female engagement and dealing in Nile perch fish on value shares could be attributed to the fact that the presence of female actors in the Nile perch fish trade may be associated with less efficient or equitable distribution of profits. This could be due to social dynamics or power imbalances within the fishing communities or value chains. The finding is in agreement with the finding of (Johnson *et al.* 2016)

Furthermore, distance to the market had a negative and significant influence on the value shares earned at the fishing node and a positive and significant influence on the value shares earned at processing. This implies that a unit increase in distance to the market resulted in a decrease in the value shares earned at fishing node but an increase in the value share earned in the processing node of the fish value chain. The reduction in the value shares earned in the fishing node could be explained by the fact that fresh fish are highly perishable and long distant markets are associated with additional costs like transportation costs, cold storage costs and market costs which reduces on the profit margins of the fish value chain actor and hence reduced value shares earned. Whereas the increase in the value shares earned at the processing node of the fish value chain could be explained by the fact that selling of processed fish in distant markets is associated with higher prices which translates into higher returns. The study finding is in agreement with the findings of (Reardon & Berdegue, 2006).

Additionally, finding reveal that access to credit is associated with a positive and significant influence on value shares earned in the retail selling node of the fish value chain. This implies that actors who have access to credit earn more value shares compared to their counter parts who have not access. With access to credit, retailers can expand their operations, such as opening new retail outlets or diversifying their product offerings. This expansion can lead to increased market

presence and a larger customer base, thereby capturing a larger share of the value in the fish value chain. The finding corroborates with the findings of (Briones, *et al.* 2012; Sharma & Sarker, 2015) that found evidence supporting the positive influence of credit access on retailers' market power and value shares within traditional fish markets.

Group membership of the fish value chain actors had a negative and significant effect on the value shares earned at processing. This implies that belonging to a group is associated with a decrease in the value shares earned in the processing node of the fish value chain. Group membership might entail collective decision-making processes that could hinder the ability of individual processors to optimize their operations and capture higher value shares. Group decisions may prioritize consensus over efficiency or innovation, leading to suboptimal outcomes for individual processors. The study finding is contradictory to the findings of Belton and Little (2011) that highlighted that group membership in fish processing cooperatives reduced challenges in individual processors' ability to increase their value shares due to constraints in decision-making processes and resource sharing within the cooperatives.

Education level of the fish value chain actors had a negative and significant effect on value shares earned at processing. This implies that an increase in the number of years spent in school will result in a reduction in the value share earned in the processing node of the fish value chain. This is not surprising because if one has attained a higher level of education, one becomes more informed about the operations of the fish business and its returns and therefore would demand a better wage for the work done and thus this would decrease on the value shares earned at processing. This is in agreement with FAO (2006) which stated the need for literacy in a business acumen.

5.3 Factors influencing vertical integration in the fish value chain

Notably, results of this study show that female-headed households are associated with increased participation in the downstream segments of the value chain as compared to the reference category of fishing only. This could probably be because of the female household heads are not very comfortable with taking risks associated with direct fishing. As such women are more likely to find it appealing to participate more in downstream activities of the value chain. These activities include fish smoking, sun-drying, frying and wholesaling and retailing. Increased number of laborers mean work is eased and thus reduction on the time needed to take the products to the market which translates to higher returns. The study finding corroborates with the findings of (Ahmed *et al.*, 2007; Hossain *et al.*, 2015).

An interaction of the female spouse with tilapia and Nile perch is significantly associated with value chain integration that is fishing_ + processing and fishing + processing + retailing. The results suggest that the more women engaged in the value chain involving tilapia and Nile perch fish, the higher the chances for such a household undertook integration downstream of the value chain. This could be attributed to the fact that participating at the three nodes mean a female spouse is not restricted from participating at processing and retail selling as it is at the fishing node due to some cultural aspects. This finding aligns with the finding of (Dolan, 2001).

Also, findings of the study show fish price to significantly increase participation at the two nodes of fishing and processing as compared to the reference category of fishing. This could be attributed to the fact that adding value to a product through processing either by drying, smoking or salting means additional costs has been incurred and thus the fish prices tend to also increase leading to vertical integration. The study finding agrees with the findings of (Ssebisubi, 2011).

Transport cost was also found to significantly decline actors' participation at the two node of the value chain that is fishing and processing as compared to the reference category of fishing. Reason being, since processing is done from the actor's home stead which is some distance away from the lake side, the value chain actor has to incur cost of transporting the fish to the processing point. The longer the distance the higher the transport cost. This is in agreement with finding of Balogun *et al.*, (2019) who found marketing costs for watermelon in terms of transportation and handling cost to increase with distance from the supply source.

The findings shows that silverfish and Nile perch significantly improves the returns of the chain actors participating at the two nodes of fishing and processing of the fish value chain to that other reference category who are dependent on only the fishing node of the value chain. Reason being, the chain actor has added value to these fish types and thus an additional extra fee is paid by the retailers who come to stock these fish types for sale right at the processing node. Further, this variable of silverfish and Nile perch significantly increases returns of the chain actors participating in all the three nodes of fishing, processing and retail selling. The reason for this finding could be that those chain actors prefer to participate in all the three nodes due to the relatively large gross margins earned which translates into higher profits due to one carrying out retail selling at market places.

Similarly, results of this study showed that marketing cost of tax significantly increased for the value chain actors participating at the two nodes of fishing and processing of the fish value chain as compared to the reference category who are participating at only the fishing node. This is because participating at the two nodes of the fish value chain means the fish value chain actor must pay taxes for operating at the two nodes of fishing and retail selling. Conversely, the same marketing cost of tax is significantly highest for the value chain actors participating at the three

nodes of fishing, processing and retail selling. This can also be explained by the fact that participating at the three nodes of fishing, processing and retail selling is related to taxes for participating at the three nodes and additional taxes to allow one to sell his/her products in the specific location.

Results also indicate that the participation of the fish value chain actors in non-fishing activity like farming and trading significantly decline for the chain actors who are participating at fishing and processing as compared to those who are participating at only fishing. This is because participating at the two nodes may be time consuming and thus the value chain actor may not be in position to fully participate in farming activities. Similarly, the study also noted that none of the fish value chain actors participating in all the three nodes of fishing, processing and retail selling carry out non fishing activities like farming. This is because participating at the three node needs time and dedication for one to achieve a better outcome.

