

BUSITEMA UNIVERSITY

FACULTY OF NATURAL RESOURCES AND ENVIRONMENTAL SCIENCES

DEPARTMENT OF FISHERIES AND WATER RESOURCES MANAGEMENT

**ASSESSING THE SOCIO-ECONOMIC IMPACTS OF POND FISH FARMING ON
LOCAL COMMUNITIES IN TORORO DISTRICT, UGANDA**

ZINUNULA JOEL

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UNIVERSITY**

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DECLARATION

I, Zinunula Joel, hereby declare that this report is my original work and it has never been submitted to any institute of higher education for award of a degree.

Name: Zinunula Joel

Date: 8/8/2025 Signature: 

APPROVAL

I certify that this research report of Zinunula Joel has been developed under my supervision as the University Supervisor. It is hereby approved for submission to the Faculty of Natural Resources and Environmental Sciences of Busitema University for further consideration.

Name: Kisu- Kisira Henry

Lecturer

Signature:  Date: 11/8/2025

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If it was not God, all the efforts would be in vain, Glory and honor back to God in heaven for his protection and guidance.

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ABSTRACT

This study assessed the socio-economic impact of pond fish farming in Tororo district. It evaluated the current status, the socio-economic effects of pond fish farming on local communities and suggesting strategies for enhancing the sustainability of pond fish farming in Tororo District, Eastern Uganda.

The study used a descriptive design, and a mixture of quantitative and qualitative approaches, data was collected from 97 pond fish farmers using structured questionnaire, interview guides for technical persons and three focus group discussions, and field observations. The data was coded and entered in Microsoft Excel version 18, then imported into Statistical Programme for Social Scientists (SPSS) version 21 for descriptive and inferential statistics. The descriptive statistics analysis was summarized using frequencies, tables and pie charts. The inferential statistics was summarized using pearson chi-square test at 5 percent confidence interval.

The findings indicated that pond fish farming is predominantly practiced by smallholder farmers with limited resources, but it has a positive impact on livelihoods, particularly in employment creation, food security, and income generation. Despite these benefits, farmers face major challenges such as high input costs, water scarcity, inadequate access to quality feeds and fingerlings, and limited knowledge of existing policies and bylaws. The majority of respondents reported slight improvements in their standards of living and expressed a willingness to join farmer cooperatives for shared growth. Support from local governments, MAAIF, and NGOs exists but remains insufficient. The analysis of these challenges using the chi square test indicated that high cost of inputs, water scarcity and low fish prices were statistically significant at $\alpha = 0.05$. Furthermore, the chi square test indicated that sources of support to pond fish farming namely local government, and MAAIF were statistically significant at $\alpha = 0.05$. Also, the strategies for support were subjected to the chi square test and fish feeds and fingerlings were the most significant at $\alpha = 0.05$. In-addition, funding and incentives including credit, subsidies, and grants and training in technical skills such as feed formulation and water management were statistically significant at $\alpha = 0.05$.

The study concluded that with targeted institutional support, legal literacy, and infrastructure investment, pond fish farming in Tororo can significantly contribute to rural development and

food systems resilience. Key strategies proposed to enhance sustainability included increasing access to credit, subsidizing inputs, strengthening extension services, promoting legal awareness, and improving market access.

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ABBREVIATIONS

Word	Abbreviation
Food and Agriculture Organisation	FAO
Local Government	LG
Ministry of Agriculture Animal Industry and Fisheries	MAAIF
National Agricultural Advisory Services	NAADS
National Agricultural Policy	NAP
National Development Plan	NDP
Non-Government Organisation	NGO
Operation Wealth Creation	OWC
Tororo District Local Government	TDLG

CHAPTER ONE: INTRODUCTION

1.1 Introduction

This chapter presents the back ground of the study, problem statement, objectives, research questions, justification of the study, significance of the study, conceptual framework, limitations and the operational definitions.

1.2 Background to the study

Fish farming is a particular type of aquaculture, which involves commercial breeding of fish, most often for food, in fish tanks or artificial enclosures such as fish ponds (Ignatius *et al.*, 2024). The fish farming industry includes activity concerned with taking, culturing, processing, preserving, storing, transporting, marketing and selling fish or fish products.

Pond fish farming is a traditional method of raising fish in ponds. The origins of pond fish farming date back to ancient China, where it is believed to have started over 2,000 years ago during the Zhou Dynasty (Neil *et al.*, 2008). The Chinese practiced aquaculture in ponds, cultivating fish such as carp and tilapia. In the Western world, pond fish farming was first introduced by the Romans, who built fish ponds to cultivate fish for food. However, it was not until the 20th century that pond fish farming began to expand rapidly, driven by advances in technology, improvements in fish feed, and growing demand for fish and fish products.

Today, pond fish farming is a global industry, with millions of people dependent on it for their livelihoods. As the global aquaculture industry continues to grow, it is estimated that over 50% of the world's fish supply will come from aquaculture by 2030 (FAO, 2020). This rapid growth has transformed the lives of millions of people, particularly in rural communities where pond fish farming has become a vital source of income, employment, and food security.

Aquaculture in Uganda is recorded to have started in 1941 after carp was imported into the country and fish farming was officially proposed by the colonial authorities (Rhodes, 1961). The introduction of carp was embroiled in controversies due to differences among the lead scientists on the possible adverse impact of common carp on the indigenous aquatic environment in case they escaped from the confines of fish pond (Agriculture, 2013). Subsistence fish farming in Uganda reached its peak in the late 1960's, when some 11,000 ponds were reported to be in

operation, covering a total area of 410 ha and yielding an annual harvest of 800 - 900 mt (FAO, 1989). By the late 1980's, prolonged economic crises, civil unrest and a general collapse of infrastructure and public services had combined to reverse the development of small-scale aquaculture almost to the point of insignificance with annual production in the order of 30 to 40 mt (FAO, 1989). Production started to recover in the 1990's, favored by relative political stability, renewed government interest in fisheries development, the introduction of donor-supported aquaculture projects, and increased research and extension efforts aimed at revitalizing the sector.

Today, there about 6,200 fish ponds distributed across the country producing 200 mt of fish (Fund, 2001). The average size of a fish pond is about 0.02 ha (200 m²). The main culture species include *Oreochromis Niloticus*, *Tilapia zilli* and *Cyprinus carpio* (FAO 2021). Pond fish farming in Tororo District is primarily practiced by small-scale farmers, who use traditional methods and techniques to farm fish. Fish farming practiced in Tororo District remains relatively limited as Uganda population census of 2014 indicated that only about 3% of the population is engaged in fish farming, with 21.1% of these farmers cultivating tilapia (Research Consult Uganda, 2024). Despite the small scale, there is potential for expansion, especially with the establishment of facilities like Rocksprings Fish Farm. This hatchery, operational since 2011, produces over 24 million fingerlings annually, supplying quality stock to farmers across Uganda (Netherlands Enterprise Agency, 2021). The socio-economic effects of pond fish farming are multifaceted (Obiero *et al.*, 2019). On the one hand, pond fish farming provides a stable source of income for farmers, fosters job creation, and enhances household nutrition by increasing the availability and affordability of fish protein. On the other hand, challenges such as high input costs, limited access to markets, and environmental degradation (e.g., water pollution) can limit the sustainability of this practice and its overall benefits to local communities (Obiero *et al.*, 2019).

1.3 Problem Statement

Pond fish farming has increasingly been promoted in Uganda as a viable strategy to improve rural livelihoods through enhanced food security, income generation, and employment opportunities (Bwire, 2021) . In Tororo District, pond fish farming has gained traction among local communities, especially with government and donor support under programs such as the National Agricultural Advisory Services (NAADS) and Operation Wealth Creation (OWC)

(Mwesigwa, 2019). However, despite its growing adoption, the socio-economic benefits of pond fish farming remain inadequately documented.

Local fish farmers often face numerous challenges, including limited access to quality inputs like fingerlings and feed, inadequate technical training, lack of extension services, poor water management practices, and market constraints (Akoko, 2020). These constraints hinder the profitability and sustainability of fish farming enterprises and may contribute to low productivity and economic returns. It is unknown which of these factors are limiting pond fish farming in Tororo district. Furthermore, it is not known to what extent pond fish farming affects the local communities in Tororo district both the peri-urban areas and urban areas.

Therefore, this study assessed the socio-economic impacts of pond fish farming on local communities in Tororo District.

1.4 Objectives of the study

1.4.1 Main objective of the study

To assess the socio-economic impacts of pond fish farming on local communities in Tororo District, Uganda.

1.4.2 Specific objectives of the study

1. To evaluate the current status of pond fish farming in Tororo District.
2. To evaluate the socio-economic effects of pond fish farming on the local communities in Tororo District.
3. To suggest strategies for enhancing the sustainability of pond fish farming in Tororo District.

1.5 Research questions

1.5.1 Main research question

What are the socio-economic impacts of pond fish farming on local communities in Tororo District, Uganda?

1.5.2 Specific research questions

1. What is the current status of pond fish farming in Tororo District?
2. What are the socio-economic effects of pond fish farming on the local communities in Tororo District?
3. What strategies can enhance sustainable pond fish farming in Tororo District?

1.6 Significance of the study

This study contributes to existing information on the socio-economic dimensions of pond fish farming in Tororo District. Its findings will inform authorities in central and local government and other stakeholders on what is needed to formulate better policy targeting pond fish farming. The findings will guide local government and extension workers in designing more appropriate community-based strategies to enhance sustainable pond fish farming. The study contributes to existing literature on pond fish farming in Uganda. It also provides research gaps for those in academia who want to conduct further research on pond fish farming in Uganda.

1.7 Justification of the study

There have not been many studies on pond fish farming in Uganda and in particular Tororo District. Yet pond fish farming if implemented sustainably can provide opportunities for local communities to address challenges of lack of livelihood, low house hold income, inadequate food security and nutrition. Furthermore, while pond fish farming has been widely promoted in Uganda, there is limited localized research assessing its actual socio-economic impact at the community level. Specifically, studies focusing on Tororo district are scarce, and little is known about the unique challenges and opportunities pond fish farmers face in this region. This gap underscores the relevance of the current study. However, numerous socio-economic and technical challenges must be addressed to fully realize the benefits of pond fish farming. This study aims to provide context-specific insights of the situation in Tororo district, to aid and contribute to the formulation of more effective interventions and policies.

1.8 Conceptual framework

The conceptual framework (figure 1) was built around the idea that pond fish farming influences the socio-economic status of local communities through various challenges and enabling factors, highlighting the relationship between independent variables (inputs, challenges, and support systems) and dependent variables (socio-economic outcomes).

Independent Variables included the challenges and conditions influencing fish farming performance, such as input availability, technical support, and access to markets.

Moderating Variables like government and NGO support influenced how the independent variables affect outcomes.

Dependent Variables are the socio-economic outcomes experienced by the community, including income changes, job creation, food availability, and social dynamics.

This framework guided the study in assessing not only what challenges exist, but also how they influence specific socio-economic outcomes and what can be done to improve the system.

