FACTORS INFLUENCING FISH FARMING PROJECTS: A CASE OF CENTRAL IMENTI CONSTITUENCY, MERU COUNTY, KENYA

BY

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DECLARATION

This research report is my original work and has not been submitted for examination or award of a degree in any university.

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

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DEDICATION

I dedicate this work to my wife Consolata Makena, children Wycliffe Mutuma and Arvin Karani for their love, support, patience and encouragement, which gave me the will and determination to complete my post-graduate studies.

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ABBREVIATIONS AND ACRONYMS

AFC: Agricultural Finance Corporation

CDF: Continuous Density Function

CIFA/OP: Consortium of Indian Farmers Association/Occasional Paper

CPA: Certified Public Accountant

DFO: District Fisheries Officer

DFID: Development for International Development

ERPARDP: Economic Recovery, Poverty Alleviation and Development Programme

ESP: Economic Stimulus Programme

EU: European Union

FAO: Food and Agricultural Organization

FCR: Feed Conversion Ration

FFE&PP: Fish Farming and Enterprise and Productivity Project

GOK: Government of Kenya

GDP: Gross Domestic Product

MDGs: Millennium Development Goals

MOF: Ministry of Fisheries

MOA: Ministry of Agriculture, Livestock and Fisheries

SPSS: Statistical Package for Social Sciences

TOC: Theory of Constraints

UNDP: United Nations Development Programme

US: United States

UNEP: United Nations Environment Programme

ABSTRACT

A trend is emerging all over the world where a lot of attention is being focused on aquaculture. However, the various infrastructures to make the enterprise more successful are not always in place. This research study therefore sought to establish at a local level the factors influencing fish farming projects in Central Imenti Constituency of Meru County. The research objectives sought to determine the influence of fish species, fishpond practices, availability of fish market, fish feed variety and government policy on fish farming projects in Central Imenti Constituency. The study targeted a population of 274 fish farmers in the Constituency. Purposive sampling was used to select respondents from the target population. A structured questionnaire was used to collect data from fish farmers who benefitted from ESP programme in Imenti Central Constituency. Five Point Likert-scales were used to rank variables. Secondary data for the study was collected from Imenti Central Sub-county Fisheries office records. An analysis of the findings was done using frequency counts, percentages and mean for descriptive statistics, and chi-square, Pearson correlation analysis and regression analysis for inferential analysis. The study established that most fish farmers had been practicing fish farming for a period of between 5 to 7 years. The study established that fish farmers from projects in Imenti Central Constituency of Meru County kept Tilapia fish. The study further established that fish farmers were satisfied with the number of fish that they harvest from their ponds. The study further concludes that availability of cold storage, transport to markets, availability of packaging materials and facilities and ease of access to market influences fish farming projects to a great extent. The study further found that the fish farmers established their fish ponds with assistance from the government through ESP funding. This study therefore finds the ESP funding very influential in fish farming and recommends that the source of the funds be supported by donors. The study established that fish farmers specifically use commercially processed fish feeds. To improve on this and give access to many fish farmers, the central government should subsidize the feeds so that more farmers can access them. The study found that fish farming was a success and that fish farmers kept records of their fish farming. This means that the records can be used to negotiate for loans. This study therefore recommends that the government encourage more financial institutions to offer loans to these farmers so that they can expand their projects even further.

CHAPTER ONE
INTRODUCTION

1.1 Background to the study

Fish and fish products constitute a major source of income, food and recreation in the global economy (UNEP, 2013). Fish products are essential to food security, providing over 1 billion people with their main source of protein and more than 4.3 billion people with about 15 per cent of their average per capita animal protein intake (FAO, 2012). Fish proteins are particularly important for preschool-aged children and pregnant women (World Fish centre, 2011). Fish products originate from two main modes of production: harvesting of wild fish (marine and freshwater) and aquaculture. The latter is defined by the Food and Agriculture Organisation of the United Nations (FAO) as ‘‘the farming of aquatic organism including fish, mollusks, crustaceans and aquatic plants’’ (FAO, 2012).

The source of significant growth in the global production of fish since the late 1980s has been aquaculture; since then, it has increased almost twelvefold, at an average annual rate of 8.8 per cent (UNEP, 2013). In 2010, global production of farmed fish was 59.9 million tonnes, compared to 55.7 million tonnes in 2009 and 32.4 million tonnes in 2000 (UNEP, 2013). World aquaculture production continued to grow in 2013 reaching 97.2 million ton with an estimated value of USD 157 billion (FAO, 2015). The production of farmed food fish (finfish, crustaceans, mollusks and other aquatic animals) was 70.2 million tonnes in 2013, up by 5.6 per cent from 66.5 million in 2012 (FAO, 2015). Following Asia, Africa improved its share in world farmed food fish production, up from 1.3 per cent in 2003 to 2.3 per cent in 2013 (FAO, 2015).

