SOCIO-ECONOMIC FACTORS INFLUENCING PERFORMANCE OF FISH FARMING IN KWANZA CONSTITUENCY- TRANS-NZOIA COUNTY, KENYA.

VICTORIA LINDA ANDAYI

A Research Project Submitted in Partial Fulfilment of the Requirements for the Award of the Degree of Master of Arts in Project Planning and Management, University of Nairobi.

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DECLARATION

This research project report is my original work and has not been submitted for any otheraward to any university

…… Date ……...

Victoria Andayi

L50/6482/2017

This research project report has been submitted for examination with my approval as the university supervisor

…… Date ……...

Dr. JoashMigosi.

Lecturer,

Department Of Open and Distance E-Learning Studies,

University of Nairobi.

DEDICATION

I dedicate this work to my entire family for their emotional and financial support. To my dad Joel Omutiti for his financial support. To my brothers Oliver Oluteyo and Grey Mausi for their financial support and advice. To my sister Valentine Amunga for her encouragement and financial support. To my in-laws Margret Muriuki for her guidance and HellenVurache for providing a peaceful environment for my studies. To my lovely mom Rebecca Omutiti for your guidance, love, patience, advice and encouragement.

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LIST OF ABBREVIATIONS AND ACRONYMS

CRSP: Collaborative Research Support Programme

ESP: Economic Stimulus Program

FAO: Food and Agricultural Organization of the United Nations

FFEPP: Fish Farming Enterprise Productivity Programme

GOK: Government of Kenya

KSHS: Kenya shillings

MOALF: Ministry of Agriculture, Livestock and Fisheries Development

MT: Metric tons

NGO: Non-governmental organization

UNDP: United Nations Development Programme

USAID: United States Agency for International Development

ABSTRACT

The purpose of this study was to investigate socio-economic factors influencing the performance of fish farming in Kwanza Constituency, Trans-Nzoia County. Specifically, the study sought to investigate how farmer knowledge and skills, farmer cultural factors, access to credit facilities and cost of production influenced fish farming performance in Kwanza Constituency. The design empoyed was descriptive survey research design that used both quantitative and qualitative methods. The study targeted all 401 documented fish farmers, both small and large scale, active and dormant; spread across the four wards of Kwanza Sub-county namely Keiyo, Kwanza, Kapomboi and Bidii wards. The study also targeted four ward fishery extension officers and the sub-county fishery extension officer. Krejcie and Morgan's sample size calculation was employed to get 196 fish farmers for the sample. Simple random sampling technique was used in selecting both active and past fish farmers with one or more fish ponds in every ward to

participate in the study. The questionnaire return rate was 170 (86.73%) out of 196. Out of the 170 questionnaires, 20 were spoilt leaving 150 (76.53%) questionnaires used for data analysis. Closed-ended questionnaires were used on fish farmers whereas; interview guides were employed in obtaining data from all the 5 fishery extension officers in the sub-county. Quantitative data analysis involved frequencies, percentages, mean and standard deviation. Collected data was processed using Statistical Package for Social Sciences (SPSS) version 21.Content analysis method was employed on qualitative data collected through interview guides in their respective themes. The findings were presented in tables and explanations in prose. Inferential statistics which is multiple linear regression analysis was used as illustrated by the model $Y=\beta_0+\beta_1F_1+\beta_2F_2+\beta_3F_3+\beta_4F_4+$ e. The findings were that three factors; farmer knowledge and skills, farmer access to credit facilities and cost of production had a significant influence on the performance of fish farming while cultural factors did not. Of the three independent variables that had significant influence on performance of fish farming, cost of production had the greatest influence at 0.001 followed by access to credit facilities at 0.007 and finally farmer knowledge and skills at 0.040, at $P<0.05$. The researcher concluded that socio economic variables highly affect performance of fish farming. The recommendations of the study were that there is need for the government to step in and help the farmer's access subsidized feeds and standardized fingerlings and also make credit facilities readily accessible. Further the study recommended that farmers could improve production levels with financial support and increased extensional services. More extension officers should be hired to cater for the shortage of staff. Extension services should be increased to help farmers acquire adequate knowledge and skills for the sustainability of the fish farming projects.

CHAPTER ONE

INTRODUCTION.

1.1 Background to the Study

Fisheries sector has the potential to grow and significantly contribute to Kenya's economy through food security, household income, creation of employment opportunities and foreign exchange earnings. Data from the department of fisheries (MOALF, 2015), points out that the fish sector benefited a total of 323,845 Kenyans who directly derived their income as farmers or fishermen. Out of this number, 75,567 or 23.33% were fish farmers and the rest were fishermen. Further, the ministry reported that over 1.5 million Kenyans also benefited as traders, fisher folks, processors or suppliers.

According to statistics from FAO (2016), Kenya produced 189,346 metric tons of fish in 2015, valued at US $ 102 million and approximately US $ 68 exported to Europe and other nations. However, the same report stated that fish production in Kenya has been decreasing since 1999 when the country recorded the highest yield (214,709 MT) of fish. This implies that with current global market prices, the country could be reaping big from the sector if it still produces the same quantity of fish.

Over 85% of fish exported or consumed in Kenya is produced from Lake Victoria. However, fish from Lake Victoria and other natural water bodies has been declining rapidly due to heightened over-fishing, water pollution, loss of fish biodiversity, water hyacinth and eutrophication (Maina, 2014). Maximum annual output now stands at 12MT against a potential annual production of 150,000MT (MOALF, 2017). Boshnakova, (2010) in his study determined that the number of Nile Perch in Lake Victoria which is a highly valued fish species is at the brink of being declared extinct.

Consequently, the Ministry of Agriculture, Livestock and Fisheries under the national oceans and fisheries policy has prioritized fish development as their major focus. The main goal according to the ministry is to lessen fishing pressure on rivers, lakes and oceans. Other goals include improving food security and nutrition, creation of wealth and jobs and economic development through foreign exchange (FAO, 2016).

The United Nations through the department of food and agriculture in its annual report stated that fish farming is one of the rapidly growing food production industries globally. The production of fish has increased in developing nations and the number of cultured species has also gone up. However, aquaculture in the world is still dominated by pink shrimp in South Africa, tilapia in Africa, carp in India and milkfish in Philippines (FAO, 2017). The same report warned that Kenya risks losing the highly valued Nile perch species if stringent measures are not taken by the government of Kenya to tame over-fishing and pollution in Lake Victoria.

In many nations particularly in Africa, fish farming is done on small scale just for domestic use or taken to rural markets. To encourage commercialization of fish farming, the state department of fisheries has been formulating policies that will ensure sustainable fish production in Kenya. Part of policy implementation has been the spread of awareness among Kenyans to take fish farming as a viable business and best option to failed agricultural ventures. This government initiative has also attracted other development partners such as USAID, collaborative research support program (CRSP) into awareness campaign (Kwamena, Ngugi and Amisah, 2015).

In most sub-Saharan Africa nations, challenges such as increased population, food insecurity and malnutrition has justified the urgency to develop the fish farming sector. Back in the late 1960s, the government of Kenya adopted "Eat more fish" campaign slogan as a way of raising awareness of need to increase fish production and consumption. Consequently, the farming of tilapia quickly extended due to development of fish ponds in both western and central provinces (Maina, Mbuthia, Ngugi and Omolo, 2014).

People's livelihoods in Kenya especially with increased climate change, inadequate water supply and reduced sources of incomes (CIA, 2013) have been affected. Fish farming is one of the best strategies to boost livelihoods in developing countries like Kenya (FAO, 2016). Mwangi (2015) portrayed fish farming households as the most secure households in Kenya due to the potential of the venture to earn them constant income. Because of this, fish farming development in Kenya has since been stimulated in the country to enhance people's livelihoods especially in rural areas.

However, according toMwamuye, Cherutich and Nyamu (2012), the number of active fish ponds started declining rapidly and by 1975, less than 38% of ponds were productive. This was attributed to insufficient extension services, low quality fingerlings and incompetent

extension officers. The low pond fish production continued until mid-1990s when the government of Kenya introduced the department of fisheries to specifically address the issue of fish development.

The department of agriculture embarked on a massive renovation of fish ponds, training of extension officers and roll out of research programs. These government efforts seemed successful when the country recorded the highest fish production in 1999. However, the celebration was short-lived since production started declining again until 2011 when the government decided to revive the sector through economic stimulus program. As expected, the sector picked briefly before it started going down again (Liti, Cherop, Munguti. Chhorn, 2016)

In developing countries such as Kenya, aquaculture commercialization is yet to be widespread. This is due to persistent systemicuncertainties and challenges such as poor policies, pest and disease outbreaks, bad weather conditions, poor technology and lack of population good will. Despite these challenges, the sector has a lot of potential in Kenya (Oriaro, 2011).

According to Ngugi, Bowman and Omolo(2017), pond based fish farming has a great potential in Kenya especially the Nile perch and African catfish. Despite this potential, aquaculture farming is yet to be fully explored. Fish farming programs in the country have been launched severally since independence-1963 and failed terribly.

Both the private sector and the government of Kenya have the responsibility and ability to improve fish farming in Kenya (Mwangi, 2015). The 2010 economic stimulus program on aquaculture farming brought several changes and hope of revival of the industry. The main objectives of the program were to commercialize the fish farming sector, create job opportunities through the sector and fight malnutrition in the country. As part of the program implementation, farmers were funded by the government to construct fish ponds and purchase high quality fingerlings. Further, the government strengthened extension services (Hino, 2011). The number of fish farmers as well as fish production levels in the country surprisingly went up. According to the study done by Maina *et al.* (2014), fish production in the country had started declining as a result of many farmers abandoning the venture for other businesses. Decreasing fish production is evident in Kwanza Constituency as seen in the Ministry's report.

Table 1.1: Fish Production in Kwanza Sub-County 2010-2017

Year	Fish Ponds	Fish Farmers	Fish Production (Kg)
2010	501	271	1617
2011	537	313	14373
2012	552	317	22071
2013	601	362	18361
2014	812	376	13478
2015	924	386	13522.7
2016	1272	398	2033.4
2017	1297	401	7218

Source: Kwanza Sub-County, Office of Livestock and Fisheries (2017)

1.2 Statement of the Problem

Despite the Kenyan government putting in tremendous effort to improve fish farming, fish production has been persistently going down in Kwanza sub-county in the last five years. Data from the Agriculture, Livestock and Fisheries ministry shows that contrary to fish production in the sub-county having a potential worth Ksh 50 million per year, it only managed to produce fish worth Ksh 3.9 million in 2017(MOALF, 2015). Worse still, most of the fish farming projects started as an economic stimulus program by the government in Kwanza sub-county have stagnated or been abandoned. There is therefore need to establish the factors that strongly contribute to the low productivity of fish in kwanza constituency.

Very few research projects have been based on socio-economic factors in Kenya. Only one study has been done in Kenya by Maina *et al.* (2014) focusing on socio-economic factors but was based on different parameters namely, gender, age and marital status. Another study by Njeru (2013) on factors influencing fresh water fish farming in Embu North District was based on ecological and marketing factors. Thus, there is still a gap in information as far as pond farming and crucial socio-economic factors influencing fish farming in Kenya is concerned.

This study will therefore, establish the effect of socio-economic factors on fish farming in Kwanza Sub-County, Trans-Nzoia County, Kenya.

1.3 Purpose of the Study

The purpose of this study was to investigate the socio-economic factors influencing the performance of fish farming in Kwanza Constituency - Trans-Nzoia County.

1.4 Objectives of the Study

i. To determine the influence of farmer knowledge and skills on performance of fish farming in Kwanza Constituency - Trans-Nzoia County.
ii. To determine the influence of farmer cultural factors on performance of fish farming in Kwanza Constituency - Trans-Nzoia County.
iii. To investigate the influence of farmer access to credit facilities on performance of fish farming in Kwanza Constituency - Trans-Nzoia County.
iv. To determine the influence of cost of production on performance of fish farming in Kwanza Constituency - Trans-Nzoia County.

