FACTORS INFLUENCING FISH PRODUCTION AMONG SMALL SCALE FARMERS IN KENYA: A CASE OF HAMISI SUB-COUNTY.

CONSOLATA MWENESI

L50/76171/2014

A RESEARCH PROJECT SUBMITTED IN PARTIAL FULFILLMENT AS A REQUIREMENT FOR THE AWARD OF DEGREE OF MASTER OF ARTS IN PROJECT PLANNING AND MANAGEMENT OF THE UNIVERSITY OF NAIROBI.

2016

DECLARACTION

This research project is my own original work and has not been presented for any award in any University.

Signature…… Date…20/8/2016……..

MWENESI CONSOLATA

L50/76171/2014

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

Signature…… Date…20/8/2016……

MR . MARANI VINCENT

Lecturer University of Nairobi

DEDICATION

I dedicate this research project to my entire family; my beloved husband Mr. Majanga Isaac for his moral and material support that has inspired me during the time of writing this work. My two sons John and Braham who continuously assisted me in typing this work. Lastly, to my daughter Annet who assisted in taking care of the home when I was busy with this studies.

ACKNOWLEDGEMENT

I would like to thank my research project supervisor Mr. Vincent Marani for his total devotion in guidance, support and positive critisms that he exercised during my project development. I am really indebted to him for his valuable encouragement and inspiration towards writing this work. I also thank the entire staff of Kakamega Extra Mural Center both teaching and non-teaching staff for their general support in bringing us this far. Not forgetting my colleagues taking Masters in Project Planning and Management who have been of great help in this project development.

I would also like to appreciate my workmates who have always stepped in my duties willingly during my absentia and worked on my behalf.

I would like to appreciate Mr. Cheti for working on chapter four and any other general corrections also the coordinator Dr. Okelo of Kakamega Mural Centre for his tireless efforts in correcting my work where necessary. I also thank Mr. Griffin for printing my work.

Lastly, I would like to thank my family members for their tireless patience towards my studies. God bless all.

TABLE OF CONTENTS

CONTENTS PAGE

LIST OF TABLES

LIST OF FIGURES

ABBREVIATIONS AND ACRONYMS

ARAC	–	African Region Aquaculture Centre
DCR	**–**	Democratic Characteristic Response
DDC	–	District Development committee
ESP	–	Economic Stimulus Programme
FAO	**-**	Food and Agricultural Organization
FTC	**–**	Farmers Training Centre
KFFDC	–	Kisumu Fish Farming Development Centre
KFRL	**–**	Kenya Freshwater Research Laboratories
KMFRI	–	Kenya Manure Fish Research Institute
KMRL	–	Kenya Marine Research Institute
LBDA	-	Lake Basin Development Authority
MC	**–**	Marginal Cost
MDG	-	Milleniun Development Goals
MINAGRI	**–**	Ministry of Agriculture
MOA	**-**	Ministry of Agriculture
MT	**-**	Metric Tonnes
MVP	–	Marginal Value Product
NACOSTI	**-**	National Council of Science and Technology Innovations
NARDTC	-.	National Aquaculture Research Development & Training Center
NGOS	-	Non-governmental organization
QUASO	**–**	Quality Assurance Officer
UNDP	-	United Nations Development Programme
WDFW	**–**	Washington Department of Fish and Wildlife
WFTI	–	Wildlife and Fisheries Training Institute
WTP	–	Willingness To Pay

ABSTRACT

Fish has always been an important source of protein in the human diet and on a global scale. This study therefore focuses on factors influencing fish production among small scale farmers of Hamisi sub – county, Vihiga County within Kenya. The study seeks to investigate how costs of production influence fish production among small scale farmers; examine the extent to which agricultural extension services influence fish production among small scale farmers; establish how demographic characteristics of farmers influence fish production among small scale farmers and finally to examine how accessibility to credit facilities influence fish production among small scale farmers in Hamisi sub- county of Vihiga county in Kenya. The study adopted the theory of allocative efficiency as postulated by Inoni (2007). The study location included Banja, Tambua, Gisambai and Shamakhokho wards whereby a descriptive survey design was used to obtain information to describe the existing phenomena. The target population was 200 involving individuals, private and public groups consisting of small scale farmer. The estimated sample size is 132 as obtained from Krejcie & Morgan (1970) table. The study employed stratified random sampling in order to include all the wards; proportional allocation was used to determine the number of farmers from each ward that was the respondent in the study. Systematic random sampling was used to select the actual respondents in the wards. Content validity was used where the researcher shared the research instrument with the supervisor to access its appropriateness in content. Split half method was employed to test the reliability of the instruments. Questionnaire with closed ended questions was be prepared and distributed to the respondents in all the four wards. The questionnaires were collected after one week. All the filled questionnaires were used for analysis. The data collected was analyzed using Statistical Package for Social Sciences (SPSS ver. 20) where descriptive analysis was obtained that included frequency tables and percentages that were used for data presentation, contingency tables with Pearson chi-square tests that provided a measure of association were employed for testing significance of individual factors within the objectives to identify their significance in influencing fish production among small scale farmers in Hamisi Sub-county of Vihiga County in Kenya. The study established that educational levels greatly influenced adoption of new fish farming techniques, extension officers provided assistance to farmers when need arose, credit accessibility as a factor greatly influenced the study with costs also coming to the fore in level of influence, further the study found out that majority among respondents with O-level education participated in fish farming either by providing labor or in other ways owning the pond, majority also sourced for unpaid labor. Farmers cried foul of the government's responsibility in ensuring proper subsidies in fish farming are found and policies were seen to neglect small and medium scale farmers and the study recommended community involvement be embraced before a project is launched of such nature where proper monitoring and evaluation training seminars should be tailored to match such needs as pertains feasibility studies, credit facilities targeting small scale fish farmers be identified and re-drawn to suit their needs with a further recommendation for county and national governments intervening in provision of market and subsidized feeds and fingerlings in proportionate quantities whereas the study suggested a study to be carried out on constraints in funds accessibility by small scale farmers and their effect on sustainability of such projects.

CHAPTER ONE: INTRODUCTION

1.1. Background of the study

Fish has always been an important source of protein in the human diet and on a global scale, fish and fish products are the most important source of protein and it is estimated that more than 30% of fish for human consumption comes from aquaculture (Håstein. et al 2006). Over the past three decades, aquaculture has developed to become the fastest growing food-producing sector in the world. A large proportion of fish products come from small-scale producers in developing countries. More than 80% of global aquaculture products are produced in fresh water. From its early development in Asia, aquaculture has undergone huge development and is today highly diversified.

Hetland (2008) observed that the economic viability of fish farming was becoming widely recognized as observed in countries like Israel where more than half the fish eaten in the country was produced from fish farms. Similarly 25% of fish in China and in India, 11% in USA and 10% in Japan were aquaculture products. In developing countries, fish farms not only improved a nation's diet but brought income to small farmers and created employment particularly in rural areas. Fish culture has proved successful in improving the standard of living of rural farmers in Asia, where fish culture had a long tradition (Edwards 2000).

Asia – including South Asia, South-East Asia, China and Japan – is projected to make up 70 percent of global fish consumption by 2030. Sub-Saharan Africa, on the other hand, is expected to see a per capita fish consumption decline of 1 percent per year from 2010 to 2030 but, due to rapid population growth of 2.3 percent in the same period, the region’s total fish consumption will grow by 30 percent overall by FAO (2007).

The sub-Saharan Africa region continues to be a minor player in aquaculture in the world, although the tilapia species most cultivated in the world originate from Africa. Nigeria leads in the region, with reported production of 44 thousand tonnes of catfish, tilapia and other freshwater species. But there are many species of greater importance such as black tiger shrimp (*Penaeus monodon*) in Madagascar, *Eucheuma* seaweed in the United Republic of Tanzania and abalone (*Haliotis* spp) in South Africa (FAO, 2006).

The total catch of Mozambique in 2001 was about 30,000 metric tonnes and had rapidly increased by 2004 when production was 45,000 metric tonnes. In 2005 the registered total was about 42,000 metric tonnes (FAO 2007). From 2005 to present, the catches have declined each year because of main constraints (like petrol, taxes and aging of vessels). The production in 2004 declined because of changes within the European Union and in 2006 one of the shrimp companies abandoned their facility, (Mozambique National Ministry of Fisheries of Mozambique 2008).

Over 24,000 Rwandan farmers practice and benefit from subsistence fish farming by Mpawenimana (1991). As of 1991, there were nearly 3,900 fish ponds in Rwanda, covering approximately 130 ha. These ponds yielded an estimated annual production of 237 metric tons. Small-scale fish farming in Rwanda may also be viewed as a means to improve food security. Daily animal protein intake in Rwanda was estimated at 2.1 g per capita Wilcock and Ndoreyaho, (1986); however, the Ministry of Agriculture MINAGRI (1987) reported that an adequate diet requires 5.9 g of animal protein daily. Fish contains high quality protein, vitamins, minerals, and other nutrients important for human health and growth Chatfield,(1954); Latham,(1965). With the current dilemma

of declining land productivity, an escalating population, and frequent food shortages, protein production deserves particular attention.

The Nigeria fishery sub- sector plays in important role in the socio – economic development of the economy. According to Eyo (1992) and Akeredolu (1990), the sector serves as an income source, facilitates the development of cottage industries and provides employment opportunities for the myriad of people engaged in fishery production, processing and marketing. It equally serves as an important protein supplement to meat protein, more so because of the persistent rise in cost of meat (Oladedji and Oyesola, 2002).

According to FAO (2008-9) Fish farming in Kenya has grown greatly over the last few decades. It started as early as 1920's. It has been taken as subsistence means of supplementing proteins sources in rural areas.(It was started as subsistence activity and not commercial. However, it has changed over the years with the government putting a lot of effort and resources in producing aquaculture as a business. Many entrepreneurs have now invested in commercial aquaculture sectors. Aquaculture activities in Kenya involve the production of species like; Tilapia scientific (Oreocaromii niloticus). The African cat fish (Clarias gariepinus), Rainbow trout (Oncorhyncus mykiss) and Common carp (Cyprinus carpio).

Aquaculture research has become a national responsibility since the collapse in 1977 of the East African Community. The Ministry of Regional Development, Science and Technology assures now overall supervision. Implementation is done by the Kenya Marine and Fisheries Research Institute (KMFRI), from Mombasa (Kenya Marine Research Laboratories) and Kisumu (Kenya Freshwater Research Laboratories). The

need for aquaculture research in Kenya was emphasised recently in the Mombasa Symposium (July 1981) entitled "Aquatic Resources in Kenya: A Need for Research". At this meeting, Balarin and Haller (1981) have, however, stressed the need for the immediate implementation of the results of past research through extension. The symposium also identified some of the shortcomings which have hindered aquaculture development in the past (Ochieng, 1981).

1.2 Statement of the problem

The fisheries sub-sector in Hamisi sub-county has faced several fish production problems with numerous challenges of which the researcher was interested to research in; the hamisi aquaculture sector suffers an inadequate supply of certified quality seed fish (fingerlings) and feed, incomprehensive aquaculture policy, and low funding for research. Because of this scenario there is no significant growth in fish farming industry and the farmer is left confused by many extension officers who visit and give varying information (FAO 2004). Lack of a comprehensive fisheries policy and a fisheries master plan, low funding levels for the department and slow capacity building and staff motivation. These have coupled with lack of proper extension services in the rural areas which have adversely affected the output of the fish projects (FAO, 2007). Commercially produced feeds were also among problems facing the fish farming and when available they were expensive for most farmers to afford.

In addition, high cost, drying up of ponds during droughts, flooding, siltation of ponds, pond maintenance and poor security. Most farmers have not yet embraced the technology for producing high quality seed. Poor record keeping by farmers and inefficient statistical data collection impeded information dissemination on fish farming. They compounded by inadequate entrepreneurship skills by the farmers and

lack of credit accessibility constraining production and growth. (Mwangi, 2008; Osure, 2011).

1.3 Purpose of the study

The Purpose of this study is to find out the factors influencing fish production among small scale farmers in Hamisi sub-county.

1.4 Objectives of the study

The study was guided by the following objectives:

1. To establish how the costs of production influence fish production among small scale farmers in Hamisi sub-county
2. To examine the extent to which agricultural extension services influence fish production among small scale farmers in Hamisi sub-county
3. To establish the extent to which demographic characteristics influence fish production among small scale farmers in Hamisi sub-county
4. To examine how accessibility to credit facilities influence fish production among small scale farmers in Hamisi sub-county.

1.5 Research questions

This study aims at answering the following questions:

1. How do the costs of production influence fish production among small scale farmers in Hamisi sub-county.?
2. To what extent does an agricultural extension service influence fish production among small scale farmers in Hamisi sub-county.?

3. To what extent does a demographic characteristic influence fish production among small scale farmers in Hamisi sub-county.?
4. How does accessibility to credit facilities influence fish production among small scale farmers in Hamisi sub-county?

1.6 Significance of the study

This was a study built up to help identify the factors that influenced the fish production among small scale farmers in Hamisi sub-county. The study findings and recommendations are hoped to help both the national and county governments to implement policies that can revitalize fish production and encourage other stake holders' participation on food security initiatives. The study is endeavored to provide information to agricultural extension personnel in identifying their own strengths and weaknesses and change as argents and come up with appropriate corrective measures and those of the farmers in fish production and come up with appropriate capacity building programmes to improve fish production among small scale farmers in Hamisi sub –county.

The findings are hopped to provide information to small scale fish farmers to efficiently produce high fish yields with minimal in puts there by maximizing profit. The study is also hopped to provide a base for further research on fish production issues especially among small scale farmers. The research is also hoped to be a reference material in the University of Nairobi's library. This will consequently hasten the realization of the MDGs and also vision 2030 in Hamisi sub –county and the whole nation at large.

1.7 Delimitation of the study

Delimitation is a process of reducing the study population and area to a manageable size. This research was delimited in terms of the scope that it will cover. It will only target small scale fish farmers in Hamisi sub- County. This is a study intended to intensify fish farming and constant fish production in Hamisi sub-county.

This is a project expected to be investigated in less than one year because harvesting of fish begins as early as six months depending on the fishing schedule. Data was collected from the farmers by the management team on frequent terms so as to assist and solve any problems that may occur e.g. insecurity, diseases, marketing, supply of fingerlings and food. Where applicable, trainings by extension workers through seminars and workshops should be done frequently who will also deliver the same to the immediate farmer.

1.8 Limitations of the study

According to Best and Khan (2008), limitations are conditions beyond the control of the researcher that may place the limitations on the conclusion of the study and their application to other situations. Some respondents may be affected by factors such as suspicion; however the researcher will assure them of the confidentiality of the study. Some respondents would want to give pleasing responses to avoid offending the researcher; although this would be solved by enlightening them that the research is purely objective and not subjective

1.9 Basic assumption underlying the study

Through this process of carrying out the study of this project - fish production; the researcher assumes that the answers given by respondents will reflect the factors influencing fish production among small scale farmers in Hamisi sub – county. That, the sample size selected was a representative of the target population and that the respondents were able to fill all the questionnaires without interacting with one another.

1.10 Definition of significant terms

Fish production and associated technologies are, preferred as a fast means of improving food production and diet quality of small holder farmers and, quickly improve their economic status (MoLFD 2007).

Fish farming involves raising fish commercially in tanks or enclosures, usually for food Small scale farmers are found mainly in the medium to high potential areas, and tend to farm for family needs rather than purely on economic objectives (Rege 1994; Kosgey 2004)

The following terms were used in this study:-

Costs of production: These are in puts involved in fish production e.g fish food supply, construction of fish production, control of diseases and predators.

Agricultural extension services: These are officers specialized in disseminating information on fish production to farmers e.g trainings.

Demographic characteristics: The quantity and characteristics of the people who live in a particular area as for this study may involve; age, financial status, gender, education qualification, sex of house hold head, size of the small scale farmers.