Aquaculture is still developing in Africa and is mostly concentrated in a few countries but it already produces an estimated value of almost US$ 3 billion per cent per year (de Graaf & Garibaldi, 2014). In the five East African countries Kenya, Uganda, Rwanda, Burundi and Tanzania the dominating type of aquaculture is small scale with extensive production of Tilapia or African catfish I earthen ponds (Censkowsy & Altena, 2013). Fish farming production in 2013 was 23, 500, 812 Kg (23, 501 metric tonnes) with a farm gate value of Ksh 4, 633, 634, 405 in 2012 (MOA, 2013). The aquaculture production in kenya rose to

over 22, 000 tons in the year 2012 as a result of the ESP programme but faced a host of constraints in 2013 (Censkowsky & Altena, 2013). They contend that many ponds in the country are abandoned nowadays and/ or have been built at non appropriate locations for aquaculture. I 2013 Kenya imported 5, 269 metric tonnes of fish and fishery products worth Ksh 523, 531, 000. The imports originated largely from Asian countries, notably India, Pakistan, Japan and Korea but all the *Tilapia niloticus* was imported from China (MOA, 2013).

1.1.1 Economic stimulus programme (ESP) and fish farming

To jumpstart the Kenyan economy towards long term growth and development, the government introduced Economic Stimulus Program (ESP) in the 2009/2010 Budget speech in parliament, and through which the government introduced fish farming projects in selected constituencies within the country in 2009. The choice of intervention measures of the ESP are within the broader policy objectives as stipulated in the Vision 2030. Among the activities covered under the ESP included construction and stocking of fishponds with fingerlings, and provision of aquaculture advisory services (GoK, 2009).

Economic stimulus programme (ESP) is a short to medium term, high intensity and impact programme aimed at jump-starting the economy towards long-term growth and development, securing the livelihood of Kenyans and addressing the challenges of regional and inter-generational inequity. The programme focuses on sectors that will generate maximum benefit, restore confidence and assist the business community to weather the storm, while protecting the livelihood of the poor and creating jobs to the youth, (GoK, 2009). Some of the activities covered under ESP include expansion of irrigation-based agriculture, construction of wholesale and fresh produce market, fishponds and jua kali sheds.

Key objectives of ESP include boosting of the country's economic recovery and return the economy to envisioned medium term growth plan, invest in long-term solution to the

challenges of food security, expand economic opportunities in rural areas for employment creation, and promoting regional development of equity and social stability.

1.1.2 Imenti Central Constituency and fish farming

According to Meru Central District Development Plan 2008-2012, Imenti central constituency lies to the east of Mt. Kenya forest covering 633 Km2. The wide range in altitude (1300-5199m above sea level) has influenced the atmospheric conditions leading to a variety of agro-ecological zones where settlement pattern is largely influenced by soil fertility and rainfall. According to the report, the forested upper zones are the catchment areas of numerous rivers. These rivers therefore supply adequate surface water, which local communities can harness for fish farming.

Table 1.1: Fishpond statistics

Division	No. of farmers	No. of active ponds	Area of active ponds (m^2)	No. of dormant ponds	Area of dormant ponds (m^2)
Abothuguchi West	94	95	28,500	4	1,200
Abothuguchi Central	75	70	21,000	8	2,400
Abothuguchi East	72	69	20,700	5	1,500
Kiagu	33	32	9,600	3	900
Total	**274**	**266**	**79800**	**20**	**6000**

Source: Adapted from Imenti Central Sub-County Fisheries Status Report (2013)

According to Imenti Central Sub-County Fisheries Status Report (2013), aquaculture is the main fisheries activity in the Sub-County. Majority of fish farmers practice small-scale fish farming. Most ponds are either liner or earthen and few concrete ones. Warm water culture is the common form of aquaculture in the Sub County where the species kept is tilapia with very few farmers keeping catfish. There are no records of any farmer in the Sub-County practicing cold-water culture even though the regions bordering forest are ideal for this kind of aquaculture.

According to Imenti central sub-county fisheries status report (2013), the Imenti central fisheries station was previously administered as division of a greater Meru central fisheries station with its headquarters at Merutown.According to the Imenti Central Sub County Fisheries Status Report, the office has only technical staff comprising of one Fisheries Officer, one Fisheries Assistant and two Extension Fisheries Officers. For capacity building, one of the staff attended management course from 13 May 2012 to 8 June 2012 at Mombasa, and two others were trained on aquaculture practices at Sagana Fish Farm in April 2012. According to Imenti Central Sub-County Fisheries Status Report (2013), Imenti central fisheries station encouraged the development of aquaculture by facilitating supply of tilapia

fingerlings. The station facilitated and coordinated the supply of fish feeds, recruited commercial fish farmers, trained fish farmers, and coordinated harvesting of fish. Another objective of the station was to promote sustainable development and utilization of inland fisheries by facilitating supply of tilapia fingerlings to stock dams.

The Ministry of Agriculture, Livestock and Fisheries Development realized a number of achievements in Imenti central sub-county in 2012. The Ministry stocked 142,000 fingerlings across the district, and supplied 1.2 tons of tilapia fish pellets. It completed rehabilitation and stocking of two dams with tilapia. These are Karimonga dam in Abothuguchi Central and Baisigria dam in Kibirichia (Imenti Central Fisheries Report, 2013).The Imenti Central fisheries report indicates that the ministry continued with Fish Farming Enterprise and Productivity Project (FFE&PP) in the financial year 2012/2013. A number of activities were carried out under ESP and ERPARDP, which are components of FFE&PP. These included stocking of completed ponds, construction, liner provision and stocking of twenty-five institutional ponds, training fish farmers in fish marketing, record keeping and fish cooking.