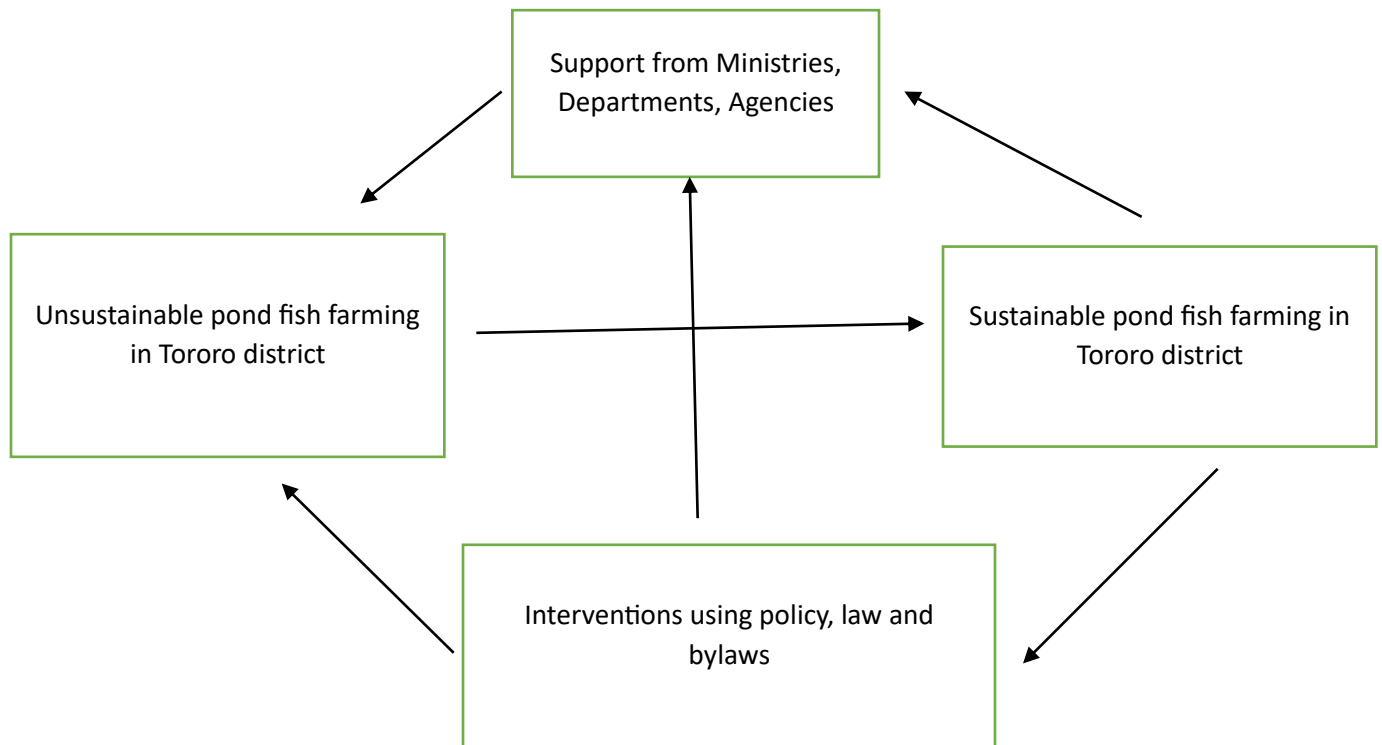


Figure 1. Conceptual framework for Pond fish farming in Tororo district.

On the current status of pond fish farming (figure 1), the study will look at inputs such as access to inputs, technical knowledge from extension services and out puts such as access to markets, impacts on income generation, employment creation, household income, poverty alleviation and household food security) over the past 3 years (2022–2025). This period has been selected to capture recent experiences, policy changes, and impacts associated with government and donor interventions in the aquaculture sector.

Concepts: From which the survey questionnaires and interview guides were developed include:

Independent variables

Demographic characteristics or variables

- Which gender is involved in pond fish farming?

- What are their age ranges: youth, middle age or elderly?
- What is their level of education, etc.?
- Where do they live: municipality or district?
- What are their income levels?

Fish

- What types of fish are reared?
- What is the quantity of fish harvested?
- What is the price of this fish when harvested?
- Where is this fish sold?
- What types of feeds are used?
- What is the price of the feeds used?
- Where are these feeds sourced from? Locally or imported

Land

- Who owns the land used for pond fish farming?
- How much do they rent the land used for ponding fish farming?

Intervening factors or variables

- Policies, laws governing pond fish farming in Uganda
- Bylaws governing pond fish farming in Tororo municipality/district
- Sensitization through trainings and awareness creation
- Support from government agencies like the ministries, departments and agencies and local government, etc
- Support from non-governmental organizations, community-based organizations
- Access to credit, inputs and market support

Dependent variable

- Pond fish farming in Tororo municipality/district

Relationships

- Does educational level influence pond fish farming?
- Does income levels influence pond fish farming?
- Does gender influence pond fish farming?
- Does land ownership influence pond fish farming?
- Does availability of inputs influence pond fish farming?
- Does access to credit and market influence pond fish farming?

CHAPTER TWO: LITERATURE REVIEW

2.1 Introduction

This chapter presents a review of relevant literature on pond fish farming, particularly its socio-economic benefits and challenges. It discusses global and local perspectives, with an emphasis on Uganda and similar developing country contexts. The review aims to establish what is already known, identify gaps in knowledge, and provide a foundation for the current study in Tororo district.

2.2 Back ground of the study

There are currently an estimated 12,000 farmers involved in aquaculture, with about 150 service providers or extension workers employed by local governments. There are officers employed by the local government in charge of technical guidance and management of the aquaculture sub-sector. Another estimated 100 technical persons with basic training in fisheries and aquaculture work as private service providers under the privatized, demand driven and farmer managed extension and advisory system (FAO, National Aquaculture Sector Overview, Fisheries and Aquaculture, .2025). It is estimated that there are 2, 000 such farmers who own nearly 5, 000 ponds, with an average pond size of 1, 500 m².

2.3 The Concept of Pond Fish Farming

Pond fish farming is the practice of raising fish in artificially constructed ponds for subsistence or commercial purposes. It is considered a sustainable and accessible form of aquaculture, especially for rural communities (FAO, 2020). In Uganda, this system has gained prominence due to government efforts to boost food security and rural incomes through aquaculture programs like Operation Wealth Creation (OWC) and the National Agricultural Advisory Services (NAADS) (MAAIF, 2019).

2.4 Socio-Economic Contributions of Pond Fish Farming

Pond fish farming has the potential to transform rural economies by creating employment, enhancing food and nutrition security, and increasing household incomes (Bwire, 2021). Fish farming supports value chain activities like pond construction, input supply, fish harvesting, and marketing, which further create job opportunities (Kassam, 2017). When integrated into rural

livelihoods, pond fish farming can significantly contribute to poverty alleviation and local development.

Pond fish farming also represents a potentially more efficient way of utilizing natural resources to produce aquatic products for food, pharmaceutical, recreational and other purposes. However, imprudent pond fish farming operations could cause environmental degradation, the socio-economic costs of which tend to outweigh the sector's short-term benefits (Cai *et al.*, 2012). Socio-economic effects are the natural results of adopting a new technology and these effects might be positive or negative, and may bring unexpected results.

Small-scale fish farming is considered as one of the crucial entrepreneurial activities in agricultural development (Ignatius *et al.*, 2024). Aquaculture's growth is an example of the 'high-value revolution' which is creating a second wave of employment growth after the Green Revolution (GR). This is because employment in fisheries and aquaculture has increased by 3.6 percent annually since 1980 which is faster than the growth in world population and employment in traditional agriculture (Rights, 2013). While capture fisheries will remain relevant, aquaculture has already demonstrated its crucial role in global food security, with its production growing at 7.5 percent per year since 1970 (Guenard, 2021). Pond fish farming meets economic objectives, such as generation of supplementary income and diversification of production activities, especially in rural communities where opportunities for economic activities are limited and also it is important in providing families with affordable food and alternative sources of protein. On top of bringing economic benefits to the poor, the socio-economic effect of aquaculture is also undeniable. Local infrastructure, for example school building, library and hospitals are built to enhance the livelihood of the locals (Olaganathan *et al.*, 2017).

2.5 Socio-Economic Challenges in Pond Fish Farming

Despite its potential, fish farming in Uganda is constrained by several socio-economic factors. Key among these is the limited access to quality inputs, such as fingerlings and commercial fish feed, which leads to poor yields and reduced profitability (Akoko, 2020).

Technical knowledge and training gaps also limit productivity. Many farmers lack access to updated skills and best practices in pond management, water quality monitoring, and disease

control (Mwesigwa , 2019). Moreover, poor market access, low farm-gate prices, and the absence of cold chain facilities affect farmers' ability to profit from their produce (FAO, 2020).

Pond fish farming is constrained by inadequate extension services, high post-harvest losses; inadequate human, technological and infrastructural capacity at all stages of the value-chain leading to low production and productivity overall (MAAIF, 2017). In addition, lack of access to finance remains a major constraint for small-scale farmers who cannot afford high input costs or invest in infrastructure (Bwire *et al.*, 2021). Environmental issues, such as seasonal water scarcity and climate variability, further threaten sustainability.

2.6 Gender and Youth Participation in Fish Farming

Pond fish farming presents opportunities for youth and women to engage in productive economic activities. However, studies show that their full participation is often hindered by limited access to land, credit, and training, as well as restrictive cultural norms (NEPAD., 2017)

Encouraging inclusive aquaculture development that actively involves women and youth can enhance community resilience and promote equitable development (FAO., 2020). Gender-sensitive and youth-focused interventions are, therefore, essential in maximizing the social impact of fish farming.

2.7 Strategies for Enhancing Sustainability and Impact

Various strategies have been proposed to improve the socio-economic outcomes of pond fish farming, and these include: Capacity building for farmers through training and extension services, Improved input supply chains for quality fingerlings and feed, Access to credit and markets, including cooperative marketing initiatives and Promotion of environmentally sustainable practices, such as integrated aquaculture systems (Kassam *et al.*, 2017; Akoko, 2020). Supportive policy frameworks and public-private partnerships have also been recommended to ensure sustainable aquaculture development (MAAIF, 2019).

2.8 Legal framework on fisheries and aquaculture

2.8.1 The National Fisheries Policy of 2004, Uganda

This policy promotes aquaculture development, including pond fish farming, as a key strategy for increasing fish production to meet domestic demand, reduce pressure on capture fisheries, and boost incomes and food security (MAAIF, 2004).

The policy supports pond fish farming as a key strategy to promote aquaculture development and improve food security, income generation and employment opportunities as highlighted below:

Promotion of aquaculture (Pond Fish Farming) (National Fisheries Policy. Government of Uganda 2024). The policy acknowledges aquaculture (including pond fish farming) as a viable alternative to declining capture fisheries, promotes small-scale pond fish farming for rural income generation and nutrition improvement, especially in communities affected by reduced access to natural water bodies. Through this policy, the government commits to supporting the development of infrastructure, quality fingerlings, feed, and technical extension services to improve pond productivity, emphasis is placed on training farmers, extension workers, and technicians in pond construction, management, and best practices for sustainable aquaculture (MAAIF, National Fisheries policy. , 2004). It encourages private investment in commercial aquaculture, including pond fish farming, through favorable policies and public-private partnerships. The policy highlights the importance of research institutions in developing improved pond farming techniques and transferring technology to farmers. It encourages practicing pond fish farming in an environmentally sustainable manner, with proper site selection, water management, and pollution control (MAAIF, National Fisheries policy. , 2004).