Accessibility to credit facilities: This is the ease to obtain farm financial assistance for fish production activities e.g loans and grants.

1.11 The organizations of the study

This study has three chapters. Chapter one generally contains the introduction of the background of the study which catches the attention and interest of the reader, the statement of the problem which is the focal point of the research shows the existing gaps, the purpose of the study shows what the study intents to achieve. The summary will also include research objectives and questions. It shows the significance of the study which provides rationale to justify the reason for the study. Delimitations and limitations are also recorded in this chapter.

Chapter two is the literature review organized according to the objectives to be achieved in the study. A theoretical frame work, conceptual frame work, research gap and summary of literature review shown at the end.

Chapter three presents; research design, target population, sampling procedure and sample size, research instruments, data collection procedure and analysis and Operationalization of study variables. Chapter four presented data collected while chapter five presented findings collected, recommended and suggested for further studies.

CHAPTER TWO: LITERATURE REVIEW

2.0 Introduction

The review of literature will draw related information from secondary sources in the libraries and the internet. It will deal with empirical evidence on the influence of costs of production and fish production, the influence of agricultural extension services and fish production, the influence of demographic characteristics and fish production and finally the influence of credit accessibility and fish production among small scale farmers in Hamisi sub-county.

2.1 Concept of fish production

Fish production and associated technologies are, preferred as a fast means of improving food production and diet quality of small holder farmers and, quickly improve their economic status. It entails all activities that take place from the start – designing and construction of fish ponds, installing finger lings, feeding and care upto harvesting. (MoLFD 2007).

2.2 Costs of production and fish production

Aquaculture profitability is commonly measured through an analysis of the costs and revenues of the enterprise (Smith and Peterson, 1982). Engle and Hatch (1986) and Hatch and Engle (1987) used financial analytical techniques to show that Panama's resource-limited farmers benefited from the adoption of fish farming. Through the development of enterprise budgets, Hishamunda and Moehl (1989) demonstrated that Rwandan aquaculture, in correctly managed ponds, is a profitable activity that competes favorably with red bean, sweet potato, and rice production. Moehl (1993)

used enterprise budgets to compare the profitability of four levels of fish production in Rwanda.

Ndu N.R. (2008) ARPN Journal examines the resources, costs and returns and other factors affecting fish production. A sample of 44 fish farmers was randomly selected from two local government areas of Kaduna State (Chikun and Kaduna South). Data was collected in 2006 production season through administration of a questionnaire to the fish farmers. Analysis of the data was done using descriptive statistics and budgeting technique. The analysis revealed that land, water, labour and capital were the main resources employed in fish production. The costs and returns analysis indicated that, variable cost constituted 97.63% of the total cost of fish production in the study area, while the fixed cost constituted 2.37%.

The study examined the costs and returns of fish production using concrete ponds in Akwa Ibom State, Nigeria. Data for the study were obtained from 40 fish farmers in Akwa Ibom State using a two-stage sampling procedure and analyzed using descriptive statistics and budgeting technique. Results showed that 72.5% of the fish farmers were males; 47.5% were between 31-40 years; and 45.0% had primary education. The costs and returns analysis indicated that the variable cost constituted 50.27% of the total cost of production, while the fixed cost constituted 49.73%. The total cost of production was N 6, 424, 400.00; the total revenue of N 9, 514, 800.00; and the net income was N 3, 090, 400.00 indicating that fish production using concrete ponds was profitable in the study area.

However, efforts made to improve fish production in Nigeria must be anchored on analysis of fish production (Kudi *et al.*, 2008). This study therefore, examined the costs

and returns of fish production using concrete ponds in Akwa Ibom State. Specifically, the objectives were to examine the socio-economic characteristics of fish farmers using concrete ponds in Akwa Ibom State and to ascertain the costs and returns of fish farming using concrete ponds in the State.

Kenyan government initiated the ambitious ESP in 2009 to stimulate economic development, foster economic recovery, alleviate poverty, and spur regional development (Nyonje et al., 2011). The Fish Farming Enterprise Productivity Program under the ESP was aimed at injecting commercial thinking into fish farming to build up a vibrant aquaculture industry. The program aimed to increase production of farmed fish from 4,000 MT to over 20,000 MT in the medium term and to more than 100,000 MT in the long term (Charo-Karisa and Gichuri, 2010). In the first year of the program, 200 fish ponds were constructed in each of 140 constituencies, totaling more than 27,000 fish ponds nationally (Charo-Karisa and Gichuri, 2010; Musa et al., 2012). This triggered an immediate short-term demand for about 28 million certified tilapia and catfish fingerlings and over 14,000 MT of formulated fish feeds, which could not be adequately and timely supplied, even by the private sector (Musa et al., 2012). The ripple effect of the ESP led some farmers to dig their own ponds, further increasing the demand for seed fish and feed to over 100 million and 100,000 MT, respectively (Charo-Karisa and Gichuri, 2010; Musa et al., 2012).

Apart from the effects of the ESP, most people who abandoned subsistence farming for fish farming, and new farmers practicing commercial aquaculture, now own bigger ponds, resulting in higher yields (Otieno, 2011). Indeed, current national aquaculture production, including harvests from the ESP and other private farms, is estimated at 12,000 MT/y (Fig. 2), equivalent to 7% of the total production and valued at $21

million (Nyonje et al., 2011). Production is projected to hit 20,000 MT/y, representing 10% of national fish production, in the next 5 years (Nyonje et al., 2011). This presents a lucrative opportunity for aquaculture development in the feed and seed fish sectors, which unfortunately still suffer from basic problems.

The public sector presently consists of the Sagana Experimental Station (Central Province), the Kiganjo trout station (Central Province), and a series of demonstration ponds and small fish culture stations, particularly in Western Kenya. In Sagana, the experimental station was built in the late fifties at an altitude of 1 350 m for applied aquaculture research and the supply of fingerlings to fish farmers. To reach its production potential, it now requires renovation. The Kiganjo Station, built in 1960, functions mainly as a trout hatchery to produce the fingerlings needed to stock the local rivers for sport fishing .A 300 t/yr production farm is soon to be established near Kisumu (Nyanza) with the assistance of the World Bank, as part of the Fish Farming Development Centre .A pilot UNDP/FAO project in collaboration with the Department of Fisheries is presently establishing a 25 ha demonstration tidal farm in a coastal mangrove swamp, north of Malindi, for the production of penaeid shrimps, mullet, siganids and possibly tilapia.

Kabaka John (2012) **West *fm*** reported that the elevation of fish development from a department in the Ministry of Agriculture to a fully fledged ministry has really contributed to the development of fish farming in the County. Vihiga County is endowed with several sites suitable for fish farming. During the financial year 2009/2010, the farm received development funds amounting to Sh1.39 million. Over 800 ponds have been dug in the County with a distribution of 200 ponds per each district in the 4 sub- counties in the County. They did consider availability of reliable

source of water, nature of the soil and the willingness of the farmer to practice fish farming, these has catapulted the productivity in that they have been able to distribute fish feeds and fertilizer. They are aiming in registering a cooperative society to promote harvesting and also to boost the membership of the farmers from Njau Stephen a fisheries officer Vihiga county.

2.3. Agricultural extension services and fish production

According to FAO (2004), the fisheries sub-sector in the country has been faced with numerous challenges. These include: declining fish stocks in the natural water bodies, conflict between various users of fisheries resources, cross-border fishing and trade conflict, fish marketing, fish quality and post harvest issues, lack of a comprehensive fisheries policy and a fisheries master plan, low funding levels for the department and slow capacity building and staff motivation. These coupled with lack of proper extension services in the rural areas can adversely affect the output of the projects (FAO, 2007).

Hishamunda (2001) observed that in rural parts of Côte d'ivoire aquaculture failed because of the separation of ownership of the project and management, with the farmers lacking adequate skills. Satia (1991) reported similar cases of unsuccessful aquaculture as a result of the lack of entrepreneurial dedication by salaried managers. Pre-requisites for commercial aquaculture included bio-technical feasibility and economic viability. Failure of one led to failure of the whole project. Shortage of human capacity and poor technical expertise at both technical and farm level equally contributed to failure of commercial aquaculture projects necessitating the need for assessment and reform of the aquaculture advisory services at the national, provincial

and local level Government to form linkages and ensure technology transfer and support to develop aquaculture at farm levels (Corbin and Young, 1997). Bamba and Assouhan (2000).indicated that, a missing link between fish farmers and researchers and the lack of aquaculture expertise among extension agents highly affected commercial aquaculture.

Mwangi (2008) had also observed inadequate technical skills by extension staff occasioned by low staff levels with limited practical aquaculture skills as the main constraint to commercial aquaculture in Kenya. Ngugi et al (2007) similarly observed the same challenges as a stumbling block towards commercial fish farming in Kenya.

Ngugi et al (2007) found that the number of productive ponds declined in the 1980s, mainly because of inadequate extension services, lack of quality fingerlings, and insufficient training for extension workers. Until the mid-1990s, fish farming in Kenya followed a pattern similar to that observed in many African countries, characterized by small ponds, subsistence-level management, and very low levels of production. Fish farming or aquaculture provides viable alternative source of fishing especially at this time when the natural stocks of fish are declining. Kenya has great potential for aquaculture growth because it is endowed with climatic diversity, natural features and other resources that favor the culture of a wide variety of fish species

There were over 1, 600 active farmers in the Vihiga County. Most of the farmers had not had practical exposure on fish farming. The farmers need to be equipped with knowledge on fish pond management, fish harvesting technology and proper fish handling, value addition and fish marketing strategies .The fisheries department came up with a fish farm called Mwitoko Fish Farm located in Emuhaya ward occupying a 5

acre piece of land plot NO.E.Bunyore/Ebuchitwam 1633.The site was allocated by Luanda town council in 2009, as reported by Kabaka ***west fm*** given by fish officer John Njau vihiga county

2.4 Demographic characteristics and fish production

Demographic characteristics of entrepreneurs have been identified as factors that influence the performance and success of enterprises (Rutherford and Oswald, 2000; Man *et al.*, 2002). For example, even though two different studies have shown that the manager's level of education is a significant determinant of the growth of enterprises, the strengths of the relationships were not statistically significant, suggesting that the level of education did not actually matter in explaining the growth of small scale enterprises (McPherson, 1996); (Unger *et al.*, 2011). However, other authors have identified education and training as contributors to the growth and success of small enterprises (Simpson *et al.*, 2004; Kolstad and Wiig, 2013).

David L. Ortega (2012) Consumers are increasingly aware of the quality and safety of the aquaculture products they consume. As dynamic demand from consumers requires changes in the production and marketing of aquaculture products, suppliers are faced with decisions regarding the adoption or discontinuation of various practices regarding the production and marketing of their aquaculture products. Midwest aquaculture producers and retailers face difficult supply management and food safety decisions partially due to significant uncertainty regarding American consumers' WTP for various food product informational attributes.

According to Ofuoku A.U (2008) in his research on Demographic Characteristic of Respondents indicated that majority (68.3%) of the fish farmers were in the age

bracket of 41-50 years, while 22.5% were on the age bracket of 31-40 years. This implies that most of the fish farmers were between the ages of 31-50 years. This indicates that very few young and old people are involved in fish farming. This is because fish farming requires adequate attention and a lot of sense of responsibility. The young people in the rural communities mostly pursuing tertiary education between the ages of 20-30 years and pay much attention to their studies that they have little or no time for other serious activities, people above the age of 50 were few in fish farming because they lack adequate stamina required in the management of fish farms. Males (93.3%) dominate fish farming. The male dominance of this rural source of livelihood implies the laborious nature of fish farming operations right from pond construction to management which their female counterparts cannot easily undertake.

Harvey (1993) investigated on factors affecting the frequency of purchase of fish and other seafood for at-home and restaurant consumption by Northeaster consumers in his Cluster analysis, he identified six groups of consumers with similar perceptions of the attributes of fish. Demographic and cluster membership variables were employed in logistic regressions to identify the characteristics of frequent at-home use and restaurant purchasers. At-home purchase was more likely to be frequent among respondents with white collar occupations, older ages, urban/suburban and New England residence, recreational fishing participation, and membership in one of five attitudinal clusters. Restaurant purchase was more likely to be frequent among whites and among those with higher incomes, white collar occupations, and recreational fishing involvement and among members of two clusters with favorable attitudes toward fish; it was less likely to be frequent in households with children age 10.

Medwell journals ((2010) research aims to determine the socio-economic factors that are effective on fish consumption. Through clarifying these factors, the study attempts to bring proposals towards increasing fish consumption which is vital for adequate nourishment.. It is seen that this group of households has lower and middle income with lower literacy level living in large families and is generally within the middle-age group. On the other hand, a smaller percent of the household 13.05%, substitutes fish only for chicken. Another important finding of the research is that a much larger group of the households, 78% with higher income, higher educational level in the older age group and covered under pension scheme has a higher propensity to buy or consume fish. According to the results of the analysis, the most effective factors on fish consumption can be stated as price and dietary attributes. Therefore, it is concluded that by setting the market price of fish in line with different household income levels, dietary habits might change as well.

2.5 Accessibility to Financial facilities and fish production

The government of Kenya encourages aquaculture development by offering credit facilities through the government agricultural finance institution, Agriculture Finance Corporation. Nevertheless, the level of credit use in fish farming is very low. Access to credit is among several factors that affect farmers' decision of whether to use particular technology or services. The study examined factors that affected the decision of fish farmers in Kenya to utilize credit facilities in fish production using a probity model. The analysis suggests that farmers in the Western province will have a 19% more probability of using credit facilities for their fish farming operations than farmers from the other provinces such as the Rift Valley, Central, and the Eastern province. The effect of tilapia sales on the probability of credit use by fish farmers is more than three

times that of catfish sales. Total pond acreage owned by fish farmers had a positive effect on credit use but the effect was very small and negligible. The level of fish farmers' use of credit facilities is very low, and there is probably the need to educate farmers on credit use and for the government agricultural lending agency and other commercial agricultural lenders to invest in this enterprise. Kenyan lending institutions have financed traditional agricultural enterprises, and with the growing production of farmed fish, more research is needed to document the aquaculture business model to assist in assessing the profitability potential in aquaculture.

Ofuoku A.U. (2008) states that majority of the fish farmers (53%) subscribed to cooperative societies; while 34% held membership of Fish Farmers' Association. Those engaged in monthly contribution (Esusu) constituted 9% of the respondents, while 4.% of them did not subscribe to any social group. Those that subscribed to cooperative societies did so mainly to have access to credit discovered that fish farmers participated in cooperative societies mainly to have access to credit, input and aids from government and extension services. Those involved in Fish Farmers' Association did so because of easy access to extension services, market and credit facilities. This is in consonance with (6 %) who stated that when Fish Farmers Association was Formed in Lagos State and fish farmers got wind of it, they joined on hearing about the results achieved by members, mostly in terms of the associations link to markets, credit facilities and extension services.

Some communities in Kenya have already demonstrated competence through the use of "informal networks" frequently known as "community self-help groups." Their actions also complement efforts of various agencies to reduce poverty (Snow & Buss, 2001) and improve the lives of people in the rural areas. Community groups are

popular institutions in Kenya's rural areas which help provide services that the government may have failed to deliver (Freeman et al., 2004). Kenya's local self-help development efforts are predicated on the spirit of Harambee – a Swahili word that connotes community efforts for a common goal (Thomas, 1988). Modern self help groups' objectives now focus more on income-generating projects rather than solely welfare activities. They are multi-purpose and combine mutual financial assistance in the form of rotating credit associations to provide the means to pursue social, educational, and economic activities (Mbugua, 1997).