Table 1.2: Stocking statistics

Division	**No. of ponds stocked**	**Area of stocked ponds (m^2)**	**No. of tilapia fingerlings stocked**
Abothuguchi West	30	9,000	30,000
Abothuguchi Central	21	6,000	21,000
Abothuguchi East	27	7,000	27,000
Kiagu	12	3,600	12,000
Total	**90**	**25600**	**90000**

Source: Adapted from Imenti Central Sub-County Fisheries Status Report (2013)

Seventeen commercial fish farmers were recruited and 329 fish farmers were trained in basic fish farming practices. A fish feed pelletizer was purchased and is to be installed in Meru town office. The Ministry carried out digital mapping of fishponds, and realized increased fish production. Fisheries Extension Officers attended short courses on fishpond management at Sagana. Two fish processing plants were completed at Kanyakine and Mituguu in Imenti South Sub County.

1.1.3 Fish processing and trade

According to Imenti Central Sub-County Fisheries Status Report (2014), fish in the Sub-County is only marketed locally where harvested fish is normally sold at the pond site and others supplied to various orders as pre-arranged. The main challenge facing fish marketing is unclear fish species and small sizes of fish due to inbreeding leading to retarded growth. The report notes that the problem can be solved by rearing all male tilapia, which is not produced locally. Fish sold are normally semi processed by gutting. The report observes that the ministry organizes demonstration to train in fish handling, processing and cooking. This has seen many people embrace fish consumption. Production statistics show that 8.892 tons of tilapia were harvested valued at about Ksh. 2,223,000 in 2012. Table 1.3 shows production data for year 2012.

Table 1.3: Harvesting statistics

Division	**No. of ponds harvested**	**Area of ponds harvested (m^2)**	**Amount of tilapia harvested (kg)**	**Value of tilapia (Ksh.)**
Abothuguchi West	89	26,700	2,695	673,750
Abothuguchi Central	57	17,100	1,859	464,750
Abothuguchi East	61	18,300	1,951	487,750
Kiagu	20	6,000	836	209,000
Total	227	68,100	7,341	1,835,250

Source: Adapted from Imenti Central Sub-County Fisheries Status Report (2014)

1.1.4 Constraints and challenges experienced in Imenti central fisheries projects

The ministry faced many challenges and constraints in 2012 that limited it from achieving all its objectives. According to Imenti Central Sub-County Fisheries Status Report (2013), tools and other facilities were generally in short supply. These included computers, printers, furniture, field kits for extension services, and means of transport. The district does not get AIE, and therefore cannot afford basic requirements of the office. The funds for development are normally received late, which delays implementation of projects in the first quarter of the financial year. There is environmental degradation especially dam siltation, and pumping of water from dams when water levels are low. Insufficient high quality fish feed, lack of department's demonstration ponds and office block, use of poor fishing gears by farmers, poor fish species, and weak financial base of the community are among the challenges and the constraints that the ministry experienced.

Table1.4: Summary of fish farming implementation output in Imenti Central Sub-County in 2012

Goal	Objective	Target	Description of activity	Achievement	Constraints
Increase fish production in the district	Encourage development of aquaculture	-Facilitate and coordinate supply of fingerlings	-Ordering and stocking of fingerlings	-Facilitated and coordinated stocking of 262000 fingerlings	-Inadequate fingerling supply -Inbreeding -Insufficiency in quality seeds
		-Facilitate and coordinate supply of fish feeds	-Procurement and issuance of fish feeds	Supplied a total of 1.2 tons of fish pellets	-High cost of feeds -Weak financial base of the farmers
		-Train fish farmers	-Knowledge dissemination through seminars, demonstration -Intensify extension services	-Trained a total of 329 fish farmers	-Inadequate transport -Lack of training materials -Lack of demonstration ponds
		-Recruit commercial fish farmers	-Mobilization through exhibition and field days -Conduct eat more fish campaign	-Recruited 17 commercial fish farmers	-Inadequate transport -High cost of fish farming inputs

Source: Imenti Central Sub-county Fisheries Status Report (2014)

1.2 Statement of the problem

In the 2009/2010 Budget speech, the government initiated Fish farming projects in 2009 through ESP to jump start the Kenyan economy towards long term growth and development. The choice of intervention measures of the ESP are within the broader objectives as stipulated in the Vision 2030, which included construction and stocking of fish ponds with fingerlings, and provision of aquaculture advisory services (GoK,2009). According to statistics in Table 1.1 (Imenti Central Sub-county Fisheries Status Report, 2013), there are 274 fish farmers in the constituency; 226 ponds are indicated as being active, while 20 are

dormant, accounting for 6000m^2 area of dormant ponds in Central Imenti Constituency in 2012. The reason(s) behind the dormancy may be symptomatic of dysfunction of a programme that is facing threats, which this research study is seeking to unearth and document.

1.3 Purpose of the study

The purpose of this study was to establish the influence of selected factors on fish farming projects inCentral Imenti Constituency of Meru County.

1.4 Research Objectives

There were four research objectives for this research study. The objectives were specifically worded to guide the researcher in collecting data that would yield knowledge in respect to the research topic. The objectives were as follows:

i. To determine the influence of fish species on fish farming projects in Central Imenti Constituency.
ii. To ascertain the influence of fish pond management on fish farming projects in Central Imenti Constituency.
iii. To assess the influence of fish feeds on fish farming projects in Central Imenti Constituency.
iv. To examine the influence of marketing of harvested fish on fish farming projects in Central Imenti Constituency.