2.8.2 National Agricultural Policy, 2013, Uganda

The NAP (2013) strengthens agricultural services and institutions which promotes innovation in aquaculture technologies and the provision of extension services to support best practices in pond management, breeding, and feeding (National Agricultural Policy. Government of Uganda, 2013). This policy was developed by the Ministry of Agriculture Animal Industry and Fisheries. Its vision is “a competitive, profitable and sustainable agricultural sector” that will be realized by transforming the sector from subsistence to commercial agriculture. This framework is being implemented through a series of supportive sub-sector policies – one of which is this Fisheries and Aquaculture Policy of 2021. This policy will directly contribute to these NAP strategies, as

well as outcomes envisaged in Vision 2040 and NDP II. The NAP and the NDP II as well as the NEDP prioritized 12 flagship commodities including fish. It encourages the integration of aquaculture (such as pond fish farming) into existing farming systems, particularly in areas with water access, to diversify livelihoods (MAAIF, The National Agricultural Policy. , 2013). The Fourth National Development Plan (NDP IV) of Uganda is scheduled to commence in the Fiscal Year 2025/26 and will run up to 2029/30. It will succeed the Third National Development Plan (NDP III), which concludes in June 2025. The NDP IV is the fourth installment in a series of six five-year plans aimed at realizing Uganda's Vision 2040, which aspires to transform the country into a modern and prosperous nation. Aquaculture including pond fishing farming is one of the initiatives that will contribute to the prosperity of local communities.

CHAPTER THREE: METHODOLOGY

3.1 Introduction

This chapter presents the research design, target population, sampling technique, and data collection methods, data analysis methods and ethical considerations.

3.2 Research design

This research adopted a descriptive design. This design was appropriate because it allowed answering of the question “What is going on with pond fish farming” rather than “why”. Since this study sought to describe and explain the social-economic impacts of pond fish farming on the farmers and local communities in Tororo district, it was the most appropriate.

3.3 Research approach

The study used a mixed methods approach. The quantitative approach was employed on the small holder pond fish farmers. This approach enabled the researcher to collect information on the status of pond fish farming in Tororo district from the pond fish farmers. The qualitative approach was employed on the technical team in the district. This approach helped to fill the missing gaps in the explanations provided by the pond fish farmers.

3.4 Description of the geographical area

The study was conducted in Tororo district (figure 2), found in the Eastern region of Uganda. It borders with the Republic of Kenya to the East, Bugiri district to the West, Butaleja district to the North, Mbale City to the North East and Busia district to the South. The district has (6) counties, one Municipality with two divisions, (30) rural sub-counties, (10) Town councils, (180) parishes and (1,337) villages (TDLG, 2023). It lies between Latitude 0° 41' 34.0008" N and Longitude 34° 10' 51.9960, (TDLG, 2023). The district is characterized by a hilly landscape, with the prominent Tororo Rock offering a majestic view. The district's weather is generally warm with two rainy seasons, making it conducive for agriculture.

The study covered the Eastern and Western divisions of Tororo municipality where small holder pond fish farming is actively practiced and some parts of Tororo district. This area was chosen due to its growing involvement in pond fish farming, support from government and non-

governmental organizations, and the presence of various fish farming initiatives. The area provides a suitable context for examining the socio-economic dynamics of pond fish farming and the impacts on local communities.

Figure 2. Map of Tororo District showing the study area

3.5 Description of the target population

The exact number of fish farmers involved in pond aquaculture in Tororo District is not definitively established. However, local-level studies provide some insights. For instance, a study conducted in Nagongera Sub-County identified eight active fish farmers, with the sub-county noted as having the highest number of active fish farmers in the district (Owor, 2023). Similarly, another study in Osukuru Sub-County highlighted ongoing government efforts to support fish farming through programs like the Parish Development Model (Ajambo, 2023).

Given the lack of comprehensive district-wide data, for research purposes, approximately 110 fish farmers were estimated. This estimation allowed for the application of Yamane's formula (Yamane, 1967) to determine the sample size required for the study. The actual population from data was collected were the households that were directly involved in small scale and a few commercial pond fish farmers, and the local communities surrounding the pond fish farms including residents, fish farming business owners and community leaders within Tororo district.

3.6 Sampling Techniques and Sample Size

3.6.1 Sampling technique

Purposive sampling was used to select key informants such as extension officers and community leaders who were knowledgeable about pond fish farming activities. Simple random sampling was used to select pond fish farmers from a sampling frame obtained from the local fisheries office and the farmer cooperatives.

3.6.2 Sampling procedure

With the help of district fisheries officer and local leaders the researcher, a comprehensive list of all pond fish farmers in Tororo District was generated. The list was used to generate the sample size using a systematic random sampling. The sample size was generated by selecting every nth element in the population. The sampling interval (n) was calculated by dividing the population size by the sample size. A random starting point within the first n elements of the population was selected and then systematic random sampling continued until the sample size was reached. The selected participants were contacted, given detailed information about the study, explained to them the purpose of the study, and then requested for their participation thereby obtaining informed consent from them.

3.6.3 Sample size

The sample size was determined using Yamane's formula (Yamane, 1967).

$$\bullet \quad n = \frac{N}{1 + Ne^2}$$

Where: n = sample size, N = population size (110)

e = level of precision (0.05)

Assuming the total number of fish farmers in Tororo district was 150, the estimated sample size would be:

- $n = \frac{N}{1+Ne^2}$
- $n = \frac{110}{1+110(0.05)^2}$
- $n = \frac{110}{1+110(0.0025)}$
- $n = \frac{110}{1.275}$
- $n \approx 86.27$

3.7. Data types and data collection methods

3.7.1 Data types

This study used both primary and secondary data in the data analysis process.

3.7.1.1 Primary Data

Primary data was generated by administering structured questionnaires to the pond fish farmers. It was also generated by using an interview guide to collect information from extension workers, NGO staff, and local leaders to obtain qualitative insights. Furthermore, primary data was generated from focus group discussions (FGDs) to explore collective experiences and community perceptions. Three FGDs each comprising eight pond fish farmers from each of the divisions of the Tororo municipality were conducted.

3.7.1.2 Secondary Data

Secondary data was generated by reviewing existing literature and documents from a variety of credible sources which include: Government reports, particularly from the Ministry of Agriculture, Animal Industry and Fisheries (MAAIF); District Development Plans (DDPs) to understand local priorities, strategies, and investment areas in aquaculture; District Statistical Abstracts; District Environment and Agricultural Reports, offering insights into environmental conditions, land use, and resource management relevant to fisheries and water resources; Non-Governmental Organization (NGO) project documents, especially those focusing on rural livelihoods and sustainable aquaculture for Rock Springs Fish Farm, Think Aqua which focuses on Smallholder aquaculture development, PESCA Project among others; Academic journals and scholarly publications to provide theoretical frameworks, case studies, and empirical evidence; Local aquaculture and fisheries policy documents, which offer guidance on regulatory frameworks, implementation strategies, and institutional arrangements.

3.8 Data collection methods

3.8.1 Self-administered questionnaire

The self-administered questionnaire (Appendix 1) was the main data collection method. It was developed, pretested on 10 people and their response were incorporated in the questionnaire and later reused on households in pond fish farming. During data collection, the questionnaire was always translated into local language whenever the respondent said he/she did not understand English well.

3.8.2 Observation

Observation was carried out on pond fish farm to identify the activities on site. The observation was captured by photographs for pond fish farming practices like fish stocking, grading, harvesting, processing and marketing were observed and recorded. These were shown in various figures (appendix 4).

3.8.3 Key informant interview guide

Key informant interviews were conducted on local leaders, fish farmers, and government officials like fisheries officers, district production and marketing officers using an interview study guide (appendix 2).

3.8.4 Focus group discussion guide

The focus group discussion guide (appendix 3) was used to interview the three focus guides. These groups had eight members each.

3.9 Data tools quality control

The questionnaire and the interview guide were designed based on a review of existing literature and consultations with the research supervisor to ensure the right appearance, length, and order of the questions. This was achieved through carrying out face validity, content validity and construct validity test to ensure that they accurately capture the socio-economic effects of pond fish farming on local communities. The questionnaire was reviewed by experts in the field to assess its clarity, relevance, and appropriateness. To ensure reliability of the questionnaire and the interview guide, a pilot test was conducted on 10 farmers and technical persons and following from their feedback, adjustments was made in the questionnaire and interview guide.

3.10 Data analysis

Data from questionnaires was coded, cleaned, and entered into Microsoft Excel and the data file imported to SPSS version 16.0 for analysis. Quantitative data from questionnaires was analyzed using descriptive statistics such as the mean, median standard deviation, and percentages to describe the socio-economic characteristics of the households involved in pond fish farming such as income, education, and occupation. Inferential statistics like pearson chi square test was used to examine the relationships the variables affecting pond fish farming and socio-economic outcomes such as income, poverty levels and employment levels. T-tests and Analysis of Variances (ANOVA) used to compare different mean groups such as households involved in pond fish farming and those that were involved. Thematic analysis was used to identify patterns and themes related to the socio-economic effects of pond fish farming on local communities. Also, both qualitative and quantitative data was triangulated to validate findings and provide a more comprehensive understanding of the socio-economic effects of pond fish farming on local communities and also integrated to provide a comprehensive understanding of the research objective. Findings of this study was summarized in the form of tables, figures, and charts. These were used to illustrate patterns, relationships, and key insights.

3.10.1 Univariate analysis

The univariate analysis involved calculating descriptive statistics to describe the socio-economic characteristics of households involved in pond fish farming. Frequency distributions were calculated to describe demographic characteristics such as age, sex, education level, occupation, and income. Measures of central tendency (mean, median, and mode) and variability (standard deviation and variance) was calculated to describe the spread of socio-economic characteristics. Summary statistics was calculated to describe demographic and economic characteristics of households involved in pond fish farming, such as percentage of households with access to education, healthcare, and clean water, as well as average income and expenditure per household. Hypothesis testing was conducted to determine if there are significant differences in socio-economic characteristics between households involved in pond fish farming and those not involved. The analysis was conducted using Microsoft Excel software version 10.

3.10.2 Bivariate Analysis

The bivariate analysis involved examining the relationships between two variables at a time to identify patterns and correlations. Specifically, the analysis examined the relationships between pond fish farming participation and socio-economic outcomes such as income, poverty levels and employment levels, economic characteristics and pond fish farming participation demographic characteristics and pond fish farming participation.

3.11 Ethical considerations

To ensure ethical consideration were met, introductory letter was got from the faculty, used together with identity card for introduction to the local leaders in the villages, the technical officials and pond fish farmers. To ensure that the rights of the participants were respected and protected, informed consent was obtained from all participants before data collection. The participants were informed that the purpose of the study was strictly for academic purposes. The researcher ensured confidentiality to keep participant's information secure, ensure that participants voluntarily participate in the research. Those not willing to participate in the study were left out. The researcher ensured that participants were fairly selected to minimize any bias.

CHAPTER FOUR: FINDINGS

4.1 Introduction

This chapter presents findings of the study presented in form of graphs and tables. These include current status of pond fish farming in Tororo District, the socio-economic effects of pond fish farming to the local community in Tororo district, challenges of pond fish farming,

4.2. Current Status of Pond Fish Farming in Tororo District

4.2.1. Gender Participation

From Figure 3, 86 percent of the respondents involved in pond fish farming were males and 14 percent were females. This finding was in agreement with FAO (2020) that stated that “more males than females were involved in pond fish farming due to the physically demanding nature of the activity”. Furthermore, cultural gender roles often assign fish farming responsibility to men. This called for gender-sensitive interventions in aquaculture.