1.5 Research Questions

i. To what extent does farmer knowledge and skills influence performance of fish farming in Kwanza Constituency - Trans-Nzoia County?
ii. To what extent do farmer cultural factors influence performance of fish farming in Kwanza Constituency - Trans-Nzoia County?
iii. To what extent does access to credit facilities influence performance of fish farming in Kwanza Constituency - Trans-Nzoia County?
iv. To what extent does cost of production influence performance of fish farming in Kwanza Constituency - Trans-Nzoia County?

1.6 Significance of the Study

The national government of Kenya and county governments would greatly benefit from information. This information would assist policy makers make sound policies to promote fish farming development by considering and addressing socio-economic issues affecting fish farmers' activities and taking advantage of economic opportunities available in aquaculture sector. Both the national government and county government would only use this information to improve its engagement with fish farmers through effective funding mechanisms and training.

Other development partners such as FAO, UNDP would also utilize this information to plan and fund fish farming programs to address poverty and food security. Finally, farmers would use the information to confront and address socio-economic factors affecting their aquaculture business.

The study will also be of great value to future researchers and scholars undertaking research projects on socio-economic factors influencing fish farming since it may be cited in literature. Also, through recommendations for future studies, the study may help researchers in developing their research titles.

1.7 Assumptions of the Study

The researcher's assumption was that the data which was given by farmers reflected on the socio-economic factors influencing fish farming performance in Kwanza sub-county. The researcher also assumed that farmers who were sampled were representative of the target population and that participants were able to fill questionnaires independently. The study relied on primary data. An assumption taken was that environmental conditions and rainfall patterns were homogenous in Kwanza Constituency.

1.8Limitations of the Study.

Limitations are circumstances beyond the researcher's control that may put restrictions on data collection, conclusions and applications of the study (Frankline&Wallen, 2014). The study was limited in scope due to budget and time constraints. This was addressed by focusing on selected fish farmers from the study area who were accessible and limited to the four wards chosen for study.

1.9Delimitations of the Study

"Delimitation is a process of minimizing the study area and population to a manageable size" (Frankline&Wallen, 2014). The study was restricted in terms of scope. Although there are other socio-economic factors influencing fish farming, this study was only focused on farmer knowledge and skills, accessibility to credit facilities, cost of production and farmer cultural

factors. This study was also limited to the four wards of Kwanza Constituency namely; Kampomboi, Bidii, Keiyo and Kwanza. The study considered both farmers who had abandoned fish projects and active ones.

1.10 Definition of Significant Terms

Fish farming: This is a type of farming that involves rearing of fish in ponds, tanks or enclosures for either domestic or commercial purposes.

Performance: This refers to the extent, to which fish farming investment is productive, profitable as well as contribution to income and food security.

Socio-economic factors: These are factors that influence investment, consumption behavior, attitudes and lifestyle of a certain class or group of people towards fish farming.

Cost of production: the total sum of money used for the production of fish

Cultural factors: beliefs, set values, traditions, laws and behaviors on indigenous fish farmers.

Access to credit: ability to get, credit, deposit, and make payments and benefit from insurance services.

Knowledge and Skills: information obtained through education, service or training.

1.11 Organization of the Study

The first chapter of the project gives an introduction of the study then background of the study, statement of the problem, purpose of the study, objectives of the study, research questions, significance of the study, basic assumptions of the study, limitations of the study, delimitations of the study and list of significant terms.

Chapter two contains literature review which consists of socio-economic factors influencing fish

farming performance, theories of development, conceptual framework, research gaps and summary. This is derived from empirical studies of scholarly articles and journals on the internet and relevant books.

Chapter three describes the research design, target population, sampling techniques and sample size, data collection procedures, validity and reliability of research instruments, data analysis and presentation, ethical considerations and operationalization of variables.

Chapter four contains data analysis, presentation, interpretation and discussion.

Chapter five entails summary of findings, conclusions, contribution to the body of knowledge, recommendations and suggestions for further research.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

The chapter examines literature relating to fish farming. Aquaculture development in Kenya is briefly described. The chapter also presents empirical studies on farmer knowledge and skills and fish farming, farmer cultural factors and fish farming, farmer accessibility of credit facilities and fish farming, and cost of production and fish farming. Finally, the theoretical framework, conceptual framework, research gap and summary of literature review.

2.2 Concept of Socio-economic Factors and Performance of Fish Farming.

Aquaculture or fish farming is one of the most rapidly growing industries worldwide. It is estimated that aquaculture farming contributes 47% to total fish production in the world. It is also estimated that due to the fast growing population, an additional 23 million tons of fish food will be needed in the world by 2030. To meet this demand, nations will have to turn to aquaculture farming since natural fish production has almost reached the limit (Brummett& Williams, 2014).

Aquaculture was first introduced in Kenya in 1890 in the form of sport fishing. Then in 1920 in the control of mosquitoes, snails, leeches and aquatic weeds, stagnant water pond culture of carp, catfish and tilapia was constructed. In 1940, aquaculture farming was started in Kenya but on small scale and was only commercialized in 1960s when the government of Kenya introduced the program “eat more fish”. The government also tried to double fish production by introducing marine fish farming in the late 1970s but never succeeded (Rothuis, Van Duijn, Van Rijsingen, Van der Pijl&Rurangwa, 2011).

Accordingly, to the department of fisheries (Kenya), fisheries development has been very slow in Kenya due to many obstacles. They include lack of proper information on the aquaculture development, cultural variations that do not support fish farming, uncertainty on returns and lack of political good will. Other factors include low investment by Kenyans in the sector, high running costs and lack of access to quality fingerlings (MOALF, 2015).

Kenya has a great potential for fish farming. According to (Rothuis*et al.,* 2011) aquaculture can offer high prospects for sustainable food security and incomes for the rural communities. Many fish species can be supported in the country because of variations inclimatic conditions. It also has many parts to support aquaculture farming owing to the fact most regions receive adequate amount of rainfall throughout the year (Alal, 2012).

Several economic factors as pointed out by Ridler and Hishamunda (2013) are very significant in aquaculture development. These factors include access to quality feeds, fingerlings, land security tenure, technical labor availability, water resources and access to adequate credits. On the other hand, Kundu (2010) identified several social factors such as age, education level, gender, occupation and cultural factors that influence fish farming. Better understanding of these factors, is very crucial in policy formulation and implementation for successful aquaculture projects. Trans-NzoiaCounty is endowed with thenecessary natural resources and weather conditions that signify the potential for aquaculture development. There is adequate rainfall, several rivers, wetlands, streams as well favorable climatic conditions.

2.3 Farmer knowledge and skills and Fish Farming

A study by Singas and Manus (2014) on factors affecting the practice of pond farming in Papua New Guinea showed that inadequate skills and knowledge was the main impediment to sustainable aquaculture farming. The study also showed that although97 % of the farmers who took part in the study had formal education (primary-university), they still lacked necessary skills and knowledge to practice aquaculture farming using high technology. However, most farmers indicated that they are not well supported by the government to obtain the training. Similarly, Njankouawandji, Pouomogne, NyemeckBinam and Nouaga(2012) found out that fish farming training and education was majorly affecting fish productivity.

A study by Abiona, Fakoya, Apantaku, Alegbeleye, Ajayi, Obasa and Arowolo, 2012), contended that a major limitation to the fish sector development is absence of systems to spread existing research information and knowledge. They further argued that for a farmer to improve the productivity in the farm, regular monitoring and maintenance of fish ponds, examining water quality, possible pond leaks, ensuring pond hygiene and fish observation requires prior adequate

training. Farmers also need refresher short trainings to keep updated with current aquaculture technological practices.

"Inadequate skills and knowledge have been a hindrance to the development of fish farming in Kenya". Mwangi (2015) in his study report pointed out inadequate technical services due to a limited number of government extension officers as the main impediment to aquaculture success in Kenya. He further claimed that the few extension officers available were not well equipped with practical aquaculture skills to adequately attend to farmers' needs. Similar results were found by Ngugi*et al.* (2017). However, the two researchers did not determine the significance of the influence of inadequate technical skills and services on investment in commercial aquaculture projects.

2.4 Cultural Factors and Fish Farming

The lack of traditional culture for aquaculture farming especially in Africa has been a major social constraint. Maina *et al.* (2014) in a study on socio-economic factors and fish productivity indicated that culture has a significant influence on fish farming. There was also a strong correlation (+0.86) between culture and gender. In another study, Wetengere (2010) revealed that cultural factors were the major issues that caused the failure of numerous fish projects that were funded by USAID in Panama and Guatemala in the 1980s.

Onzere (2013) in his report argued that fish farming acceptability by the community was a major challenge and recommended that community sufficient support was necessary for sustainable aquaculture farming. The report further stated that consumer perceptions and preferences were main factors that affected demand of fish. Most interviewees said they weren't ready to abandon livestock farming for aquaculture business since their culture did not allow. According to Shitote, Wakhungu and China *(*2012), environmental degradation that comes with intensive fish farming was a major factor affecting adoption of fish farming.

2.5 Accessibility to Credit Facilities and Fish Farming

Adu (2015) found out that financial institutions were always willing to finance construction of fish ponds through loans but could only do so to economically established borrowers. Banks could only give loans equivalent to the current value of attached assets

(collaterals) at the time. Fish farmers could also not access credit at their nearest branches; rather they were being referred to the head office in Accra. Consequently, as established by Adu, most potential fish farmers abandoned their plans to set up fish ponds.

In a study done by Ugwumba (2011), it was established that a majority of aquaculture farmers (53%) joined cooperative movements to increase their chances of accessing credits, quality fingerlings and feeds. However, the study did not determine the level of significance of this factor on the influence of fish farming among the sampled farmers. Ngugi*et al.* (2017) got similar results that farmers always want to form associations or join cooperatives with the aim of benefiting from credit facilities. Further, the relationship between credit access and fish farming was significantly positive.

In a study by Kalinda, Shute and Filson (2013) on accessibility of credit by Zambian farmers, it was established that farmers are highly limited in their quest to access credit services from commercial banks. The study also revealed that Zambian government lacked policy and goodwill to support farmers through direct issuance of loans to farmers or aiding them obtain the same facilities in financial institutions. This is despite Vetrivel and Selvi's (2012) findings that credit permits farmers to adopt new technologies, improve production and contribute to national food security.

Many fish farmers in Kenya as determined by Oloo (2011) in his study faced problems in terms of access to credit. 84% of those sampled said that they could not access credit from commercial banks due to inability to offer enough collateral. However, the study did not show the significant influence of inability to access credits on the performance of their aquaculture projects.

2.6 Costs of Production and fish Farming.

Brummet and Rana (2010) argued that the cost of fish feeds is estimated to be 40-70% of total production costs. This implies that practicing large scale fish farming requires a great investment in terms of physical resources and finance. According to Ogello, Mlingi, Nyonje, Charo-Karisa and Munguti (2013), financial resources are needed to cover starting costs, operational costs such as purchasing top quality fingerlings and feeds. On the influence of cost of

production on fish farming, Singas and Manus (2014) established that the cost of buying fish feeds significantly affected the productivity of fish farming business in Papua New Guinea.

Gamal, Nasr-alla and Kareem (2012) conducted a study on factors affecting fish farming in Behera governorate of Egypt. A correlation matrix was performed and revealed a high positive association between fingerlings quantity, revenues generated from the project, costs of feeds and transportation costs. It was determined that fish seed was the strongest factor influencing aquaculture commercialization. In another study, Olawumi, Dipeolu and Bamiro(2010) sampled 72 fish farmers to carry out an economic analysis of fish yielding in Ogun state Nigeria. He applied regression models and budgetary and determined that the size of ponds, quantity of fingerlings, feeding labour, use of poultry waste feeds, harvesting, stocked influenced the profitability of aquaculture farming.