1.5 Research questions

Research questions were used to enable the researcher focus on the specific concerns of the research objectives. In line with the research objectives, the researcher used the following four research questions to sharpen focus on the research variables.

i. What is the influence of fish species on fish farming projects in Central Imenti Constituency?
ii. What is the influence of fish pond management on fish farming projects in Central Imenti Constituency?

iii. What is the influence of fish feeds on fish farming projects in Central Imenti Constituency?

iv. How does marketing of harvested fish influence fish farming projects in Central Imenti Constituency?

1.6 Significance of the Study

A research study of the factors influencing fish farming projects in Imenti Central is important because the findings can contribute to the achievement of ESP fish farming goals by addressing present challenges in aquaculture at Constituency level. Nationally, ESP goals include boosting the country's economic recovery, investing in long-term solutions to the challenges of food security, and expanding economic opportunities in rural areas for employment creation among many others (GoK, 2008).

Inland small-scale fish farming seeks to raise the profitability and enhance the growth and competitiveness of enterprises, which directly raise incomes. Successful aquaculture will provide finance for local tourist economy with the use of recreational fisheries, and better use of land resources. If sustainably managed, aquaculture can generate economic opportunities that can spur growth through wealth creation especially for remote rural populations that lack access to diversified economic activities. In addition, aquaculture can boost conservation efforts by alleviating pressure on wild fish if sustainably managed to reduce damages to local ecosystems.

Inland small-scale fish farming can lead to enhanced economic security and incomes, thus empowering resource-poor entrepreneurs, not least women, to invest in improved nutrition, housing, health and education of their families. Equally, inland small-scale fish farming can lead to creation of employment, thus absorbing excess labour, stimulating innovation and adding value to goods and services. A dynamic aquaculture will be flexible in responding to volatile markets, and provide fiscal contributions to hard-pressed governments (DFID, 2000).

The recommendations of this research will seek to improve small-scale fish farming in terms of revenue, efficiency and expansion hence enabling local fish farmers to participate in hastening the national economic growth for the achievement of millennium development goals (MDGs) and Vision 2030. A well performing aquaculture will promote other auxiliary industries such as manufacturing of packaging materials, transport, recreation, and feed production among others. This will consequently improve the living standards of the majority of Kenyans who are struggling to make a living from inland small-scale fish farming.

The study will create a better insight into fish farming and therefore inform the introduction of the most appropriate interventions for optimal performance. Besides being a platform for future Government policy on inland small-scale fish farming, the study will be useful to future scholars, as it will also add to the existing body of knowledge.

1.7 Delimitation of the study

The target group for the research was comprised of individual households participating in fish farming in Imenti Central Constituency. The study was carried out in Central Imenti Constituency, one of the first regions in Eastern Province where aquaculture was granted GOK support under the Economic Stimulus Programme.

1.8 Limitations of the Study

This research limited itself to 273 fish farming projects, which have fishponds in Central Imenti Constituency. For a more conclusive result, interested researchers should consider several Constituencies for the study. This is not possible for this research study because of financial and time constraints. It would not be possible, for example, to cover fish farming projects in more than one Constituency, as this would require considerable time, resources and planning.

1.9 Assumptions of the study

In this study, it was assumed that all the sampled respondents would be honest while filling in the questionnaires, and the collected samples would be representative of the target

population. It was also assumed that the respondents would be available during data collection and be cooperative in filling the questionnaires openly.

1.10 Definition of significant terms

Economic Stimulus Programme refers to the Kenya Economic Stimulus Program (ESP) introduced in 2009/2010 to jumpstart the Kenyan economy towards long-term growth and development.

Fisheries officers: these are the staff employed by the ministry of agriculture, livestock and fisheries development and stationed in Imenti Central Sub-county.

Fish farming project: refers to a fishpond owned by an individual household in Imenti Central Constituency.

Central Imenti Constituency: refers to a political administrative area in Meru County represented by a member of parliament and comprising the following divisions: Abothuguchi West, Abothuguchi East, Abothuguchi Central, and Kiagu. It is also one of the administrative Sub-Counties of Meru County.

Performance of fish farming project: refers to the degree of success to which a fish farming project as an investment is meeting its specific objectives.

1.11 Organization of the study

The research subject for this study is aquaculture. The study is organized under five chapters giving it a research framework. Chapter 1 introduces fish farming as a research area of interest in Central Imenti Constituency through a description of the background to the study. Chapter 2 gives a literature review of the research objectives taking a global perspective, then regional, and down to the Constituency level. Next, the chapter gives the theoretical and conceptual frameworks of the study. Lastly, the chapter gives a summary of knowledge gaps that the study sought to fill. Chapter 3 consists of research methodology, operationalization of variables and ethical issues of the study. Next is chapter 4 which comprises data analysis, presentation and interpretation. Lastly there is chapter 5 which is made up of a summary of findings, discussions, conclusions and recommendations, and suggestions for further studies.

CHAPTER TWO
LITERATURE REVIEW

2.1 Introduction

This chapter discusses the variables that influence fish farming projects in Central Imenti Constituency. The chapter reviews other researches and official documents in line with the research objectives of this study. Later, the chapter gives the theoretical framework and conceptual framework that focuses on the linkage of independent variables and dependent variable.