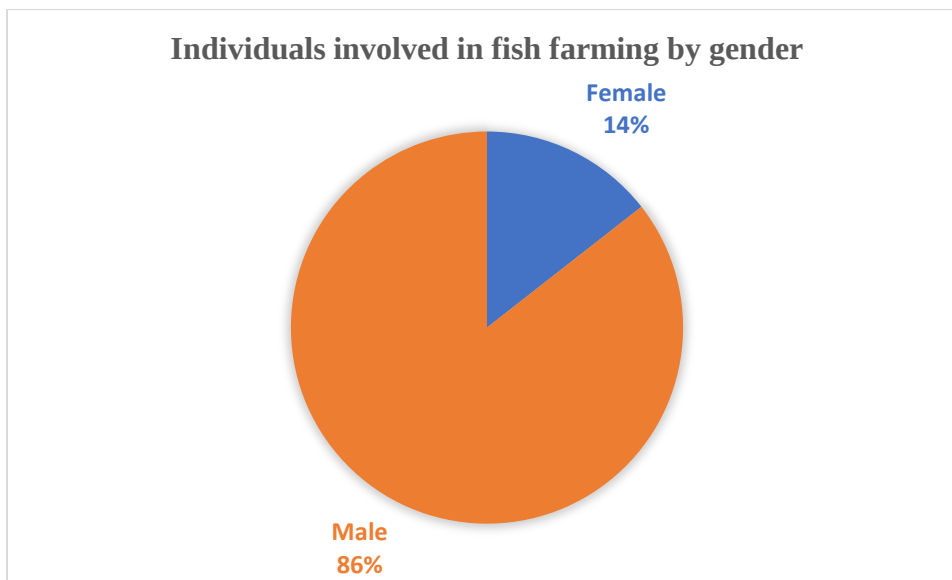


Figure 3. Females and Males involved in pond fish farming in Tororo district and the municipality.

4.2.2. Age group and Education levels

In Table 1, it was found that 60.8 percent of the respondents were in the age brackets 40-50 years, 19.6 percent in the age bracket 31-40 years, 13.4 percent in the age bracket over 50 years, 5.15 percent in the age bracket 26-30 years and 1.03 percent in the age bracket 19-25 years. The findings meant that most of the respondents were in their middle age and few were in their youthful age.

In terms of education level, 70.1 percent of the respondents had attained at least secondary education, 15.5 percent had attained tertiary education, 11.3 percent had attained primary education and 3.1 percent university education. This finding was agreement with Musa *et al.*, (2012), who stated that “pond fish farming was predominantly practiced by elderly individuals with low levels of formal education, often due to limited alternative livelihood options and the lack of interest by the youth in pond fish farming.

Table 1: Age group for pond fish farmers and their education level

Age group	Education Level					Percent (%)
	Primary	Secondary	Tertiary	University	Total	
19_25 yrs		1			1	1.03
26_30 yrs		4	1		5	5.15
31_40 yrs	5	10	2	2	19	19.6
40_50 yrs	3	45	11		59	60.82
Above 50 yrs	3	8	1	1	13	13.4
Total	11	68	15	3	97	
Percent (%)	11.3	70.1	15.5	3.1		

4.2.3. Employment and Economic Independence

According to Table 2, 53 percent of fish farmers were self-employed, 38 percent employees and 9.3 percent unemployed. Almost 60 percent were informally employed suggesting that pond fish farming offered an important livelihood option for the local communities in Tororo district. As regards marital status, 78.4 percent of the respondents were married, 12.4 percent widowed, 5.2 percent divorced and 4.1 percent single. The high number of individuals being married means that they are forced to have a source of livelihood to support their families. The findings agreed with Adewumi & Olaleye (2011), who found that fish farmers consisted of a mixture of employed, self-employed and un-employed individuals.

Table 2. Employment and marital status of pond fish farmers

Marital Status	Employment status				Percent (%)
	Employees	Not employed	Self-employed	Total	
Divorced	5			5	5.2
Married	20	9	47	76	78.4
Single	2		2	4	4.1
Widowed	10		2	12	12.4
Total	37	9	51	97	
Percent (%)	38.1	9.3	52.6	100	

4.2.4. Income Levels of Pond Fish Farmers

From figure 4, 52 percent of the pond fish farmers earned between 310,000–500,000 shillings per month, 24 percent earned above 500,000 shillings per month and 16 percent earned between 160,000-300,000 shillings. The rest of the farmers earned below 150,000 shillings per month. Therefore, pond fish farming formed a distinct source of livelihood for those engaged in fish farming. According to Ajana *et al.*, (2006), the variation in income levels significantly depends on factors like production scale, market access, input costs and education levels with higher earnings associated with commercial scale farmers and those with better access to resources and market.

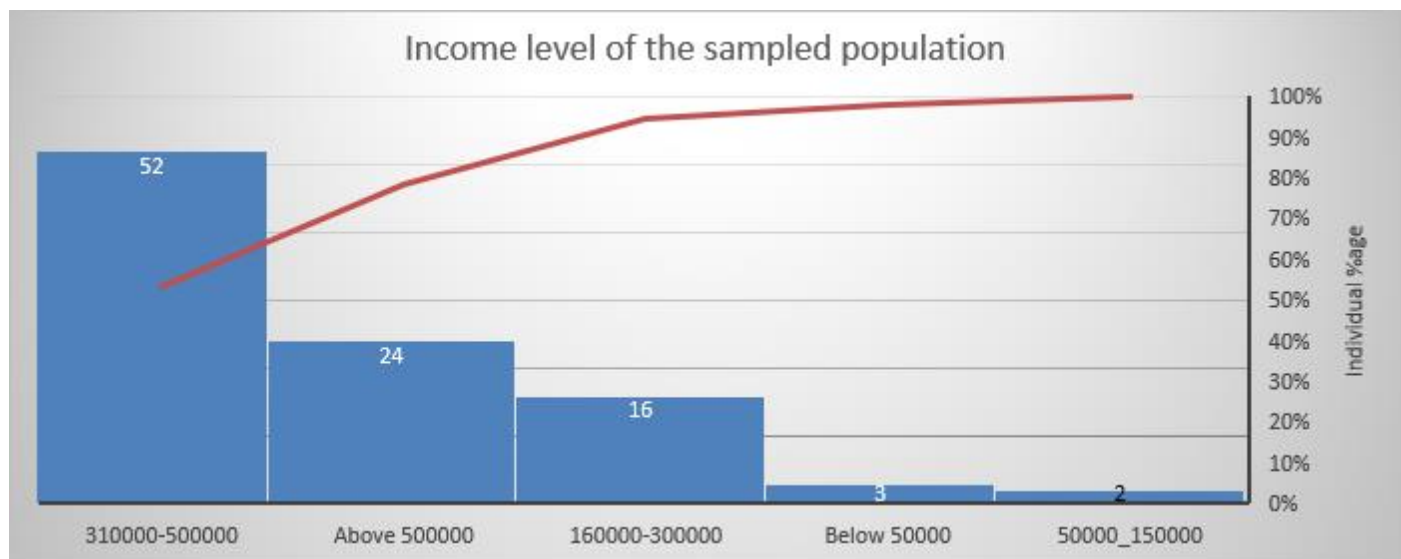


Figure 4 Income Levels of Pond Fish Farmers

4.2.5. Occupation Distribution

Table 3 Distribution of the occupation for the Pond fish farmers

Occupation	Count	Percent (%)
Trader	43	44
Civil Servant	32	33
Pond Fish Farmer	21	22
Civil servant & trader	1	1

From Table 3, 44 percent of the respondents were traders, 33 percent were civil servants and 22 percent had no other occupation other than pond fish farming. The study revealed that pond fish farming in Tororo district and municipality was practiced by mostly traders and civil servants. The finding was in agreement with Nabbuye *et al.*, (2015), who found that pond fish farmers in Uganda engaged in various occupations, including farming, civil service, business, and informal sectors activities, with many practising fish farming as a secondary activity.

4.3 The socio-economic effects of pond fish farming to the local community in Tororo district

4.3.1 Number of ponds owned by fish farmers

From Table 4, out of 437 ponds sampled, 17.2 percent ponds were owned by one farmer, 14.6 percent ponds were owned by each of 16 farmers, 13.7 percent ponds were owned by each of the 20 farmers, 12.4 percent ponds were owned by each of the nine farmers, 10.29 percent ponds were owned by each of nine farmers, 9.6 percent ponds were owned by each of six farmers, 7.78 percent ponds were owned by 2 farmers, 5.9 percent ponds were owned by each of 13 farmers and 4.3 percent ponds were owned by each of the 19 farmers. The ownership of ponds showed their level of production whether commercial or subsistence farming.

Table 4. Number of fish ponds owned by farmers

Farmers	Number of ponds owned by each	Percent (%)
1	75	17.2
16	64	14.6
20	60	13.7
9	54	12.4
9	45	10.29
6	42	9.6
2	34	7.78
13	26	5.9
19	19	4.3
2	18	4.1
97	437	100

4.3.2 Benefits of pond fish farming analysis by Socio-Economic Theme

Benefits of pond fish farming	Frequency	Percent (%)
Employment opportunities and income	30	31
Employment, improved nutrition and income	2	2.0
Food security and proteins source	5	5
Food security and employment opportunities in the community	15	15.4
Improved household income livelihood to the community	8	8
Increased food security and skills development	1	1
Proteins source and employment opportunities	16	16.4
Provision of employment and skill development	4	4
Provision of proteins and employment	4	4
Provision of skills development, employment, cheap proteins to the community	7	7.2
Providing free capital to farmers (constructing ponds for farmers)	2	2
Wasted land has been put into use	4	4
Total	97	100

Table 5. Benefits of pond fish farming to the farmers

From Table 5, 31 percent of the farmers identified employment opportunities and income as the major benefit from pond fishing farming. When grouped with other employment-related combinations (e.g., employment opportunities and income (31 percent), employment, improved nutrition and income 2 percent, + nutrition (2.0 percent), employment (15 percent) + food security, proteins and employment (4 percent) + proteins source and employment opportunities (16.4 percent), employment and skill development (4 percent)), this rises to over 70 percent. This

indicates that pond fish farming contributes significantly to reducing unemployment and supporting livelihoods. These findings show that pond fish farming is a valuable tool for rural socio-economic transformation. However, more structured support and equitable access (e.g., for women, youth, and landless people) could amplify its benefits. Pond fish farming has been shown to significantly contribute to employment, income generation, and food security in rural Ugandan communities Okello *et al.*, (2023). The second highest benefit was protein source and employment opportunities at 16.4 percent. Fish is a key source of affordable animal protein, and its availability enhances dietary diversity in the community. According to Basiita *et al.* (2021), small-scale aquaculture in Uganda plays a critical role in improving household nutrition and offering alternative livelihoods, particularly in areas with high poverty levels. The third highest benefit identified was food security and employment opportunities in the community at 15.4 percent. This finding aligns with Chitundu *et al.*, 2023; FAO, 2020 who found that smallholder aquaculture households were nearly twice as likely to achieve improved food security, supported by both increased fish consumption and sales that generated income and employment along the value chain. The fourth highest benefit identified was improved household income livelihood to the community at 8 percent. Similar findings were reported by Mhlanga *et al.*, 2018, where smallholder pond aquaculture boosted household income and enabled diversification into other enterprises such as apiculture and piggery. The fifth highest benefit identified was provision of skills development, employment, cheap proteins to the community at 7.2 percent which corresponds with findings by Ahmed *et al.*, (2024) where aquaculture projects provided farmers with technical and business skills, generated employment, and improved access to affordable protein sources. The sixth benefit identified was food security and protein source at 5 percent. Similar findings were documented by Shahabuddin *et al.*, (2024) in Bangladesh, where homestead pond aquaculture significantly improved dietary diversity and nutrition through the regular consumption of fish and other pond-based foods. The seventh benefit identified was wasted land put in use, provision of employment and skills development, provision of proteins and employment at 4 percent. This was supported by studies done by Dey *et al.*, (2021) who noted that pond aquaculture puts idle land into productive use while simultaneously generating employment, enhancing skills, and providing nutritious protein. The eighth benefit identified was providing free capital to farmers (construction of ponds and employment, improved nutrition and income at 2 percent. This agreed with evidence from Sierra Leone where Sawadogo *et al.*, (2021)

found that support in the form of pond construction and technical assistance acted as free capital, leading to improved household nutrition, income and post-harvest.