These groups open new opportunities to generate, save, and invest income and assist rural people in effectively responding to dynamic socio-economic changes as individuals, families, or as a community (Kiteme, 1992). Conversely, many international development aid agencies are now embracing such informal institutions because of their role in economic development, especially in Sub-Saharan Africa. They help complement bottom-up community development and correct government failures where national policies may have stymied growth (Snow & Buss, 2005)

2.6 Theoretical framework

In this study the theory of allocative efficiency was used. Allocative efficiency is a measure of how an enterprise uses production inputs optimally in the right combination to maximize profits (Inoni, 2007). Thus the allocatively efficient level of production is where the farmer operates at the least-cost combination of inputs. Most studies have been using gains obtained by varying the input ratio based on assumption about the future price structure of products say fish output and factor markets. This study follows Chukwuji, et al., (2006) reviewed assumption used by farmers to allocate resources for profit maximization. Such assumption included, farmers choosing the

best combination (low costs) of inputs to produce profit maximization output level; there is perfect competition in input and output markets; producers are price takers and assume to have perfect market information; all inputs are of the quality from all producers in the market.

Allocative efficiency can also be defined as the ratio between total costs of producing a unit of output uses actual factor proportions in a technically efficient manner, and the total cost of producing a unit of output using an optimal factor proportions in a technically efficient manner, (Inoni, 2007). Thus for the farm to maximize profit, under perfectly competitive markets, which requires that the extra revenue (Marginal Value Product) generated from the employment of an extra unit of a resource must be equal to its unit cost (Marginal Cost=unit price of input) Chukwuji, et al., (2006). In summary if the farm is to allocate resources efficiently and maximize its profits, the condition of MVP=MC should be achieved.

2.7 Conceptual frame work

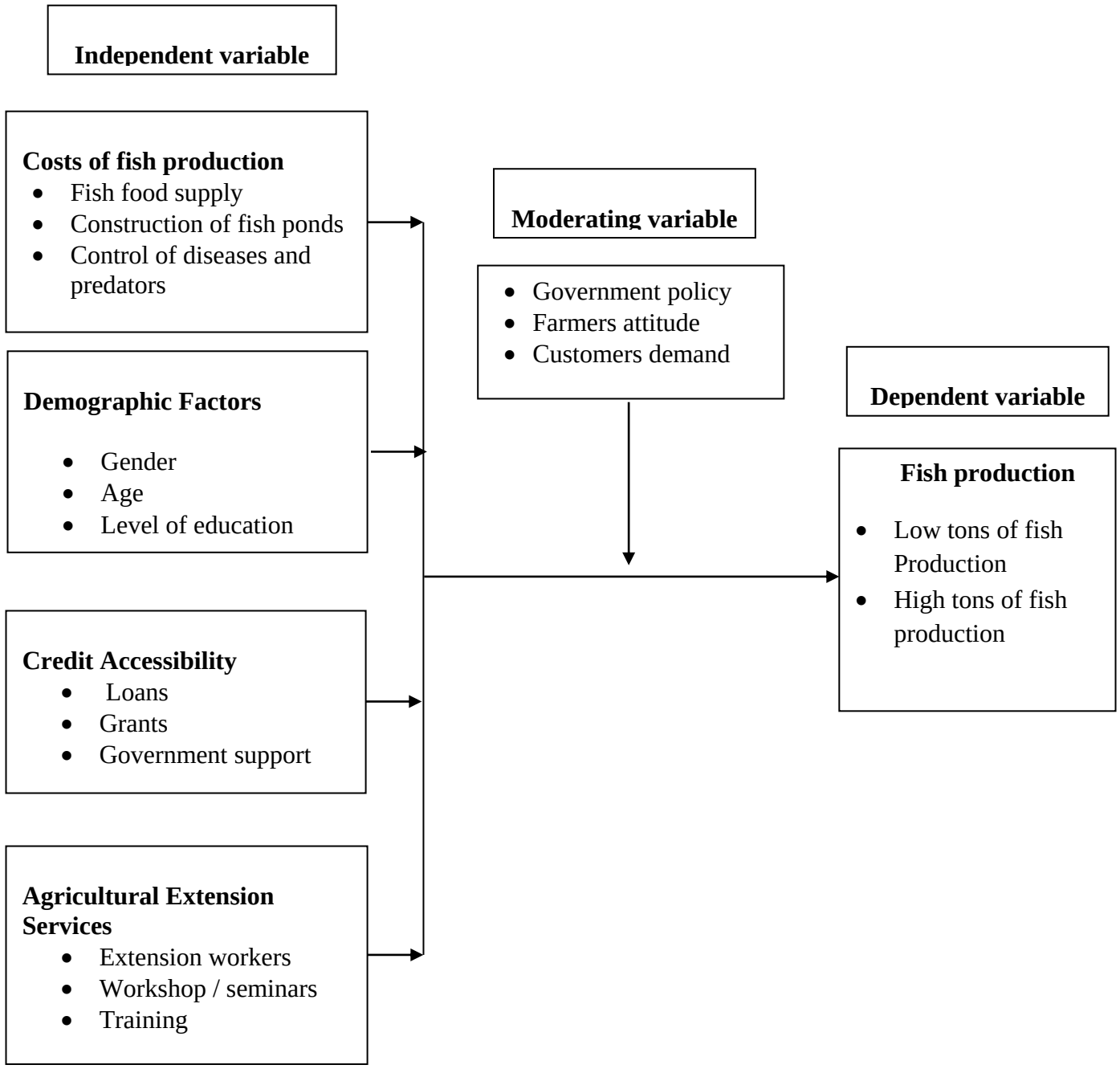


Fig 2.1 Conceptual frame work showing the relationship between the interdependent and dependent variables

2.7 Research gap

The knowledge gap that is going to be addressed in this study is that despite the fact that the government's effort to improve fish production through Economic Stimulus Programme (ESP) of Kenya's economy (Manyala, 2011), boost the nutritional situation of the farmers and create employment (TISA, 2010) by funding Fish pond construction costs as well as the costs for feeds and fingerlings being subsidized by the programme, governmental infrastructure supporting the aquaculture sub-sector, i.e. trainings, research farms and extension officers (Hino, 2011), Kenyan aquaculture production is still insignificant (Rothuis *et al 2011)*

Mwangi (2008) has also observed inadequate technical skills by extension staff occasioned by low staff levels with limited practical aquaculture skills as the main constraint to commercial aquaculture in Kenya. Ngugi et al (2007) similarly observed the same challenges as a stumbling block towards commercial fish farming in Kenya.

Ngugi et al (2007) found that the number of productive ponds declined in the 1980s, mainly because of inadequate extension services, lack of quality fingerlings, and insufficient training for extension workers.

Medwell journals ((2010) research aims to determine the socio-economic factors that are effective on fish consumption. According to the results of the analysis, the most effective factors on fish consumption can be stated as price and dietary attributes. Therefore, it is concluded that by setting the market price of fish in line with different household income levels, dietary habits might change as well which can create a gap in fish production amongst small scale farmers.

Inadequate entrepreneurship skills by the farmers and lack of credit accessibility constraining production and growth on small scale fish farmers despite of community self help groups providing services where the government might have failed (Mwangi, 2008; Osure, 2011).

Summary of literature review

The main purpose of the above literature review is to find out related literature among other concern and to examine how other factors possibly influence on fish production are interrelated to that of the case study and other places.

The literature review is intended to help the researcher identify gaps in knowledge in order to create a framework and a direction for other knew research studies. In the literature reviewed, costs of production, demographic factors, extension services and credit accessibility and their influence on fish production was investigated.

CHAPTER THREE: RESEARCH METHODOLOGY

3.1. Introduction

This chapter gives a brief overview of various steps and methods that the researcher will employ in the study. It gives a description of the research design which was used, study area, target population, sample and sampling procedure, validity and reliability of the instruments for data collection procedure and data analysis.

3.2. Research design

A design refers to an approach to be used in any research undertaking .According to Kothari (2004), states that research design is the arrangement of conditions for collection and analysis of data in a manner that aims to combine relevance to the research purpose with economy in procedure. In order to achieve the objectives of this study, a descriptive cross –section survey was used to explore and describe characteristics of the target population. Kothari says that descriptive survey design will assists the researcher in collecting data from a relatively larger number of cases at a particular time. The descriptive survey designed will help answer the questions like who, what, where, and how on describing the phenomenon on study. This design was appropriate for this study because it will enable data collection from the sample intended on the factors influencing fish production among small scale farmers .

3.3. Target population

Target population is that population that the researcher wants to generalize the results of the study. Mugenda and Mugenda (2003) define target population as the entire group which a researcher is interested in or the group about which the researcher wishes to draw conclusion from. The target population for this study was 200 small

scale fish farmers of Hamisi -Sub County which has four Wards; Banja ward, Tambua ward, Gisambai ward and Shamakhokho ward.

3.4. Sample size and sampling procedure

This section presents the method that was used to determine the study sample size from which data was collected. It also describes the sampling procedure that was used in selecting elements to be included as the subjects of the study sample. A sample size is a sub-set of the total population of that is used to give the general views of the target population (Kothari 2004). The sample size must be a representative of the population on which the researcher would wish to generalize his research findings.

3.4.1 Sample size determination

According to Kothari (1985), Mugenda and Mugenda (1999) and Peter (1996) in a survey, a sample enables a researcher to gain information about the population. Therefore, using Krejcie & Morgan (1970) tables (**See appendix 5**) a suitable sample size of 132 as a target population is 200.

3.4.2. Sampling procedure

To select individuals from the wards to participate in the study, systematic random sampling was used, whereby using farmers' lists, the names of the respondents was chosen at an interval in which all the four wards was considered

Table 3.1 Population and sample size

WARD	POPULATION	SAMPLE SIZE
Banja	55	36
Gisambai	64	42
Shamakhokho	42	28
Tambua	39	26
TOTAL	200	132

3.5. Data collection instruments

Creswell (2003) indicates that research instruments are the tools used in the collection of data on the phenomenon of the study. For this study the researcher will use questionnaires in order to collect data for the study from the selected farmers in Hamisi Sub- County. A questionnaire according to Mugenda (2003) is a list of standard questions prepared to fit a certain inquiry. The questionnaire will have closed ended questions to reduce biasness

3.5.1 Pilot study

Piloting is trying out of research instruments on the respondents who will not be used in the main study. Groll (1986) notes that a pilot study is necessary because a researcher embarking on classroom research for the first time will find it valuable to spend some time in the classroom using one or more established systems and looking at the kind of issues which will arise in turning his/ her own research questions into a set of criteria and definition for use in the classroom. It is important for a pilot study to be carried out before any research is done as stated by Peter (1994). He states “even the most carefully constructed instrument cannot guarantee to obtain a hundred percent

reliable data". Therefore it was necessary to pretest the instruments of the research on a small sample of respondents in a preparatory exercise to find out if there is any weakness so that it can be corrected. The research instruments was piloted in order to standardize them before the actual study. I n this study , the pilot study was done using small scale fish farmers of East Bunyore ward (Mwitokho) in Emuhaya sub-county using simple random sampling. This will help in identifying problems that respondents might encounter and determine if the items in research instrument will yield the required data for the study. Using simple random sampling, the researcher will select a sample of 13 subjects equivalent to 10% of the study sample size 132 subjects. According to Mugenda and Mugenda (2003) a sample equivalent to 10% of the study sample is enough for piloting the study instruments. After responding to the instruments, the subjects was encouraged to make necessary corrections and adjustments of the instruments to increase their reliability.

3.5.2. Validity of the research instruments

Validity is defined as the appropriateness, correctness and meaningfulness of the specific interferences which are selected on research results (Frankel & Wallen, 2008). It is the degree to which results obtained from the data analysis actually represents the phenomenon under study. In this study, content validity was applied. Content validity according to Kothari (2004) is the extent to which a measuring instrument provides adequate coverage of the topic under study.

Content validity ensures that the instruments will cover the subject matter of the study as intended by the researcher. Therefore, the content validity of the instrument was determined by colleagues and experts in research who will look at the measuring techniques and coverage of specific areas (objectives) covered by the study. The

experts will then advise the researcher on the items to be corrected. The corrections on the identified questions was incorporated in the instrument hence fine tuning the items to increase its validity. Validity was ascertained by checking whether the questions were measuring what they were supposed to measure such as the clarity of wording and whether the respondents were interpreting all questions in the similar ways. Validity was established by the researcher through revealing areas causing confusion and ambiguity and this will lead to reshaping of the questions to be more understandable by the respondents and to gather uniform responses across various respondents.

3.5.3. Reliability of the research instruments.

Mugenda and Mugenda (2003), research instruments are expected to yield the same results with repeated trials under similar conditions. For them, the instrument to return the same measurement when it is used at different times. Therefore, in order to determine the consistency of the measuring instruments to return the same measurements when used at different times, the researcher will use the split half method to determine reliability of the instrument. First it was used during the pilot study, before the actual research is done. The questionnaire items responded by the respondents of the pilot testing group was assigned arbitrary scores. , where two sets of scores was obtained from the same test, one set from odd items and one set from even items (http://www.answers.com/topic/split-half-method) .The results was used to compute the correlation coefficient. The scores obtained was used in Spearman's rank correlation coefficient, of which if a correlation coefficient of 0.75 is obtained then the relationship is strong between the actual and the pilot study. According to

Mbwesa (2006), if the reliability correlation coefficient of the instruments is 0.75 and above, then the instrument is taken reliable and therefore suitable for data collection.

3.6. Data collection procedure

The researcher will obtain an introductory letter from the University of Nairobi which was used to apply a research permit from the National Council of Science and Technology and Innovation (NACOSTI), and then will proceed to the study area for appointments with farmers and QUASO's for data collection. A covering letter was attached to the questionnaire to request the respondent to participate in the study. The QUASO's was informed beforehand about the purpose of the study. A total of 132 small scale fish farmers will participate in the study and was given questionnaires and the researcher will collect the filled ones one week after distribution.

3.7. Data analysis techniques

The study will employ descriptive statistical methods in order to analyze the data collected. There was cross checking of the questionnaires to ensure that the questions are answered properly. The data will first be divided into themes and sub-themes before being analyzed. Frequency and percentages was used in the analysis and presented in a tabular form to enhance interpretation of data. Frequency and percentages was used to determine the factors influencing fish production among small scale farmers. This was analyzed and reported by descriptive narrative (Mugenda & Mugenda, 1999). The results of the data will give the researcher a basis to make conclusions about the study.

3.8. Ethical Considerations

This study was conducted within the strict ethical code guiding research at University of Nairobi. During the development of the proposal, data collection, analysis and final proposal write up, plagiarism has been highly avoided by citing relevant sources and authorities of the secondary sources of information.

The research will assure the respondents of the confidentiality of the information provided, including their own personal information. The respondents was informed of the purpose of the study, that is, for academic purposes only. This is to enable them to provide the information without any suspicions.

3.9. Operationalization of variables

This section showed the objectives of the study, dependent variable and indicators and the indications of the independent variables and how they can be measured.

Table 3.2: Operationalization of Variables

Objectives	Variables	Indicators	Measurement scale
To investigate how costs influence fish production of small scale farmers of Hamisi S/county	Costs	- Fish food supply - Construction of fish ponds - Control of diseases and predator	- Frequencies - Percentages - Chi-square
To establish how demographic characteristics of farmers influence fish production of small scale farmers of Hamisi S/county	Demographic factors	- Gender - Age - Level of education	- Frequencies - Percentages - Chi-square
To determine the extent to which agricultural extension services influence fish production of small scale farmers of Hamisi S/County	Extension services	- Seminars/workshops - Trainings - Extension workers	- Frequencies - Percentages - Chi-square
To examine how accessibility to credit facilities influence fish production of small scale farmers of Hamisi S/county	Accessibility to credit	- Loans - Grants - Government support	- Frequencies - Percentages - Chi-square

CHAPTER FOUR

DATA ANALYSIS, PRESENTATION AND DISCUSSION

4.0 Introduction

This chapter presents findings of the study which have been discussed under thematic and sub-thematic sections in line with the study objectives. The thematic areas included costs of production, extent to which agricultural services influence production, extent to which demographic characteristics influence fish production and how accessibility to credit facilities influence fish production among small scale farmers in Hamisi sub-county

4.1 Questionnaire return rate

The researcher was interested in establishing response return rate owing to the fact that the return rate determines the quality of data collected and significance of the study findings to an existing population. This was presented as in table 4.1.