Distance to the market significantly increased for value chain actors participating at fishing and processing as compared to those that are dependent at only the fishing node. This is because the value chain actors participating at the two nodes had to transport their fish to the processing points and in most cases, retail selling of the processed fish takes place here. On the contrary, distance to the market was significantly highest for the value chain actors participating at the three nodes of fishing, processing and retail selling. The value chain actors participating at all the three nodes were found to sell their products in very far distances like Congo because they believe that selling their products to these far distances fetches them higher returns. This is in line with finding of Dhatemwa (2009) who found Congo to be a major export regional market and a major destination for salted heads, frames and skins of Nile perch.

It was evident that Group membership in this study significantly increased the participation of the value chain actors at the three nodes of the value chain as compared to the reference category which is fishing. This could be attributed to the fact that, the actors who are participating at the three nodes of the value chain needs more financial assistance than those other participants at one or two nodes. Group membership therefore is very vital for the actors participating at three nodes because they do not only get financial assistance but also do collective transportation of their products and thus reducing on some marketing costs.

CHAPTER SIX: SUMMARY, CONCLUSION AND RECOMMENDATION

6.0 Introduction

This chapter presents the summary, conclusions, and recommendations of the study. It is presented in line with the study objectives which were to map the gender-disaggregated value chain in the supply of fish, to determine the drivers of value shares earned at the various nodes of the fish value chain, to determine the factors influencing vertical integration of the fish value chain in Amolatar district.

6.1 Summary of the study

The study sought to explore and gain understanding on gender participation in the fish value chain in Amolatar district. Specifically, the study aimed at mapping the gender disaggregated value chain in the supply of fish, determining the drivers of value shares earned at the various nodes of the fish value chain and determining factors influencing vertical integration of the fish value chain in Amolatar district. A cross-sectional study was conducted in Amolatar district wherein 355 fish value chain actors were interviewed which included the producers, processors and the marketers using pretested structured questionnaires. Data was analyzed using descriptive statistics and econometric analysis including Tobit regression modelling and the Multinomial regression modelling.

The study established that fishing and processing of fish is mostly done by men whereas women are mostly found at the retail selling node of the fish value chain. The number of men participating in more than one node of the fish value chain was higher than the number of women participating in more than one node of the fish value chain. The study also revealed that both men and women

take part in fishing and are owners of fishing vessels such as boats, engines and nets. Fishing was viewed as a male job and therefore women were discouraged from fishing. Regarding the predictors of value shares earned at each node of the value chain, boys, tilapia, silverfish, Nile perch, an interaction between female spouse and tilapia were significant predictors across “fishing”, “processing” and “retail selling”

The multinomial logistic regression results generally showed that silverfish, Nile perch, an interaction between female spouse and tilapia, an interaction between female spouse and Nile perch, transport cost, trading, distance to the market and group membership positively and significantly influence vertical integration while sex, fish price, tax cost and farming negatively influence vertical integration.

6.2 Conclusions

The study was set out to analyze gender participation in the fish value chain in Amolatar. Specifically, the study assessed the relationship between socio-economic factor and gendered participation in the fish value chain, determined the drivers of value shares at the various nodes of the fish value chain, and determine the factors influencing vertical integration in the fish value chain. This study concludes that various roles of men, women and youth are critical in the fish value chains. However, the study established that there is less women involvement in the fish value chains due to factors such as disparity in ownership of boats and fishing gears. Currently, there are a higher percentage of motorized boats belonging to men. In addition, limited access to finances among women hinder their participation in the fishery value chains thus the number of women who practice fishing is much lower than their male counterparts. This makes fishery to be a male dominated activity in the study area.

This study has established that the retailer earns the highest profit from the different fish types while the lowest profit is from those participating at the fishing node. Among the different explanatory variables, sex, boys, males, fish types (tilapia, Nile perch and silverfish), interaction between female spouse and the fish types, education, distance to the market, group membership, buyer information and access to credit could significantly influence the value shares earned at each node of the value chain. Thus, it can therefore be concluded that value shares is influenced by sex of household head, participation of boys, males, fish types (tilapia, Nile perch and silverfish), interaction between female spouse and the fish types, education, distance to the market, group membership, buyer information and access to credit.

For determinants of factors influencing vertical integration, it was clear that the fish types Nile perch and tilapia and distance to the market posted a positive and significant effect at both fishing-processing and fishing-processing and retail selling. Yet tax cost and non-fishing activity (farming) posted a negative and significant effect at both fishing-processing and fishing-processing and retail selling. Thus, the study concludes that these explanatory variables could negatively and positively but significantly influence vertical integration. Sex and fish price posted a negative but significant effect at fishing-processing-retail selling and fishing-processing respectively. An interaction between female spouse and fish type (tilapia and Nile perch), transport costs, distance to the market and group membership posted a positive and significant effects on factors influencing vertical integration at fishing-processing-retail selling and fishing-processing respectively. It can therefore be concluded that vertical integration is influenced by sex of household head, tax cost, relying on Nile perch, and Tilapia, distance to the market, engagement in farming, group membership, and transport costs.

6.3 Recommendations

To enhance gender parity in the fish value chain, interventions should focus on providing women with equal access to ownership of fishing equipment such as boats, engines, and nets. This could be achieved through targeted programs that offer financial support, training, and resources specifically tailored to women fishers. Additionally, efforts should be made to challenge the perception of fishing as solely a male occupation, encouraging and supporting women to participate in fishing activities by providing training, mentorship, and creating supportive environments that empower women to engage in all aspects of the value chain.

In order to improve profitability and value shares earned at each node of the fish value chain, it is crucial to address factors such as access to credit, education, and market information. Providing financial literacy training and facilitating access to credit and market information for all participants, regardless of gender, can help level the playing field and enable more equitable distribution of profits. Furthermore, efforts to increase vertical integration should prioritize reducing tax costs and improving transportation infrastructure, particularly in remote areas, to facilitate smoother flow of goods and reduce barriers to market access.

To foster greater vertical integration within the fish value chain, policymakers and stakeholders should prioritize investments in infrastructure, such as cold storage facilities and processing plants, to add value to fish products locally. This can create opportunities for fishers and other actors along the value chain to capture more value from their products and reduce reliance on middlemen. Additionally, promoting collaborative initiatives and group membership among fishers and other stakeholders can enhance bargaining power and facilitate collective action towards achieving common goals, such as accessing markets, negotiating fair prices, and adopting sustainable

practices. Overall, by addressing these recommendations, stakeholders can work towards building a more inclusive, equitable, and sustainable fish value chain in Amolatar district.