Other respondents mentioned food security and skills development 1 percent employment and skill development 4 percent, skills development, employment, cheap proteins to the community 7 percent, approximately, 12 percent mentioned skill development, either alone or alongside employment and nutrition. These responses showed that fish farming also contributed to capacity building and knowledge dissemination within the community. This agreed with research findings by Ssebisubi and Onyango (2019) stated that aquaculture provided affordable protein sources and enhanced skill development among rural populations.

A small number of respondents 4 percent reported that pond fish farming put previously unused land into productive use. This reflected positive land utilization and transformation of otherwise idle natural resources. In Tororo and neighbouring districts, aquaculture initiatives helped convert unused land into productive assets and provided capital support through government and NGO partnerships (Mugisha *et al.*, 2022).

A few respondent's 2 percent received free capital in the form of pond construction, showing that external support can increase adoption. Studies in Butaleja and Kibuku Districts also supported the assertion that aquaculture offers diversified income streams and contributes to rural economic resilience (Kyamuhangire *et al.*, 2020).

4.3.3 Challenges of pond fish farming

From Table 6, 98.9 percent of the respondents reported challenges such as inadequate training and technical skills, high cost of inputs, poor access to markets, limited access to quality fingerlings and feeds (appendix 4), and inadequate extension support and environmental challenges like water scarcity. This combination of challenges, suggested that pond fish farming was constrained by systemic and interlinked issues. Only 1 percent identified challenges such environmental challenges such as water scarcity.

Table 6 . Challenges of pond fish farming

Challenges associated with pond fish farming	Frequency	Percent (%)
Environmental challenges (e.g water scarcity)	1	1
Inadequate training and technical skills, High cost of inputs, Poor access to markets, Limited access to quality fingerlings and feed, Inadequate extension support.	96	98.9
Total	97	100

The key challenges identified were:

High Costs of Inputs: Feeds and fingerlings remain unaffordable for many smallholder farmers, especially without cooperative models or government subsidies (appendix 4). Mugisha *et al.*, (2022) observed that input costs especially feed constituted over 60 percent of operational costs making pond fish farming expensive for rural households.

Limited Access to Quality Fingerlings and Feeds: Quality of fingerlings and feeds was poor and access unreliable (appendix 4), leading to low productivity and high mortality rates for fish.

Environmental Challenges (e.g., Water Scarcity): Seasonal water shortages or pollution from nearby sources compromised pond operation, especially in dry areas.

Poor Access to Markets: Most farmers faced difficulty selling their fish due to poor road networks, lack of aggregation centres, or low farm-gate prices. Okello *et al.*, (2023) emphasized that inadequate extension services and poor market access discouraged sustained pond fish farming investments.

Inadequate Extension and Technical Support: Lack of ongoing training and advice from fisheries officers' limited knowledge dissemination on pond management, disease control, and business planning.

Limited Training and Skills: Where most farmers lacked formal or informal aquaculture training, this hampered optimal production practices (appendix 4). Ssebisubi & Onyango (2019) also

reported that access to quality fingerlings, water challenges, and lack of training remained critical constraints to aquaculture expansion in Uganda.

These challenges were not isolated, but rather overlapping, suggesting the need for: Holistic capacity building (training, demonstrations), Strengthening input supply chains, Infrastructure development (roads, cold storage), Consistent technical support (extension services), and Policy and financial interventions to reduce the cost burden on smallholder pond fish farmers.

4.3.4 Willingness to Join Farmer Groups

Table 7. Willingness to join farmer groups

Response	Frequency	Percent (%)
Yes	91	93.8
No	2	2.1
Maybe	7	4.1
Total	97	100

From Table 7, 93.8 percent of the respondents were willing to join farmer groups. This reflected a high level of social cohesion and readiness for collective development. FAO (2021) noted that farmers' groups improved access to services, markets, and technical skills, especially in small-scale aquaculture in Sub-Saharan Africa. This showed that fish farmers were aware of the benefits of working together, such as: Bulk purchase of inputs (feeds, fingerlings) at lower cost; Easier access to credit and government support; Shared knowledge and skills training; Improved bargaining power and better access to markets. Ssebisubi & Onyango (2019) found that collective farmer action in aquaculture improved input access and reduced operational risks. Also, Mugisha *et al.*, (2022) argued that fish farmer cooperatives in Uganda have contributed to improved income and training uptake. The 4.1 percent of the respondents were uncertain, possibly due to: previous bad experiences with cooperatives; lack of information about the benefits; fear of mismanagement or corruption in group settings. Only 2.1 percent of the respondents expressed a clear disinterest, to engage in cooperatives, this could stem from individualistic preferences, mistrust of group dynamics, or lack of time and resources.

4.3.5 Existing support to promote fish farming

From figure 5, 85 percent of the respondents acknowledged that some form of support exists to promote fish farming. Which reflects a positive perception of stakeholder involvement, although

effectiveness and consistency still varied. Ten percent of respondents were uncertain about available support. This was due to: inconsistency in delivery of services, poor awareness or communication, limited engagement with extension workers or support institutions. The findings were in agreement with Okello *et al.*, (2023) who noted that although many government and NGO programs existed, challenges remain in equitable access to aquaculture support services. Furthermore, FAO (2021) stated that local support systems in aquaculture often existed but were fragmented or underfunded, limiting their full potential. Five percent of the respondents believed that there was no support at all, suggesting gaps in coverage, accessibility, or impact of existing intervention. This was in agreement with Kyamuhangire *et al.* (2020) who found gaps in awareness and delivery of extension services among rural fish farmers in Eastern Uganda.

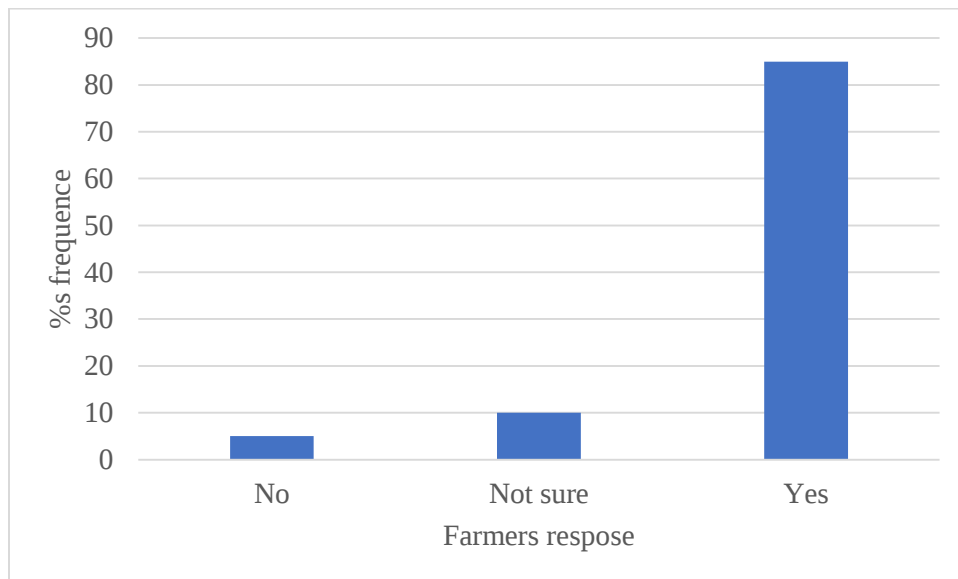


Figure 5. Existing support sufficient to promote fish farming

4.3.6 Distribution of Support Sources for Pond Fish Farming

Table 8. Source of support to pond fish farming

Source of support	Frequency	Percent (%)
Farmer cooperative	6	6.2
MAAIF and Local government	21	21.6
MAAIF and Local government, NGOs, Private companies	1	1
Local government	49	50.5
NGOs, Local government, Private companies	15	15.4
Private companies	5	5.1
Total	97	100

From Table 8, 50.5 percent of the farmers received support from local government. This support came through the District Agriculture Production and Marketing department, community-based programmes, and fisheries extension staff. However, this also suggested that support was heavily localized, possibly leading to uneven quality or coverage and limited technical specialization compared to national or private players. Ssebisubi & Onyango (2019) found that relying solely on local government limits access to advanced technologies and capital-intensive inputs. The support from the Ministry of Agriculture, Animal Industry and Fisheries (MAAIF) was 21.6 percent. This support was provided jointly with that from local government. The support from Non-Government Organisations (NGOs), local government and private companies was 15.4 percent. Farmer cooperatives provided 6.2 percent of the support to farmers. Farmer Cooperative participation was only 6.2 percent meaning that very few farmers received support through cooperatives, despite high willingness to join them (as seen earlier). This showed an untapped opportunity for structured farmer-led organizations to deliver training, bulk input purchase, and marketing support. Private companies provided 5.1 percent. Only 1 percent of the support was received from multi-stakeholders such as MAAIF, NGOs, and private sector showing limited integrated support. The NGOs and private companies, either independently or with government, provided 20.7 percent support to farmers. Their role was less dominant but significant, especially where they brought in innovation, resources, or specialized training on feed formulation, hatchery management, etc.

FAO (2021) emphasized the need for multi-stakeholder partnerships to achieve sustainable aquaculture in Africa and Okello *et al.* (2023) recommended building the capacity of farmer groups and linking them with public and private actors to enhance support delivery.

The sources of support in Table 8, namely MAAIF, local government, NGOs, Private companies were subjected to a test of significance using a pearson chi square test at $\alpha = 0.05$. The findings were summarized in Table 9.