2.2 Fish farming as an economic activity

According to a FAO report (2014) more people than ever before rely on fisheries and aquaculture for food and as a source of income, but harmful practices and poor management threaten the sector's sustainability. The report notes that global fisheries and aquaculture production totaled 158million tonnes in 2012- around 10 million tones more than in 2010. Fish farming holds tremendous promise in responding to surging demand for food, which is taking place due to global population growth (FAO, 2014).

Aquaculture consists of a broad spectrum of systems, from small ponds to large scale, highly intensified commercial systems. The Food and Agriculture Organization (FAO) of the United Nations has estimated that more than 30% of all fish used for human consumption originates from aquaculture. These fish comprise primarily herbivorous species such as tilapia and carp. In 2004, the total global production in aquaculture was 17.3 million tons of carp (Cypriniuscarpio), 1.2 million tones of tilapia (Tilapia spp.), 1.1 million tons of shrimp and more than 10 million tons of mollusks. The production of algae is estimated to be more than 12 million tons. The People's Republic of China is, by far, still the largest producer of aquaculture products in the world.

Hetland (2008) observed that the economic viability of fish farming was becoming widely realized 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 India, 11% in

USA and 10% in Japan were aquaculture products. In developing countries, fish farms not only improved a nation's diet but also 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). Roderick (2000) realized that more recently, a new wave of optimism for agriculture in Africa had been observed with several privately funded tilapia farming projects showing promise. These included the Kafue Fish Farm in Zambia, Lake Harvest in Zimbabwe, and several farms in Ghana, Nigeria and Malawi.

Despite that progress, the promotion of aquaculture for rural development had a poor record in many developing countries, especially in Africa where insufficient attention had been paid to the role of aquaculture in the livelihood or farming system of the intended beneficiaries the result being poor adoption by the intended target groups, the rural poor (FAO, 2002). Social, economic and institutional issues remained the greatest constraints to enhanced contributions towards rural development by aquaculture but a more holistic approach towards improved livelihoods and greater household food security was emerging (Halwart and Gupta, 2004).

Earlier failures in reaching the rural poor prompted a decline in donor support for aquaculture over the last decade (FAO). However, with adequate support, aquaculture could contribute significantly to rural development in countries where it was neither a traditional nor a widespread practice (Edwards, 2000). Despite the generally poor results achieved in many of the African countries where subsistence aquaculture had been supported, efforts were being made to build on some of the pioneering work, which took place during pre-independence days and within UNDP/FAO projects.

In Kenya, fish farming began in the 1920s, initially using tilapia species and later including the common carp and the African catfish. In the 1960s, Kenya government popularized rural fish farming with the construction of many small ponds and because of this effort, tilapia farming expanded rapidly in Kenya's Central and Western Provinces. However, the number of productive ponds declined in the 1970s, mainly because of inadequate services, a lack of

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 (Ngugi et al, 2007).

Following the renovation of several government fish rearing facilities, the establishment of research programs to determine best practices for pond culture, and an intensive training program for fisheries extension workers, there was renewed interest in fish farming in Kenya of late. In the year 2006 alone the fisheries department contributed 0.5% of the Kenya GDP while in the year 2005 registered a 4.1% sub-sector growth (Mwangi, 2008).
Owing to its prominence, the Kenyan government in the 2009/2010 financial year under the Economic Stimulus Program introduced commercial fish farming in Kenya in 140 political constituencies. Each constituency benefited with funds for 200 fishponds, 15 kilograms of fertilizer and 1,000 fingerlings. The exercise got into the second phase in the 2011/2012 financial year where an additional 20 constituencies were brought on board adding an extra 100 fish ponds for the first 140 constituencies and 300 fish ponds for the new constituencies making a total of 48,000 ponds costing about 15 million US dollars. This figure includes the operational cost and cost for 15 kilograms of fertilizer per pond and 1,000 fingerlings per pond among other costs.

There are hosts of factors that influence the growth of kenya's fish farming industry. These factors include un-coordinated promotion of fish farming through many institutions, Government, research institution, Universities, NGOs and regional authorities among others (Mwangi, 2008; Osure, 2011). The demand for fingerlings to stock the fast-growing number of fishponds has skyrocketed from 1 million to 28 million in less than a year, forcing the government to lean heavily on private industry. 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. Furthermore, there are no comprehensive policies on fish farming and legislation are inadequate (Mwangi, 2008; Osure, 2011). Because of this, policy makers have accorded low priority to fish farming as an economic activity.

Subsequently, the sector has operated without a comprehensive policy or legislation. This has reduced management and research effectiveness, discouraged investment in fish farming and constrained production and growth (Mwangi, 2008). Furthermore, lack of certified quality seed (Fingerlings) and commercially produced feeds are also among the problems facing the fish farming sector. Most farmers have not yet embraced the technology for producing high quality seed. Commercially produced feeds are hard to come by and when available they are expensive for most farmers to afford. Inadequate training programmes for farmers and extension workers have retarded the growth of the fisheries sector. The inadequacy in provision of extension services has been a major challenge to development of fish farming in Kenya. The situation results from lack of resources and technical staff (MOFD, 2011).