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APPENDICES

Appendix I: Questionnaire

Version 2.0
Gulu University
Faculty of Agriculture and Environment
Gender Participation in the fish value chain in Amolatar District

INTRODUCTION

I am Coming from the Faculty of Agriculture and Environment, Gulu University. I am conducting a study on gender participation in the fish value chain. You have been selected to participate in the study as a respondent and we kindly request for your time to respond to our study questions. For your assurance, all your responses will be treated with the utmost confidentiality and only for purpose of completing this study. Neither your identity nor responses will be shared with any other person or organization. If you are consenting to participate in the study kindly confirm by signing or inserting a thumbprint in the space below. Thank you,
Signature or Thumb Print of respondent.....

GENERAL INFORMATION

Interviewer: Interview date:
District: Sub-County: Parish: Village:
Questionnaire number:

PART ONE (A): SOCIO-DEMOGRAPHIC INFORMATION

Here, I am interested in knowing some information concerning your household. Kindly, respond to the questions in the spaces provided and circle where applicable.

Characteristics of Fish value chain actor				Household Structure		Household Livelihood diversification				
1A.1 Sex of fish value chain actor (A1)	1A.2 Age of fish value chain actor (years)	1A.3 Education level of fish value chain actor (years of formal schooling.)	1A.4 Marital status (A2)	1A.5 Experience of the fish value chain actor head (Years)	1A.6 Household Size (number of members)	1A.7 Dependency (Number of non-working household members)	1A.8 Is your household involved in non-fish activities for earning a living? (A3)	1A.9 If yes, which of the following activities?	1A.10 If yes, how much do you estimate to earn from these activities in a month (UGX)?	1A.11 If yes, which of the following household members participate in non-fish income activities
Sex (A1) 1 = Male 2 = Female		Marital status (A2) 1 = Married 2 = Single 3 = Divorced 4 = Widowed					Non-fish Activities (A3) 1=Yes 2=No if no skip questions 1.9 & 1.10	List of activities (A4) 1=farming 2=livestock rearing 3=trading 4=employed (salaried) 5=casual worker 6=other, specify	1= 2= 3= 4= 5= 6=	Members(A5) 1= Male Spouse 2= Female spouse 3= Boys 4 = girls

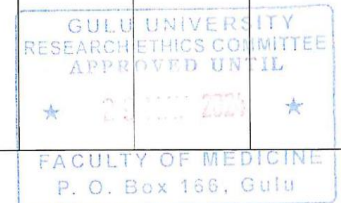
Version 2.0

PART ONE (B): INSTITUTIONAL FACTORS In this table, I am interested in knowing some information about the institutional aspects.

1B.1 DO you have access to fish information services?	1B.2 If yes, from whom do you get this information service?	1B.3 If yes, what kind of information services do you access? Choose as many as may apply.	1B.4 Have you borrowed money in the previous two years?	1B.5 If yes, what was your source of borrowing? Choose as many as may apply	1B.6 Are you a member of any club or group?	1B.7 If yes, what is the nature of the group?	1B.8 If yes, what type of group is it?	1B.9 If yes, what is the purpose of the group?	1B.10 what is the distance to the main town market where you sell fish in KM?
1=yes 2=no	1=government institutions 2=non-government organizations 3= Peer fish actors 4= others (specify)	1=good fishing practices 2=resource management 3=processing 4=packaging 5=buyer information 6=Price information 7=Buyer preferences 8=Market trends 9= others (specify)	1=yes 2=no	1= financial institutions (banks) 2=cooperative unions 3=money lenders 4=self-financing 5= village savings and loan association (VSLA) 6=others (specify)	1= yes 2= no	1= formal (registered) 2= informal	1=young farmer's group 2=women's group 3=Men's group 4=general group (mixed) 5=others (specify)	1=credit services 2=marketing information 3=marketing of products 4=transportation 5=subsidized inputs 6=others (specify)	

PART TWO (A): FISHING ACTIVITIES

2A.1, Do any of your household members participate in fishing?	2A.2. If yes, which of the following household members?	2A.3, If yes, which of the following types do you fish?	2A.4, If yes, what quantity of fresh fish do you estimate to wholesale in a week (kg/ number)?	2A.5, If yes, what quantity of fresh fish do you estimate to retail sale in a week (kg/ Number)	2A.6. If yes, what is the average weekly price (UGX) for each fish/ unit of fish	2A.7, Do you hire fishing equipment (e.g., boat, engine, net.)?	2A.8, If yes in 2A.7, how much money (UGX) do you estimate to spend on hiring fishing equipment (e.g. boat, net, engine) in a week?	2A.9, If yes, how much money (UGX) do you estimate to spend on transport of fish to buyers in a week	2A.10, If yes, how much money (UGX) do you estimate to spend on phone calls for your fish business in a week?	2A.11, if yes, how much money (UGX) do you estimate to spend on cold storage of fresh fish in a week?	2A.12, If yes, how much money (UGX) do you estimate to spend on packaging materials in a week?	2A.13, If yes, how much money (UGX) do you estimate to spend on taxes in a week?
1= yes 2= no	Members 1= Male Spouse 2= Female spouse 3= Boys 4 = girls	Fish types 1= Tilapia 2= Catfish 3= Nile perch 4= Silverfish 5= Mudfish				1= yes 2= no						



Version 2.0

PART TWO (B): FISH PROCESSING ACTIVITIES

2B.1. Do any of your household members participate in fish processing	2B.2. If yes, what type of fish do you process?	2B.3. If yes what type of fish processing do they do	2B.4. If yes, which of the following household members participate in fish processing? (Select as many as may apply)	2B.5. For the household members below indicate as appropriate the number of times each participates in fish processing in a week?	2B.6. If yes, which of the following fish types do each household member participate in processing?	2B.7. If yes, which type of fish processing is done by each of member(s) of your HHI? Indicate as many processing activities as may apply for each HHI member	2B.8. If yes, what quantity of processed fish by type do you estimate to sell in a week? Indicate quantity in space below by the codes at the bottom	2B.9. If yes, what is the average weekly purchase price for each unit of fresh fish you stock for processing ?	2B.10. If yes, what is the average weekly selling price (UGX) for each unit of processed fish?	2B.11. If yes, how much money (UGX) do you estimate to spend on the transportation of processed fish to buyers in a week?	2B.12. If yes, how much money (UGX) do estimate to spend on phone calls for your processed fish business in a week?	2B.13. If yes, how much money (UGX) do you estimate to spend on the storage of processed fish in a week?	2B.14. If yes, how much money (UGX) do you estimate to spend on packaging materials in a week?	2B.15. If yes, how much money (UGX) do you estimate to spend on taxes in a week for processing fish?
					Male spouse.... Female Spouse.... Boys..... Girls.....	Members 1. Male spouse..... 2. Female spouse..... 3. Boys..... 4. Girls.....	1=..... ... 2=..... ... 3=..... ... 4=..... ... 5=..... ...							
2A.1 1= yes 2= no	2A.2 Fish types 1= tilapia 2= catfish 3= Nile perch 4= silverfish 5= mudfish	2A.3 Fish processing 1=salting 2=smoking 3=sun drying 4=frying	2A.4 Members 1= male spouse 2= female spouse 3= boys 4= girls	Members 1. Male spouse..... 2. Female spouse..... 3. Boys..... 4. Girls.....	Fish types 1= tilapia 2= catfish 3= Nile perch 4= silverfish 5= mudfish	Methods 1. sun drying 2. smoking 3. frying 4. salting	1 = Tilapia 2 = Catfish 3 = Nile perch 4 = Silver fish 5 = Mud-fish							