Uguoma, Ohajianya and Nwosu (2010) conducted a study on the aquaculture performance amongst a hundred smallholder fish farmers in resource efficiency in Imo state, Nigeria using stochastic translog frontier production function model. They revealed that fingerlings, water, fertilizer, labor, feed and starting capital were significant. In a similar study, Ugwumba (2011) performed an analysis of systems of farming catfish and its influence on net earnings in Anambra state, Nigeria. Results showed that farm area, cost of feed, stock size had a significant influence on net earnings of 204 farmers sampled.

In a study done by Oladejo (2010) in Oyo state Nigeria on analysis of smallholder catfish farming showed how the cost of production affects the aquaculture. An association between cost of production and earnings was determined using regression analysis. He found out that cost of hiring land, purchase of high quality fingerlings, costs incurred in pond construction, transportation costs, feed cost and employee compensation were significantly influencing performance of commercial aquaculture and profits.

Ndu (2010) investigated costs and profitability as factors influencing fish production in Chikun and Kaduna States in Nigeria. He used questionnaires to collect data from 40 fish farmers randomly sampled using multiple stage technique. Descriptive statistics and budgeting technique were employed in data analysis. The study was spread across two years. The results showed that water, land, labor and capital were the major factors of production employed in aquaculture business. The analysis of costs and revenues revealed that the cost of running the venture was higher at 97.63% as compared to capital investment which stood at 2.37%. The cost-

revenue analysis also indicated that farmers on average obtained 33.33% profit showing that pond production was a profitable investment.

2.7 Theoretical Framework

The main theory of this study was that of Allocative Efficiency. According to this theory, Allocative efficiency is the enterprise's ability to optimally and correctly use inputs to realize higher returns (Inoni, 2007). The theory advocates for an efficient level of production, where the business owner runs the business at the least-cost combination of factors of production.

The current study adopted allocative efficiency theory that farmers should apply to apportion inputs for profit optimization. This theory requires farmers to select the right mix of inputs to obtain highest output possible. The theory assumes that there is a perfect competition on input and outputs markets. This is because farmers are price absorbers and are assumed to be in possession of the right information about the market. Also, all farm inputs are assumed to be of the highest quality from the market.

In other terms, allocative efficiency theory can be expressed as the ratio between sum of all costs of yielding one unit of output in optimal production manner and the total cost of yielding one unit of output (Inoni, 2007). Therefore, for the fish farmer to optimize returns, under competitive markets that require additional revenue obtained from using additional unit of input to be the same ton its unit cost (Chukwuji, 2006). In relation to this study, the theory states if the fish farmer is to allocate resources in an efficient manner and optimize its revenues, the condition of marginal value product must be equal to marginal cost. This is with respect to influence cost of production on fish.

Alternative development theory was another theory that informed this study. This theory stresses on human welfare and economic development using alternative ways. It rejects the idea that failure in one sector of the economy means the end of life (Martinussen, 1999). The theory was first put forward in the early 1970s to criticize the conventional economic model of modernization that was unable to solve issues such as environmental sustainability and massive poverty. The theory was advanced by John Friedman who viewed past attempts to economic development as a big flop and alternative economic development as a source of hope. Alternative

development was considered a solution in enhancing the welfare of the poor particularly in rural settings while ensuring environmental sustainability.

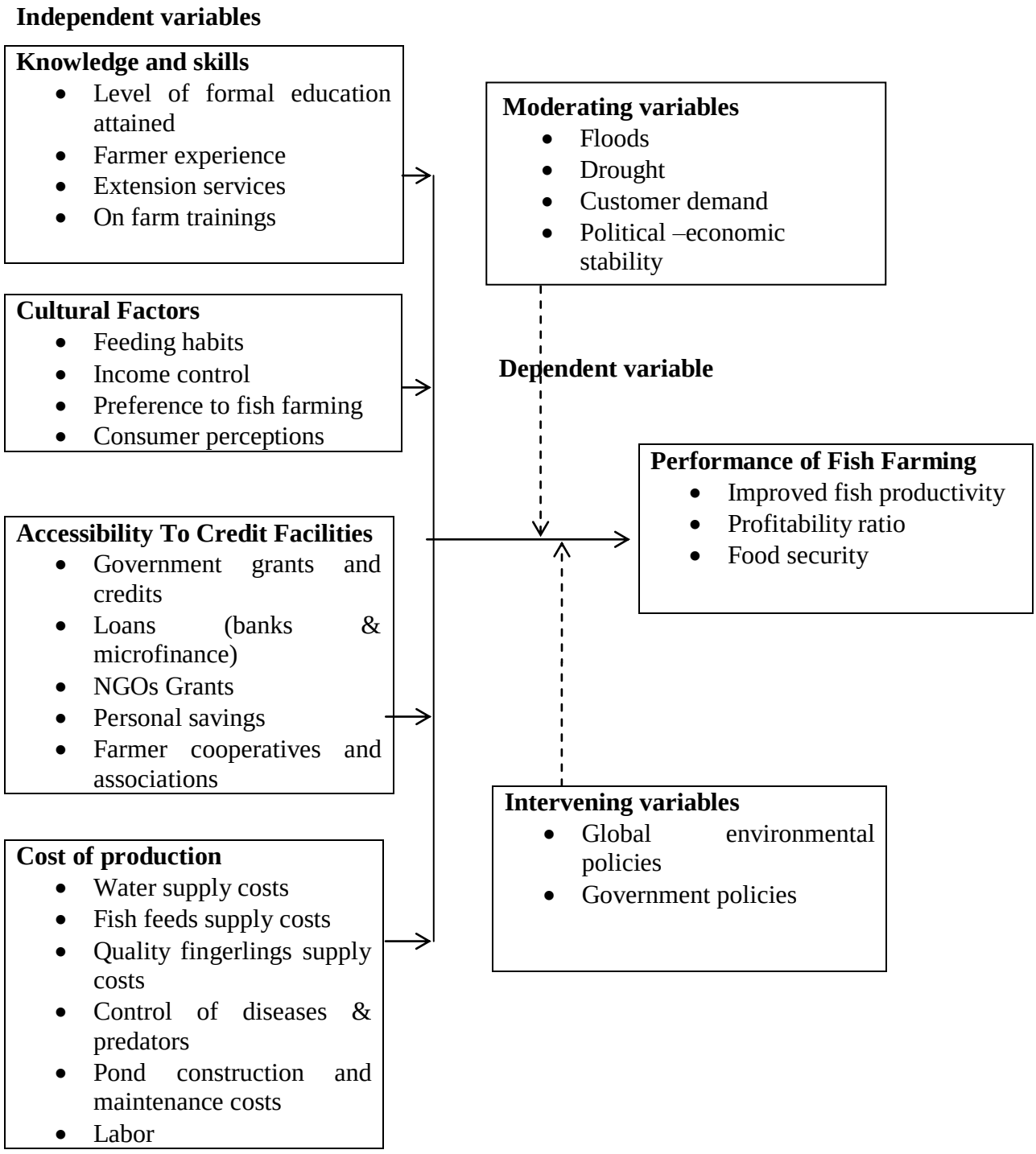
A major idea behind this theory was not to substitute the conventional development path but rather to champion the transformation agenda so that all people including the poor can contribute to economic and political processes and also have their rights respected. The theory therefore, promoted a bottom-up approach with the major focus on thewelfare of people and not just profits. Alternative development concentrates on achievement of strategic interests by bringing all the people on board and empowering them to take care of themselves. The theory emphasizes that it's only through bottom-up approach and people-centered approaches that the nation can realize collective social, economic as well as political empowerments. Through this theory, fish farming is considered as the best alternative source of income and food for all Kenyans either as farmers or traders. The theory also emphasizes as an alternative to the natural way of getting fish, pond farming can be more productive thus helping to lessen heightened overfishing in natural water bodies and promoting environmental sustainability.

The study was also guided by symbolic interaction theory. This theory advances the fact that people cannot act in isolation, neither live without interacting and exchanging ideas. This perspective is premised on the belief that communication through symbols and language is how human beings make sense of social life. According to Herman and Reynolds (1994), this theory considers people as very active in shaping their environment and destiny, rather than as bodies who can be moved by their societies. This theory looks at the people and society at large from micro-level point of view. The use of the theory in this study assisted in analyzing families, communities and society's behavior towards fish consumption and involvement in farming activities.

2.8 Conceptual Framework

A conceptual framework is basically "a structure that comprises a summary that reflects the experiential, observational, synthetical or the analytical elements of a conceived research process. The relationship between these elements realizes the framework for specific expected results" (Bogdan&Biklen, 2003). A dependent variable is a factor that is assumed to be influenced by the independent variable. This means that a dependent variable (output) is determined by the independent variables (input).

Figure 2.1: A Conceptual Framework Showing the Relationship between Socio-Economic Factors and performance of Fish Farming



According to figure 2.1, it was conceptualized that the independent variables: farmer education level, farmer accessibility to credit facilities, cost of production and farmer cultural factors would influence the dependent variable- performance of fish farming. This is the factor that was measured in the study and it's what was affected during the study. Fish farming performance was measured in terms of improved fish productivity, venture profitability, food and security. The way socio-economic factors influenced fish farming performance was moderated by floods, drought, customer demand and political- economic stability of the study area.

2.9 Research Gap.

The literature review shows that aquaculture has a huge potential for growth in Kenya. However, fish farming is still practiced at very low levels and is alarmingly declining in fish producing areas. Socio-economic factors are so dynamic and their influences on certain activities are region specific. Past studies have been done to address similar issues in other areas using different parameters. There has been a study in kwanza that has been centered on gender issues influencing fish farming. Therefore, there was still need to examine the socio-economic factors to find out their influence on the low levels of fish production in Kwanza sub-county, Trans-Nzoia County.

2.10 Summary of Literature Review

The literature review examined past studies on socio-economic variables influencing fish farming performance in specific areas worldwide. The literature review was done so as to identify knowledge gaps and build direction and support for the study. In the reviewed literature, farmer access to credit facilities, farmer education level, production costs and farmer cultural factors were examined in relation to their influence on fish farming performance in Kenya.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction

This chapter presents research design, target population, sampling procedure and sample size, instruments of data collection, reliability and validity of research instruments, data collection procedure, data analysis and presentation, operational definition of variables and ethical considerations.

3.2 Research Design

Kothari (2004) said a research design is "the organization for gathering and analysis of data in a way that aims to achieve relevance and meet objectives of the study". The design used was descriptive survey research design. A descriptive survey research design enabled the researcher to gather large quantities of qualitative and quantitative data at a particular time. The research design was considered suitable because it helps show the current state of fish farming in the Kwanza Constituency without changing the study variables.

3.3 Target Population

Mugenda and Mugenda (2003), states that "target population is the total number of objects or individuals to which the researcher intends to study and make some generalizations about them". This study targeted all 401 documented fish farmers, both small and large scale, past (those whose projects stalled) and present; spread across the four wards of Kwanza Sub-county: Kwanza, Keiyo, Bidii and Kampomboi. The study also targeted four ward fishery extension officers and the sub-county fishery extension officer.

3.4Sampling Procedure and Sample Size

The sampling method applied was the probability sampling method. Probability sampling ensures every unit of the population has a chance to be selected in the sample which can be

accurately determined. The sample size representative of the fish farmers in this study was 196. It was determined based on the Krejcie and Morgan's sample size table (Krejcie and Morgan, 1970).