Table 4.1 Sample population and response rate

WARD	SAMPLE SIZE	RETURN RATE	PERCENT
Banja	36	36	27.27
Shamakhokho	42	38	28.78
Tambua	28	28	21.21
Gisambai	26	26	19.69
Total	**132**	**128**	**96.9697**

Results from table 4.1 revealed that there was a return rate of 96.96%. This is majorly attributed to the researcher's accurate timing of scheduled meetings that were organized by extension officers in the field. In this way the instruments were

collected from the respondents well after they were through with them. The few cases of non-return were present as regards the poor terrain in the target area, where during the rainy season, muddy road hindered transportation and therefore late receipt of the instruments.

4.2. Demographic characteristics of respondents

The study was interested in identifying the whether demographic characteristics inflicted fish production of small scale farmers and this was achieved by studying respondents gender, age bracket, level of education and source of labor respectively.

Table 4.2. **respondents gender**

Gender	Frequency	Percent
Male	52	40.6
Female	76	59.4
Total	**128**	**100.0**

Results from table 4.2 revealed that majority of the respondents in the study 76 (59.4%) were females, followed by 52 (40.6%) that were males therefore indicating more females than males participated in the study. Thereafter the study investigated age brackets majorly involved in fish production in Vihiga and respondents were asked to indicate the bracket they belonged and results were as follows in table 4.3;

Table 4.3 respondents age bracket

Bracket	Frequency	Percent
18 - 20 years	37	28.9
20 - 30 years	58	45.3
30 - 40 years	20	15.6
40 - 50 years	7	5.5
50 - 60 years	6	4.7
Total	**128**	**100.0**

Results from table 4.3 revealed that majority of the respondents in the study were aged from between 20 – 30 years, 58 (45.3%), followed by those within 18 – 20 years, 37 (28.9%), 30 – 40 years, 20 (15.6%), 40 – 50 years, 7 (5.5%) and lastly those within 50 – 60 years, 6 (4.7%). This implied that most of the participants in fish farming were aged from between 20 – 30 years that is a productive age of youths.

The study moreover sought to establish as a factor, the level of education of respondents in the study and the results were as shown in table 4.4;

Table 4.4. Indicate your level of education

Level of education	Frequency	Percent
Primary school	45	35.2
secondary school	64	50.0
College	19	14.8
Total	**128**	**100.0**

Results from table 4.4 revealed that majority of participants in the study were secondary school graduates as represented by 64 (50.0%) followed by primary

school graduates at 45 (35.2%) and lastly college graduates at 19 (14.8%). Further, the source of labor as part of the demographics in the study was sought by the researcher where the respondents were asked to indicate where they sourced for labour and the results were as shown in table 4.5;

Table 4.5 Source of labour

Source	**Frequency**	**Percent**
hired manual labour	39	30.5
unpaid family and friends labour	62	48.4
mechanical labour	27	21.1
Total	**128**	**100.0**

Results from table 4.5 indicated that majority of farmers in the fish production acquired labour on their ponds from unpaid family and friends 62 (48.4%) followed by hired manual labour, 39 (30.5%) and lastly mechanical labour 27 (21.1%).

4.3. Investigating the costs of fish production

This was the first objective of the study that sought to investigate whether costs of production influenced fish production among small scale farmers in Hamisi sub-county. As a theme it was guided by indicators that were studied under the following sub-themes in effort to outline their influences on fish production in the county and subsequent influences to further studies related to fish production.

4.3.1. Selection of good fish ponds

Table 4.6. Selection of good fish ponds reduces the cost of preparation

Level of response	Frequency	Percent
Strongly agree	40	31.3
Agreed	68	53.1
Disagreed	20	15.6
Total	**128**	**100.0**

Results from table 4.6 revealed that majority of farmers in the study agreed 68 (53.1%) that selection of good fish ponds reduces the cost of preparation, followed by 40 (31.3%) that strongly agreed on the same whereas 20 (15.6%) declined. The study followed a cross tabulation to indicate variables' relationship within the study by their categorical representation and the results were as presented in table 4.7 with their subsequent chi and p-values;

Table 4.7. Influence/no influence on fish production and selection of good fish ponds reduces the cost of preparation

influence/no influence on fish production		selection of good fish ponds reduces the cost of preparation			Total
		strongly agree	agreed	disagreed	
Yes	Count % within selection of good fish ponds reduces the cost of preparation	16 40.0%	44 64.7%	8 40.0%	**68 53.1%**
No	Count % within selection of good fish ponds reduces the cost of preparation	24 60.0%	24 35.3%	12 60.0%	**60 46.9%**
Total	**Count % within selection of good fish ponds reduces the cost of preparation**	**40 100.0%**	**68 100.0%**	**20 100.0%**	**128 100.0 %**

Results from table 4.7 revealed that responses within strongly agree that acknowledged the influence of selection of good fish ponds reducing cost of preparation and fish production stood at 16 (40.0%) while 24 (60.0%) declined, 44 (64.7%) within agree acknowledged its influence while 24 (35.3%) in the same category declined its influence and lastly 8 (40.0%) within disagreed acknowledged the influence selection of good fish ponds reducing cost of preparation on fish production whereas in the same category 12 (60.0%) declined. When a chi statistic was conducted to establish association between the factor and the dependent variable, a chi – value of 7.813 at 2df drew a .020 likelihood of association, thereby showing significant relationship existed as this was below the alpha value of .050.

4.7 Right ratio and returns

The study was interested in establishing whether right feeds ration influenced fish production returns among farmers in Vihiga county and the results were as presented in table 4.8;

Table 4.8. Use of right feeds in their right ratio increases returns from fish production

Level of response	Frequency	Percent
Strongly agree	59	46.1
Agreed	59	46.1
Disagreed	10	7.8
Total	**128**	**100.0**

Results from table 4.8 revealed that majority of farmers in the study strongly agreed 59 (46.1%) and respectively in the subsequent level of response that the

use of right feeds increased their production The study followed a cross tabulation to indicate variables' relationship within the study by their categorical representation and the results were as presented in table 4.9 with their subsequent chi and p-values to reveal the association and relationship;

Table 4.9: Cross tabulation showing influence/no influence on fish production and use of right feeds in their right ratio increases returns from fish production

influence/no influence on fish production		**use of right feeds in their right ratio increases returns from fish production**			**Total**
		strongly agree	**agreed**	**disagreed**	
Yes	Count % within use of right feeds in their right ratio increases returns from fish production	32 54.2%	34 57.6%	2 20.0%	**68** **53.1%**
No	Count % within use of right feeds in their right ratio increases returns from fish production	27 45.8%	25 42.4%	8 80.0%	**60** **46.9%**
Total	**Count % within use of right feeds in their right ratio increases returns from fish production**	**59** **100.0%**	**59** **100.0%**	**10** **100.0%**	**128** **100.0%**

Results from table 4.9 revealed that responses within strongly agree that acknowledged the influence of right feeds in their right ratios on fish farming and fish production stood at 32 (54.2%) while 27 (45.8%) declined, 34 (57.6%) within agree acknowledged its influence while 25 (42.4%) in the same category declined its influence and lastly 2 (20.0%) within disagreed acknowledged the influence right feed had on fish production whereas in the same category 8 (80.0%) declined.

When a chi statistic was conducted to establish association between the factor and the dependent variable, a chi – value of 4.916 at 2df drew a .086 likelihood of association, thereby showing significant relationship existed as this was below the alpha value of .050.

4.3.3. Prevention of diseases and predators lowering fish production

The study further sought to establish, whether as an indicator within production, prevention of predator and diseases influenced fish production and the results were as presented in table 4.10;

Table 4.10: Prevention of diseases and predators lowers costs of fish production

Level of response	Frequency	Percent
strongly agree	60	46.9
Agreed	58	45.3
Disagreed	10	7.8
Total	**128**	**100.0**

Results from table 4.10 revealed that majority of farmers in the study strongly agreed at 60 (46.9%) that prevention of diseases and predators lowered the cost of fish production followed by 58 (45.3%) who agreed moderately on the same and lastly 10 (7.8%) that disagreed. This implied that predators and diseases majorly impacted on the cost of fish production in Vihiga County. The study followed a cross tabulation to indicate variables' relationship within the study by their categorical representation and the results were as presented in table 4.11 with their subsequent chi and p-values;

Table 4.11: cross tabulation showing influence/no influence on fish production and prevention of diseases and predators lowers costs of fish production

Measuring Scale			prevention of diseases and predators lowers costs of fish production			Total
			strongly agree	**agreed**	**disagreed**	
influence/no influence on fish production	Yes	Count % within prevention of diseases and predators lowers costs of fish production	38 63.3%	27 46.6%	3 30.0%	**68** **53.1%**
	No	Count % within prevention of diseases and predators lowers costs of fish production	22 36.7%	31 53.4%	7 70.0%	**60** **46.9%**
	Total	**Count % within prevention of diseases and predators lowers costs of fish production**	**60** **100.0%**	**58** **100.0%**	**10** **100.0%**	**128** **100.0%**

Results from table 4.11 revealed that responses within strongly agree that acknowledged the influence prevention of diseases and predators had on fish farming and fish production with 38 (63.3%) while 22 (36.7%) declined, 27 (46.6%) within agree acknowledged its influence while 31 (53.4%) in the same category declined its influence and 3 (30.0%) within disagreed acknowledged the influence prevention of diseases and predators had on fish production whereas in the same category 7 (70.0%) declined. A chi statistic was conducted to establish association between the factor and the dependent variable, a chi – value of 5.665 at 2df drew a .059 likelihood of association, slightly higher than the table constant of .050 and thereby indicating a relatively strong significant relationship existed between prevention of diseases and predators and fish production.

4.3.4. Lining and refilling of fish ponds

The study further sought to establish whether as an indicator, lining and refilling of fish ponds to avoid drying influenced production by small scale farmers in Vihiga. The results were as presented in table 4.12;

Table 4.12: Lining and refilling of fish ponds helps prevent drying of fish ponds

Level of response	Frequency	Percent
Strongly agree	82	64.1
Agreed	34	26.6
Disagreed	12	9.4
Total	**128**	**100.0**

Results from table 4.12 revealed that majority of farmers in the study strongly agreed 82 (64.1%) that lining and refilling of fish ponds helped prevent drying of fish ponds and thus reducing the cost of production, followed by, followed by 34 (26.6%) that agreed whereas 12 (9.4%) declined. This implied that costs were incurred majorly when fish ponds dried and that why farmers would most probably opt for refilling of their fish ponds. A cross tabulation was conducted to indicate variables' relationship within the study by their categorical representation and the results were as presented in table 4.13 with their subsequent chi and p-values;

Table 4.13: Cross tabulation influence/no influence on fish production and lining and refilling of fish ponds helps prevent drying of fish ponds

Measuring scale			lining and refilling of fish ponds helps prevent drying of fish ponds			Total
			strongly agree	agreed	disagreed	
influence/no influence on fish production	**Yes**	Count % within lining and refilling of fish ponds helps prevent drying of fish ponds	48 58.5%	16 47.1%	4 33.3%	**68** **53.1%**
	No	Count % within lining and refilling of fish ponds helps prevent drying of fish ponds	34 41.5%	18 52.9%	8 66.7%	**60** **46.9%**
	Total	**Count % within lining and refilling of fish ponds helps prevent drying of fish ponds**	**82** **100.0%**	**34** **100.0%**	**12** **100.0%**	**128** **100.0%**

Results from table 4.13 revealed that responses within strongly agree that acknowledged the influence lining of fish ponds had on fish farming and fish production with 48 (58.5%) while 34 (41.5%) declined, 16 (47.1%) within agree acknowledged its influence while 18 (52.9%) in the same category declined its influence and lastly 4 (33.3%) within disagreed acknowledged the influence lining fish ponds to prevent drying had on fish production whereas in the same category 8 (66.7%) declined. When a chi statistic was conducted to establish association between the factor and the dependent variable, a chi – value of 3.354 at 2df drew a .187 likelihood of association, thereby showing slight significant relationship existed as this was slightly above a table value of .050.

4.3.5. Major costs of fish production

Table 4.14: Major cost of fish production

Level of response	Frequency	Percent
fish pond preparation	71	55.5
purchase of plots	49	38.3
fingerlings acquisition	8	6.3
Total	**128**	**100.0**

Results from table 4.14 revealed that majority of farmers in the study revealed that fish pond preparation 71 (55.5%) majorly influenced fish production, followed by purchase of plots 49 (38.3%) and lastly the purchase of fingerlings came at 8 (6.3%). This implied that majorly, cost of fish pond production highly inflicted fish production. To establish variables' relationship within the study by their categorical representation and the results of cross tabulations were as presented in table 4.15 with their subsequent chi and p-values;

Table 4.15: Cross tabulation showing influence/no influence on fish production and major cost of fish production

Measuring scale			major cost of fish production: fish pond preparation	major cost of fish production: purchase of plots	major cost of fish production: fingerlings acquisition	Total
influence/no influence on fish production	**Yes**	Count % within major cost of fish production	45 63.4%	21 42.9%	2 25.0%	**68** **53.1%**
	no	Count % within major cost of fish production	26 36.6%	28 57.1%	6 75.0%	**60** **46.9%**
	Total	**Count % within major cost of fish production**	**71** **100.0%**	**49** **100.0%**	**8** **100.0%**	**128** **100.0%**

When a chi statistic was conducted to establish association between the factor and the dependent variable, a chi – value of 7.614 at 2df drew a .022 likelihood of association, thereby showing significant relationship existed as this was below the alpha value of .050.

4.4. Demographic characteristics of farmers influencing fish production

Farmer's characteristics were studied to establish whether they influenced fish production. In this way, common age bracket, education level and adoption to new technologies, were studied among others and the results were as presented as follows;

4.4.1. Age bracket and fish farming

The study was interested in establishing the common age bracket involved in fishing activates and respondents were asked to indicate their age brackets. The results were as presented in table 4.16;

Table 4.16: Common age bracket

Bracket	Frequency	Percent
18 - 20 years	89	69.5
20 - 30 years	28	21.9
30 - 40 years	11	8.6
Total	**128**	**100.0**

Results from table 4.16 revealed that majority of farmers in the study were aged between 18 – 20 years 89 (69.5%), followed by those within 20 – 30 years 28 (21.9%), and those from within 30 – 40 years 11 (8.6%). The study followed a cross tabulation to indicate variables' relationship within the study by their

categorical representation and the results were as presented in table 4.17 with their subsequent chi and p-values;

Table 4.17: Cross tabulation showing influence/no influence on fish production and common age bracket

Measuring scale			Common age bracket			Total
			18 - 20 years	**20 - 30 years**	**30 - 40 years**	
influence/no influence on fish production	Yes	Count % within common age bracket	43 48.3%	18 64.3%	7 63.6%	**68** **53.1%**
	No	Count % within common age bracket	46 51.7%	10 35.7%	4 36.4%	**60** **46.9%**
	Total	**Count % within common age bracket**	**89** **100.0%**	**28** **100.0%**	**11** **100.0%**	**128** **100.0%**

When a chi statistic was conducted to establish association between the factor and the dependent variable, a chi – value of 2.716 at 2df drew a .257 likelihood of association, thereby showing no significant relationship existed as this was above a table constant of .050.