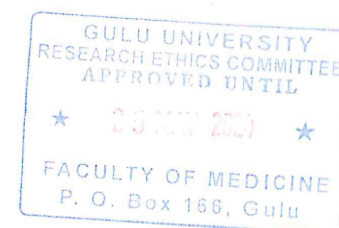
GULU UNIVERSITY
RESEARCH ETHICS COMMITTEE
APPROVED UNTIL
★ 29 MAR 2024 ★
FACULTY OF MEDICINE
P. O. Box 166, Gulu

Version 2.0

PART TWO (C): FISH SELLING

2C.1. Do any of your HHI members participate in fish retail selling?	2C.2. If yes, which of the following HHI members participate in fish retail selling?	2C.3. If yes, what kind of fish do you retail sell in HHI?	2C.4. who are your final buyers?	2C.4. For the HHI members below, indicate as appropriate the number of times each participates in fish retail selling in a week?	2C.5. If yes, what quantity of fresh fish do you estimate to retail sell in a week?	2C.6. If yes, what quantity of processed fish do you estimate to retail sell in a week?	2C.7. If yes, what is your average weekly purchase price (UGX) for a unit of fresh fish for retail selling?	2C.8. if yes, what is the average weekly selling price (UGX) for each fresh fish/unit to your customers ?	2C.9. If yes, what is the average weekly purchase price (UGX) for each processed fish/unit for retail selling?	2C.10. If yes, what is the average weekly selling price (UGX) for each processed fish/unit to your customers ?	2C.11. If yes, how much money (UGX) do you estimate to spend on transportation of fish to your market stall in a week?	2C.12. If yes, how much money (UGX) do you estimate to spend on phone calls for your fish business in week?	2C.13. If yes, how much money (UGX) do you estimate to spend on the storage of fish in a week?	2C.14. If yes, how much money (UGX) do you estimate to spend on packaging materials in a week?	2C.15. If yes, how much money (UGX) do you estimate to spend on taxes in a week for fish?
1= yes 2= no	Members 1= male spouse 2= female spouse 3= boys 4= girls	Fish types 1= tilapia 2= catfish 3= Nile perch 4= silverfish 5= mudfish	Buyers 1=local consumers 2=local vendors 3=domestic long-distance traders 4=exporters (Specify Congo, Kenya, Sudan)	Members 1. Male spouse ... 2. Female spouse..... 3. Boys..... 4. Girls											

Thank you for your time!



Appendix II: Informed consent form (b)

Version 3.0

INFORMED CONSENT DOCUMENT

Title of the study: GENDER PARTICIPATION IN THE FISH VALUE CHAIN IN AMOLATAR DISTRICT

Invigilator(s): Laker Viola

Institution(s): Gulu University

Introduction

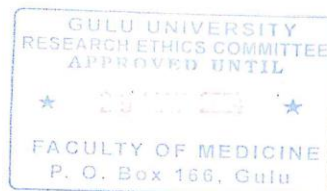
I am **Laker Viola** from the Faculty of Agriculture and Environment, at Gulu University. I am conducting a study on Gender Participation in the Fish Value Chain in Amolatar District. You have been selected as a study participant. We kindly request you to respond to our questions. For your assurance, this information shall not be shared with any organization or institution but shall only be used for this study.

A brief Description of the Sponsors of the Project

This study is funded by Regional Universities Forum for Capacity Building in Agriculture RUFORUM, Gulu University. RUFORUM is an international Non-governmental Organization contributing to the well-being of small-scale farmers and economic development of countries throughout the sub-Saharan Africa region. They promote rural transformation through outreach to foster rural transformation and entrepreneurship, support researches to develop new technologies and skills to improve food and nutrition security.

Purpose

The study seeks to analyze gender participation in the fish value chain in Amolatar District. The study will serve as a suitable tool for agricultural researchers and it will enable gender and value chain development specialists to gain adequate knowledge needed for gender mainstreaming



and developing the fish value chain. This will in turn enhance the participation of men and women in the fish value chain. The discoveries of the study will attract the attention of researchers, and promote awareness among scientists, policymakers, and producers.

Procedures

your participation in this study will involve answering the questions that is going to be asked by the researcher. The researcher is going to explain each question to the participants using the language that he or she understands best and also write down their responses to the different questions in the questionnaires.

Who will Participate in the Study

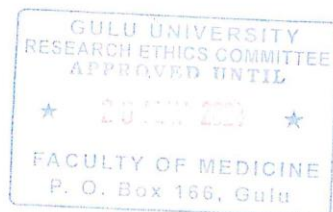
You have been chosen to participate in this study because you are a fish value chain actor in Amolatar. The interview will last for approximately thirty minutes or less and the participants will be 355 with you inclusive.

Risks/Discomforts

There is no foreseeable risk of harm or discomfort that will arise from your participation in this study. The only risk or discomfort will be the inconvenience in terms of time spent during the interview. The only risk that could be faced in the course of this survey is the risk of the spread of COVID-19 during the conduct of research and this will be mitigated by adhering to COVID-19 and Ebola SOP measures such as ensuring the use of hand sanitizers and nose masks and keeping social distancing.

Benefits

The potential benefit of this study is that it will increase the participation of men, women and youths in the fish value chain. Research participants will also get feedback on the findings and progress of the study, and any new information that affects the study participants (including



incidental findings) will be made available to research participants.

Confidentiality

Your identity will not be revealed to anyone as we shall only use codes to identify participants. Information obtained will only be accessible to the research team. Soft copies of the data will be protected by password and hard copy files will be kept under lock and key. Confidential information will only be accessed by the principal investigator.

Refreshments

Research respondents will be compensated for their time in participation in the study by providing each respondent with refreshments (soda + biscuits) and a bar of washing soap.