3.5 Research Instruments

This study employed qualitative and quantitative data collection methods. For quantitative data questionnaires were used. They were filled by the fish farmers. A questionnaire "is a set of standard questions formulated to assist in data collection during the study" Mugenda and Mugenda (2003). The study used closed-ended questionnaires to reduce biasness. Questionnaires were preferred since they were easy to administer to fish farmers who are scattered in the study area. They were also suitable to gather large amounts of data in a short span, for easy analysis and interpretation.

Qualitative data was obtained using an interview guide by conducting interviews with the five fishery extension officers in Kwanza Sub-County. According to McNamara (2009), "an interview guide is a number of questions that the researcher asks during the interview". Interviews were preferred on the fishery extension officer of Kwanza-Sub County and ward fishery extension officers from all the four wards. Interviews were used on these groups because they were few and allowed for direct interaction with the respondents and the collection of in-depth qualitative information that the questionnaires could not gather. Interview guides also provide flexibility, the ability to analyze and clarify answers and provide high response rates (Kothari, 2004).

3.5.1 Piloting of Instruments

A pilot study is an exercise done to test whether research instruments will produce similar and valid results. Piloting is necessary to establish whether there are errors or weaknesses in the research instrument so that they can be corrected and standardized before the main study (Dooley, 2007). In pilot study, 20 fish farmers located in Kiminini Sub-County were sampled using purposive sampling technique. "A pilot sample in a survey research must be 10% of the target group," Connelly (2008). Purposive sampling enabled the researcher reach a sample

quickly. The method is also suitable because “sampling for proportionality is not the main concern in pilot study” (Dooley, 2007).

3.5.2Validity of Instruments

“Validity is the suitability, accuracy and relevance of contents of research instruments” Ngechu (2004). It’s the level at which findings generated from data analysis are representative of the phenomenon under study. Content validity was applied in this study. “content validity is the degree at which the instrument of data gathering offers adequate and acceptable coverage of the subject under study” Kothari (2004). Content validity was established by the supervisor who had an opportunity to carefully go through the questionnaire and interview guide.

3.5.3 Reliability of Instruments

“Reliability is the ability of research instruments to produce similar findings in every round of trial under same conditions” Mugenda and Mugenda (2003). In this study, a split half method was used in establishing reliability. Questionnaires filled by participants in the pilot study were given arbitrary scores. Two sets of scores were produced from similar test, one set from even items and another set from odd items. The findings were used to calculate correlation coefficient. As Nsubuga (2003) stated, a reliability correlation coefficient of the research instrument equal to or more than 0.75 denotes the instrument is reliable and appropriate for data gathering.

3.6 Data Collection Procedure

First, a letter of introduction was acquired from University of Nairobi to aid in application for a study permit from National Council of Science and Technology and Innovation. Second, armed with a study permit, the researcher proceeded to Kwanza Sub-County, livestock and fisheries office for further guidance. Third, farmers were identified and listed down for the study with the help of sub-county extension officers. Fourth, the researcher commenced with the study covering each ward at a time.

3.7 Data Analysis Techniques

Both quantitative and qualitative data were analyzed. Analysis involves finding patterns, describing key variables and testing assumptions about the study (Mugenda&Mugenda, 2003). Items on the questionnaire were cleaned, organized, categorized and coded correctly. Data analysis was done using Statistical Package for Social Sciences (SPSS) software version 21.0. The study also employed descriptive analysis which included mean, standard deviation, percentages and frequency distributions.

In determination of the relationship between independent variables: farmer knowledge and skills, culture, cost of production, access to credit facilities, and fish farming performance. Multiple linear regression model was employed.

The regression model used was;

$Y=\beta_0+\beta_1F_1+\beta_2F_2+\beta_3F_3+\beta_4F_4+ e$

Where:

Y= performance of fish farming

F_1= farmer knowledge and skills

F_2= farmer cultural factors

F_3= access to credit facilities

F_4= cost of production.

$\beta_1, \beta_2, \beta_3, \beta_4$ = coefficients to the independent variables

β_0= Intercept term

e= error term

3.8Ethical Considerations

This study was carried out on a strict ethical code guiding research at the University of Nairobi. The participants were assured of the confidentiality of data provided. The respondents were informed that the data given was purely for academic research and would not be shared by anyone for other benefits. The respondents were treated with respect and their identities protected.

3.9 Operationalization of Variables

Table 3.2: Operationalization of Variables

Specific Objective	Variables	Indicators	Scale of measurement	Methods of Data collection	Tools of data analysis
Influence of Farmer knowledge and skills on Performance of fish farming	Knowledge and skills	Formal education Farmer experience Extension services On-farming training	Nominal Ordinal	Questionnaires Interviews	Content analysis Descriptive statistics Regression analysis SPSS
Influence of culture fish farming performance	Farmer culture	Feeding habits Income control Farming preferences Consumer perceptions	Nominal Ordinal	Questionnaires Interviews	Content analysis Descriptive statistics Regression analysis SPSS
Influence of Farmer access to credit on the Performance of fish farming	Access to credit	Government grants Bank loans Personal savings Farmer cooperatives	Nominal Ordinal	Questionnaires Interviews	Content analysis Descriptive statistics Regression analysis SPSS

Influence of Cost of production on Performance of fish farming	Cost of production	Fish feeds supply costs Pond construction costs Control of diseases and pests costs Fingerlings supply costs Labour costs Maintenance costs	Nominal Ordinal	Questionnaires Interviews	Content analysis Descriptive statistics Regression analysis SPSS

CHAPTER FOUR

DATA ANALYSIS, PRESENTATION, INTERPRETATION AND DISCUSSION.

4.1 Introduction

Findings from the study are presented in thematic arrangement as per the study objectives. It discusses the questionnaire response rate, demographic characteristics of respondents, influence of farmer knowledge and skills on fish farming performance, influence of farmer cultural factors on fish farming performance, influence of farmer accessibility to credit facilities on performance of fish farming, influence of cost of production on performance of fish farming and influence of Socio-economic factors on fish farming performance in kwanza constituency.

4.2 Questionnaire return response rate

A hundred and ninety-six (196) questionnaires representing a hundred percent (100%) of the sample were distributed among the respondents in Kwanza Constituency to be filled. Of the questionnaires, 170 were returned for analysis (86.73%).20 (10.2%) of the questionnaires were incomplete and therefore could not be used. The remaining (76.53%) of the questionnaires constituted the response rate. This number represents the target population according to Mugenda and Mugenda (2003) that "a response rate constituting 70% and above is sufficient and thus allowed the researcher to carry on with data analysis".

A hundred percentage (100%) return rate could not be attained attributing to the heavy rains experienced during data collection which rendered most roads impassable and therefore inhibiting access to some areas. The fishery extension officers played a great role in assisting to retrieve the questionnaires from the respondents in the field.

4.3 Demographic characteristics of respondents.

This section documented the fish farmers' general information. General information explored included gender, age, years of fish farming, mode of fish farming, number of ponds, size of ponds, largest harvest and earnings per year.

4.3.1 Gender of farmers

The farmers indicated their gender on the questionnaires in order to determine the involvement of the two genders in fish farming. The respondents indicated their gender in relation to either female or male and their profile is shown in table 4.1.

Table 4. 1: Gender profile of farmers

Gender of respondents	Frequency	Percentage
Female	60	40
Male	90	60
Total	**150**	**100.0**

It was revealed that many farmers in the fish farming enterprise were male at 60% while female respondents were 40%. This shows that more men were involved in fish farming than women in Kwanza Constituency. This depicts a fair distribution of gender involved in fish farming in Kwanza Constituency.

4.3.2 Age of farmers.

The farmers were requested to choose the category of their age. The age profile is portrayed in Table 4.2.

Table 4.2: Age distribution profile of farmers

Age of respondents	Frequency	Percentage
Less than 25years	4	2.6
25-34 years	28	18.7
35-44 years	70	46.7
45-54 years	24	16.0
55-64 years	14	9.3
Above 64 years	10	6.7
Total	**150**	**100.0**

The outcome of the findings depicted that many respondents in fish farming at 46.7%, were aged between 35 - 44 years while respondents who were less than 25 years were the least at 2.6%. Generally, age distribution was uneven among the respondents.

The researcher wanted to determine the age distribution in order to determine the number of youth involved in fish farming in line with creation of jobs for the unemployed. It also depicts the age bracket that is actively involved in fish farming. It also helps point out the availability of farm labor to work in the fish farms.

4.3.3 Respondents formal education level

The farmers had to state the highest level of formal education attained. This would determine their level of literacy and how well they were able to understand and fill the questionnaires to get valid results. Formal education level is important since it influences knowledge and skill factors involved in fish farming. Table 4.3 shows the outcome.

Table 4.3: Highest level of formal education attained by the respondent

Level of formal education	**Frequency**	**Percentage**
Primary	15	10
Secondary	73	48.67
College	50	33.33
University	12	8
Total	**150**	**100.0**

The study findings on formal education level attained by farmers portrayed that the highest number of respondents had secondary school level of education (73) at 48.67%, primary school level had (15) at 10%, colleges had (50) at 33.3% and (12) representing 8% in universities. This information also shows how adaptable the farmers are in embracing new technology in the fish farming sector. The young farmers were in a better position to access fish farming ideas from other sources like internet rather than waiting for extension officers whereas the older ones were already used to their ways of farming and would need a lot of convincing to

embrace new fish farming technologies. This infers that workers in the fish farming sector in Kwanza constituency are literate and therefore can easily understand trainings.

4.3.4 Respondents years of experience in the fish farming sector

The farmers were requested to state how many years they were involved in fish farming. This was important in order to ascertain their level of expertise in the fish farming sector. Table 4.4 shows the outcome.

Table 4.4:farmers' number of years in fish farming.

Respondent years of experience	**Frequency**	**Percentage**
0- 4years	44	29.3
5-9 years	88	58.7
Above 9 years	18	12.0
Total	**150**	**100**

The study revealed that a high number of farmers (58.7%) had practiced fish farming for 5-9 years. Second were those who had been in the industry for 0-4 years at (29.3%) and the least are those who have been in the sector for above 9 years (12%). Those involved in the sector for less than four years were in a position to embrace new methods of fish farming as compared to those with nine years and above. Those with a lot of experience were used to their way of farming and would be less reluctant to embrace the new methods of fish farming.

4.3.5 Respondents mode of fish farming.

The farmers were asked to state the mode of fish farming they practiced. This was important in order to know the amount of time allocated to the projects in the fish farming sector. Table 4.5 depicts the findings.

Table 4.5: Respondents mode of fish farming.

Farmer mode of farming	Frequency	Percentage
Part-time	129	86
Full –time	21	14
Total	**150**	**100**

The study findings depicted that most farmers practiced fish farming as a part-time venture (86%) whereas only a few were involved full-time (14%). This shows that most of the fish farmers run part-time fish projects and thus not fully involved.

4.3.6 Respondents number of ponds.

The farmers were asked to indicate the number of ponds they owned. This knowledge was useful in determination of production levels of the ponds. Table 4.6 depicts the outcome.

Table 4.6: Respondent number of ponds.

Respondent number of ponds	Frequency	Percentage
1 pond	64	42.67
2 ponds	47	0.61
3 ponds	23	15.33
4 ponds	13	8.67
5 ponds	3	2
6 ponds and more	16	10.67
Total	**150**	**100**

The analysis showed that the highest percentage of farmers owned one pond (42.67%).those with five ponds were at a percentage of (2%). Those with six ponds and more

were 16 with a percentage of (10.67%). This portrays that many farmers practiced small scale fish farming. This affects production since smaller ponds produce less and increase in number of ponds gives alternative boost to production.

4.3.7 Respondents pond size

The farmers were asked to state the size of their fish ponds. The outcome is depicted in table 4.7.

Table 4. 7: Respondents pond size.