Inadequate outreach programmes and inefficiency in dissemination of technology transfer to farmers also play a key role in the backwardness in developing the sector. Many farmers with good land that can be put into fish farming are not even aware of this potential. Poor record keeping by farmers and inefficient statistical data collection has impended information dissemination on fish farming. Coupled with this, low funding of the sub-sector activities by the Government and low investment by the private sector are a major constraint to this sector. In addition, these challenges are compounded by inadequate entrepreneurship skills by the farmers and lack of credit. Nevertheless, although it has not been scientifically quantified, Kenya has enormous potential for fish farming in the agricultural rural zones. In fact, extensive water bodies provide great potential for food and income for rural population. Munialo (2011) stressed that the potential for growth and expansion is given the many favourable physical endowments of the region. These include adequate rainfall, a well-distributed network of rivers, streams, dams, satellite lakes and wetlands as well as suitable climate characterize the region. The Kenya Household Survey of 2005/06 indicated that 46% of the rural population living near perennial and seasonal water bodies fall below the poverty line. This is despite the potential these water bodies hold. In reaffirming the potential of the region, Munialo (2011) explains other advantages, which include favorable physical features such as the vast gently sloping land, fertile soil with high water retention

capacity, regional and international markets. This potential can be tapped to increase fish production through fish farming (Mwangi, 2008; FAO, 2007.

The sector currently provides direct employment to over 200,000 Kenyans and indirectly supports over one million people (Gitonga et al, 2004). In 1970, only 5 per cent of the fish eaten came from farms, today over 40% of the fish eaten is farmed. It is predicted that by 2048 all species of sea fish will have collapsed forcing us to rely almost exclusively on farmed fish (FAO, 2011). Rural populations in Kenya- an East African Low-Income Food-Deficit Country (LIFDC) (FAO, 2013a) - are facing increasing pressure on their livelihoods through, for example, the combined impacts of HIV/AIDS, climate change and water scarcity (CIA, 2013). Aquaculture of low –tropic level fish species is one way to improve livelihoods in developing countries (FAO, 2012). Russel et al (2008) for example described fish farming households as being among the more livelihood-secure households of their studied communities in Malawi. Aquaculture development has since been stimulated in numerous countries in order to improve livelihoods with varying success rates.

Kenya has potential for pond-based aquaculture of Nile tilapia (Oreochromisniloticus) and African catfish (Clariasgariepinus). However, in 2008 this potential was by no means fully explored (Mbugua, 2000a) despite about 30 years of various aquaculture extension services (Ngugi &Manyala, 2004). Support for aquaculture development in Kenya comes from the Government of Kenya (GoK) but also from the industry, the private sector and a number of Non-Governmental Oganisations (NGO) (Rothuis et al, 2011). In the development of Nile tilapia and African catfish aquaculture became part of the GoK's Economic Stimulus Programme (ESP), in order to commercialize this sub-sector of Kenya's economy (Manyala, 3011), to improve the nutritional situation of the farmers and create employment (TISA, 2012). The programme subsidized fish pond construction costs as well as the costs for feeds and fingerlings. Additionally, governmental infrastructure supporting the aquaculture sub-sector, i.e. trainings, research farms and extension officers, is in place (Hino, 2011). This program led to an increase in the number of farmers engaged in fish farming as well as to increase fish production (FAO, 2013b).

On a global scale, however, Kenyan aquaculture production is still insignificant (Rothuis et al, 2011). Top-down government support policies for aquaculture development sometimes prove to be unsuccessful in terms of increasing production (Russel et al, 2008). However, in Kenya the increasing demand for fish connected to a rapidly increasing population may improve the likelihood of success from government intervention (CIA, 2013). Fish consumption patterns in Kenya used to reflect the proximity to fishing areas and cultural tradition. Traditionally the major fish consumers have the Luo ethnic group, inhabiting areas around Lake Victoria. However, the demand for fish has increased fast because more and more people have embraced fish on their household menus and aquaculture production is widespread throughout the country (Rothuis et al, 2011).

Mwangi (2008) observed that aquaculture contributed about 15% of the national fish production with approximately 1,000 metric tons harvested from 7,477 ponds owned by 4 742 fish farmers annually. With an introduction of 48 000 fish ponds at a cost of over 15million US dollars across the country, the contribution of aquaculture in fish production and the economy was therefore bound to increase enormously. That notwithstanding, very little had been done to establish the performance and challenges of the project as it went into the second phase. It is against this backdrop that a study will be conducted to enable the government, other development agencies and farmers get information to enable them make informed decisions for optimal production of farmed fish. A study by Mwangi (2008) entitled "Aquaculture in Kenya" observes that, Fisheries sector contributes significantly to the National economy through employment creation, foreign exchange earnings, poverty reduction and food security support. The study further states that the sector contributed 0.5% to GDP in the year 2006. This contribution could be higher if value addition at the various stages of the supply chain are considered and post harvest losses minimized. The sub-sector's growth was estimated at 4.1% in 2011 (National Economic Survey, 2011).According to Imenti Central Sub-County fisheries office documents (2013), Imenti Central Sub-County alone earned Ksh.2,223,000from sale of fish harvested from the fishponds in the Sub-County in 2011-2012.

According to a study conducted by Mwangi (2008), the government has taken keen interest in fisheries due to its potential and has given it the priority it deserves. His sentiments are confirmed by the government's incorporation of fish farming in the ESP to help jump start the economy by providing food and income to the rural inhabitants as a way of eradicating poverty and creating jobs to the poverty-stricken areas (GoK, 2011). According to Rarama (2011), many farmers in Central Imenti Constituency have adopted fish farming not only as a source of food but also as an income generating activity. The ESP programme was targeted for areas with high population, small farmland and mass poverty with low incomes and fluctuating farm productivity, but with water available to sustain the programme. Ngugi et al (2008), further postulates that Kenya is endowed with numerous aquatic resources with aquaculture potential. However, since its introduction under ESP, fish farming has not made much further progress, and has in many cases even declined resulting in discouraged farmers abandoning their fishponds.