4.4.2. Education level and fish farming

As an indicator within demographics, the study sought to ascertain whether education level as a factor affected adoptability of new farming techniques and the results obtained from respondents were as presented in table 4.18;

Table 4.18: Frequency distribution on education level to adopt to new fishing farming techniques

Level of education	Frequency	Percent
Primary	77	60.2
Secondary	24	18.8
Tertiary	27	21.1
Total	**128**	**100.0**

Results from table 4.18 revealed that majority of farmers in the study that were graduates from primary school highly adopted to new farming techniques, 77 (60.2%) followed by 27 (21.1%) from tertiary levels of education washing to adopt to new technologies and lastly, respondents from within secondary school level of education 24 (18.8%) this implied that respondents from within primary school level of education's adoptability to new farming technologies was easier than those from secondary and tertiary level of education respectively. To establish variables' relationship within the study by their categorical representation and the results of cross tabulations were as presented in table 4.19 with their subsequent chi and p-values;

Table 4.19: influence/no influence on fish production and education level to adopt to new fishing farming techniques

			education level to adopt to new fishing farming techniques			Total
Measuring scale			**primary**	**secondary**	**tertiary**	
influence/no influence on fish production	Yes	Count % within education level to adopt to new fishing farming techniques	48 62.3%	8 33.3%	12 44.4%	**68** **53.1%**
	No	Count % within education level to adopt to new fishing farming techniques	29 37.7%	16 66.7%	15 55.6%	**60** **46.9%**
	Total	**Count % within education level to adopt to new fishing farming techniques**	**77** **100.0%**	**24** **100.0%**	**27** **100.0%**	**128** **100.0%**

When a chi statistic was conducted to establish association between the factor and the dependent variable, a chi – value of 7.217 at 2df drew a .027 likelihood of association, thereby showing significant relationship existed as this was below the alpha value of .050.

4.4.3. Category of application for fingerlings

The study further attempted to ascertain whether male headed households as compared to their female counterparts applied for more fingerlings as a factor within fish production in Vihiga County and the results were as shown in table 4.20;

Table 4.20: Frequency distribution on Male headed households apply for more fingerlings than female counterparts

Level of response	Frequency	Percent
Strongly agree	97	75.8
Agreed	30	23.4
Disagreed	1	.8
Total	**128**	**100.0**

Results from table 4.20 revealed that majority of farmers in the study strongly agreed to male headed household applying for more fingerlings than their female counterparts in Vihiga, 97 (75.8%) followed by 30 (23.4%) who agreed to the same and a minority disagreeing at 1 (.8%). This implied that there are more male farmers. A further insight into the relationships between variable the study conducted a cross tabulation analysis by their categorical representation and the results of cross tabulations were as presented in table 4.21 with their subsequent chi and p-values;

Table 4.21: Cross tabulation showing Influence/no influence on fish production and male headed households apply for more fingerlings than female counterparts

Measuring scale			Male/female households apply for more fingerlings			Total
			strongly agree	**agreed**	**disagreed**	
influence/no influence on fish production	Yes	Count % Male/female households apply for more fingerlings	48 49.5%	19 63.3%	1 100.0%	**68 53.1%**
	No	Count % Male/female households apply for more fingerlings	49 50.5%	11 36.7%	0 .0%	**60 46.9%**
	Total	**Count % Male/female households apply for more fingerlings**	**97 100.0%**	**30 100.0%**	**1 100.0%**	**128 100.0%**

A chi statistic conducted by the study established a very slight association between male and female household's frequency in application for fingerlings and subsequent fish production as a chi – value of 2.654 at 2df drew a .265 likelihood of association, thereby showing no significant relationship existed.

Table 4.22: Farmers with large fish ponds apply for more fingerlings than those with smaller farms

Response level	Frequency	Percent
Strongly agree	87	68.0
Agreed	24	18.8
Disagreed	17	13.3
Total	**128**	**100.0**

Results obtained from table 4.22 showed that 87 (68.0%) among respondents strongly agreed, 24 (18.8%) representation agreed and lastly 17 (13.3%) disagreed. This implied that majority of farmers contended that colleagues with large fish ponds applied for more fingerlings than those with smaller ponds.

Table 4.23: Cross tabulation showing influence/no influence on fish production and farmers with large fish ponds apply for more fingerlings than those with smaller farms

			farmers with large fish ponds apply for more fingerlings than those with smaller farms			**Total**
			strongly agree	**agreed**	**disagreed**	
influence/no influence on fish production	yes	Count % within smaller farms	51 58.6%	14 58.3%	3 17.6%	68 53.1%
	No	Count % within smaller farms	36 41.4%	10 41.7%	14 82.4%	60 46.9%
	Total	**Count % within smaller farms**	**87 100.0%**	**24 100.0%**	**17 100.0%**	**128 100.0%**

With a chi statistic being conducted to establish association between the factor and the dependent variable, a chi – value of 9.909 at 2df drew a .007 likelihood of association, thereby showing significant relationship existed as this was below the alpha value of .050.

4.5. Establishing the extent to which agricultural extension services influence fish production among small scale farmers

Table 4.24: Agricultural field days in my area

Response level	Frequency	Percent
Yes	76	59.4
No	52	40.6
Total	**128**	**100.0**

Results obtained from table 4.24 showed that 76 (59.4%) among respondents had attended a farmers field day while 52 (40.6%) hadn't. this followed a cross tabulation to identify categorical responses within variables relationships and the results obtained also attempted to reveal the relationship significance, therefore calculating a chi-statistic as shown in table 4.25;

Table 4.25: Cross tabulation showing influence/no influence on fish production and i have attended agricultural field days in my area

			i have attended agricultural field days in my area		**Total**
			yes	**no**	
influence/no influence on fish production	**yes**	Count % within i have attended agricultural field days in my area	43 56.6%	25 48.1%	**68** **53.1%**
	no	Count % within i have attended agricultural field days in my area	33 43.4%	27 51.9%	**60** **46.9%**
Total		**Count % within i have attended agricultural field days in my area**	**76** **100.0%**	**52** **100.0%**	**128** **100.0%**

When a chi statistic was conducted to establish association between the factor and the dependent variable, a chi – value of .896 at 1df drew a .344 likelihood of occurrence in the association between attending an agricultural field day and fish production and thereby showing no significant relationship existed.

Table 4.26: when one attended field day

Response level	**Frequency**	**Percent**
within the last half year	72	56.3
within the last one year	51	39.8
within the last two years	5	3.9
Total	**128**	**100.0**

Results obtained from table 4.26 showed that 72 (56.3%) among respondents had attended a farmer's field day from the period of within the last half of the year, 51 (39.8%) representation agreed t have attended a farmer's field day form the period within a year and lastly 5 (3.9%) had attended a farmer's field day from the period of within the last two years. This implied that majority of farmers were in contact with agricultural field office The study followed a cross tabulation to identify categorical responses within variables relationships and the results obtained also attempted to reveal significance between relationship, therefore calculating a chi-statistic as shown in table 4.27;

Table 4.27: Cross tabulation showing Influence/no influence on fish production and when one attended field day

			Attending a field day			
			within the last half year	**within the last one year**	**within the last two years**	**Total**
influence/no influence on fish production	yes	Count% within when one attended field day	41 56.9%	23 45.1%	4 80.0%	**68 53.1%**
	no	Count % within when one attended field day	31 43.1%	28 54.9%	1 20.0%	**60 46.9%**
	Total	**Count % within when one attended field day**	**72 100.0%**	**51 100.0%**	**5 100.0%**	**128 100.0 %**

When a chi statistic was conducted to establish association between the factor and the dependent variable, a chi – value of 3.192 at 2df drew a .203 likelihood of association with fish production and thereby showing a slight significance of the factor.

Table 4.28: farmer group has been visited by an agricultural extension officer

Response level	**Frequency**	**Percent**
Yes	80	62.5
No	48	37.5
Total	128	100.0

Results obtained from table 4.28 showed that 80 (62.5%) among respondents had been visited by an agricultural extension officer, 48 (37.5) had not been visited. The study followed a cross tabulation to identify categorical responses within variables relationships and the results obtained also attempted to reveal

significance between relationship, therefore calculating a chi-statistic as shown in table 4.29;

Table 4.29: Cross tabulation showing Influence/no influence on fish production and a farmer group has been visited by an agricultural extension officer

			a farmer group has been visited by an agricultural extension officer		**Total**
			yes	**no**	
influence/no influence on fish production	yes	Count % within a farmer group has been visited by an agricultural extension officer	38 47.5%	30 62.5%	**68** **53.1%**
	No	Count % within a farmer group has been visited by an agricultural extension officer	42 52.5%	18 37.5%	**60** **46.9%**
Total		**Count % within a farmer group has been visited by an agricultural extension officer**	**80** **100.0%**	**48** **100.0%**	**128** **100.0%**

When a chi statistic was conducted to establish association between the factor and the dependent variable, a chi – value of 2.711 at 2df drew a .100 likelihood of association, thereby showing slight significant relationship.

Table 4.30: Soil testing

Response	**Frequency**	**Percent**
Yes	77	60.2
No	51	39.8
Total	**128**	**100.0**

Results obtained from table 4.30 showed that 77 (60.2%) among respondents had had soil testing before putting up his/her pond, whereas 51 (39.8%) did not. The study followed a cross tabulation to identify categorical responses within variables relationships and the results obtained also attempted to reveal significance between relationship, therefore calculating a chi-statistic as shown in table

Table 4.31: Cross tabulation showing influence/no influence on fish production and one has heard of soil testing

			one has heard of soil testing		**Total**
			yes	**no**	
influence/no influence on fish production	yes	Count % within one has heard of soil testing	39 50.6%	29 56.9%	**68** **53.1%**
	no	Count % within one has heard of soil testing	38 49.4%	22 43.1%	**60** **46.9%**
	Total	**Count % within one has heard of soil testing**	**77** **100.0%**	**51** **100.0%**	**128** **100.0%**

When a chi statistic was conducted to establish association between the factor and the dependent variable, a chi – value of .476 at 2df drew a .490 likelihood of association, thereby showing no significant relationship.

Table 4.32: Extension visits play a significant role in influencing use of right species

Response level	Frequency	Percent
Strongly agree	58	45.3
Agreed	55	43.0
Disagreed	15	11.7
Total	**128**	**100.0**

Results obtained from table 4.32 showed that 58 (45.3%) among respondents strongly agreed, 55 (43.0%) representation agreed and lastly 17 (13.3%) disagreed. The study followed a cross tabulation to identify categorical responses within variables relationships and the results obtained also attempted to reveal significance between relationship, therefore calculating a chi-statistic as shown in table

Table 4.34: Cross tabulation showing influence/no influence on fish production and extension visits play a significant role in influencing use of right species

			extension visits play a significant role in influencing use of right species			Total
			strongly agree	**agreed**	**disagreed**	
influence/no influence on fish production	Yes	Count % within extension visits play a significant role in influencing use of right species	33 56.9%	30 54.5%	5 33.3%	**68** **53.1%**
	No	Count % within extension visits play a significant role in influencing use of right species	25 43.1%	25 45.5%	10 66.7%	**60** **46.9%**
	Total	**Count % within extension visits play a significant role in influencing use of right species**	**58** **100.0%**	**55** **100.0%**	**15** **100.0%**	**128** **100.0%**

When a chi statistic was conducted to establish association between the factor and the dependent variable, a chi – value of 2.735 at 2df drew a .255 likelihood of association, thereby showing no significant relationship.

Table 4.35: Farmers who adopt the improved agricultural practices realize higher yields

Response level	**Frequency**	**Percent**
strongly agree	75	58.6
Agreed	50	39.1
Disagreed	3	2.3
Total	**128**	**100.0**

Results obtained from table 4.35 showed that 75 (58.6%) among respondents strongly agreed, 50 (39.1%) representation agreed and lastly 3 (2.3%) disagreed.

The study followed a cross tabulation to identify categorical responses within variables relationships and the results obtained also attempted to reveal significance between relationship, therefore calculating a chi-statistic as shown in table

Table 4.36: Cross tabulation showing influence/no influence on fish production and farmers who adopt the improved agricultural practices realize higher yields

			farmers who adopt the improved agricultural practices realize higher yields			**Total**
			strongly agree	**Agreed**	**disagreed**	
influence/no influence on fish production	yes	Count % within realize higher yields	43 57.3%	24 48.0%	1 33.3%	**68** **53.1%**
	no	Count % within realize higher yields	32 42.7%	26 52.0%	2 66.7%	**60** **46.9%**
Total		**Count % within realize higher yields**	**75** **100.0%**	**50** **100.0%**	**3** **100.0%**	**128** **100.0%**

When a chi statistic was conducted to establish association between the factor and the dependent variable, a chi – value of 1.533 at 2df drew a .465 likelihood of association, thereby showing no significant relationship existed.

Table 4.37: Given the limited availability of lands near rivers increase in fish yields can only be achieved by well constructed and maintained ponds plus the use of modern technologies among the rural poor

Response level	Frequency	Percent
Strongly agree	74	57.8
Agreed	49	38.3
Disagreed	5	3.9
Total	**128**	**100.0**

Results obtained from table 4.37 showed that 74 (57.8%) among respondents strongly agreed, 49 (38.3%) representation agreed and lastly 5 (3.9%) disagreed. The study followed a cross tabulation to identify categorical responses within variables relationships and the results obtained also attempted to reveal significance between relationship, therefore calculating a chi-statistic as shown in table 4.38;

Table 4.38: Cross tabulation showing influence/no influence on fish production and given the limited availability of lands near rivers increase in fish yields can only be achieved by well constructed and maintained ponds plus the use of modern technologies among the rural poor

			given the limited availability of lands near rivers increase in fish yields			**Total**
			strongly agree	**agreed**	**disagreed**	
influence/no influence on fish production	yes	Count % given the limited availability of lands near rivers increase in fish yields	45 60.8%	22 44.9%	1 20.0%	**68** **53.1%**
	no	Count % given the limited availability of lands near rivers increase in fish yields	29 39.2%	27 55.1%	4 80.0%	**60** **46.9%**
Total		**Count % given the limited availability of lands near rivers increase in fish yields**	**74** **100.0%**	**49** **100.0%**	**5** **100.0%**	**128** **100.0%**

When a chi statistic was conducted to establish association between the factor and the dependent variable, a chi – value of 5.290 at 2df drew a .071 likelihood of association, thereby showing significant relationship existed as this was below the alpha value of .050.

Table 4.38: Extensional workers assisted farmers

Assistance by extension officer	Frequency	Percent
calculate their farm input needs	72	56.3
identify where to buy their inputs	52	40.6
organize group transport	4	3.1
Total	**128**	**100.0**

Results obtained from table 4.38 showed that 72 (56.3%) among respondents strongly agreed, 52 (40.6%) representation agreed and lastly 4 (3.1%) disagreed. The study followed a cross tabulation to identify categorical responses within variables relationships and the results obtained also attempted to reveal significance between relationship, therefore calculating a chi-statistic as shown in table 4.39;

Table 4.39: Cross tabulation showing influence/no influence on fish production and extensional workers assisted farmers

			extensional workers assisted farmers			
			calculate their farm input needs	**identify where to buy their inputs**	**organize group transport**	**Total**
influence/no influence on fish production	yes	Count % within extensional workers assisted farmers	41 56.9%	27 51.9%	0 .0%	**68** **53.1%**
	no	Count % within extensional workers assisted farmers	31 43.1%	25 48.1%	4 100.0%	**60** **46.9%**
Total		**Count % within extensional workers assisted farmers**	**72** **100.0%**	**52** **100.0%**	**4** **100.0%**	**128** **100.0%**

Responses from table 4.39 revealed relationships between variables in their categories of response, and further on the dependent variable indicating, 41 (56.9%) acknowledging extension officers assisting farmers had on fish production, while 31 (43.1%) declined, followed by 27 (51.9%) within identifying where to buy their inputs that acknowledged, whereas in the same category 25 (48.1%) declined, 0 (0.0%) within the organizing group transport acknowledge its influence whereas 4 (100.0%) held a contrary opinion. When a chi statistic was conducted to establish association between the factor and the dependent variable, a chi – value of 4.985 at 2df drew a .083 likelihood of association, thereby showing significant relationship existed.