Size of ponds (m^2)	Frequency	Percentage
50-400	97	64.67
401-750	28	18.67
751-1100	21	14
1101-1800	4	2.67
Total	**150**	**100**

Table 4.7 depicts that most farmers owned fish ponds with an average size of 50-400 square meters (64.67%). Those with large ponds ranging between one thousand one hundred and one to one thousand eight hundred square meters (1101-1800) were very few (4%). This means that most of them have small ponds thus production is based on the stocking rate. It affects productivity and profitability ratios.

Production rates will also establish whether there is optimal usage of the ponds as per the recommended stocking rate.

4.3.8 Respondents average yearly harvest.

The respondents had to indicate their average yearly harvest. Table 4.8 depicts the outcome.

Table 4.8: Respondents average yearly harvests.

Average yearly harvest	Frequency	Percentage

(kg)		
0-100	98	65.33
101-300	26	17.33
301-500	10	6.67
501-900	16	10.67
Total	**150**	**100**

Table 4.8 shows that, a great number 65.33% of farmers harvested below a hundred kilograms yearly. Farmers who harvested five hundred kilograms and above were the least with a percentage of 10.67%.Most of the farmer had low production rates due to the constraints of the cost of production and poor maintenance.

4.3.9 Respondents yearly earnings.

The respondents were required to indicate the amount of earnings they got on a yearly basis. This would help determine the profitability ratios of the fish project. Table 4.9 portrays the outcome.

Table 4.9: Respondent yearly earnings.

Earnings per year (Kshs)	Frequency	Percentage
Below 5000.00	47	31.33
5001.00-20 001.00	72	48
20 002.00-50 002.00	16	10.67
50 003.00 and above	15	10
Total	**150**	**100**

The study revealed that, the respondents who earned below Kshs5000.00 had the highest frequency of 47 (31.33%) while those that earned above 50,003.00 had the least frequency of 15 (10%). This portrays that many farmers make very little money from the fish farming business

yearly. This is due to poor management of the ponds and the high cost of production that has led to the abandonment of most of the ponds.

4.4Influence of farmer knowledge and skills on performance of fish farming.

The first objective endeavored to determine the influence of farmer Knowledge and Skills on fish farming performance in Kwanza Constituency, Trans-Nzoia County. The respondents were asked whether farmer Knowledge and Skills influenced the performance of fish farming. They indicated their response as depicted in table 4.1.0.

Table 4.1.0: Response on whether farmer Knowledge and Skills influenced the performance of fish farming in kwanza constituency, Trans-Nzoia County.

Does farmer knowledge and skills influence fish farming performance?	**Frequency**	**Percentage**
No	9	6
Yes	141	94
Total	**150**	**100.0**

Table 4.1.0 depicts most of the farmers, 141 (94%) we on the affirmative to the fact that farmer knowledge and skills affected the performance of fish farming. The remaining 9 (6%) said it did not affect the performance of fish farming.

Table 4.1.1: The mean response score on the extent of influence of farmer knowledge and skill factors on fish farming performance in Kwanza Constituency.

Knowledge and skill indicators	Mean	Std. Deviation
Formal education	1.1067	.30972
New technologies	2.4533	1.09659
On-farm trainings	2.8054	1.11911
Seminars/workshops	3.4600	1.26719
Farmer experience	3.5267	1.19673
Extension Services	3.6067	1.31024

Key: Std=Standard

Mean score Key: =>1.0 (No Extent), =>2 (Low Extent) , =>3 (Moderate Extent), =>4 (High Extent) and =>5 (Very high Extent).

From the findings, knowledge and skill factors influenced the performance of fish farming positively. The mean score ranged between 2.8 to 3.6 with an exception of new technology which scored the lowest with a mean score of 2.4. This points to the fact that most of the farmers are reluctant to adapt to new technology whereas some feared that the maintenance costs would be too high to manage.

Extension services offered to the fish farmers had the highest influence on performance of fish farming with a mean of 3.60.The formal education level attained by the farmer had the lowest influence with a mean score of 1.11. Based on the study findings, the formal education level attained by the fish farmer didn't negatively affect fish farming performance .A great number the farmers had attained primary and secondary education with a few with college and university levels. This insinuates that the knowledge and skills obtained by the farmers over time as a result of experience played a major part in the performance of fish farming. Most farmers had not embraced new technologies while some were reluctant and preferred to stick to their old methods of farming.

In an interview conducted to the field extension officers, field days were organized for the farmers yearly. The farmer's education day was conducted yearly and knowledge could also be gathered from Agricultural shows. Information also obtained from the interview indicated that extension services were carried out daily but based on demand. Most respondents however said that they lacked adequate trainings to carry out sustainable fish farming projects. These results concur with Singas and Manus, (2014), that "lack of knowledge and skills, was among the problems facing fish farming projects. This could be the reason why many farmers are not performing well".

Information obtained from the interviews also revealed that Extension services were carried out on a small scale to the farmers based on request to the fishery extension officers. Extension programmes to the farmers were therefore inadequate because there were few extension officers with a large coverage area which put a strain on their service delivery. Most of the operational fish ponds were owned by farmers who had attained the knowledge and skills on a large part from experience, which is farming for more than four years.Fish farming field days were organized on occasional basis.

Extension services were of a significant positive influence on fish farming performance. Farmers provided with extension services performed well as compared to those who were not. These findings collaborate with Ngugi (2007) who reported that "poor government funding to aquaculture extension staff was a major factor affecting the performance of fish farming". The level of significance of the factors was however not indicated. Mwangi (2015) in his study report also pointed out that "inadequate technical services due to a limited number of government extension officers was the main impediment to aquaculture success in Kenya".

New technology had a low contribution to the performance of fish farming at a mean of 2.5.This is because change of technology is very slow and some of the farmers were not ready to adopt them. This derails the fish farming activity among the farmers. The interview report also depicts that adaptation to new technologies in Kwanza Constituency was hampered by hesitation of farmers to adopt new technologies on a preference of sticking to what they were already used to. The hesitation was also caused by the high cost of investment capital which includes pumping

of water, filtration and the high level of management. The new technologies included RAS (recirculating aquaculture system), aquaponics system and hanging ponds in greenhouses.

The interview further pointed out that most of the respondents had not even heard of the new methods and therefore had no options to choose from. These findings echo Chi & Yamada findings that “They have not yet seen the demonstration or not understood or they were worried of low yield and also Old behavior of cultivation practices embedded in farmers for long periods, were not persuaded to use new technology” (Chi & Yamada 2002).

These factors have contributed to the slow pace at which farmers are picking up the use of new technology. Adaptation and the use of technology can be efficient in promoting fish farming if extension officers help the farmers understand the advantages and constraints of fish farming. Organization of enough extensional services, seminars and training workshops and on-farm trainings are essential in promoting fish farming in most rural areas in Kenya. These findings agree with Agbamu (2000) who reported that “the clamors for higher productivity in fish farming can be achieved not only by coming up with improved technology but to properly organize sufficient extension services. This is when the impact of technology can have desired effects on fish farmers”.

Most rural areas in Kenya are remote and dominated by poor fish farmers who cannot afford to sustain their projects without financial or material support. It becomes even worse when the farmers lack the skills to maintain their projects. This leads to stalling of fish projects and wastage of resources that were initially put into the project. A study by Ogello, also pointed out that “despite enormous resources and great potential, the integrated livestock-fish farming has failed to take off due to social and economic challenges. Integrated livestock-fish aquaculture is confined to remote villages by few poor farmers with little knowledge, whose work in most cases is unreported even in national aquaculture statistics.”(Ogello 2013).

4.5 Influence of farmer cultural factors on performance of fish farming.

The Second objective endeavored to determine the influence of farmer Cultural factors on fish farming performance in Kwanza Constituency, Trans-Nzoia County. The respondents were asked if farmer Cultural factors affected the performance of fish farming. Table 4.1.2 indicates their response.

Table 4.1.2: Response on whether farmer Cultural factors influenced the performance of fish farming in kwanza constituency, Trans-Nzoia County.

Do farmer cultural factors influence fish farming performance?	**Frequency**	**Percentage**
No	22	14.67
Yes	128	85.33
Total	150	100.0

Table 4.1.2 depicts a large number of the respondents at a frequency of 128 (85.33%) agreed to the fact that farmer cultural factors influence the performance of fish farming. 22 (14.67%) however disagreed.

Table 4.1.3: The mean response score on the extent of influence of farmer cultural factors on fish farming in Kwanza Constituency.

Indicators	**Mean**	**Standard deviation**
Attitude/perception	2.8467	1.09751
Income control	3.0933	1.08897
Family structure	2.6533	.89732
Fish preference	3.5667	1.23384
Feeding habits	2.9533	.93648
Religious beliefs	1.8800	1.21468

Mean score Key: =>1.0 (No Extent), =>2 (Low Extent) , =>3 (Moderate Extent), =>4 (High Extent) and =>5 (Very high Extent).

From table 4.1.3, the mean score ranged from 2.6 to 3.5 which are above average except for religious practices which had a mean score of 1.8 which is below average. This clearly

indicates that all the other factors including attitudes and perception, income control, family structure, fish farming preference and feeding habits positively contributed to the performance of fish farming. Religious factors had no significant effect on fish farming performance. The findings concur with Mwamuye et al. (2012), when he observed that "cultural factors were said to have caused the failure of many of the subsistence fish culture projects supported through USAID programmes in Guatemala and Panama".

Fish consumption is influenced by feeding habits of the people and the acceptance of fish farming as an activity of the community. We should be concerned on whether farmers accept aquaculture as an activity with enough capability to change from other enterprises to fish farming. Fish farming is yet to be fully embraced by most farmers. This agrees with Ngugi, Bowman and Omolo(2017), that "pond based fish farming has a great potential in Kenya especially the Nile perch and African catfish but despite this potential, aquaculture farming is yet to be fully explored". Attitudes and perceptions of the farmers did affect fish farming though not significantly. Family structure positively contributed to performance of fish farming and so did income control. Generally, there is a low preference for the farming of fish in the area.

An interview conducted on the fishery extension officers revealed that most of the respondents considered fish farming an expensive and demanding enterprise and shied away from it. The farmers preferred poultry, sheep and cattle farming. In his report, Onzere (2013) reported that "fish farming acceptability by the community was a major challenge and recommended that community sufficient support was necessary for sustainable aquaculture farming". There were no religious beliefs or practices that prevented fish consumption or farming. Due to changing feeding habits, more people were encouraged to embrace fish farming to meet the high fish demand in the market.

The interview further revealed that most of the income from fish farming is controlled by men. Pond care is mostly left to children and women which includes feeding. For a large family structure, availability of labor would be ready but it did not necessarily influence fish farming performance. A large number of farmers had to hire labor for pond maintenance practices. Changes in the family structures in Kenya especially in rural areas may negatively affect fish

farming in Kenya including Kwanza Constituency. This can be attributed to reduced number of children in a family, increased single parenting and rural to urban migration.

Haque et al. (2010) explains that "the high levels of uptake and retention of fish farming culture introduced by a rice field-based tilapia seed production project, despite low financial returns, which is attributed to socio-cultural factors appear insignificant if considered discretely". It is evident that the society's attitudes and perceptions towards fish farming are changing for the better. Feeding habits have also changed owing to the mixed culture of communities in Kwanza Constituency and the demand for food. This could have a positive impact on the preference to fish farming which is still quite low as most members of the community prefer other livestock farming to fish farming projects.

4.6 Influence of farmer access to credit facilities on fish farming performance.

The third objective endeavored to investigate the influence of access to credit facilities on performance of fish farming in Kwanza Constituency-Trans-Nzoia County. The respondents were asked whether farmer access to credit facilities influenced the performance of fish farming. They had to indicate whether or not it influenced the performance of fish farming. The outcome is depicted in Table 4.1.4.

Table 4.1.4: Results on whether farmer access to credit facilities influenced the performance of fish farming in kwanza constituency, Trans-Nzoia County.