Table 9: Chi-Square Summary of Sources of Support to Pond Fish Farming

Variables Compared	χ^2 Value	df	p-value	Significance
Local government	92.330	1	0.000	Significant at $p < 0.05$
MAAIF and Local government	15.672	1	0.001	Significant at $p < 0.05$
NGOs, Local government, Private companies	8.245	1	0.020	Significant at $p < 0.05$

The Chi-Square results show that local government support was the most significant source of support to pond fish farming ($\chi^2 = 92.330$, $df = 1$, $p < 0.05$), indicating that most farmers rely heavily on local government initiatives. In addition, support from MAAIF and local government combined was statistically significant ($\chi^2 = 15.672$, $df = 1$, $p < 0.05$), suggesting an important collaborative role in promoting fish farming. Similarly, contributions from NGOs in partnership with local government and private companies were also significant ($\chi^2 = 8.245$, $df = 1$, $p < 0.05$), showing that multi-sectoral partnerships play a meaningful role in supporting aquaculture development. Other sources of support such as farmer cooperatives, private companies alone, or all institutions combined had low frequencies and did not show statistical significance in this study

4.3.7 Negative Socio-Economic Impacts of Pond Fish Farming

From Table 10, high cost of inputs at 26.8 percent was identified as the most challenging negative socio-economic impact. This cost included that for fingerlings, fish feeds, construction and maintenance of ponds (appendix 4). These high costs undermined profitability, making fish farming economically unsustainable for smallholders. This finding agreed with Okello *et al.*, (2023) who reported that input costs are a major barrier to aquaculture scaling in Uganda. The

second highest negative socio-economic impact was water scarcity during the dry season at 8.2 percent. Farmers struggled with water shortages, especially during dry seasons. This was partly accounted to land use and climate change. The third highest negative socio-economic impact was flooding of fish at 6.18 percent. Flooding destroyed ponds, especially during heavy rains and was also accounted to climate change. The fourth highest negative socio-economic impact was predation at 3.09 percent. This was especially in unfenced or community-based ponds by birds and reptiles. The fifth highest negative socio-economic impact was fish death and diseases at 2.06 percent. Disease outbreaks contributed to fish mortality. The sixth highest negative socio-economic impact was poor fish growth 1.03 percent. Some reported polluted or unreliable sources, worsening conditions for pond fish health and growth. NEMA (2020) noted climate variability and land-use changes are increasing seasonal water stress. Some farmers experience limited profitability due to fluctuating or depressed prices for farmed fish. Theft and Predation was at 8.2 percent, Fish theft especially at harvest and predation by birds and reptiles were reported as major causes of losses, especially in unfenced or community-based ponds.

Table 10. Negative socio-economic impacts of pond fish farming

Negative impacts	Frequency	Percent (%)
High costs of inputs and low price of fish	2	2.06
Diseases	2	2.06
Fish death	2	2.06
Flooding and low market price	1	1.03
Flooding of fish	6	6.18
High-cost inputs	26	26.8
High cost of input and water scarcity	13	13.4
High costs of inputs, water shortage, low price of fish	2	2.06
High costs of inputs and low prices for fish	10	10.3
High costs of inputs and theft of fish	3	3.09
Lack of enough capital and high costs of inputs	2	2.06
Low prices of fish and diseases, predation	1	1.03
Individuals who did not have any negative impact	10	10.3
Poor fish growth	1	1.03
Poor quality feeds and fingerlings	2	2.06
Predation, flooding and low prices for fish	1	1.03
Predations	3	3.09
Theft, water pollution and water scarcity	1	1.03
Water scarcity during dry season	8	8.2
Water shortage and low prices of fish	1	1.03
Total	97	100

Table 10. Chi-Square Analysis of Negative Impacts in Pond Fish Farming

All the negative impacts in Table 10 were analysed for significance using the pearson chi square (p) test at $\alpha = 0.05$.

Variables Compared	χ^2 Value	df	p-value	Significance
High cost of inputs	100.21	1	0.000	Significant at $p < 0.05$
High cost of inputs $\times$ Water scarcity	15.49	1	0.001	Significant at $p < 0.05$
High cost of inputs $\times$ Low fish prices	6.42	1	0.040	Significant at $p < 0.05$
Water scarcity during dry season	2.560	1	0.049	Significant at $p < 0.05$
No negative impact reported	6.420	1	0.040	Significant at $p < 0.05$

The high cost of inputs emerged as the most dominant constraint ($\chi^2 = 100.210$, $df = 1$, $p < 0.05$), indicating that it significantly influences the sustainability of fish farming enterprises. In addition, the interaction between high input costs and water scarcity was statistically significant ($\chi^2 = 15.490$, $df = 1$, $p < 0.05$), showing that farmers are greatly affected when these two challenges occur simultaneously. The combination of high input costs and low fish prices also showed a significant association ($\chi^2 = 6.420$, $df = 1$, $p < 0.05$), suggesting that farmers face a double burden from both market and production constraints. Furthermore, water scarcity during the dry season was found to be weak but statistically significant effect ($\chi^2 = 2.560$, $df = 1$, $p < 0.05$), demonstrating that water shortages negatively influence pond productivity. Interestingly, a portion of farmers reported no negative impacts, and this category was also statistically significant ($\chi^2 = 6.420$, $df = 1$, $p < 0.05$), reflecting variations in the extent to which fish farming challenges are experienced across different households.

4.3.8 Impact on pond fish farming on the farmers standards of Living

Table 11 Effect of pond fish farming on standards of living

Change in Standard of Living	Frequency	Percent (%)
Improved greatly	7	7.2
Improved slightly	88	90.7
No change	2	2.1
Total	97	100

From the Table 11, 90.7 percent of the farmers reported a slight improvement in their standard of living due to pond fish farming, while 7.2 percent of the farmers reported a great improvement and only 2.1 percent reported that their standards of living did not change. These findings agreed with national studies like MAAIF (2022), which reported that smallholder aquaculture improved household welfare, especially when supported with inputs and training. The FAO (2021) and Nabweteme *et al.* (2019) also reported improved livelihoods in regions with strong fish farming adoption.

4.3.9 Suggestions to government to support pond fish farming

From Table 12, 24.7 percent of the respondents suggested a strategy of provision of inputs to improve pond fish farming. Most farmers emphasized the urgent need for good quality feeds and affordable fingerlings, Subsidizing inputs increased production capacity and reduced the burden of high operating costs. This would be done through provision of provision of good quality and cheap feeds and other inputs. From the Table 12, 23.3 percent of the respondents suggested a strategy of increasing funding and provision of incentives to the farmers. Increased government investment in aquaculture and direct financial aid such as grants or access to soft loans would help farmers scale up their operations and invest in better infrastructure. Therefore, government should increase more funding into MAAIF and this would in turn increased access to credit/loans or provide funds to fish farmers.

Table 12 Suggestions to government to support pond fish farming

Strategy to support pond fish farming	Frequency	Percent (%)
Provision of inputs (feeds, fingerlings, etc.)	18	24.7
Funding and incentives like credit, subsidies, grants	17	23.3
Training in technical, feed formulation, water management	12	16.4
Improving markets and price stability	10	13.7
Access to equipment (feed machines, pelleting)	6	8.22
Extension services/support services	5	6.85
Environmental sustainability (e.g., water access/dams)	2	2.74
NA/non-responses	3	4.11
Total	73	100

From Table 12, 16.4 percent of the respondents suggested training in technical expertise, feed formulation, water quality management and modern aquaculture practices. Capacity building was essential for quality production and long-term sustainability. From Table 13, 13.7 of the respondents suggested a strategy of improving markets and price stability. Farmers suggested the creation of structured market systems and price regulation to avoid exploitation and boost profitability. This would reduce post-harvest losses and create stable income hence providing better market for fish and improving on the fish market access and linkages. From Table 14, 8.22 percent suggested a strategy of improving access to equipment and technologies. Some farmers advocated for machines for feed production, pelleting machines, and storage facilities, which reduce costs and improve feed quality. The 6.85 percent suggested extension and support services. The 2.74 percent of the respondents suggested promoting environmental sustainability. This could be through the establishment of environmental resilience measures such as construction of valley dams that would support farmers during the dry seasons and mitigate climate shocks that disrupted pond management. The majority of respondents believed that support in inputs, funding, training, and market infrastructure is key to making pond fish farming sustainable in Tororo District. Many strategies aligned with the challenges already identified earlier and suggested a clear direction for intervention.

The strategies for sources of support in Table 14, were subjected to a test of significance using a pearson chi square test at $\alpha = 0.05$. The findings were summarized in Table 13.

Table 13. Summary of strategies for sources of support to Pond Fish Farming

Strategy of Support	χ^2 Value	df	p-value	Significance
Provision of inputs (feeds, fingerlings, etc.)	18.560	1	0.000	Significant at $p < 0.05$
Funding and incentives (credit, subsidies, grants) government	16.740	1	0.001	Significant at $p < 0.05$
Training (feed formulation, water management)	12.920	1	0.003	Significant at $p < 0.05$

Provision of inputs such as feeds and fingerlings were the most significant strategy for supporting pond fish farming ($\chi^2 = 18.560$, $df = 1$, $p < 0.05$). This reflects the high demand for essential production inputs to improve fish productivity. Similarly, funding and incentives including credit, subsidies, and grants were statistically significant ($\chi^2 = 16.740$, $df = 1$, $p < 0.05$), highlighting the importance of financial support in sustaining aquaculture operations. Training in technical skills such as feed formulation and water management was also significant ($\chi^2 = 12.920$, $df = 1$, $p < 0.05$), underscoring the role of capacity building in enhancing fish farmers' efficiency. Other strategies such as market improvement, access to equipment, extension services, and environmental sustainability were identified but did not show statistical significance, likely due to their limited representation in the sample.

4.3.10. Knowledge of laws and regulations governing pond fish farming

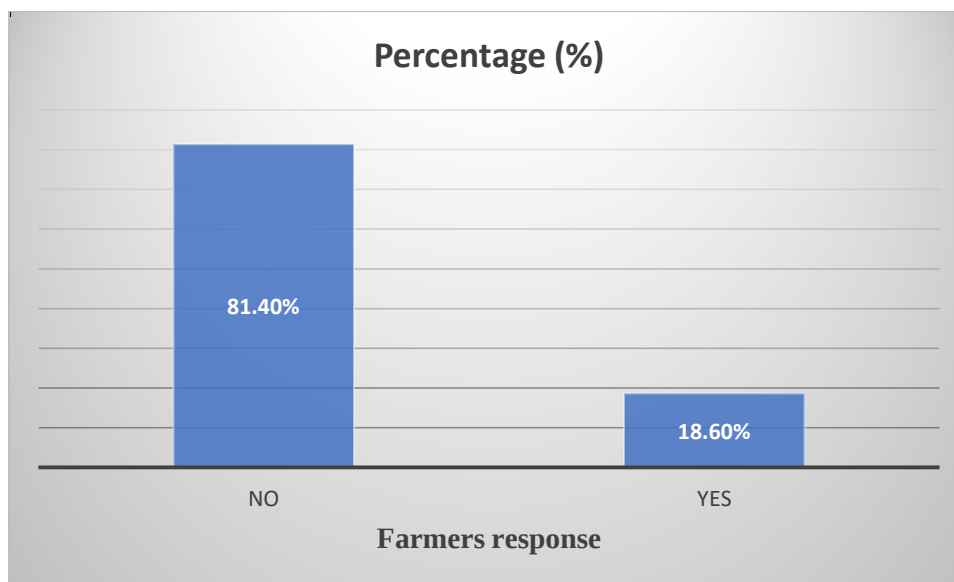


Figure 6. Farmers knowledge of laws and regulations governing pond fish farming

From figure 6, 81.4 percent of the respondents lacked knowledge of laws and regulations governing pond fish farming. Only 18.6 percent had knowledge of law and regulations governing pond fish farming. This confirms a critical policy literacy gap, which may hinder regulatory compliance, environmental protection and access to legal protections and structured development schemes.