4.6. Accessibility to credit facilities by farmers' influence on fish production

Table 4.40: Farmers receive credit facilities from financial institutions

Response	Frequency	Percent
Yes	74	57.8
No	54	42.2
Total	**128**	**100.0**

Results obtained from table 4.40 showed that 74 (57.8%) among respondents strongly accepted that farmers received credit facilities, flowed 54 (42.2%) who said farmers did not receive credit facilities. The study followed a cross tabulation to identify categorical responses within variables relationships and the results obtained also attempted to reveal significance between relationship, therefore calculating a chi-statistic as shown in table 4.41;

Table 4.41: influence/no influence on fish production and farmers receive credit facilities from financial institutions

			credit facilities from financial institutions		Total
			yes	**no**	
influence/no influence on fish production	yes	Count % within credit facilities from financial institutions	36 48.6%	32 59.3%	**68** **53.1%**
	No	Count % within credit facilities from financial institutions	38 51.4%	22 40.7%	**60** **46.9%**
	Total	**Count % within credit facilities from financial institutions**	**74** **100.0%**	**54** **100.0%**	**128** **100.0%**

Responses from table 4.41 revealed relationships between variables in their categories of response, and further on the dependent variable indicating, 36 (48.6%) acknowledging the influence credit facilities had on fish production, while 38 (51.4%) declined, followed by 32 (59.3%) within no category that acknowledged, whereas in the same category 22 (40.7%) declined. When a chi statistic was conducted to establish association between the factor and the dependent variable, a chi – value of 1.411 at 2df drew a .235 likelihood of association, thereby showing no significant relationship existed.

Table 4.42: Farmers received credit facilities within the period

Response level	Frequency	Percent
last one year	82	64.1
last two years	41	32.0
last three years	5	3.9
Total	**128**	**100.0**

Results obtained from table 4.42 showed that 82 (64.1%) among respondents had received credit for between the last one year, 41 (32.0%) had received credit for the period between the last two years and 5 (3.9%) had received credit for between the period of the last three years. The study followed a cross tabulation to identify categorical responses within variables relationships and the results obtained also attempted to reveal significance between relationship, therefore calculating a chi-statistic as shown in table 4.43;

Table 4.43: Cross tabulation showing influence/no influence on fish production and farmers received credit facilities within the period

			farmers received credit facilities within the period			
			last one year	**last two years**	**last three years**	**Total**
influence/no influence on fish production	Yes	Count % within farmers received credit facilities within the period	50 61.0%	15 36.6%	3 60.0%	68 53.1%
	no	Count % within farmers received credit facilities within the period	32 39.0%	26 63.4%	2 40.0%	60 46.9%
	Total	**Count % within farmers received credit facilities within the period**	**82 100.0%**	**41 100.0%**	**5 100.0%**	**128 100.0%**

Responses from table 4.43 revealed relationships between variables in their categories of response, and further on the dependent variable indicating, farmers that had received credit for between the last one year, 50 (61.0%) acknowledging the influence farmers associations had on fish production, while 32 (39.0%) declined, followed by 15 (36.6%) within having received credit for the last two years that acknowledged, whereas in the same category 26 (63.4%) declined, 3

(60.0%) within those who had received credit within the last three years acknowledge its influence whereas 2 (100.0%) held a contrary opinion. When a chi statistic was conducted to establish association between the factor and the dependent variable, a chi – value of 6.628 at 2df drew a .036 likelihood of association, thereby showing significant relationship existed as this was below the alpha value of .050.

Table 4.44: Farmers belonging to groups or cooperatives

Response level	**Frequency**	**Percent**
Yes	79	61.7
No	49	38.3
Total	**128**	**100.0**

Results obtained from table 4.44 showed that 79 (61.7.0%) among respondents belonged to a cooperative, 49 (38.3%) did not belong to any cooperative. The study followed a cross tabulation to identify categorical responses within variables relationships and the results obtained also attempted to reveal significance between relationship, therefore calculating a chi-statistic as shown in table 4.45;

Table 4.45: Cross tabulation showing influence/no influence on fish production and farmers belonging to groups or cooperatives

			farmers belonging to groups or cooperatives		**Total**
			yes	no	
influence/no influence on fish production	yes	Count % within farmers belonging to groups or cooperatives	43 54.4%	25 51.0%	**68** **53.1%**
	no	Count % within farmers belonging to groups or cooperatives	36 45.6%	24 49.0%	**60** **46.9%**
	Total	**Count % within farmers belonging to groups or cooperatives**	**79** **100.0%**	**49** **100.0%**	**128** **100.0%**

Responses from table 4.45 revealed relationships between variables in their categories of response, and further on the dependent variable indicating, 43 (54.4%) acknowledging the influence farmers belonging to cooperative societies had on fish production, while 36 (45.6%) declined, followed by 25 (51.0%) within not belonging to any cooperative that acknowledged, whereas in the same category 24 (49.0%) declined. When a chi statistic was conducted to establish association between the factor and the dependent variable, a chi – value of .141 at 2df drew a .707 likelihood of association, thereby showing no significant relationship existed.

Table 4.46: Government and county governments contribution to accessible credit

Response	Frequency	Percent
Yes	69	53.9
No	59	46.1
Total	**128**	**100.0**

Results obtained from table 4.46 showed that 69 (53.9%) among respondents accepted that county and national government's contribution to credit had an influence on fish production, 59 (46.1%) did not and thereby prompting the study to a a cross tabulation to identify categorical responses within variables relationships and the results obtained also attempted to reveal significance between relationship, therefore calculating a chi-statistic as shown in table 4.47;

Table 4.47: Cross tabulation showing influence/no influence on fish production and government and county governments contribution to accessible credit

			government and county governments contribution to accessible credit		
			yes	no	**Total**
influence/no influence on fish production	**yes**	Count % within government and county governments contribution to accessible credit	35 50.7%	33 55.9%	68 53.1%
	no	Count % within government and county governments contribution to accessible credit	34 49.3%	26 44.1%	60 46.9%
	Total	**Count % within government and county governments contribution to accessible credit**	**69 100.0%**	**59 100.0%**	**128 100.0%**

Responses from table 4.47 revealed relationships between variables in their categories of response, and further on the dependent variable indicating, 35 (50.7%) acknowledging the influence county and national government's contribution to accessible credit had on fish production, while 34 (49.3%) declined, followed by 33 (55.9%) within agreeing that acknowledged, whereas in the same category 26 (44.1%) declined. When a chi statistic was conducted to establish association between the factor and the dependent variable, a chi – value of .346 at 1df drew a .556 likelihood of association, thereby showing no likelihood of occurrence in relationship between the two elements.

Table 4.48: Access to credit influences the decision to select right species

Response level	**Frequency**	**Percent**
Strongly agree	78	60.9
Agreed	43	33.6
Disagreed	7	5.5
Total	**128**	**100.0**

Results obtained from table 4.48 showed that 78 (60.9%) among respondents strongly agreed, 43 (33.6%) representation agreed and lastly 7 (5.5%) disagreed. The study followed a cross tabulation to identify categorical responses within variables relationships and the results obtained also attempted to reveal significance between relationship, therefore calculating a chi-statistic as shown in table 4.49;

Table 4.49: Cross tabulation showing influence/no influence on fish production and access to credit influences the decision to select right species

			access to credit influences the decision to select right species			Total
			strongly agree	agreed	disagreed	
influence/no influence on fish production	yes	Count % within access to credit influences the decision to select right species	45 57.7%	22 51.2%	1 14.3%	68 53.1%
	no	Count % within access to credit influences the decision to select right species	33 42.3%	21 48.8%	6 85.7%	60 46.9%
	Total	**Count % within access to credit influences the decision to select right species**	**78 100.0%**	**43 100.0%**	**7 100.0%**	**128 100.0%**

Responses from table 4.49 revealed relationships between variables in their categories of response, and further on the dependent variable indicating, 45 (57.7%) acknowledging the influence farmers access to credit facilities had on fish production, while 33 (42.3%) declined, followed by 22 (51.2%) within agreeing that acknowledged, whereas in the same category 21 (48.8%) declined, 1 (14.3%) within the disagreed acknowledge its influence whereas 6 (85.7%) held a contrary opinion. When a chi statistic was conducted to establish association between the factor and the dependent variable, a chi – value of 4.960 at 2df drew a .084 likelihood of association, thereby showing significant relationship existed as this was below the alpha value of .050.

Table 4.50: Barter arrangements with inputs suppliers can help farmers exchange their fish for required inputs

Response level	Frequency	Percent
Strongly agree	72	56.3
Agreed	43	33.6
Disagreed	13	10.2
Total	**128**	**100.0**

Results obtained from table 4.50 showed that 72 (56.3%) among respondents strongly agreed, 43 (33.6%) representation agreed and lastly 13 (10.2%) disagreed. The study followed a cross tabulation to identify categorical responses within variables relationships and the results obtained also attempted to reveal significance between relationship, therefore calculating a chi-statistic as shown in table 4.51;

Table 4.51: Cross tabulation showing influence/no influence on fish production and barter arrangements with inputs suppliers can help farmers exchange their fish for required inputs

			barter arrangements with inputs suppliers can help farmers exchange their fish for required inputs			**Total**
			strongly agree	**agreed**	**disagreed**	
influence/no influence on fish production	yes	Count % within barter arrangements with inputs suppliers can help farmers exchange their fish for required inputs	38 52.8%	25 58.1%	5 38.5%	68 53.1%
	no	Count % within barter arrangements with inputs suppliers can help farmers exchange their fish for required inputs	34 47.2%	18 41.9%	8 61.5%	60 46.9%
	Total	**Count % within barter arrangements with inputs suppliers can help farmers exchange their fish for required inputs**	**72 100.0%**	**43 100.0%**	**13 100.0%**	**128 100.0 %**

Responses from table 4.51 revealed relationships between variables in their categories of response, and further on the dependent variable indicating, 38 (52.8%) acknowledging the influence of barter arrangement by farmers had on fish production, while 34 (47.2%) declined, followed by 25 (58.1%) within agreeing that acknowledged, whereas in the same category 18 (41.9%) declined, 5 (38.5%) within the disagreed acknowledge its influence whereas 8 (61.5%) held a contrary opinion. When a chi statistic was conducted to establish association between the factor and the dependent variable, a chi – value of 1.560 at 2df drew a .458 likelihood of association, thereby showing no significant relationship existed.

Table 4.52: Farmers associations can assist in the supply of inputs and credit to individual association members and markets produced through a collective marketing mechanism

Level of response	Frequency	Percent
Strongly agree	91	71.1
Agreed	36	28.1
Disagreed	1	.8
Total	**128**	**100.0**

Results obtained from table 4.52 showed that 91 (71.1%) among respondents strongly agreed, 36 (28.1%) representation agreed and lastly 1 (.8%) disagreed. The study followed a cross tabulation to identify categorical responses within variables relationships and the results obtained also attempted to reveal significance between relationship, therefore calculating a chi-statistic as shown in table 4.52;

Table 4.52: Cross tabulation showing influence/no influence on fish production and farmers associations assisting through a collective marketing mechanism

			Count % within farmers associations assisting through a collective marketing mechanism			
			strongly agree	agreed	disagreed	**Total**
influence/no influence on fish production	**yes**	Count % within farmers associations assisting through a collective marketing mechanism	46 50.5%	22 61.1%	0 .0%	**68** **53.1%**
	no	Count % within farmers associations assisting through a collective marketing mechanism	45 49.5%	14 38.9%	1 100.0%	**60** **46.9%**
	Total	**Count % within farmers associations assisting through a collective marketing mechanism**	**91** **100.0%**	**36** **100.0%**	**1** **100.0%**	**128** **100.0%**

Responses from table 4.52 revealed relationships between variables in their categories of response, and further on the dependent variable indicating, 46 (50.5%) acknowledging the influence farmers associations had on fish production, while 45 (49.5%) declined, followed by 22 (61.1%) within agreeing that acknowledged, whereas in the same category 14 (38.9%) declined, 0 (0.0%) within the disagreed acknowledge its influence whereas 1 (100.0%) held a contrary opinion. When a chi statistic was conducted to establish association between the factor and the dependent variable, a chi – value of 2.298 at 2df drew a .317 likelihood of association, thereby showing no significant relationship existed.

Table 4.53: Saving the surplus cash at harvest times can be used to purchase inputs for the following seasons

Level of response	Frequency	Percent
strongly agree	81	63.3
agreed	37	28.9
disagreed	10	7.8
Total	128	100.0

Results obtained from table 4.53 showed that 81 (63.3%) among respondents strongly agreed, 37 (28.9%) representation agreed and lastly 10 (7.8%) disagreed. The study followed a cross tabulation to identify categorical responses within variables relationships and the results obtained also attempted to reveal significance between relationship, therefore calculating a chi-statistic as shown in table

Table 4.54: Cross tabulation showing influence/no influence on fish production and saving the surplus cash at harvest times can be used to purchase inputs for the following seasons

			saving the surplus cash at harvest times can be used to purchase inputs for the following seasons			**Total**
			strongly agree	**agreed**	**disagreed**	
influence/no influence on fish production	yes	Count % within saving the surplus cash at harvest times can be used to purchase inputs for the following seasons	50 61.7%	16 43.2%	2 20.0%	68 53.1%
	no	Count % within saving the surplus cash at harvest times can be used to purchase inputs for the following seasons	31 38.3%	21 56.8%	8 80.0%	60 46.9%
	Total	**Count % within saving the surplus cash at harvest times can be used to purchase inputs for the following seasons**	**81 100.0%**	**37 100.0%**	**10 100.0%**	**128 100.0%**

Results from table 4.54 revealed that responses within strongly agree that acknowledged the influence on fish production stood at 50 (61.7%) while 31 (38.3%) declined, 16 (43.2%) within agree acknowledged its influence while 21 (56.8%) in the same category declined its influence and lastly 2 (20.0%) within disagreed acknowledged the influence surplus cash purchasing inputs on fish production whereas in the same category 8 (80.0%) declined. When a chi statistic was conducted to establish association between the factor and the dependent variable, a chi – value of 8.265 at 2df drew a .016 likelihood of association,

thereby showing significant relationship existed as this was below the alpha value of .050.

Table 4.55: the perennial fish shortage in the sub-county would be a thing of the past if small-scale farmers are given incentives to increase production

Level of response	Frequency	Percent
Strongly agree	49	38.3
Agreed	57	44.5
Disagreed	22	17.2
Total	**128**	**100.0**

Results obtained from table 4.55 showed that 49 (38.3%) among respondents strongly agreed, 57 (44.5%) representation agreed and lastly 22 (17.2%) disagreed. The study followed a cross tabulation to identify categorical responses within variables relationships and the results obtained also attempted to reveal significance between relationship, therefore calculating a chi-statistic as shown in table 4.56;

Table 4.56: Cross tabulating showing influence/no influence on fish production and the perennial fish shortage in the sub-county would be a thing of the past if small-scale farmers are given incentives to increase production

			the perennial fish shortage in the sub-county to be addressed			**Total**
			strongly agree	**agreed**	**disagreed**	
influence/no influence on fish production	yes	Count % within the perennial fish shortage in the sub-county to b addressed	23 46.9%	34 59.6%	11 50.0%	68 53.1%
	no	Count % within the perennial fish shortage in the sub-county to b addressed	26 53.1%	23 40.4%	11 50.0%	60 46.9%
	Total	**Count % within the perennial fish shortage in the sub-county to b addressed**	**49 100.0%**	**57 100.0%**	**22 100.0%**	**128 100.0%**

Results from table 4.56 revealed that responses within strongly agree that acknowledged the perennial fish shortage's influence on fish production stood at 23 (46.9%) while 26 (53.1%) declined, 34 (59.6%) within agree acknowledged its influence while 23 (40.4%) in the same category declined its influence and lastly 11 (50.0%) within disagreed acknowledged the influence perennial fish shortage's had on fish production whereas in the same category 11 (50.0%) declined. When a chi statistic was conducted to establish association between the factor and the dependent variable, a chi – value of 1.814 at 2df drew a .404 likelihood of association, thereby showing no significant relationship existed.