Does farmer access to credit facilities influence fish farming performance?	**Frequency**	**Percentage**
No	2	1.33
Yes	98	65.33
Total	150	100.0

Table 4.1.4 portrays that 98(65.33%) of the respondents were affirmative to the fact that fish farming performance was influenced by farmer access to credit facilities. 2(1.33%) of the respondents however disagreed.

Table 4.1.5: The mean response score on the extent of influence of farmer access to credit facilities on performance of fish farming.

Indicators	**Mean**	**Std. Deviation**
NGOs	1.0600	.23828
National government	2.4200	1.30188
County government	2.7067	1.67711
Co-operatives	2.8333	1.55186
Family and friends	2.9667	1.01939
Co-operatives	3.1333	1.28839
Bank loans	3.2800	1.53754
Personal savings	4.3302	1.10134

NGO-Non Governmental Organizations.

Mean score Key: =>1.0 (No Extent), =>2 (Low Extent), =>3 (Moderate Extent), =>4 (High Extent) and =>5 (Very high Extent).

The findings from table 4.1.5 show that credit access moderately affected fish farming performance. Availability of Personal savings to fish farmers had the highest influence on performance of fish farming with a mean of 4.33.The least influence was from Non-Governmental organizations (NGOs) with a mean of 1.06.

Analysis showed that the mean score of all variables was between 2.6 to 4.2, indicating that the extent of influence of these indicators is between moderate to high. Respondents' mean score on level of access to credit facilities had positive contribution towards fish farming where personal savings had the highest score of 4.23. NGOs access was a problem and had the least score of 1.06.

Access to NGOs had the least score as the farmers were not aware of any organizations that supported fish farming projects. Personal savings scored the highest. It indicates that most of the farmers with successful fish projects were dependent on their own sources of capital or had other income generating activities to support the sustainability of their projects. Most of the abandoned ponds were owned by farmers who had no alternative sources of income.

A large number of the fish ponds in the constituency were started during the initiation of the Economic Stimulus Programme (ESP) of 2011 which was meant to stimulate economic development countrywide, provide employment and job opportunities for the masses and also address food security. A few individuals however had self-sponsored ponds. The government sponsored ESP gave most of the farmers a boost since it catered for pond construction and the initial supply of fingerlings. Since then there has been no other support from the national government. This is one of the reasons why most of the ponds have stagnated or declined in production. Most of the operational ponds were funded by individuals with alternative sources of employment and personal savings. Friends and relatives were easy to access but their willingness to offer support was not certain. Accessibility to NGOs support was also lacking in Kwanza constituency. This portrayed that farmers were having problems obtaining loans to venture profitably into fish farming.

An interview conducted on the fishery extension officer of kwanza ward revealed that, the farmers had formed cluster groups with a minimum of 8 farmers each. Only a few co-operatives were in existence and functioning. The county government should use the co-operatives as a platform to provide access to affordable loans and subsidized fish feeds. By joining co-operatives, it will be easy for the farmers to access loans, grants, subsidies and any other form of supply for their fish projects. Ugwumba (2011) established that “a majority of aquaculture farmers (53%) joined cooperative movements to increase their chances of accessing credits, quality fingerlings and feeds.” Individual farmers had a difficult time accessing credit and more importantly getting them on time.

The constraints in the study area therefore are linked to inaccessibility to credit for the farmers. This is echoed in a study by Kalinda, Shute and Filson (2013) on accessibility of credit

by Zambian farmers. It was established that “farmers are highly limited in their quest to access credit services from commercial banks”. FAO (2006) also pointed out that “provision of credit is known to fuel household and national economic development”. With access to credit, many fish farmers have a great potential of growing and playing a part in building Kenya economically.

In another interview conducted to the sub-county fishery extension officer, the researcher gathered that bank loans were accessible to those who could provide collateral thus it could be a hindering block to a number of the farmers who were not able to provide collateral so as to be provided with the loans. This meant that the poor farmers had no access to the loans. The interview also revealed that 80% of the farmers had not joined co-operatives that could make them access government grants and credits. The rest of the 20% had formed cluster groups which members used to learn new fish farming techniques from extension workers. It is therefore evident that access to credit facilities in the study area is constrained. All the factors from the analysis had a positive impact on fish farming. Studies conducted by (Mwangi 2008), show that “a lot of challenges face fish farming enterprises in Kenya. Furthermore, comprehensive policies on fish farming and legislation are inadequate”.

Another study that collaborates with this findings stated that “The inadequacy in provision of extension services has been a major challenge to the development of fish farming in Kenya. This situation results from lack of resources and technical staff (GoK, 2010). Additionally, these challenges are met by inadequate entrepreneurship skills by the farmers and lack of credit”. Fish farming has a huge potential in most of Kenya’s rural agricultural areas. With the decentralization of governments and improved technology, access to services can easily be availed to the farmers. It is therefore imperative that the government makes a point of providing sufficient credit accessibility to fish farmers especially those living in remote areas and with limited financial capability.

4.7 Influence of cost of production on performance of fish farming.

The fourth objective was to determine how the cost of Production influenced performance of fish farming in Kwanza Constituency- Trans-Nzoia County. The respondents were asked whether cost of production influenced the performance of fish farming. They had to indicate whether or not it affected the performance. The outcome is tabulated in Table 4.1.6.

Table 4.1.6: Response from farmers on the influence of cost of production on fish farming performance in kwanza constituency, Trans-Nzoia County.

Does cost of production influence fish farming performance?	**Frequency**	**Percentage**
No	4	2.67
Yes	146	97.33
Total	150	100.0

From table 4.1.6 most farmers agreed that cost of production affected the performance of fish farming in Kwanza Constituency. This is represented by 146 (97.33%) of the respondents. 4 (2.67%) of the respondents disagreed.

Table 4.1.7: The mean response score on the extent of influence of cost of production on fish farming.

Indicators	**Mean**	**Standard deviation.**
Capital	3.9333	1.13910
Water costs	1.9133	1.23667
Pest & Diseases	2.5733	1.07658

Harvesting & storage	2.8533	1.08304
Purchase of land	3.0533	1.69795
Fencing for security	3.1800	1.08727
Labour cost	3.2533	.94256
Pond construction	3.5067	.98816
Purchase of feeds	3.7067	1.06530
Fencing	3.8933	1.25931
Fingerling purchase	4.0134	1.11124

Key: Std=Standard

Mean score results depicts that the mean scores of all variables were between 2.5 to 3.9, indicating that the extent of influence of these indicators is between moderate to high extent. Respondents' mean score on production cost had negative contribution towards fish farming whereas water supply cost did not affect most of the farmers. Purchase of fingerlings had the highest score at a mean of 4.01 followed by capital used for the investment at a mean of 3.93. It is therefore imperative that the cost of fingerlings be subsidized and farmers aided in the initial investment to address these challenges.

Based on findings from the study, cost of water supply had no negative effect on fish farming performance. Nonetheless, other water factors like water quality could affect fish production. The study findings indicated that fingerlings cost, capital, cost of feeds, pond construction, fencing for security and land purchase were of major concern. Accessibility to water supply was not so much of a problem to most of the farmers since their ponds were situated along the river bed thus dependent on river water and ground water supply (in swampy areas).The problem now arises during droughts when water levels decrease and in cases of floods which sweep away most of the fish.

An interview conducted to the Kapomboi fishery extension officer revealed that the start-up costs including pond construction are high and demanding. Most of the farmers complained of high start-up costs for the fish ponds.Uguoma, Ohajianya and Nwosu(2010) conducted a study which revealed that "fingerlings, water, fertilizer, labor, feed and starting capital were significant" in the performance of fish farming. This implies that the start-up costs had a negative influence on fish farming performance.

The interview further revealed that there was the major problem of abandoned ponds. Most of the farmers were unable to maintain their ponds leading to infestation by weeds and other animals thus reducing the productivity levels. Poor pond maintenance also led to a decrease in production levels of the ponds which subsequently led to reduction in their income levels.

The interview further pointed out that during the rainy season; farmers in areas prone to flooding were discouraged from stocking fish. This is because most ponds were constructed without buffers such that flood water infiltrated the ponds causing temperature fluctuations. It also discouraged phytoplankton growth on which fish feed. These environmental challenges discouraged most farmers from replenishing their stocks during the rainy season for the fear of losing the stocks to floods.

Flood water also exposes the fish to diseases and danger of death due to exposure to agricultural chemicals. Helfrich (2009) stated that "pollution can cause oxygen depletion by killing phytoplankton, rooted aquatic plants or both. Pollution contaminates the fish and makes them unhealthy to eat". High levels of Ammonia leads to pollution and infestation by parasites subsequently causing the death of fish. A large number of fish are also swept away leading to low count and eventually a drop in the production. This result agrees with the findings of Carballo (2008), when he reported that "sites for fish farming should only be where water of the needed quality and volume is available at the time needed for operating the farm. Preference should be given to sites where gravity water supply to the farm is possible". These challenges have led to the abandonment of some ponds owing to maintenance costs and inadequate skills on how to maintain them.

High cost of fish feeds was also another factor that influenced fish farming performance. A large number of the farmers had resorted to use local feeds on their fish since they found the commercial ones a bit on the expensive side. This finding corroborates the report of Brummet and Rana (2010) who argued that "the cost of fish feeds is estimated to be 40-70% of total production costs". If the feeds are expensive it so follows that the number of times the feeds are administered to the fish is also reduced. This makes it tricky to balance the meals for healthy and fast fish growth. This is one of the reasons as to why some of the farmers were complaining that their fingerlings did not grow.

From another interview with the Keiyo fishery extension officer, the researcher gathered that most farmers did not have enough knowledge on cheap and affordable feeds for their fish and more so how to balance the feeds. The county government had made available some subsidized fish feeds that are more affordable and could be bought cheaply from local agro vets. These feeds include the Pearson square mix, maize bran, maize flour, rice (sources of starch), wheat bran (protein), sunflower seed cake, cotton seed cake (lipids). Other feeds that could also be used include blood from the slaughterhouse, shrimps, omena dust, and soya beans among others. Some farmers use food leftovers like ugali, sukumawiki and arrowroot leaves.
Recommended feeding for the fish is 2-3 times per day depending on size of the fish, age of the fish and capability of the farmer. Fish feeding in hot weather increases whereas it decreases in cold weather. The climate experienced in kwanza is mostly cold during the rainy season with a few hot months.

Pests and predators also play a substantial part in influencing performance of fish farming. Predation is also high which makes farmers incur high expenses on fencing for fish security. Predators reduce the number of fish and also cause damages to the fish and create conducive conditions for secondary infections from bacteria and fungi. The Organic farmer (2013) stated that "predators especially birds and mammals play an important role in life cycles of certain parasites".

The interview further revealed that the major Pests and predators negatively affecting the production of fish included humans, otters, snakes, birds among others. Controlling of pests and

diseases also affected the performance of fish farming. Diseases are caused by bacteria, fungi, protozoa and nematodes. Some diseases are also caused by stress which has a number of causes including; nutritional diseases caused by lack of proteins or lipids, lack of oxygen, disturbance, transportation of fingerlings, alkalinity of the water, ammonia (released in overstocked fish ponds as a waste product and a byproduct of digestion of protein in ponds with excessive food.), PH fluctuations, fluctuating temperature and low levels of dissolved oxygen in the water.

Fencing for security has also proved to be a very expensive venture for most farmers. Most of the ponds are situated on farms close to the river but the homesteads are a distance away. This made it hard to keep away thieves who on a large part contribute to decreasing levels of production. It therefore, necessitates good fencing and sometimes to employ a watchman to keep guard. It also encompasses installation of buffers to prevent flood water from getting into the pond.