Alternatives

You do not have to participate in this study if you are not interested. You will not lose any benefit in case of no participation.

Costs

There will not be any additional cost incurred as a result of participating in this study.

Inquiries

If you have any questions related to the study or your rights as a research participant, you can contact the principal investigator, Laker Viola on telephone 0778849912 or via email at lakerviola33@gmail.com

Statement of Voluntaries

Participation in the research study is voluntary and you may join of your own free will. You have a right to withdraw from the study at any time without penalty.

If you have any issues pertaining to your rights and participation in the study, please contact the Chairperson, Gulu University Research Ethics Committee (GUREC), Dr. Gerald Obai Tel: No.,



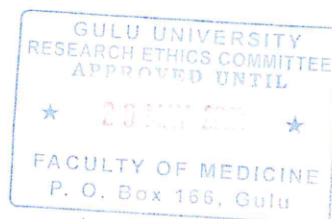
0772305621; email: lekobai@yahoo.com/lekobai@gmail.com; or the Uganda National Council for Science and Technology on plot 6 Kimera Road, Ntinda, Kampala on Tel 0414705500.

If you consent to participate in the study, kindly indicate by signing/thumb print in the space below;

Name of participant.....Signature/Thumbprint..... Date.....

Name of witness.....Signature..... Date.....

Name of interviewer.....Signature.....Date.....



Appendix III: Translated informed consent form

Version 3.0

BALU AME NYUTO YEO NI ME GAMO APENY ME RICAC

Ricac man tye me neno tic apapat ame coo, mon, kede buli tiyo alubere kede kop me ciko,yiko kede cato rec iyi Amolatar District.

Atim ricac: Laker Viola

Kwano kwene: Gulu Unibasity

Nyute acegocego

Apwoyo yin ba. An nyinga olwongo ni **Laker Viola**. Atye atin kwan me Gulu Unibasity ame tye akwano digiri me aryo ikop me tiyo biacara ipur. Atye atimo ricac me neno tic apapat ame coo, mon, kede buli tiyo alubere kede kop me ciko, yiko kede cato rec iyi Amolatar District. Ikare me pwonyere man, ikare me kwan man obino kwayi me pongo karacel kedwa form me apenyo wu kede nyec alubere kede ikweda man pur kit pur Aber ni . Man kop ame omiyo wu alubere kede ryeko me ka pwonyere man acil Iyore yore kito kobere kede boti .ongee yin inyang aber ikwan man apenyoro keken ame itye kede agamo oko, kede dang yin iromo moko me bedo atye ika kwan man, obino kwayi mme onyo obino penyi me yin icyo ping gina amoko ni yin iyec cikere me kwan, obino dang miyi cogocogo me cik me ka kwan man ame yin aye igwoko.

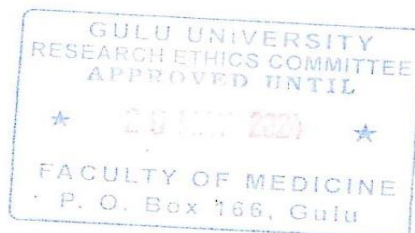
Kopa atidi ame kwako jo ame culu pi kweda man.

Ikweda man oculu oko kun jo ame oculu obedo 'Regional University Forum for Capacity Building in Agriculture (RUFORUM) 'Universiti ame loyo kop me pur itye grup adwong gi ocoko opur ducu me dongo pur iyi potu me Agriculture itee twero aproject me TAGDEV, Loko kwo opur me universitis pi jo Africa onyo jo acol pire tek me konyo dongo bot ocol me Africa medo nyayo rwom diro me ngec iyi pur, Ryeko me medo diro , nyayo ngec, kede cato wil onyo biacara.

Recac man tye pingo?

Ricac man tye me neno tic apapat ame coo, mon, kede buli tiyo alubere kede kop me ciko,yiko kede cato rec iyi Amolatar District. Ikweda man bino bedo acalo dul tic ame okwed kwed me pur romo tic kede, dang bino miyo coo, mon, kede buli nwo ngec alubere kede kop me ciko,yiko kede cato rec. man iyii agiki mere bino miyo rwom me ciko, yiko kede cato rec iyii akina coo,mon kede buli dongo malu me icel. Adwogi me ngec man obino miyo bot jo amoko cik kede dul jang gamente ame loo kop me pur kede cato wil.

Ngo amyero itim ka iye:



Ikare me kwan man obino kwayi me pongo karacel kedwa form me apeny wu kede nyec alubere kede ikweda man. Ka iye, ibino gamo apeny ame obino penyi kede.

Nga ame twero gamo apeny me ricac man?

Yin obino oyeri me bedo ikwan man pien ibedo dano acel ame ciko, yiko kede cato rec iyii Amolatar Distric. Apenyere abedo iyi akinakina dakika (30-35). Kede jo aromo 355 ame abedo ika Kwan man.

Ngo ame romo timere arac ikare me ricac man?

Ginoro pe ame bino timere arac ikare me ricac man, kono kara cawa ni en ame romo bale anonok.

Berere anga ame yin itwero nwongo?

Adwogi me ricac man obino cwalo cen bot jo duc ame ogamo apeny ikare me ricac man. Kede ka kop ngecoro anyen tye, obino pwonyo gi iyore Aber amyero oti kede akina paci.

Gwoko imung ikare me ricac man:

Ikare me ricac man, pe obino nyuto nying ngatoro keken ni en aye ogamo apeny man. Wan keken ame obino tic kede ngec man. Coc ame ocwalo ikompita obino gwoko kede passwad atek ame ngatoro keken pe romo yabo. Coc ipapara dang obino gwoko I canduk ame opungo doge oko.

Obal kare ikare me kwan man

Jo ducu ame bino bedo ikwan man, obino miyo gi soda kede bicikwit kara cel kede dang cabun me lwoko bongo bar acel.

Yore okene:

Pe myero ibed ik as Kwa man ka ipe itye kede miti iye. Yin pe ibino rwenyo beroro mere kadi ipe ibedo iyee.

Welere:

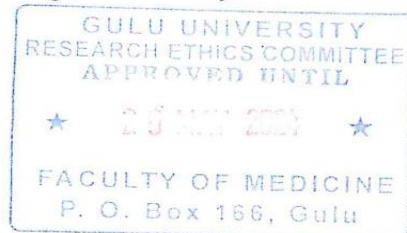
Pe tye weloro abino Mede malo alubere kede Kwan man.