4.7. Other factors influencing fish production

The study also established other factors that affected fish production beyond the farmer's capability of control. The factors included; government policies, farmers attitudes and market demand for the commodity.

Table 4.57: Government policy of ESP (fish farming)

Level of response	Frequency	Percent
Strongly agree	74	57.8
Agreed	45	35.2
Disagreed	9	7.0
Total	**128**	**100.0**

Results obtained from table 4.57 showed that 74 (57.8%) among respondents strongly agreed, 45 (35.2%) representation agreed and lastly 9 (7.0%) disagreed. The study followed a cross tabulation to identify categorical responses within variables relationships and the results obtained also attempted to reveal significance between relationship, therefore calculating a chi-statistic as shown in table 4.58;

Table 4.58: Cross tabulation showing influence/no influence on fish production and government policy of ESP (fish farming)

			Government policy of ESP (fish farming)			**Total**
			strongly agree	**agreed**	**disagreed**	
influence/no influence on fish production	yes	Count % within government policy of ESP (fish farming)	36 48.6%	28 62.2%	4 44.4%	**68** **53.1%**
	no	Count % within government policy of ESP (fish farming)	38 51.4%	17 37.8%	5 55.6%	**60** **46.9%**
	Total	**Count % within government policy of ESP (fish farming)**	**74** **100.0%**	**45** **100.0%**	**9** **100.0%**	**128** **100.0%**

Results from table 4.58 revealed that responses within strongly agree that acknowledged the influence government policy on ESP had on fish production as

shown with 36 (48.6%) while 38 (51.4%) declined, 28 (62.2%) within agree acknowledged its influence while 17 (37.8%) in the same category declined its influence and lastly 4 (44.4%) within disagreed acknowledged the influence government policy on ESP fish production whereas in the same category 5 (55.6%) declined. When a chi statistic was conducted to establish association between the factor and the dependent variable, a chi – value of 2.363 at 2df drew a .307 likelihood of association, thereby showing no significant relationship existed.

Table 4.59: Farmer's attitudes on fish farming

Response level	**Frequency**	**Percent**
Strongly agree	56	43.8
Agreed	60	46.9
Disagreed	12	9.4
Total	**128**	**100.0**

Results obtained from table 4.59 showed that 56 (43.8%) among respondents strongly agreed, 60 (46.9%) representation agreed and lastly 12 (9.4%) disagreed. The study followed a cross tabulation to identify categorical responses within variables relationships and the results obtained also attempted to reveal significance between relationship, therefore calculating a chi-statistic as shown in table 4.60;

Table 4.60: Cross tabulation showing influence/no influence on fish production and farmers attitudes on fish farming

			farmers attitudes on fish farming			
			strongly agree	**agreed**	**disagreed**	**Total**
influence/no influence on fish production	yes	Count % within farmers attitudes on fish farming	26 46.4%	33 55.0%	9 75.0%	**68** **53.1%**
	no	Count % within farmers attitudes on fish farming	30 53.6%	27 45.0%	3 25.0%	**60** **46.9%**
	Total	**Count % within farmers attitudes on fish farming**	**56** **100.0%**	**60** **100.0%**	**12** **100.0%**	**128** **100.0%**

Results from table 4.60 revealed that responses within strongly agree that acknowledged the influence of farmers attitudes on fish farming and fish production stood at 26 (46.4%) while 30 (53.6%) declined, 33 (55.0%) within agree acknowledged its influence while 27 (45.0%) in the same category declined its influence and lastly 9 (75.0%) within disagreed acknowledged the influence farmers attitudes had on fish production whereas in the same category 3 (25.0%) declined. When a chi statistic was conducted to establish association between the factor and the dependent variable, a chi – value of 3.399 at 2df drew a .183 likelihood of association, thereby showing no significant relationship existed.

Table 4.61: Market demand for product

Level of response	Frequency	Percent
Strongly agree	40	31.3
Agreed	68	53.1
Disagreed	20	15.6
Total	**128**	**100.0**

Results obtained from table 4.61 showed that 40 (31.3%) among respondents strongly agreed to market demand for product influencing production, 68 (53.1%) representation agreed and lastly 20 (15.6%) disagreed. The study followed a cross tabulation to identify categorical responses within variables relationships and the results obtained also attempted to reveal significance between relationship, therefore calculating a chi-statistic as shown in table 4.62;

Table 4.62: Cross tabulation influence/no influence on fish production and market demand for product

			market demand for product			**Total**
			strongly agree	**agreed**	**disagreed**	
influence/no influence on fish production	yes	Count % within market demand for product	17 42.5%	43 63.2%	8 40.0%	**68** **53.1%**
	no	Count % within market demand for product	23 57.5%	25 36.8%	12 60.0%	**60** **46.9%**
	Total	**Count % within market demand for product**	**40** **100.0%**	**68** **100.0%**	**20** **100.0%**	**128** **100.0%**

Results from table 4.62 revealed that responses within strongly agree that acknowledged the influence on fish production stood at 17 (42.5%) while 23

(57.5%) declined, 43 (63.2%) within agree acknowledged its influence while 25 (36.8%) in the same category declined its influence and lastly 8 (40.0%) within disagreed acknowledged the influence market demand had on fish production whereas in the same category 12 (60.0%) declined. When a chi statistic was conducted to establish association between the factor and the dependent variable, a chi – value of 5.988 at 2df drew a .050 likelihood of association, thereby showing significant relationship existed.

CHAPTER FIVE

SUMMARY OF FINDINGS, CONCLUSIONS AND RECOMMENDATIONS FOR FURTHER RESEARCH

5.1 Introduction

Chapter five presents a summary of the research findings based on research objectives discussions, conclusion and recommendation of the study.

5.2 Summary of findings

The study aimed to establish factors influencing fish production among small scale farmers of Hamisi sub-county and was guided by the following four objectives;

The study sought to;

a) Investigate how the costs of production inflicted fish production among small scale farmers in Hamisi sub-county
b) Examine the extent to which agricultural extension services influence fish production among small scale famers in Hamisi sub-county
c) Establish the extent to which demographic characteristics influence fish production among small scale farmers in Hamisi sub-county
d) To examine how accessibility to credit facilities influence fish production among small scale farmers in Hamisi sub-county

5.3. Conclusions

The study established that educational levels greatly influenced adoption of new farming techniques in fish farming, extension officers provided assistance to

farmers when need arose, credit accessibility as a factor greatly influenced the study with costs also coming to the fore in level of influence.

National government and county government's position as lending and facilitating factors were evident with least significance as most farmers had accessed credit facilities from between one and three years. Majority among respondents with O-level education participated in fish farming either by providing labor or in other ways owning the pond, majority also sourced for unpaid labor.

Farmers cried foul of the government's responsibility in ensuring proper subsidies in fish farming are found and policies were seen to neglect small and medium scale farmers.

5.4 Recommendations and suggestions

Following the finding of the study, the researcher recommends the following;

5.4.1. Recommendation for the policy makers

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

ii) Credit facilities targeting small scale fish farmers be identified and re-drawn to suit their needs

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

5.4.2. Recommendation for the programs

i) Project sustainability ought to be checked as most of the fish ponds initiated during the economic stimulus plan have stalled due to lack of such sustainability programs.

ii) Such project should not be imposed on a population before proper feasibility studies are carried out, this will aid to cub negative attitudes that eventually fail the program.

iii) Extension services by agricultural service support were really needed by farmers and in this manner, agricultural extension officers should make follow up and reach out to farmers on the ground.

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

5.4.3. Recommendation for further research

i) Future researchers should dwell on extensive feasibility studies need to be carried out to establish proper demographic factors about a population for swift program initiation, implementation through to monitoring and evaluation for targeted goals accomplishments.

ii) Furthermore, studies on constraints affecting sustainability of small scale fish production in Hamisi Sub-county.

iii) A study ought to be carried out on constraints in funds accessibility by small scale farmers and their effect on sustainability of such projects.

REFERENCES

Akeredolu, M.O. (1990): Constraints to technology transfer in artisanal fisheries. Ph.D. Aquaculture Planning in Africa, ADCP/REP/75/1, pp. 61 -65.

Bamba, A. and Kienta, M. (2000). Integration irrigation aquaculture: Consultancy Report. Rome, FAO

Charo-Karisa H and Gichuri M. (2010). Overview of the Fish Farming Enterprise Productivity Program. In: End of Year Report Fish Farming Enterprise Productivity Program Phase I. Aquaculture Development Working Group Ministry of Fisheries Development, Nairobi, KE.

Chatfield, C., (1954). Food Composition Tables—Minerals and Vitamins for International Use. FAO Nutritional Studies No. 11. Food and Agriculture Organization of the United Nations, Rome, 56 pp

Corbin, J.S., & Young, L.G.L. (1997). Planning, Regulation, and Administration of Sustainable Aquaculture. In Bardach, J. (ed.) *Sustainable Aquaculture.* New York: Wiley and Sons *DO Ohajianya, SU Onyeagocha, CU Ibekwe Animal Production Research Advances* Vol. 2(1) 2006: 23-27

Chukwuji et al. (2006) Department of Agriculture Economics and Extension, Delta State University Asaba Campus , Nigeria Agricultural Conspectus Scientific cus ,Vol 71(2006) No 1 (21-26)

Creswel ,J.W.(2003) Research Design Qualitative , Quantitative and Mixed Methods Approach (2nd Edition) .Sage Publications, Thousand Oaks , California

Engle, C.R. and L.U. Hatch, 1986. Cooperatively managed rural Panamanian fish ponds: the integrated approach. In: L.L Lovshin, N.B

Eyo, A.A. (1992): Traditional and improved fish handling, preservation and processing

F.A.O.: *Fish for Food and Employment*. Food and Agricultural Organization, Rome (1991).

FAO. (1993). Availability of fish supplies for international trade. FAO COFI:FT/IV/3/3. Rome.

FAO (1995). The State of World Fisheries and Aquaculture. FAO. Rome, Italy.

FAO. (1997). Review of the state of World Aquaculture. FAO Fisheries Cir., 886 (Rev.1).

FAO (1997). *Rural Aquaculture: Overview and Framework for Country Reviews.* Retrieved from http://www.fao.org/docrep/003/X6941E/x6941e04.htm

FAO (2004). The state of the world Fisheries and Aquaculture 2004. FAO. Rome, Italy .

FAO (2007). Aquaculture in Kenya: Status, Challenges and Opportunities, Fishery Country Profile FID/CP/KEN, http:/www.researchintouse.com. accessed on 7/04/2011

FAO (2008). FAO Yearbook, Fisheries and aquaculture statistics 2008, http://www.fao.org/publications/en/ accessed on 12/6/2011

FAO (2008). *The State of Food and Agriculture; Biofuels: Prospects, Risks and Opportunities.* Rome: Food and Agriculture Organization of the United Nations. 83

FAO (2009). Fisheries and aquaculture technical paper 521, Prospective Analysis of Aquaculture Development, Delphi Method, FOA, Rome, Italy, Pg104.

FAO (2011).Fishery Statistics, Aquaculture production 2011, http:/www.qualasaexpertise.wordpress.com/2011/…/fao yearbook accessed on 12/6/2011

FAO, 2011. National aquaculture sector overview. FAO Fisheries and Aquaculture Department.

FAO, 2012. The state of world fisheries and aquaculture. FAO Fisheries and Aquaculture Department, Rome: 209.

FAO (2012). *The State of World Fisheries and Aquaculture 2012.* Rome: Food and Agriculture Organization of the United Nations

FAO (2013a). *Low-Income Food-Deficit Countries (LIFDC) – List for 2012.* Retrieved from http://www.fao.org/countryprofiles/lifdc/en/

FAO (2013b). *National Aquaculture Sector Overview Kenya.* Retrieved from http://www.fao.org/fishery/countrysector/naso_kenya/en

Frankline ,J.R, and Wallen , E. (2004), How to Design and Evaluate Research in Education , 7th Ed Mc Graw-Hill International Edition.

Freeman, H. A., Ellis, F., & Allison, E. (2004). Livelihoods and rural poverty reduction in Kenya. Development Policy Review, 22(2), 147-171.

Harvey, David J (1993) "Outlook for U.S. Aquiculture. " Agriculture Outlook Conference. U.S. Department of Agriculture.

Håstein, T.B., A. Hjeltnes, J. Lillehaug, U. Skåre, M. Berntssen and A.K. Lundebye, (2006)Food safety hazards that occur during the production stage: challenges for fish farming and the fishing industry. *Rev. Sci. Technol., 25(2): 607-625.*

Hatch, U. and C.R. Engle(1987) ,Economic analysis of aquaculture as a component of integrated agroaquaculture systems: some evidence from Panama. Journal of Aquaculture in the Tropics, 2:93-105.

Hetland J (2008) *The challenge of sustainable fish farming* Utilization held at New Bussa, 4th – 8th May, pp48 – 53

Hino, J. (2011). *Uncharted Waters: Kenya Takes Dramatic Leap In Aquaculture.* Corvallis: Global Aquaculture Advocate.

Hishamunda, N. and J.F. Moehl (1989) Rwanda National Fish Culture Project. Alabama Agricultural Experiment Station: Research and Development Series No. 34. Auburn University, Alabama, 19 pp.

Hishamunda, N.(2001). Commercial shrimp farming in Mozambique: a summary. In Promotion of sustainable commercial aquaculture in Sub-Saharan Africa

Inoni ,O.E. (2007) Allocative Efficiency in Pond Production in Delta State , Nigeria : A Production Fu Nction Approach Agricultura Tropica Et Subtropica Vol 40 (4) 2007

Khanna S. S., An introduction to Fishes : 1996

Kolstad, I. and A. Wiig, 2013. Is it both what you know and who you know? Human capital, social capital and entrepreneurial success. Journal of International Development, 5(25): 626-639.

Kothari .C.R.(2004) Research Methodology , Methods and Techniques .2nd Edition .New

Kosgey I. S (2004) Breeding Objectives and Breeding Strategies for Small Ruminants in the Tropics. PhD Thesis, Wageningen University, The Netherlands, 272 pp.nternational, New Delhi

Kudi, T. M., Bako, F. P. and Atala, T. K. (2008) "Economics of fish production in Kaduna State, Nigeria", *ARPN Journal of Agricultural and Biological Science* 3 (5 and 6): 17 -21

Krejcie, R.V., & Morgan, D.W., (1970). Determining Sample Size for Research Activities. *Educational and Psychological Measurement.*

Latham, M., 1965. Human Nutrition in Tropical Africa. Food and Agriculture Organization of the United Nations, Rome, 268 pp.

Manyala, J.O. (2011). *Fishery Value Chain Analysis Background Report – Kenya.* (n.p.)

Man, T.W.Y., T. Lau and K.F. Chan, 2002. The competitiveness of small and medium enterprises - a conceptualization with focus on entrepreneurial competences. Journal of Business Venturing, 17(2): 123-142.

Mbugua, H.M. (2008a). *Aquaculture in Kenya; Status, Challenges and Opportunities.* Directorate of Aquaculture Development, Kenya.

Mbugua –Murithi ,T. (1997) Strategies for Survival in Kenya : Women ,Education and Self-Helf Groups . International Journal of Educational Reform 6(4), 420-427

McPherson, M., 1996. Growth of micro and small enterprises in Southern Africa. Journal of Development Economics, 48(2): 253 – 277.

MINAGRI (Ministère de l'Agriculture, de l'Elevage et es Forets), 1987. Semaine Nationale sur la Vulgarisation Agricole. Document de Travail. Kigali, Republique Rwandaise, 192 pp.