4.2.11. Farmer awareness of bylaws

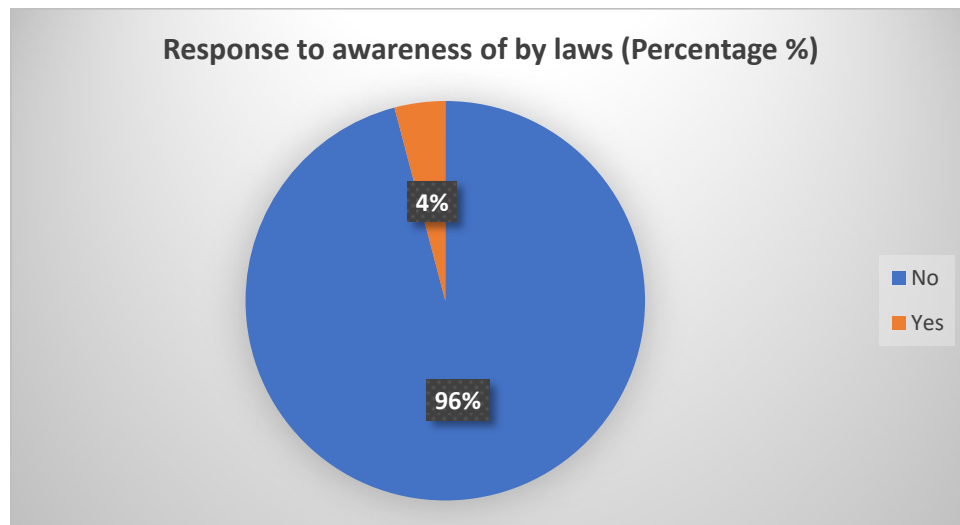


Figure 7. Awareness of Bylaws

From figure 7, 96 percent of the respondents reported not knowing any bylaws governing pond fish farming. Only 4.1 percent of the pond fish farmers in Tororo District reported knowing any local bylaws related to pond fish farming. This revealed a serious disconnect between local governance structures (e.g. district ordinances, community Bylaws) and actual farmers. The reported Bylaws were “no harvesting of fish using poison, transfer of fish from one person to another”, etc.

Table 14. Bylaws Reported by Farmers

Reported Bylaw	Frequency	Percent (%)
No harvesting of fish using poison	2	2.1
Fish (Aquaculture) Rules, 2022	1	1.0
Transfer of fish from one person to another	1	1.0
No known bylaw	93	95.9
Total	97	100

From Table 14, only 4.1 percent of respondents identified any bylaw. This suggested their limited or fragmented understanding of pond fish farming bylaws. The fact that some listed national regulations (*Fish (Aquaculture) Rules, 2022) as bylaws indicates confusion between national law and local ordinances. For examples “no harvesting of fish using poison”.

CHAPTER FIVE: DISCUSSION

5.1 Introduction

This chapter provides a detailed discussion of the study findings in relation to the three specific objectives: evaluating the current status of pond fish farming in Tororo District, assessing its socio-economic impacts, and proposing strategies for enhancing sustainability.

5.2 Current Status of Pond Fish Farming in Tororo District

The study established that pond fish farming in Tororo District is a growing practice practiced by a cross-section of community members with varying educational and socio-economic backgrounds, supported by local government, MAAIF, NGOs, and private entities. Most farmers operated on a small scale, with local government being the leading source of support. The support from local government and MAAIF were found to be statistically significant. The activity showed potential for both income generation and food security, although constraints such as inadequate inputs and training persisted. However, the sector still faced limitations in terms of inputs, access to quality fingerlings, extension services, and availability of quality feeds. These findings agreed with Efitre *et al.* (2020), who reported that small-scale aquaculture in Uganda is gaining ground despite systemic challenges.

5.3 Socio-economic Impacts of Pond Fish Farming

The study showed that pond fish farming had significantly contributed to local livelihoods in several ways. The most cited benefit was "Employment opportunities and income", followed by other combinations such as "proteins source and employment opportunities" and "Food security and employment opportunities in the community". These findings reflected the multifaceted nature of pond fish farming. As it contributed to income, nutrition, skill development, and land use. Similar findings were documented by Ogello *et al.* (2013) in Kenya, where aquaculture was shown to boost rural development through income and protein provision. Despite the positives, the sector also faced multiple challenges that included high costs of inputs, inadequate training and technical skills, poor market access, limited access to quality fingerlings and feed (appendix 4), and environmental issues such as water scarcity. However, amongst the challenges those that were statistically significant were high cost of inputs, water scarcity during the dry season and low fish prices. These challenges hindered production, growth and sustainability, a trend echoed

by FAO (2021) and Nabwire & Okumu (2021), who highlighted similar structural and operational barriers in East Africa's aquaculture sectors. Furthermore, when asked about existing support mechanisms, 85 percent of farmers affirmed there was some support, primarily from local government, MAAIF, and NGOs/private sector. This indicated a reasonably active institutional presence, though effectiveness and reach still varied. Concerning the perceived change in standard of living, over 90 percent of the respondents reported a slight improvement, and 7.2 percent noted a significant improvement. This supports the assertion that aquaculture enhances livelihoods over time, albeit gradually. The negative impacts, however, must be acknowledged. The most statistically significant negative impacts were high input costs, water scarcity, and low fish prices. These issues were further complicated by fish theft, flooding, predation, and fish diseases. Such multifactorial constraints reinforce the need for more integrated support frameworks. Finally, the majority of farmers expressed willingness to participate in farmer groups to improve fish farming. This highlights strong community interest in collaborative solutions and capacity-building platforms.

5.4 Strategies for Enhance Sustainability

A diverse array of strategies was suggested to improve the sector. The most popular included: increased access to credit and funding, provision of quality feeds and fingerlings, Support with feed formulation training, improved market linkages, Use of environmentally friendly practices, and provision of inputs and incentives. Of these strategies those that were statistically significant were provision of quality feeds and fingerlings, increased access to credit and funding and support with training in feed formulations. One respondent noted: "Leverage prices for fish to give farmers hope and courage" reflecting the psychological and economic need for stable returns. The presence of similar sentiments in aquaculture literature supports these calls. Jahan *et al.* (2010) stressed that sustainability in aquaculture requires institutional support, credit facilities, and capacity building. However, when examining knowledge of legal frameworks, only 18 respondents knew any policies, and just four knew of local bylaws. While some mentioned the Fish (Aquaculture) Rules, 2022, others cited non-specific or misunderstood references such as "transfer of fish" or "no harvesting using poison." This indicates a critical gap in legal literacy, which could compromise compliance and environmental sustainability. This agreed with Nabwire & Okumu (2021), who noted that many Ugandan fish farmers operate without a clear understanding of existing fisheries laws and bylaws. This situation demands improved legal awareness campaigns and localized policy dissemination.

CHAPTER SIX: CONCLUSION AND RECOMMENDATIONS

6.1 Introduction

This chapter presents the conclusion, recommendations and further areas of study.

6.2 Conclusions

The study concluded that pond fish farming in Tororo District holds considerable socio-economic promise, improving income, employment, and food security. However, the sector faces substantial constraints in terms of inputs, knowledge, and market structure. Furthermore, while institutional support exists, awareness of regulations and bylaws is minimal.

6.3 Recommendations

1. Enhance Farmer Training and Extension Services, and emphasis should be placed on feed formulation, water quality, disease management, and legal awareness.
2. Subsidize Inputs and Improve Feed Access, the Government and NGOs should support input supply chains and encourage feed production technologies.
3. Promote Farmer Cooperatives and Group Participation, Groups should be strengthened to improve access to credit, inputs, and marketing.
4. Legal and Policy Dissemination, simplified and community-oriented campaigns should be run to increase awareness of fisheries laws and bylaws.
5. Infrastructure Support, Valley dams and feed machinery should be made available to reduce vulnerability to seasonal challenges.
6. Increase Government Funding and Private Investment, targeted aquaculture development funds should be established under MAAIF.
7. Price Stabilization and Incentives: Government should explore strategies for fish price stabilization and provide subsidies for start-up farmers.
8. Research and Innovation: Encourage innovation through partnerships with universities and research institutions to address local fish farming challenges

6.4 Areas for further study

Further research should investigate gender participation in pond fish farming, the effect of climate variability, and the role of youth in aquaculture sustainability.

REFERENCES

- Adewumi, A. A., & Olaleye, V. F. (2011) catfish culture in Negeria: progress prospects and problemms. *African jounal of Agriculture Research*.
- Ajambo, R. (2023). *Assessment of fish farming as a source of livelihood among fish farmers in Osukuru Sub-County, Tororo District* . . [Undergraduate dissertation, Busitema University].
- Ajana, A .M., Ibrahim,K., Adisa, B. O., &Agbontale, W. (2006). Economic contributions of artisanal fisheries to house hold income in coastal communities.
- Akello, J., & Mugisha, R. (2018). *Challenges Facing Smallholder Aquaculture in Uganda*. *Journal of Agricultural Research*.
- Akoko, D. O. (2020). *Constraints to aquaculture development in East Africa: A farmer perspective*. *Aquaculture Reports*, 17, 100347.
- Ali, M. G. (2020). *The effect of differnt feeding strategies on the growth performance of Nile tilapia*.
- Ahmed, N., et al. (2024). *Small-scale aquaculture's role in rural employment and nutrition*. *Aquaculture Research*, 55(3), 421–436.
- Asiimwe, R., et al. (2020). *Aquaculture and Rural Livelihoods in Eastern Uganda*. Makerere University Press.
- Bank, A. D. (2001). *Republic of Uganda: Fisheries Development Project Appraisal Report*. *African Development Bank*.
- Basiita, R. K., Luwemba, J. N., & Nambuya, J. B. (2021). *Socioeconomic contribution of small-scale aquaculture to rural livelihoods in Uganda*. Makerere University Aquaculture Research Series.
- Bwire, M. N. (2021). *The role of aquaculture in enhancing rural livelihoods in Uganda: Case studies from Eastern and Central regions*. *Uganda Journal of Agricultural Sciences*, 22(1), 15–29.
- Chitundu, M., et al. (2023). *The role of smallholder aquaculture in improving food and nutrition security in Zambia*. *Agriculture & Food Security*, 12(4), 1–15.
- Creswell, J. W. (2014). *Research design: Qualitative, quantitative, and mixed methods approaches (4th ed.)*. Sage Publications.
- Dey, M. M., et al. (2021). *Livelihood impacts of ponds in Asia: Opportunities and constraints*.
- FAO. (2025). *National Aquaculture Sector Overview, Fisheries and Aquaculture*.
- FAO. (2021). *The State of World Fisheries and Aquaculture 2021*. Rome: FAO.

FAO. (2020). *The State of World Fisheries and Aquaculture 2020: Sustainability in action*. Rome:

FAO. (1989). *Book for the inland fishery resources of Africa Vol1*.

FAO. (1989). *Inland fishery resources of Africa*.

FAO Fisheries and Aquaculture Technical Paper No. 658.

EI-Sayed, A. F. (2006). *fish nutrition and feeding*.

Fund, A. D. (2001). *Fisheries Development Project Appraisal Report*. African Development Bank. Republic of Uganda.

Huang, Y. W. (2021). Journal of Aquaculture research . *Nutritional evaluation of farm made feeds for tilapia*.

Kassam, L. & ? (2017). *A comparative assessment of the poverty impacts of pond aquaculture in Asia and Africa*. *Aquaculture*, 470, 232–244. .

Kyamuhangire, W., Agaba, H., & Nattabi, J. (2020). *Impact of aquaculture on household income and food security in Butaleja District, Eastern Uganda*. *Uganda Journal of Agricultural Sciences*, 25(2), 103–111.