Apeny:

Ka itye kede apeny mono keken alubere kede ricac man, nyo lok kom twero ni acalo agam apeny me kwed man, iromo rwate kede akwed man, LAKER VIOLA 0778849912 nyo lakerviola33@gmail.com

Lok ame nyutu dyere

Ye me gamo apeny man tye idyere ni, dok itwero ye alubere kede miti ni. Itwero kwero me gamo apeny man kace cunyi pe mito icawa mono keken, dok ginoro arac pe bino timere ikomi. Ka itye kede apenyoro keken alubere kede twero me bedo agam apeny man, iromo goyo cim bot adwong kom ame loyo ricac ducu me gulu unibaciti, Dr. Gerald Obai. Nama



cim mere tye: 0772305621; email: lekobai@yahoo.com/lekobai@gmail.com; onyo jang gamente me Uganda aloyo kop ikom ricac kede tet, ame gin nwongere ipulot 6 iyoo ame nyinye Kimera, Ntinda, Kampala I nama cim: 0414705500.

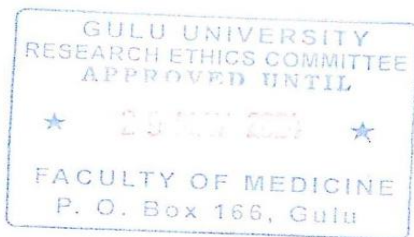
Lok me nyutu yeyo ni:

..... otito bota ngo ame bino timere, racere, berere kede twero na acalo agam apeny me ricac man. Aniang ni mano ye me bedo agam apeny man pe atimo ginoro arac ikoma. Dok, oniang ni agam mera pe obino nyutu ingatoro okene. Angeyo dang ni pwod atwero kwero mede igamo apeny magi icawa mono keken ame cunya pe mito kede. Angeyo dang ni keto cinga ipapara man pe nyutu ni twero na myero otur, ento tye kara me nyutu ni aye ni openya. Kopi acel me balu man bino dong bota iyonge gamo apeny magi.

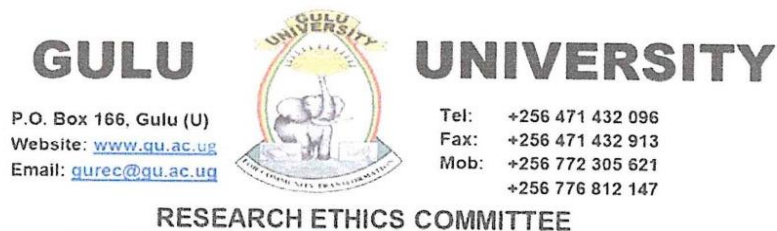
Nying cing agam apeny.....Nino dwe

Nying.....cing caden.....Nino dwe.....

Nying.....cing apeny Nino dwe.....



Appendix IV: GUREC Approval



29/05/2023

To: Viola Laker

Gulu University
0778849912

Type: Initial Review

Re: GUREC-2023-515: Gender Participation in the fish value chain in Amolatar District

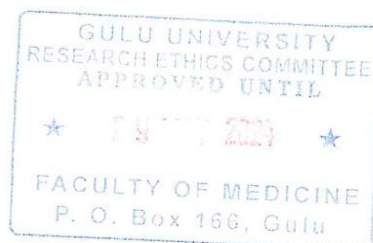
I am pleased to inform you that at the **96th** convened meeting on **15/02/2023**, the Gulu University REC, committee meeting voted to approve the above referenced application.

Approval of the research is for the period of **29/05/2023** to **29/05/2024**.

As Principal Investigator of the research, you are responsible for fulfilling the following requirements of approval:

1. All co-investigators must be kept informed of the status of the research.
2. Changes, amendments, and addenda to the protocol or the consent form must be submitted to the REC for re-review and approval **prior** to the activation of the changes.
3. Reports of unanticipated problems involving risks to participants or any new information which could change the risk benefit: ratio must be submitted to the REC.
4. Only approved consent forms are to be used in the enrollment of participants. All consent forms signed by participants and/or witnesses should be retained on file. The REC may conduct audits of all study records, and consent documentation may be part of such audits.
5. Continuing review application must be submitted to the REC **eight weeks** prior to the expiration date of **29/05/2024** in order to continue the study beyond the approved period. Failure to submit a continuing review application in a timely fashion may result in suspension or termination of the study.
6. The REC application number assigned to the research should be cited in any correspondence with the REC of record.
7. You are required to register the research protocol with the Uganda National Council for Science and Technology (UNCST) for final clearance to undertake the study in Uganda.

The following is the list of all documents approved in this application by Gulu University REC:



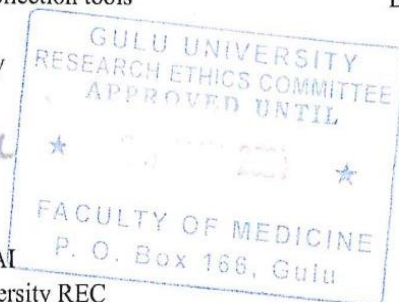
No.	Document Title	Language	Version Number	Version Date
1	Protocol	English	V3	2023-05-17
2	Informed Consent forms	English	V3	2023-05-17
3	Informed Consent forms	Lango	V3	2023-05-17
4	Data collection tools	English	V2	2023-04-20

Yours Sincerely



Dr. Gerald OBAI

For: Gulu University REC



Appendix V: Multinomial logit regression (STATA OUTPUT)

Iteration 12. log pseudolikelihood = -75.938886

Multinomial logistic regression	Number of obs	=	218
	Wald chi2(34)	=	3854.32
	Prob > chi2	=	0.0000
Log pseudolikelihood = -75.938886	Pseudo R2	=	0.5783