Moehl, J.F (1993) Aquaculture development in Rwanda: a case study of resources, institutions, and technology. Ph.D. dissertation. Auburn University, Alabama, 321 pp

.MOFA, 2012. Agriculture in Ghana: Facts and figures, SRID. MOFA

MOLFD 2003, 2006 and 2007 Ministry of Livestock and Fisheries Development, Annual Reports, Livestock Production Division, Nairobi, Kenya.a.

Mpawenimana, P., 1991. Rapport Annuel du Service Pisciculture National. Miméo. Butare, Republique Rwandaise, 27 pp.

Mugenda, O.M. and Mugenda,A.G (2003) Qualitative and Quantitative Approaches. Research Methods Africa Center for Technology Studies (Acts) Press. Nairobi Kenya**.**

Mwangi HM (2008). Aquaculture in Kenya, Status Challenges and Opportunities, Directorate of Aquaculture, Nairobi,Kenya

Ndu N. R. 2006. Fish Farm Layout, Pond Construction, Management and Maintenance-Hatchery Techniques. A paper presented at the National Workshop on the Principles and Techniques of Fish Farming organized by Nigerian Agricultural, Cooperative and Rural Development Bank Kaduna with collaboration of Life Riches Consulting.

Ngugi C,C., Bowman J. R.and Omolo, B. O. (2007) A *New Guide to Fish Farming in Kenya*

Ngugi, C.C. & Manyala, J.O. (2004). *Aquaculture extension services in Kenya.* Retrieved from http://www.fao.org/docrep/007/y5641e/y5641e09.htm#bm9

Nyonje BM, Charo-Karisa H, Macharia SK and Mbugua M. 2011. Aquaculture Development in Kenya: Status, Potential and Challenges. In Samaki News: Aquaculture Development in Kenya towards Food Security, Poverty Alleviation and Wealth Creation. Vol. 7. No. 1. pp. 8-11.

*Ofuoku, A.U 2G.N. Emah and 1B.E. Itedjere*1 (2008)Department of Agricultural Economics and Extension, Delta State University, Asaba Campus, Asaba, Delta State, Nigeria

Oladeji, J.O. and O.B. Oyesola (2002): *African Journal of Livestock Extension* Vol. 1, pp50

Ortega, David L., H. Holly Wang, and Nicole J. Olynk (2012) "Demand for Food Safety and Eco-Friendly Attributes in Aquaculture Products" Submitted to the International Agricultural Economics Association Tri-Annual Conference, Foz de Iguaçu, Brazil

Ortega, David L., H. Holly Wang, and Nicole J. Olynk (2012)"Modeling Consumer Preferences for Sustainability, Food Safety, and Production Process Attributes of Imported Aquaculture Products" Submitted to the Agricultural and Applied Economics Association Agricultural Annual Conference, Seattle, WA.

Ortega, David L., Nicole .J Olynk, and H. Holly Wang(2012) “Food Safety and Sustainability: Consumer Preferences for Imported Aquaculture Products” Submitted to the joint Agricultural and Applied Economics Association - European Agricultural Economics Association Symposium titled “Food Environment: The Effects of Context on Food Choice,” Boston, MA May 2012. .

Otieno MJ. (2011) Fishery Value Chain Analysis: Background Report – Kenya. FAO, Rome, IT, pp. 2-10 .

Rege J E O(1994) Indigenous African small ruminants: a case for characterization and improvement. In: Lebbie S B H, Rey B and Irungu E K (Eds.), Small ruminant research and development in Africa, Proceedings of the Second Biennial Conference of the African Small Ruminants Research Network, December, 1992, AICC, Arusha, Tanzania, 205-211

Rothuis A., van Duijn, A.P., van Rijsingen, J., van der Pijl, W. & Rurangwa, E. (2011). *Business opportunities for aquaculture in Kenya with special reference to food security*. The Hague: Wageningen UR.

Rutherford, M.W. and S.L. Oswald, (2000)Antecedents of small business performance. New England Journal of Entrepreneurship, 3(2): 21-33.

Thomas, B. P. (1988). Household strategies for adaptation and change: Participation in Kenyan rural women’s associations. Africa: Journal of the International African Institute, 58(4), 401-422.

Satia, B., (1989). A Regional Survey of the Aquaculture Sector in Africa South of the Sahara. Food and Agriculture Organization of the United Nations, Rome ADCP:REP:89:36.

Simpson, M., N. Tuck and S. Bellamy, 2004. Small business success factors: The role of education and training. Education and Training, 46(89): 481-491.

Smith, L.J. and S. Peterson (1982) Aquaculture Development in Less Developed Countries. Westview Press, Boulder, Colorado, 152 pp.

Snow, D. R., Buss, T. F. (2001). Development and the Role of Microcredit. Policy Studies Journal, 29(1), 296-307.

TISA (2010). *How is the ESP Performing in Your Constituency?* [Brochure]. Nairobi: The Institute for Social Accountability.

Unger, J., A. Rauch, M. Frese and N. Rosenbusch, 2011. Human capital and entrepreneurial success: A meta analytical review. Journal of Business Venturing, 26(3): 341-358.

Wilcock, D. and V. Ndoreyaho, 1986. The Rwanda Social and Institutional Profile, Volume Two. Development Alternatives, Inc. Report. Washington, D.C., 152 pp.

APPENDICES

APPENDIX 1: LETTER OF INTRODUCTION

CONSOLATA MWENESI

P.O BOX 37 -50312

HAMISI

30-1-2016

Dear Respondents,

I am a student at the University of Nairobi pursuing a Master of Arts degree in Project Planning and Management at the University of Nairobi. I am undertaking a research on 'factors influencing fish production among small scale farmers in Hamisi sub- county, Kenya.'

I am kindly requesting for your assistance. Do assist by filing the questionnaires provided honestly and completely. The information was assist me accomplish the research objectives. All responses was treated with total confidentiality.

Thanks in advance,

Yours faithfully,

Mwenesi Consolata.

APPENDIX 2 : QUESTIONNAIRES

SECTION A : FISHERIES OFFICERS' QUESTIONNAIRES

This questionnaire relates a study on factors facing fish production among small scale farmers in Hamisi sub-county .

Your answers will be treated with utmost confidence and will only be used for purpose of this research.

Please do not write your name to ensure complete confidentiality.

Your assistance in this project is appreciated.

Designation……

Locality……

Sub-location……

Location……
Sub –county……

County……

SECTION B : FARMERS QUESTIONNAIRE

The purpose for this questionnaire is to gather information about factors influencing fish production among small scale farmers in Hamisi Sub- County.

Please answer the questions freely. The information you provide will be treated with utmost confidentiality and will only be used for academic research purposes by the research herself.

PART A: demographic characteristics

Put a tick (√) or fill with appropriate response(s).

1 What is your gender? Male ☐ Female ☐

2 what is your age?

18-20 [ ]

20-30 [ ]

30-40 [ ]

40-50 [ ]

50-60 [ ]

60-70 [ ]

Above 70 [ ]

3 What is your highest level of education?

Primary [ ]

Secondary [ ]

College [ ]

University [ ]

Post graduate [ ]

SECTION B: OPEN - ENDED QUESTIONS

For each question in section **B,** read and tick either **yes** or **no**. Please give reasons to your **yes** response in any case on a separate sheet of paper.

1. . **COST OF PRODUCTION AND FISH PRODUCTION**

If you agree with the following activities, tick [Yes] or [No];

- The source of power on my farm during the ponds construction is;

Source	**Yes**	**No**
Hired manual labour		
Unpaid family and friends labour		
Mechanical labour		

If you agree with the following activities, tick [Yes] or [No];

Activity	**Yes**	**No**
I can choose the best soils for pond construction		
I can practice water refilling		
You have heard lining of fish ponds		
I practice alternative species that need minimal care		

I can control predators and diseases to minimize costs of production by

Activity	**Yes**	**No**
Identifying those species that feed on others and not mixing them with others.		
Practicing the modern techniques to keep off predators		
Using certified seeds (fingerlings) and maintaining high hygiene to reduce diseases		

What is the source of food for my fish?

source	**Yes**	**no**
I use government subsidized fish foods		
I make feeds using locally available materials		
I sometimes use feeds for other animals		

2. DEMOGRAPHIC CHARACTERISTICS AND FISH PRODUCTION.

What is our take on gender in the production of fish

	Yes	**no**
Do male headed households apply for more fingerlings than female counterparts		
Do you think the female counter parts will apply for more fingerlings than male		
Or do u think the number of fingerlings depends on ones attitude not really be a male or female		

Do you think the following age bracket can easily practice fish farming in the rural areas .write yes or no

18-20 [ ]

20-30 [ ]

30-40 [ ]

40-50 [ ]

50-60 [ ]

60-70 [ ]

Above 70 [ ]

Basing on the level of education, which levels can easily adopt new fish farming techniques .write yes or no

Primary [ ]

Secondary [ ]

College [ ]

University [ ]

Post graduate [ ]

AGRICULTURAL EXTENSION SERVICES AND FISH PRODUCTION.

Do you agree with the following statements; tick (√) appropriately.

	Yes	**No**
Your farm or farmer group has been visited by an agricultural extension officer and given advices regularly		
You have held workshops or seminars within your clusters regularly and worked on your weaknesses		
Your extension workers have called farmers for regular trainings		

1. I have attended agricultural field days in my area: Yes[ ] No[ ]
2. If yes in one above, when was the last field day that you attended?

Within the last half year [ ]

Within the last one year [ ]

Within the last two years [ ]

3. Do you agree with the following statements; tick (√) appropriately.

Activity	**Yes**	**No**
Your farm or farmer group has been visited by an agricultural extension officer		
You have ever heard of soil testing on your soil.		

CREDIT ACCESSIBILITY AND FISH PRODUCTION.

1. I have once received loans from a financial institution; Yes [ ] No [ ]
2. If yes to Q1 above, indicate when you took the last credit?

Within the last one year [ ]

Within the last two years [ ]

Within the last three years [ ]

Four years above [ ]

3 I belong to an active farmer group or cooperative where I can secure credit facilities; Yes [ ] No [ ]

4 As pertains credit, do you think both the national and county governments can assist famers with affordable and accessible credit in form of loans or grants? Yes [ ] No [ ]

SECTION C : LEVEL OF MEASUREMENT

Please read each statement carefully and indicate your level of agreement with the statement by ticking the appropriate response

COST OF PRODUCTION AND FISH PRODUCTION

Tick (√) to indicate the level you agree with the following statements**.**

	Strongly disagreed	**disagreed**	**Uncertain**	**agreed**	**Strongly agreed**
Selection of good soils for fish ponds construction reduces the cost of preparation					
If the government subsidized fish foods are used in right their right ratio increases returns from fish production					
control of diseases and predators lowers costs of fish production					

DEMOGRAPHIC CHARACTERISTICS AND FISH PRODUCTION.

Tick (√) to indicate the level you agree with the following statements.

	Strongly disagreed	**disagreed**	**Uncertainty**	**agreed**	**Strongly agreed**
Male headed households apply for more fingerlings than female counterparts.					
The old age could easily practice fish farming in the rural as compared to the young age ones					
The university level can easily adopt new fish farming technique as compared to other levels of education					

AGRICULTURAL EXTENSION SERVICES AND FISH PRODUCTION

Tick (√) to indicate the level you agree with the following statements.

	Strongly disagreed	**disagreed**	**Uncertain**	**agreed**	**Strongly agreed**
Regular extension workers visits play a significant role in influencing the use of right species					
Farmers who attend regular seminars and workshops within their clusters adopt the improved agricultural practices and realize higher yields.					
Extension workers who provide sufficient trainings regularly to farmers improve their production					

CREDIT ACCESSIBILITY AND FISH PRODUCTION

Tick (√) to indicate the level you agree with the following statements.

	Strongly agreed	**Agreed**	**Uncertain**	**Disagreed**	**Strongly disagreed**
Access to credit facilities e.g. loans can influence the decisions like selecting the right species for better production.					
Grants of any kind whether from individuals, NGOs, government or a cooperate society can be of great impact towards fish production					
The perennial fish shortage in the sub - county would be a thing of the past if small-scale farmers are given government support like subsidizing fish foods can increase production.					

APPENDIX 3 : SCHEDULE OF ACTIVITIES

DATE	ACTIVITY
October 2014	Commencement of course work
September 2015	End of course work
October 2015 –January 2016	Proposal writing
March 2016	Proposal Defense
April – May 2016	Thesis writing
June 2016	Thesis Defense

APPENDIX 4: SAMPLE SIZE DETERMINATION

DETERMINING SAMPLE SIZE FOR RESEARCH ACTIVITIES

N	S	N	S	N	S
10	10	220	140	1200	291
15	14	230	144	1300	297
20	19	240	148	1400	302
25	24	250	152	1500	306
30	28	260	155	1600	310
35	32	270	159	1700	313
40	36	280	162	1800	317
45	40	290	165	1900	320
50	44	300	169	2000	322
55	48	320	175	2200	327
60	52	340	181	2400	331
65	56	360	186	2600	335
70	59	380	191	2800	338
75	63	400	196	3000	341
80	66	420	201	3500	346
85	70	440	205	4000	351
90	73	460	210	4500	354
95	76	480	214	5000	357
100	80	500	217	6000	361
110	86	550	226	7000	364
120	92	600	234	8000	367
130	97	650	242	9000	368
140	103	700	248	10000	370
150	108	750	254	15000	375
160	113	800	260	20000	377
170	118	850	655	30000	379
180	123	900	269	40000	380
190	127	950	274	50000	381
200	132	1000	278	75000	382
210	136	1100	285	1000000	384

From R.V. Krejcie and D.W Morgan, (1970)

APPENDIX 7: LETTER FROM THE INSTITUTION

UNIVERSITY OF NAIROBI
COLLEGE OF EDUCATION AND EXTERNAL STUDIES
SCHOOL OF CONTINUING AND DISTANCE EDUCATION
DEPARTMENT OF EXTRA-MURAL STUDIES
KAKAMEGA & WESTERN KENYA AREA

Your Ref:

Our Ref: Uon/Cees/Kak/1/47/(159)

Telephone: Kakamega 056-31038/0204917206

P.O. Box 422
KAKAMEGA
KENYA

27TH May, 2016

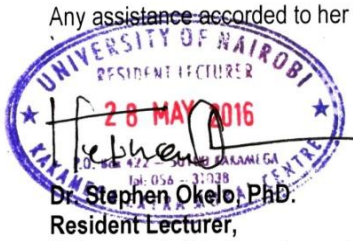
TO WHOM IT MAY CONCERN

REF: CONSOLATA MWENESI L50/76171/2014

This is to confirm that the above named is a student at the University of Nairobi, College of Education and External Studies, School of Continuing and Distance Education, Department of Extra-Mural Studies, Kakamega Extra-Mural Centre taking a Course in Master of Arts (Project Planning Management). She has completed her course work for Semester 1, 2 and 3 and is working on her Project Paper.

She is undertaking a Research Project entitled Factors Influencing Fish Production Among Small Scale Farmers in Kenya: A case of HAMISI SUB – COUNTY

Any assistance accorded to her will be highly appreciated.



Dr. Stephen Okelo, PhD.
Resident Lecturer,
Kakamega & Western Kenya Area.

THIS IS TO CERTIFY THAT:
MS. CONSOLATA MWENESI BUSUTU
of UNIVERSITY OF NAIROBI , 37-50312
HAMISI,has been permitted to conduct
research in *Vihiga County*

on the topic: *FACTORS INFLUENCING FISH PRODUCTION AMONG SMALL SCALE FARMERS IN KENYA: A CASE OF HAMISI SUB-COUNTY*

for the period ending:
26th August,2017

.....
Applicant's Signature

Permit No : NACOSTI/P/16/98876/13257
Date Of Issue : 29th August,2016
Fee Recieved :Ksh 1000

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

HARAMBEE

REPUBLIC OF KENYA

NACOSTI

National Commission for Science, Technology and Innovation

RESEACH CLEARANCE PERMIT

Serial No.A 11850

CONDITIONS: see back page