Lack of quality fingerlings also affected the production of the fish farms. Due to nationwide demand, the supplies were also limited. The interview further revealed that the cost of buying quality fingerlings was relatively high and in some cases affected by scarcity of fingerlings from suppliers. This necessitated some farmers to source fingerlings from far and uncontrolled sources; sometimes as far as Uganda. This has made them prey to sub-standardized fingerlings which the farmers complain do not grow. Sourcing from far off places makes transportation costs high and also stresses the fingerlings due to the long distance covered. This finding agrees with Gamal, Nasr-alla and Kareem (2012) who conducted a study on factors affecting fish farming in Behera governorate of Egypt. It was determined that “fish seed was the strongest factor influencing aquaculture commercialization”. The lack of good quality of fingerlings therefore affects the performance of fish farming in kwanza constituency.

On the matter of purchase of land, most farmers were not affected since most of them had the ponds on their own parcels of land. A few individuals who found it expensive were those without farms and so had to rent other people’s land. Labor costs affected most farmers who said it was expensive to maintain the ponds. This included the occasional cleaning and change of water in the fish ponds and fertilizing.

The interview further revealed that Impassable roads during the rainy season led to inaccessibility to organized markets. This forced 80% of the farmers to sell their produce locally and sometimes at very low prices. The income from the fish therefore declines as most of the fish are underpriced. These findings concur with the department of international development (2005), which reported that "almost all the fishes (95%) produced are consumed locally and within nearby towns". Adu (2005) also indicated that "the prices of various fish were influenced by its size". This is also supported by the Ministry of Livestock and Fisheries Development (2007) who revealed that "majority of the fish farmers sell their fish raw at local and nearby markets, with variation of price according to weight".

The interview also revealed that marketing is also done for the farmers at the county offices but most farmers in remote areas find the cost of transportation too high to guarantee profitable returns. It was also apparent that some farmers did not know that the County helps in marketing of the fish. It is therefore important for the farmers to be informed of all the available services at the County that may be of help to them. Based on data collected through the interview, the county government is in the process of establishing hatcheries to provide fingerlings to the farmers. Cold storage facilities are also to be put in place to prevent post-harvest losses incurred by farmers as they look for suitable markets. Subsidized fingerlings and fish feeds will also be available to the farmers. These projects have however not been implemented.

In Kenya, fish farming therefore "followed a pattern similar to that observed in many African countries, characterized by small ponds, subsistence level management, and very low levels of production", (Ngugi *et al.,* 2007). Finances for the startup of most of the fish ponds in the study area were given by the government through the Economic Stimulus Programme in all parts of the country. It is recommended that government assistance on fish farmers be effected to reduce the cost of feeds and fingerlings. It is also important to carry out Monitoring and Evaluation so as to identify problems and tackle them in time. This will boost production levels of fish in Kwanza Constituency and Kenya in general.

4.8 Influence of socio-economic factors on performance of fish farming.

On the influence of socio-economic factors on fish farming performance, inferential analysis was used. This was to establish whether there was a significant relationship between the socio-economic factors and performance of fish farming (dependent variable).The results were presented showing their level of significance.

4.8.1 Multiple Linear Regression Model for Fish Farming Performance

Inferential statistics was used to determine the level of influence of each independent variable (socio-economic factor) on the performance of fish farming. The multiple linear regression model was used in the analysis and the results were shown for each. It was important for the researcher to establish which of the socio-economic factors had a significant influence on performance of fish farming.

The multiple linear regression model was used because it depicts the influence of each independent variable to the dependent variable thus determining the relationship between the two. Computing of the data was done using Statistical Package for Social sciences (SPSS) version 21.

The regression model was as follows:

$Y=\beta_0+\beta_1F_1+\beta_2F_2+\beta_3F_3+\beta_4F_4+ e$

Where:

Y= performance of fish farming

F_1= farmer knowledge and skills

F_2= farmer cultural factors

F_3= access to credit facilities

F_4= cost of production.

$\beta_1, \beta_2, \beta_3, \beta_4$ = coefficients to the independent variables

β_0= Intercept term

e= error term

$Y=1.792+0.189X_1-0.072X_2+0.098X_3+0.143X_4+Ɛ$. Where: Constant **$(\beta_0)$**, cost of production **(X_1)**, Cultural factors **(X_2)**, knowledge and skills **(X_3)**, access to credit **(X_4)**

Table 4.1.8: Findings on the significance of influence of socio-economic factors on performance of fish farming.

Socio-economic factors	Unstandardized Coefficients		Standardized Coefficients	T	Sig.
	B	Std. Error	Beta		
Constant (β_O)	1.792	.285		6.282	.000
Cost of production (X_1)	.189	.058	.326	3.255	.001
Cultural factors (X_2)	-.072	.055	-.103	-1.310	.192
Knowledge & skill (X_3)	.098	.047	.192	2.070	.040
Access to credit (X_4)	.143	.052	.213	2.738	.007

The model had the following results: β_o =1.792, β_1 =0.189, β_2= -0.072, β_3= 0.098 and β_4=0.143 as shown in table 4.1.8 above. At 5% (0.05) level of significance; Knowledge and Skills, cost of production and Access to Credit were statistically significant since the p-values were less than (<0.05). Cultural factors were not significant with p-value being higher than 0.05. These results imply that Cost of Production, Knowledge and Skills, and Farmer access to Credit had a significant influence on performance of fish farming whereas Cultural factors had no significant influence on performance of fish farming with p-value being higher than 0.05.

The socio-economic factors were ranked based on their level of influence on performance of fish farming from the highest to the lowest. Table 4.1.9 portrays the outcome.

Table 4.1.9: Ranking in significance level of socio-economic factors influencing performance of fish farming.

Socio-economic factors	Level of significance
Cost of production	0.001
Access to credit	0.007
Knowledge and skills	0.040
Cultural factors	0.192

From table 4.1.9, it was evident that cost of production had the highest influence on performance of fish farming in Kwanza Constituency at a significance of 0.01.This was followed by Access to credit facilities which accounted for 0.007 level of significance. Third was farmer knowledge and skills at 0.040 and lastly Cultural factors at 0.192 level of significance.

CHAPTER FIVE

SUMMARY OF FINDINGS, CONCLUSIONS, RECOMMENDATIONS AND SUGGESTIONS FOR FURTHER RESEARCH.

5.1 Introduction

This chapter entails the findings in relation to the research study, the discussion of the findings, conclusions made from the findings, contribution to the body of knowledge, recommendations and suggestions for further research.

5.2 Summary of study findings

The summary was done based on study objectives.

5.2.1 Demographic characteristics of farmers.

Gender results of the data analysis showed that a large number of farmers were male at 60% while female respondents were 40%. This shows all genders are involved in fish farming sector in Kwanza Constituency.

Results on age of the respondents showed a high number of respondents in fish farming at 46.7% were aged between 35 - 44 years while respondents who were less than 25 years were the least at 2.7%. Generally, age distribution was uneven among the respondents.

On farmer level of formal education, the findings portrayed that most respondents had secondary school level of education(73%), primary school level had (15%), colleges had (9%)and (3%) in universities.

The findings also portray that many respondents (58.7%) have been practicing fish farming for 5-9 years, followed by those who have practiced for 0-4 years (29.3%) and the least are those who have been in the sector for above 9 years (12%).

On the mode of fish farming, those involved full time were more with (70.2%), whereas the part timers were (29.8%).The size of fish ponds in square meters were varied with (68.2%) ranging between fifty to four hundred square meters, (19.2%) between four hundred and one to seven

hundred and fifty, (10.6%) between seven fifty one to one thousand one hundred and finally (2.0%) between one thousand one hundred and one to one thousand eight hundred square meters. The amount of harvest in kilograms was also varied with (61.6%) harvesting between zero to a hundred kilograms of fish , (33.3%) harvesting between a hundred and one to three hundred kilograms, (3.5%) harvesting between three hundred and one to five hundred kilograms and lastly (1.52%) harvesting between five hundred and one to nine hundred kilograms of fish yearly.

5.2.2 Influence of farmer knowledge and skills

The first objective intended to determine the influence of farmer knowledge and skills on fish farming performance in Kwanza Constituency - Trans-Nzoia County. To find out how knowledge and skills factors had influenced the socio-economic development of fish farming. Knowledge and Skill indicators were: farmer level of formal education, farmer experience, extension services, fish farming seminars and workshops, use of new technologies and on-farm trainings. From the study, all the knowledge and skills factors contributed positively on the performance of the fish farming sector.

5.2.3 Influence of farmer cultural factors.

The second objective determined the influence of farmer cultural factors on fish farming performance in Kwanza Constituency - Trans-Nzoia County. These factors included attitudes and perceptions, income control, family structure, preference to fish farming, feeding habits and religious beliefs/practices. The cultural factors affected the performance of fish farming with an exception to the religious beliefs and practices which had little influence on fish farming.

5.2.4 Influence of farmer access to credit facilities.

The third objective investigated the influence of farmer accessibility to credit facilities on performance of fish farming in Kwanza Constituency - Trans-Nzoia County. Discussed were access to national government grants and credits, access to county government funds, access to bank loans and micro-finance institutions, access to co-operatives and associations, access to non-governmental grants and credits, availability of personal savings and support from friends family. According to the findings, personal savings by the farmers contributed the highest with a

mean score of (4.2), followed by bank loans at (3.3) and cooperatives at 3.13 respectively. Non-governmental organizations had the least score at a mean of 1.06.

5.2.5 Influence of cost of production.

The fourth objective involved examining the influence of cost of production on performance of fish farming in Kwanza Constituency - Trans-Nzoia County. Factors of interest were capital/start-up costs, water supply cost, control of pests and diseases, harvest and storage costs, land purchase cost, fencing, labor cost, pond construction cost, feed cost and cost of fingerlings.

Findings indicated that the Purchase of fingerlings had the highest score at a mean of 4.01 followed by capital used for the investment which had a mean of 3.93.water availability had the least score with a mean of 1.91. It is therefore imperative that the cost of fingerlings be subsidized and farmers aided in the initial investment to address these challenges faced by farmers. The government should make a point of ensuring that farmers can access credit facilities, subsidized feeds and standardized fingerlings in order to lower production costs.

5.3 Influence of socio-economic factors on fish farming performance.

The study found out that fish farming performance (dependent variable) was greatly influenced by the independent variables, which are farmer knowledge and skills, farmer access to credit facilities and cost of production. The order of influence was cost of production, access to credit facilities, and farmer knowledge and skills in the order of highest to lowest. Farmer cultural factors had the least influence on performance of fish farming.

5.4 Conclusion.

Based on the outcomes of this study, these conclusions were made;

It was established that farmer knowledge and skills greatly influenced adoption of new farming techniques in fish farming. In some areas however, the farmers lacked the necessary skills of balancing fish feeds and maintaining fish ponds. With such knowledge, they can be able to balance and use locally available feeds that are easily accessible and affordable. Extension services were equally influential on the performance of fish farming. As much as extension

services positively influenced fish farming, the services were few and strained in some areas. This proved that adequate knowledge and skills are lacking in the study area. The county government should therefore make a point of employing more extension officers owing to public demand.

Cultural factors also influenced fish farming. There was slow uptake of fish farming due to farmers' preferences for other livestock sectors. Their attitudes were also changing towards fish farming and income control seemed to play a major part in ensuring the sustainability of the fish farms.

Accessibility to credit facilities also played a major role in boosting fish farming performance. Access to credit was constrained to most farmers leaving those with personal savings and access to bank loans to dominate the enterprise. This led to stalling of most ponds. Credit facilities should be readily accessible to farmers since knowledge and skills without financial assistance would not be of much impact.

Cost of production was also high for most farmers. The cost of fingerlings was high and fraud from unscrupulous people who sold low quality fingerlings was rampant. The county government should ensure that the farmers can easily access their fingerlings at an affordable price and from standardized and trusted suppliers.