vertical_integration	Robust					
	Coef.	Std. Err.	z	P> z	[95% Conf. Interval]	
1	(base outcome)					
2						
sex	.0478213	2.152977	0.02	0.982	-4.171935	4.267578
fishtype_tilapia	1.172145	.8080527	1.45	0.147	-.4116087	2.7559
fishtype_silverfish	22.50722	1.196037	18.82	0.000	20.16303	24.85141
fishtype_nileperch	1.951334	.7233627	2.70	0.007	.5335695	3.369099
c.sex#c.fishtype_tilapia	1.675376	1.776509	0.94	0.346	-1.806517	5.15727
c.sex#c.fishtype_silverfish	-.0191906	2.491683	-0.01	0.994	-4.9028	4.864419
c.sex#c.fishtype_nileperch	.2619278	1.569032	0.17	0.867	-2.813318	3.337174
lnFishPrice	-.2565183	.1094657	-2.34	0.019	-.4710671	-.0419694
nonfishingactivity_farming	-1.022766	.6042241	-1.69	0.091	-2.207024	.161491
nonfishingactivity_trading	1.026233	.5887277	1.74	0.081	-.1276524	2.180118
logdistancetomarket_km	.6320144	.1542379	4.10	0.000	.3297137	.9343151
lnEduc	.0324905	.4647253	0.07	0.944	-.8783544	.9433354
lnExp	-.391389	.2707005	-1.45	0.148	-.9219523	.1391743
groupmembership	.6050207	.5795463	1.04	0.297	-.5308692	1.740911
lnTaxCost	-.8609601	.352354	-2.44	0.015	-1.551561	-.1703589
D_TranspCost	1.127568	.6551906	1.72	0.085	-.1565821	2.411718
D_StorageCost	-.6682283	.7926005	-0.84	0.399	-2.221697	.8852401
_cons	4.378479	2.994882	1.46	0.144	-1.491382	10.24834
3						
sex	-32.87258	2.513367	-13.08	0.000	-37.79869	-27.94647
fishtype_tilapia	1.032569	.962111	1.07	0.283	-.8531336	2.918272
fishtype_silverfish	4.232726	1.41642	2.99	0.003	1.456595	7.008857
fishtype_nileperch	3.512021	1.141241	3.08	0.002	1.27523	5.748813
c.sex#c.fishtype_tilapia	19.32728	1.908634	10.13	0.000	15.58643	23.06813
c.sex#c.fishtype_silverfish	3.654377	3.302301	1.11	0.268	-2.818015	10.12677
c.sex#c.fishtype_nileperch	15.68131	2.052633	7.64	0.000	11.65822	19.7044
lnFishPrice	-.133946	.1479702	-0.91	0.365	-.4239623	.1560702
nonfishingactivity_farming	-2.430326	1.002699	-2.42	0.015	-4.395581	-.4650717
nonfishingactivity_trading	1.400551	.9766355	1.43	0.152	-.5136199	3.314721
logdistancetomarket_km	.5000997	.1715223	2.92	0.004	.1639221	.8362773
lnEduc	1.657219	1.18077	1.40	0.160	-.6570465	3.971485
lnExp	.0941842	.5772001	0.16	0.870	-1.037107	1.225476
groupmembership	2.794542	1.129255	2.47	0.013	.581244	5.007841
lnTaxCost	-1.145011	.4474109	-2.56	0.010	-2.02192	-.2681014
D_TranspCost	1.261941	.9047242	1.39	0.163	-.5112857	3.035168
D_StorageCost	-.7621222	1.05987	-0.72	0.472	-2.839429	1.315184
_cons	-1.406403	4.860193	-0.29	0.772	-10.93221	8.1194

Appendix VI: Multicollinearity test result

	vertical~n	sex	fish~n	fish~n	fish~n	lnFish~e	non~ming	non~ding	logdis~m	lnEduc	lnExp	groupm~p	lnTaxC~t
vertical_i~n	1.0000												
sex	0.2458	1.0000											
fish~n	-0.2233	-0.2114	1.0000										
fish~n	0.4567	0.2161	-0.6242	1.0000									
fish~n	0.0220	-0.0271	0.0186	-0.3411	1.0000								
lnFishPrice	-0.1361	-0.0445	0.0517	-0.0531	0.0169	1.0000							
nonfish~ming	-0.1190	0.0177	0.2009	-0.1965	0.1938	-0.0915	1.0000						
nonfish~ding	0.1449	0.0313	0.0219	-0.0434	0.1054	0.0078	0.1213	1.0000					
logdistanc~m	0.4143	0.1592	0.1113	0.0168	0.0448	-0.1572	-0.0315	0.0818	1.0000				
lnEduc	0.1165	-0.1156	0.0343	0.0381	-0.0122	-0.0486	0.0385	0.0937	0.1419	1.0000			
lnExp	-0.0561	-0.0184	0.1050	-0.1410	0.0282	0.0498	0.1213	0.0921	-0.0038	-0.0931	1.0000		
groupmembe~p	0.1583	0.1295	0.1630	-0.1643	0.1894	0.0718	0.1437	0.1553	0.2554	0.0257	0.2125	1.0000	
lnTaxCost	-0.2084	-0.1171	0.1435	-0.2208	0.0796	-0.0779	0.0805	-0.0137	0.0041	0.0236	-0.0832	0.0828	1.0000
D_TranspCost	0.0864	0.1152	-0.0345	0.0025	-0.0398	-0.0825	-0.0248	0.0101	0.0414	-0.0560	0.0274	0.0632	0.2658
D_StorageC~t	-0.0337	0.1080	-0.0104	0.0423	-0.1113	-0.0012	-0.0211	-0.0784	-0.0067	-0.0543	-0.0464	-0.0151	0.2447
	D_TranspCost D_StorageC~t												
D_TranspCost	1.0000												
D_StorageC~t	0.4144	1.0000											

Appendix VII: Tobit Regression for Fishing (STATA Output)

Tobit regression

Number of obs = 355

LR chi2(19) = 521.70

Prob > chi2 = 0.0000

Pseudo R2 = 0.2326

Log likelihood = -860.67681

valueshare_fishing	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
sex	-54.72584	10.37773	-5.27	0.000	-75.13936	-34.31233
fishtype_tilapia	19.82485	6.746927	2.94	0.004	6.553307	33.09638
fishtype_silverfish	-28.63736	12.18285	-2.35	0.019	-52.60163	-4.673092
fishtype_nileperch	10.8096	5.047379	2.14	0.033	.8811556	20.73804
hh_fishprocessing	-51.23672	6.132608	-8.35	0.000	-63.29986	-39.17357
log_qtyF	12.38483	1.989817	6.22	0.000	8.470763	16.2989
c.sex#c.fishtype_tilapia	48.0062	11.78855	4.07	0.000	24.81754	71.19485
c.sex#c.fishtype_silverfish	-5.738813	34.2405	-0.17	0.867	-73.09157	61.61395
c.sex#c.fishtype_nileperch	45.1409	11.70187	3.86	0.000	22.12275	68.15905
logdistancetomarket_km	-5.029636	1.062111	-4.74	0.000	-7.11886	-2.940411
informationaccessed_buyerinforma	-19.96485	7.276244	-2.74	0.006	-34.27758	-5.652115
informationaccessed_googhygiene	-1.495897	4.405298	-0.34	0.734	-10.16134	7.169541
borrowedmoney	-7.207094	5.600008	-1.29	0.199	-18.22259	3.808398
lnExp	-3.256258	2.312506	-1.41	0.160	-7.805071	1.292555
lnEduc	-5.47528	3.574164	-1.53	0.126	-12.50584	1.555276
householdsize	.3327023	.5755867	0.58	0.564	-.7995053	1.46491
groupmembership	-1.406533	5.077337	-0.28	0.782	-11.39391	8.580839
hhmember_fishing_boys	13.69223	5.972116	2.29	0.022	1.944783	25.43968
hhmember_fishing_malespouse	26.12546	5.850888	4.47	0.000	14.61648	37.63445
_cons	29.06661	10.87223	2.67	0.008	7.680393	50.45283
/sigma	30.17481	1.753903			26.7248	33.62482