The Africa Regional Aquaculture Review Meeting (CIFA/OP24, FAO, 2000) identified a number of constraints affecting the development of the aquaculture sector in Africa. Among other things, the review concluded that Small-scale farmers have rural social constraints such as limited access to market, inadequate extension services, and poor pond management among others that affect their needs, priority assessments and aspirations (Kimathi, 2011).These findings concur that despite the critical role played by aquaculture sector, it is faced with many challenges and constraints that include limited access to financial services and markets, inadequate access to skills and technology, insecurity of land tenure, poor access to infrastructure, and inadequate business knowhow among others. However, the findings are too general, and fail to address fish farming specifically under ESP, which is a government's initiative, and more so in the new areas where fish farming did not exist before.

2.3 Influence of fish species on fish farming projects

The Nile tilapia (*O.niloticus)* is the most common cultured warm water species in the Mt Kenya region .*Oreochromisniloticus* and its hybrid have been cited as the most important cultured fish species in the tropics under semi-intensive smallholder farms (Charo-Karisa et

al 2006; Mbugua, 2002). Many farmers did not rear the African Catfish although it is known to be versatile under different water qualities, and to have a high flesh to bone ratio (Charo-Karisa et al 2008). Okwu and Achenje (2011) showed that in Nigeria, a large number of farmers cultured Catfish because of its good marketability, resistance to harsh environmental conditions and survival in diverse water conditions.

It was evident in a study carried out in the region that implementing the management practices specified in the ESP has positive results, that is, the semi-intensive system of managing fish with limited external inputs (Mwatsuma, 2012). Practices adopted by farmers in this region are not different in relation to the diverse sources of water used for fish farming. The main practice implemented in all the areas to try to boost off-take is the use of both organic and inorganic fertilizers to promote the growth of plankton, one of the main fish feeds. Fish farmers in other regions have been able to increase fish yields in ponds by using inorganic or chemical fertilizers and organic fertilizers or manures, which help maintain the nutrient status of ponds (Bocek 2009; Brunson et al 1999).

However, the greater challenge is the loss of fish through predators like fish eating birds (e.g. kingfishers); frogs and reptiles (snakes and monitor lizards) and man. The communities need to determine collaboratively measures for pond security with the most optimal management of time in order to enhance fish production in the Mt. Kenya region (Kimathi, 2011).Imenti North Sub-county fisheries office documents (2014) note that the desired mono-sex tilapia fingerlings are not readily available, because there are limited breeders and hatcheries. The process of obtaining mono-sex fingerlings is relatively new to the farmers, and the cost of obtaining such fingerlings is generally prohibitive.

2.4 Influence of fish feeds on fish farming projects

Farmers under the ESP were provided with formulated fish feeds by the government at a subsidised cost. Fish nutrition and feeding are critical for growth, reproduction and health in fish populations. Availability of adequate feeds also greatly influences the response of fish to the physiological environment and to various pathogens. Fish willingness to spawn and the quality of sperm and eggs produced is greatly affected by the quality of feed. Selective

breeding for growth improvement in fish also improves feed retention and feed conversion ratio (FCR) (Neely et al. 2008; Thodesen et al. 1999).

Enhanced fish nutrition could be achieved through more efficient use of by-products from the fishing industry. Bacterial protein meal produced using natural gas (methane) as a carbon source, has been shown to be an excellent substitute for fish meal in fish feed (Aas et al, 2006). Feed for carnivorous fish such as the catfish can be substituted, largely with grain protein and oils instead of animal protein and fat (Gatlin et al, 2007). Algae and aquatic macro types are good feed sources for farmed fish but should not exceed 15-20% of dietary requirements (Hasan and Chakrabarti, 2009). Fish farmers in Imenti Central Sub-county feed fish on low quality feeds when they cannot afford to purchase processed fish feeds. It would be interesting to investigate the extent to which the quality of fish feeds affect fish farming projects in Imenti Central Sub-county.

2.5 Influence of fishpond management on fish farming projects

Fishpond management is crucial for optimal performance of a fishpond once all other considerations for fishpond requirements are met. In fish farming enterprises, efficient operation and high production can only be achieved if ponds are properly managed. Management activities begin with the preparation of the pond for the fish crop and continue with stocking and feeding the fish, ensuring that water quality remains high throughout the culture period, taking measures to prevent invasion by predators and the occurrence of diseases, and harvesting the fish. An important ancillary management practice that should never be overlooked is keeping good records of expenses and income and of all activities and events associated with the pond or farm, so that this information can be used to improve operations in the future (Ngugi, Bowman &Omolo, 2007).

Fishpond management issues are evident in Imenti Central sub-county fisheries office documents (2014), which warrant research in this respect. For example, the documents indicate over breeding in ponds leading to poor growth and overpopulation of fish. There is also the issue of water shortages during dry seasons due to high demand of water for other agricultural activities. Fish theft and fish kills are among the other issues that the documents

highlight. These important management and environmental issues should be researched to determine the extent to which they influence fish farming in Central Imenti Constituency.