5.5 Contributions to the body of knowledge

Table 5:1 Contribution to the Body of Knowledge.

Objective	Contribution to knowledge
To establish the influence of farmer knowledge and skills on performance of fish farming in Kwanza Constituency - Trans-Nzoia County.	Farmer knowledge and skills are important in fish farming since it helps farmers improve on their farming methods that will lead to increase in production. This will ensure sustainability of the projects, provide employment and also provide food to many Kenyans. Farmer knowledge and skills influences the performance of fish farming. Extension services should therefore be enhanced to equip farmers with the adequate skills required for fish farming. On-farm trainings should also be done regularly.
To determine the influence of farmer cultural factors on fish farming performance in Kwanza Constituency - Trans-Nzoia County	Cultural factors differ in different study areas. The attitude that people have will affect the uptake of fish farming. There's preference for other farming enterprises such as poultry farming, sheep rearing and cattle rearing prevalent in Kwanza Constituency. Fish farming uptake has become a quite a slow process. Farmer cultural factors therefore affect the performance of fish farming. To this measure, the government should make a point of sensitizing the public of the benefits of fish farming in order to change negative attitudes and perceptions.
To investigate the influence of farmer access to credit facilities on performance of fish farming in Kwanza Constituency - Trans-Nzoia County.	Without access to credit facilities most farmers have a problem in securing capital and also getting the money to sustain the ponds. On a large part, inaccessibility to credit has made many fish projects in the study area stagnate. If it was made available would have a great impact in boosting the fish farming sector. Accessibility to credit facilities

	therefore influences the performance of fish farming. Owing to this fact, the county government should establish good financial assistance networks to help the farmers. Loans should be provided through co-operatives for easy access by the farmers.
To establish the influence of cost of production on fish farming performance in Kwanza Constituency - Trans-Nzoia County.	The cost of production carries a significant weight on the performance of fish farming. Expensive feeds and fingerlings put a strain on the farmer. Labor costs incurred in the maintenance of the ponds are also taxing on the farmers. Since Costs of production greatly influence the performance of fish farming, the government can help by making available subsidized feeds and ensuring availability of fingerlings.

5.6 Recommendations

Based on conclusions made from the study, these recommendations were made which the researcher believes will help improve fish farming production.

5.6.1. Recommendation for the policy makers

i) That community involvement ought to be embraced before a project is launched of the nature that proper monitoring and evaluation is done. Training seminars should be tailored to match such needs as pertains feasibility of the studies.

ii) Credit facilities targeting small scale fish farmers be identified and redrawn to suit their needs. Farmers can form co-operatives through which the county government can help in ensuring there is easy access to credit for all farmers.

iii) County and national governments to intervene in provision of market and subsidized feeds and standardized fingerlings in proportionate quantities.

5.6.2. Recommendation for the programs

i) Project sustainability ought to be checked as most of the fish ponds have stalled due to lack of sustainability mechanisms and support for the farmers.

ii) Proper feasibility studies should be carried out, to aid in curbing negative attitudes that eventually fail the fish farming programs.

iii) Extension services by agricultural service support are really needed by farmers and a follow up to be carried out regularly. More extension officers should be employed by the county government to assist in dissemination of knowledge and skills in fish farming. This will also help farmers in the adaptation of new farming technologies that will improve production rates and also ensure food security.

iv) Monitoring and evaluation on monies allocated should be carried out frequently to ensure proper fish farming success.

5.7 Suggested areas for further research.

In accordance to this study findings, suggestions made for further research were;

- Future researchers should dwell on extensive feasibility studies to be carried out in establishing proper demographic factors about a population for swift program initiation, implementation, monitoring and evaluation for targeted goals accomplishments.
- A study on factors affecting sustainability of small scale fish production should be investigated.
- A study on the influence of pests, predators and diseases on the production in fish farming.
- A study on factors affecting credit accessibility for fish farmers in Kenya

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APPENDICES

APPENDIX A: TRANSMITTAL LETTER.

Victoria Andayi

P.O BOX 1846-30200,

Kitale.

University of Nairobi,
P.O Box 30197-0100,
Nairobi.

Dear Respondents,

I am a student pursuing a Master of Arts degree in Project Planning and Management at the University of Nairobi. I am undertaking a research on socio-economic factors influencing fish farming in Kwanza sub- county-Trans-Nzoia County, Kenya.

I am kindly requesting for your assistance. Do assist by filing the questionnaires provided honestly and completely. The information is to assist me accomplish the research objectives. All responses will be confidential. Thank you.

Yours faithfully,

Victoria Andayi

APPENDIX B: STUDY QUESTIONNAIRE.

I am a student at the University of Nairobi undertaking a Master of Arts degree in project planning and management. This questionnaire is meant to gather information about socio-economic factors influencing performance of fish farming in Kwanza constituency-Trans-nzoia County. The information you provided will be confidential and only be used for academic research purposes ONLY.

Section A: Demographic factors

1. Indicate your gender: male ☐ female ☐
2. Indicate your age Bracket

less than 25 ☐

25-34 ☐

35-44 ☐

45-54 ☐

55-64 ☐

Above 64 ☐

3. Years in fish farming

0-4 years ☐

5-9 years ☐

Above 9 years ☐

4. Fish farming mode

Full time ☐

Part time ☐

5. Ponds owned by farmer

_____

6. Size of fish pond in meters (M)

_____

_____

7. Last harvest of pond in kilograms (Kgs)

_____

8. Average earnings per pond in shillings (Kshs)

In 2 months _____

In 6 months _____

In 1 year _____

Section B: Knowledge and skills and fish farming

1. Indicate your highest formal education level

Primary ☐

Secondary ☐

College ☐

University ☐

2. Does knowledge and skills of farmer influence fish farming?

   YES ☐

   NO ☐

3. On a scale of 1-5, indicate the extent to which the following knowledge and skill factors influence fish farming performance.(use a tick√)

	No Extent=1	Low Extent=2	Moderate Extent=3	High Extent=4	Very high Extent=5
Level of formal education attained by farmer.					
Farmer experience in fish farming					
On- farm trainings					
Fish farming seminars/workshops					
Use of new technologies.					
Extension services					

Section C: Cultural factors and fish farming

1. Do farmer cultural factors influence fish farming?

YES ☐

NO ☐

2. Indicate the extent to which the following cultural factors influence fish farming performance

	No extent=1	Low Extent=2	Moderate Extent=3	High extent=4	Very high Extent=5
Attitudes/consumer perceptions					
Income control					
Family structure					
Preference to fish farming					
Feeding habits					
Religious practices/beliefs.					

Section D: Access to credit facilities and fish farming.

1. Does access to credit facilities influence the performance of fish farming?

   YES ☐

   NO ☐

2. Use a Tick (√) to indicate the extent to which accessibility to the following sources of credit facilities influence fish farming.

	No Extent=1	Low Extent=2	Moderate Extent=3	High Extent=4	Very high Extent=5
Access to national government grants and credits					
Access to County government grants					
Access to bank loans/micro-finance institutions.					
Access to farmer co-operatives and associations.					
Availability of personal savings					
Support from friends and relatives					
NGO(non-governmental organization) grants					

Section E: Cost of production and fish farming.

1. Does cost of production influence the performance of fish farming?

   Yes ☐

   No ☐

2. Using a scale of 1-5, indicate the extent to which the following costs of production affect fish farming

	no extent=1	Low extent=2	Moderate extent= 3	High extent=4	Very high extent=5
Capital/start-up costs					
Buying of fingerlings					
Cost of water supply					
Purchase of feeds					
Pond construction and maintenance					
Labor costs					
Controlling diseases and pests					
Harvesting and storage					
Fencing for security					
Purchase of land					

Section F: Performance of fish farming.

1. Indicate the extent to which the following factors influence fish farming performance.

Use a tick to mark the appropriate box. (√)

INDICATOR	No extent=1	Low extent=2	Moderate extend=3	High extent=4	Very high extent=5
Farmer knowledge and skills					
Cultural factors					
Access to credit facilities					
Costs of production					

Thank you for your time and contribution.

APPENDIX C: INTERVIEW GUIDE.

1. In your opinion, how does farmer knowledge and skills influence the performance of fish farming in Kwanza Constituency - Trans-Nzoia County?
2. How do cultural factors influence performance of fish farming in Kwanza Constituency - Trans-Nzoia County Kenya, and to what extent?
3. In your opinion, how does farmer access to credit facilities influence performance of fish farming in Kwanza Constituency - Trans-Nzoia County?
4. How does cost of production influence performance of fish farming in Kwanza Constituency - Trans-Nzoia County?

APPENDIX D: RESEARCH PERMIT.

THIS IS TO CERTIFY THAT:
MS. VICTORIA LINDA ANDAYI
of UNIVERSITY OF NAIROBI, 4386-30200 KITALE,has been permitted to conduct research in *Transnzoia County*

on the topic: *SOCIO-ECONOMIC FACTORS INFLUENCING PERFORMANCE OF FISH FARMING IN KWANZA CONSTITUENCY- TRANS-NZOIA COUNTY, KENYA*

for the period ending:
20th June,2019

Permit No : NACOSTI/P/18/49210/22907
Date Of Issue : 21st June,2018
Fee Recieved :Ksh 1000

.....
Applicant's Signature

.....
Director General
National Commission for Science, Technology & Innovation

CONDITIONS

1. **The License is valid for the proposed research, research site specified period.**
2. **Both the Licence and any rights thereunder are non-transferable.**
3. **Upon request of the Commission, the Licensee shall submit a progress report.**
4. **The Licensee shall report to the County Director of Education and County Governor in the area of research before commencement of the research.**
5. **Excavation, filming and collection of specimens are subject to further permissions from relevant Government agencies.**
6. **This Licence does not give authority to transfer research materials.**
7. **The Licensee shall submit two (2) hard copies and upload a soft copy of their final report.**
8. **The Commission reserves the right to modify the conditions of this Licence including its cancellation without prior notice.**

REPUBLIC OF KENYA

National Commission for Science, Technology and Innovation

RESEARCH CLEARANCE PERMIT

Serial No.A 19049

CONDITIONS: see back page

Appendix E: National Commission For Science, Technology and Innovation

NATIONAL COMMISSION FOR SCIENCE, TECHNOLOGY AND INNOVATION

Telephone:+254-20-2213471,
2241349,3310571,2219420
Fax:+254-20-318245,318249
Email: dg@nacosti.go.ke
Website : www.nacosti.go.ke
When replying please quote

NACOSTI, Upper Kabete
Off Waiyaki Way
P.O. Box 30623-00100
NAIROBI-KENYA

Ref: No. **NACOSTI/P/18/49210/22907**

Date: **21st June, 2018**

Victoria Linda Andayi
University of Nairobi
P.O. Box 30197-00100
NAIROBI.

RE: RESEARCH AUTHORIZATION

Following your application for authority to carry out research on ***"Socio-economic factors influencing performance of fish farming in Kwanza Constituency- Trans-Nzoia County, Kenya"*** I am pleased to inform you that you have been authorized to undertake research in **Trans Nzoia County** for the period ending **20th June, 2019.**

You are advised to report to **the County Commissioner and the County Director of Education, Trans Nzoia County** before embarking on the research project.

Kindly note that, as an applicant who has been licensed under the Science, Technology and Innovation Act, 2013 to conduct research in Kenya, you shall deposit **a copy** of the final research report to the Commission within **one year** of completion. The soft copy of the same should be submitted through the Online Research Information System.

BONIFACE WANYAMA
FOR: DIRECTOR-GENERAL/CEO

Copy to:

The County Commissioner
Trans Nzoia County.

The County Director of Education
Trans Nzoia County.

National Commission for Science, Technology and Innovation is ISO9001:2008 Certified