Appendix VIII: Tobit Regression for Processing (STATA Output)

Tobit regression

Number of obs = 355

LR chi2(18) = 582.16

Prob > chi2 = 0.0000

Log likelihood = -671.63945

Pseudo R2 = 0.3024

valueshare_processing	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
sex	-2.264479	10.63264	-0.21	0.831	-23.17919	18.65023
processedfish_tilapia	83.6126	7.430037	11.25	0.000	68.99751	98.2277
processedfish_nileperch	35.34918	7.208551	4.90	0.000	21.16976	49.52861
processedfish_silverfish	130.3783	7.210381	18.08	0.000	116.1953	144.5613
log_qtyP	-15.1424	3.631834	-4.17	0.000	-22.28632	-7.998478
c.sex#c.processedfish_tilapia	40.20314	12.98788	3.10	0.002	14.65562	65.75067
c.sex#c.processedfish_silverfish	-.0623461	12.45915	-0.01	0.996	-24.56984	24.44515
c.sex#c.processedfish_nileperch	-28.26205	11.11793	-2.54	0.011	-50.13133	-6.39277
logdistancetomarket_km	1.908963	.9051372	2.11	0.036	.1285328	3.689394
informationaccessed_buyerinforma	-1.609454	6.500644	-0.25	0.805	-14.3964	11.1775
informationaccessed_googhygiene	6.241224	4.447574	1.40	0.161	-2.507281	14.98973
borrowedmoney	6.376541	4.85636	1.31	0.190	-3.176057	15.92914
lnExp	-1.91523	2.045627	-0.94	0.350	-5.939036	2.108577
lnEduc	-6.731857	3.139078	-2.14	0.033	-12.90651	-.5572024
householdsize	-.7335033	.5940652	-1.23	0.218	-1.902046	.4350397
groupmembership	-16.79685	4.722306	-3.56	0.000	-26.08576	-7.50794
hhmemberprocessing_boys	17.42073	6.061298	2.87	0.004	5.497988	29.34348
hhmemberprocessing_malespouse	8.851731	5.934491	1.49	0.137	-2.821581	20.52504
_cons	-21.82346	9.749757	-2.24	0.026	-41.00151	-2.645414
/sigma	25.20506	1.599378			22.05904	28.35108

Appendix IX: Tobit Regression for Retail selling (STATA Output)

Tobit regression

Number of obs = 355

LR chi2(19) = 448.07

Prob > chi2 = 0.0000

Pseudo R2 = 0.3076

Log likelihood = -504.34437

valueshare_retail	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
sex	55.55747	12.764	4.35	0.000	30.45005	80.66489
fishtypesold_tilapia	150.6692	18.17682	8.29	0.000	114.9145	186.4239
fishtypesold_silverfish	190.0549	31.94656	5.95	0.000	127.2144	252.8953
fishtypesold_nileperch	37.5517	12.28259	3.06	0.002	13.39124	61.71216
hh_fishprocessing	-63.58279	12.2028	-5.21	0.000	-87.5863	-39.57928
log_qtyR	1.774815	3.148642	0.56	0.573	-4.41872	7.96835
c.sex#c.fishtypesold_tilapia	-71.80184	21.93306	-3.27	0.001	-114.9453	-28.65843
c.sex#c.fishtypesold_silverfish	-125.481	35.65979	-3.52	0.000	-195.6255	-55.33641
c.sex#c.fishtypesold_nileperch	-12.36385	15.85581	-0.78	0.436	-43.55302	18.82532
logdistancetomarket_km	1.187971	1.756445	0.68	0.499	-2.267042	4.642985
informationaccessed_buyerinforma	-5.274258	11.24108	-0.47	0.639	-27.38601	16.8375
informationaccessed_googhygiene	6.249177	7.092701	0.88	0.379	-7.702517	20.20087
borrowedmoney	18.86939	7.397879	2.55	0.011	4.317396	33.42138
lnExp	-3.613635	3.645402	-0.99	0.322	-10.78432	3.557051
lnEduc	1.595135	5.714863	0.28	0.780	-9.646284	12.83655
householdsize	.1957367	.9255044	0.21	0.833	-1.624776	2.01625
groupmembership	-11.0146	7.179543	-1.53	0.126	-25.13711	3.10792
hhmemberretailfishselling_boys	-46.17095	13.95346	-3.31	0.001	-73.6181	-18.7238
hhmemberretailfishselling_malesp	-29.28011	14.00334	-2.09	0.037	-56.82536	-1.734852
_cons	-65.99719	17.48685	-3.77	0.000	-100.3947	-31.59968
/sigma	32.75655	2.505259			27.82858	37.68452

Appendix X: Morgan Table

<i>N</i>	<i>S</i>	<i>N</i>	<i>S</i>	<i>N</i>	<i>S</i>
10	10	220	140	1200	291
15	14	230	144	1300	297
20	19	240	148	1400	302
25	24	250	152	1500	306
30	28	260	155	1600	310
35	32	270	159	1700	313
40	36	280	162	1800	317
45	40	290	165	1900	320
50	44	300	169	2000	322
55	48	320	175	2200	327
60	52	340	181	2400	331
65	56	360	186	2600	335
70	59	380	191	2800	338
75	63	400	196	3000	341
80	66	420	201	3500	346
85	70	440	205	4000	351
90	73	460	210	4500	354
95	76	480	214	5000	357
100	80	500	217	6000	361
110	86	550	226	7000	364
120	92	600	234	8000	367
130	97	650	242	9000	368
140	103	700	248	10000	370
150	108	750	254	15000	375
160	113	800	260	20000	377
170	118	850	265	30000	379
180	123	900	269	40000	380
190	127	950	274	50000	381
200	132	1000	278	75000	382
210	136	1100	285	1000000	384

Note.—*N* is population size. *S* is sample size.

Source: Krejcie & Morgan, 1970

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