MAAIF. (2022). *National Aquaculture Development Strategy: Uganda 2021–2030*. Ministry of Agriculture, Animal Industry and Fisheries.

MAAIF. (2020). *National Aquaculture Strategy 2020–2025*. Ministry of Agriculture, Animal Industry and Fisheries.

MAAIF. (2013). *The National Agricultural Policy*. Republic of Uganda.

MAAIF. (2004). *National Fisheries policy*. . Government of Uganda.

Malaysia:policy implication for aquaculture development

Mhlanga, B., et al. (2018). *Socio-economic impacts of smallholder aquaculture in Zimbabwe: A case of Masvingo District*. *Journal of Applied Aquaculture*, 30(2), 118–133.

Mugisha, J., Okumu, L., & Nyende, P. (2022). *Aquaculture for development: Lessons from small-scale pond farming in Eastern Uganda*. *Journal of Rural Development and Aquatic Studies*, 18(1), 25–40.

Mwesigwa, T. M. (2019). *Reviving Uganda’s fish farming sector: A review of public policy interventions and farmer experiences*. Economic Policy Research Centre (EPRC), Kampala.

- Musa, M., Yusoff, F. M., & Sheriff, N. (2012). Socio economic characteristics of fish farmers in
- Nabbuye, R., Walakira, J.K., & Taabu Munyaho, A. (2015). Social economic characteristics and profitability of small scale aquaculture enterprise in central uganda. *uganda journal of Agricultural sciences*, 16(1)
- Nabweteme, J., *et al.* (2019). “Socioeconomic impact of fish farming in Eastern Uganda.” *Uganda Journal of Fisheries and Aquatic Sciences*
- Nabwire, R., & Okumu, J. (2021). *Local Governance and Aquaculture in Uganda*. African Journal of Fisheries and Aquatic Studies, 8(2), 44–56.
- NAFIRRI. (2019). *Aquaculture Development Report*. National Fisheries Resources Research Institute.
- NEPAD. (2017). *Policy framework and reform strategy for fisheries and aquaculture in Africa*. AUC-NEPAD. African Union Development Agency .
- Obiero, K. N. (2019). The contribution of Fish farming to rural livelihood in Kenya. *Food and Agriculture*, 19(1), 14179-14195.
- Okello, J., Sserwadda, B., & Tumushabe, A. (2023). *Assessment of pond fish farming as a tool for economic empowerment in Uganda*. African Journal of Aquatic Science, 48(1), 54–67. <https://doi.org/10.2989/AJAS.2023.048.01.005>
- Owor, H. (2023). *Fish farming as a strategy to improve household income in Nagongera Sub-County, Tororo District* . [Undergraduate dissertation, Busitema University]. Busitema University Institutional .
- Rhodes, D. (1961). *History of carp culture in uganda and progress to December ,1960* Department, Entebbe, Uganda.
- Sawadogo, B., et al. (2021). *Economic profitability of farm ponds in Burkina Faso*. Agriculture & Food Security, 10(21), 1–12.
- Shahabuddin, A., et al. (2024). *Homestead pond aquaculture and household dietary diversity in Bangladesh*. Public Health Nutrition, 27(2), 205–217.
- Ssebisubi, M., & Onyango, E. (2019). *Role of aquaculture in household nutrition and income generation in Uganda: A case of Wakiso and Buikwe districts*. Fisheries and Aquaculture Journal, 10(2), 239. <https://doi.org/10.4172/2150-3508.1000239>
- Tacon, A. a. (2008). *Global trends in aquaculture and the importance of feeds*.
- TDLG. (2023). *Tororo district local government report*.
- USAID. (2019). *Fish farming brings food and nutrition security to Sierra Leone*. U.S. Agency for International Development
- Yamane, T. (1967). *Statistics: An introductory analysis (2nd ed.)*. Harper & Row.

APPENDIX

APPENDIX 1: QUESTIONNAIRE



FACULTY OF NATURAL RESOURCE AND ENVIRONMENTAL SCIENCE

DEPARTMENT OF FISHERIES AND WATER RESOURCES

NAMASAGALI CAMPUS

QUESTIONNAIRE

ID NO:

Dear respondent,

I am Zinunula Joel a student of Busitema University pursuing a Bachelor of Science degree in Fisheries and Water Resources Management, carrying out an academic study on “**Assessing the socio-economic impacts of pond fish farming on local communities in Tororo district**”.

You have been purposely selected to voluntarily participate in this study and you are kindly requested to freely and objectively respond to the listed questions. Be assured that the information you give out will be treated with utmost confidentiality. This study is strictly for academic purposes. Your identity will be kept confidential.

Instructions

- Read the questions carefully and ask for clarity on any question that troubles you.
- Please tick in the box where necessary.
- Write your response in the space provided.

Section A: Bio data

1.Name: (Optional)

2. Gender: (1). Male (2). Female

3. Age Group

(1). 18 and below. (2). 19 – 25. (3). 26 – 30. (4). 31- 40. (5). 41 – 50 (6). Above 50

4. Education Level

(1). Primary (2).Secondary (3).Tertiary (4). Others. If others specify.....

5. Marital status

(1). Single (2). Married (3). Divorced (4). widowed (5). Others specify.....

6. Employment

1. Not employed 2. Self-employed 3. Employed 4. Others specify.....

7. Income level per month in Ugandan Shs.

1). Below 50,000 2). 50,000 – 150,000 3). 160,000 -300,000 (4). 310,000 – 500,000 5). Above 500,000

8. Occupation:

1). Pond fish farmer 2). Trader 3). Civil servant 4) Student 5). Other (specify): _____

9. Years of experience in pond fish farming (if applicable): _____

Section B: Status of fish pond farming over the past five years

1b. Do you own or operate a fish pond?

- a. Yes
- b. No

2b. If yes, how many ponds do you operate? _____

3b. Fish Farming Practices and Marketing Information.

Instructions: Please fill in the table below based on your fish farming activities. Tick (✓) the species you rear, and provide the relevant information for each row as accurately as possible.

Fish species reared	Tilapia	Catfish	Mirror carp	Others(specify)_____
Types of feeds used				
Price of the feeds used				
Where are these feeds sourced from? (a) Locally or (b) imported				
Quantity of fish harvested (kgs)				
Price of fish when harvested per kg				
Market location where fish is sold				

4b. What is the scale of your fish farming?

- a. Small scale
- b. Medium scale
- c. Large scale

5b Who owns the land used for pond fish farming?

- Private ownership (b) Public (c) Rented

If rented, how much do they rent the land used for ponding fish farming?

_____ (UgShs)

Section C: Challenges to fish pond farming

1c. Has Pond fish farming improved your household income?

- a) Yes
- b) No
- c) Not sure

2c. Has it provided employment opportunities for you or others?

- a) Yes
- b) No

3c. In what ways has pond fish farming benefited your community? (Tick all that apply)

- a) Improved income levels
- b) Improved nutrition
- c) Increased employment
- d) Enhanced skills and knowledge
- e) Other (specify): _____

4c. What challenges do you face in pond fish farming? (Tick all that apply)

- a) Lack of capital
- b) Inadequate technical knowledge
- c) Poor market access
- d) Diseases
- e) High cost of inputs
- f) Other (specify): _____

Section D: Impacts of fish pond farming

1d. Has Pond fish farming had any impact on your household income?

- a) Yes
- b) No
- c) Not sure

2d. If yes, how would you rate the change in your household income due to fish farming?

- a) Significant increase
- b) Moderate increase
- c) Slight increase
- d) No change
- e) Decrease

3d. Has Pond fish farming created employment opportunities for you or others in your household?

- a) Yes
- b) No
- c) Not sure

4d. If yes, how many people (including yourself) in your household are employed through pond fish farming? _____ (Number)

5d. Has Pond fish farming contributed to improved food availability or nutrition in your household?

- a) Yes
- b) No
- c) Not sure

6d. What are the key socio-economic benefits you have experienced from pond fish farming?
(Tick all that apply)

- a) Increased income
- b) Employment opportunities
- c) Improved household nutrition
- d) Skills development
- e) Empowerment of women or youth

- f) Improved community relations/cooperation
- g) Others (please specify): _____

7d. Have you faced any negative impacts or challenges due to pond fish farming?

- a) Yes
- b) No

8d. If yes, please specify the nature of the negative impacts:

9d. Has Pond fish farming changed your standard of living in any way?

- a) Improved greatly
- b) Improved slightly
- c) No change
- d) Worsened

10d. Do you feel that pond fish farming has benefited the broader community in Tororo District?

- a) Yes
- b) No
- c) Not sure

11d. Please explain how pond fish farming has affected your community (positively or negatively):

Section E: Interventions and Mitigation measures

1E. What support do you think is needed to sustain pond fish farming? (Tick all that apply)

- a) Access to credit/loans
- b) Training and extension services
- c) Access to quality fingerlings and feed
- d) Improved market access
- e) Formation of cooperative groups
- f) Government support/policies

2E. Have you ever received any form of support related to pond fish farming?

- a) Yes
- b) No

3E. If yes, what type of support have you received? *(Tick all that apply)*

- a) Training/workshops
- b) Start-up capital or credit
- c) Fingerlings
- d) Fish feed
- e) Equipment/tools
- f) Extension/advisory services
- g) Other (please specify): _____

4E. Who provided this support? *(Tick all that apply)*

- a) Government (e.g., Ministry of Agriculture/Fisheries)
- b) NGOs or development agencies
- c) Private companies
- d) Farmer cooperatives or groups
- e) Local government
- f) Other (please specify): _____

5E. In your opinion, are the existing support services sufficient to promote sustainable pond fish farming?

- a) Yes
- b) No
- c) Not sure

6E. What challenges still exist despite current interventions? *(Tick all that apply)*

- a) Inadequate training and technical skills
- b) High cost of inputs
- c) Poor access to markets
- d) Limited access to quality fingerlings and feed
- e) Inadequate extension support
- f) Environmental challenges (e.g., water scarcity)
- g) Other (specify): _____

7E. What strategies do you think can improve the sustainability of pond fish farming in Tororo District? *(Tick all that apply)*

- a) Increased access to credit/loans
- b) More training and capacity building
- c) Better supply of quality fingerlings and feed
- d) Formation of fish farmer cooperatives
- e) Government subsidies or grants
- f) Improved market access and linkages
- g) Use of environmentally friendly practices
- h) Other (please specify): _____

8E. Would you be willing to participate in a farmers' group or cooperative to improve pond fish farming outcomes?

- a) Yes
- b) No
- c) Maybe

9E. What suggestions would you give to government or other stakeholders to support pond fish farmers better? _____

10E. Are you aware of any law or policy regarding pond fish farming?

- 1). Yes 2). No

11E. If yes, what are these policies and laws?

12E. What can be done to ensure that pond fish farmers are knowledgeable about these policies and laws?

13E. Are you aware of any bylaw governing pond fish farming? Yes, No

14E. If yes, specify this bylaw. _____

Thank you very much for your time and participation

Appendix 4. Field Pictures



Plate 1 . Measures of reducing predation on a farmers fish pond



Plate 2. Evaluating quality of fish feeds



Plate 3. Minimising flooding by increasing banks on farmer's pond



Plate 4. Evaluating quality of fish fingerlings.



Plate 5. Focus group discussion one



Plate 6. Focus group discussion two



Plate 7. Focus group discussion three.