2.6 Influence of fish marketing on fish farming projects

The production practices introduced by the ESP mean that farmers tend to harvest their fish in large batches resulting in periodic gluts and lower prices. Prices offered for fish in the local markets also tend to be low as intermediaries involved in transactions pass on the costs of transportation to the farmers. In her research study, Njoroge (2011) found that the majority of fish farmers preferred to sell fish and other fish products directly to consumers. In the same study, she concluded that a few farmers representing 22% of the population surveyed in Central Imenti Constituency use intermediaries to market their produce. According to Kristyn and Sergio (2005), fish is the most heavily traded food commodity and the fastest growing agricultural commodity in the international market.

From the beginning of fish farming projects, farmers tended to focus more on the production and management of fish than on issues related to the markets and marketing of fish. There was some misconception that the ESP that introduced the fish would also be a key supporter in the marketing of fish produced. A challenge for those implementing the ESP is to manage the expectations of communities targeted in development (Kimathi, 2011).

The domestic market for Nile tilapia is quite promising. Prices are as high as Ksh 300 (US $1.87) per kg in major cities and other parts of the country (World Bank, 2006). The major towns surrounding the aquaculture production centers constitute assured markets. The market for Nile tilapia and African catfish is mainly confined to whole fish and the distribution chain is mostly short, characterized by farm-gate sales. Small-scale production of Nile tilapia in Kenya provides significant economic returns to justify capital investment using borrowed capital (Vincke, 1995).

According to FAO (2008), Fish farming has become one of the most profitable, fast growing enterprise to run, and has been an alternative to agriculture, which depends on seasonal rainfall; fish farming is all season's enterprise that provides nutritious food, constant income

and can help alleviate poverty. However, the report identifies the fish market as a major factor hindering the prosperity of the venture. According to FAO, marketing involves all the activities associated with getting fish to the consumers in the desired form, such as processing, packaging, transporting, storing, and other functions. Learning institutions and health facilities in the locality are another important source of market for the subsistence fish farmers (Ngugi et al. 2007). According to him, it is advisable that small-scale producers form marketing groups, which will assure them a regular market. The same is echoed by the government in her advice to beneficiaries of economic stimulus programme to form clusters of local associations and, if possible, cooperative societies to market their products in order to achieve maximum benefits (GOK, 2009).

The findings by these scholars and institutions agree that a major problem for many fish farmers is where to sell their fish. According to the available information in Imenti central Sub-county fisheries office (2014), fish farmers in the Sub-county find fish market exploitative and sometimes unreliable. For this reason, a research study in fish marketing will establish the extent to which fish marketing affect the performance of fish farming projects in the Sub-county.

According to Ngugi et al (2007), before starting a fish farming enterprise, a farmer should conduct a market survey. Such a survey would help a farmer determine type and size of fish preferred by consumers (fingerlings, whole fish, fillets, etc.), quantity of fish required by the market, best time to market fish, which other farmers are supplying fish and prices at which fish are being sold. Their study states that fresh-farmed fish whose source is known, and whose quality is assured will fetch better prices in market. It is important to note that fish farmers will want a marketing system that provides high quality fish on demand at the lowest cost, efficient and effective in delivery of services and reliable when needed (Kimathi, 2011).

Studies and practice have shown that the value of fish can be added by doing some basic processing, which improves marketability. Refrigeration is required, for instance, to preserve the perishable fish, but it is beyond the reach of the ordinary fish farmers in the

constituency. It is therefore advisable that fish farmers take the fish to the market and sell them as quickly as possible as holding the fish for too long will spoil them and make them unfit for human consumption. Njoroge (2011) notes that marketing systems in the constituency need to be improved to increase farmer earnings from fish sales. Mwangi (2008) notes that diversification of aquaculture products and value additions are not fully developed. His study recommends that government needs to develop market infrastructure, build farmer capacity, organize promotion through trade fairs, develop market information systems, promote and facilitate value addition for aquaculture products.

However, just like Njoroge (2011), Mwangi (2008) equally fails to identify how and what measures the government will put in place noting that the ministry of fisheries is understaffed and under resourced. The studies by the above researchers failed to consider that under ESP most of fish farms are in remote rural areas where poor infrastructure as evidenced by poor state of road network is a critical factor that constrains profitable businesses. For example, poor state of roads adds to the cost of producing and marketing of goods and services, thereby rendering them less competitive. These studies further fail to associate marketing with relevant marketing information that is crucial to help access new markets and address the issue of technology, which being too expensive to rural fish farmers renders them unable to produce quality products that are competitive in the market, thus the contention of this study (Kimathi, 2011).

2.7 Theoretical framework

The study was based on the broad framework of the theory of constraints (TOC), sometimes known as constraint analysis as advanced by Israeli physicist Eliyahu. According to Bushong et al (1999) the theory of constraints (TOC) is a systematic and iterative approach to management that emphasizes adapting business practices in order to best cope with limitations, or constraints, that stand in the way of key objectives. The goal of TOC is to maximize the efficiency of a process selectively at the most critical point and thereby maximize profitability, quality, or other corporate objectives. The theory of constraints aims at optimizing profits and the use of resources**.**

2.8 Conceptual framework

The conceptual framework defines the variables of research and shows how independent variables influence the dependent variable. In this study, conceptual framework shows how factors such as marketing, fish species farmed, and pond management influenced fish farming projects in Central Imenti Constituency.

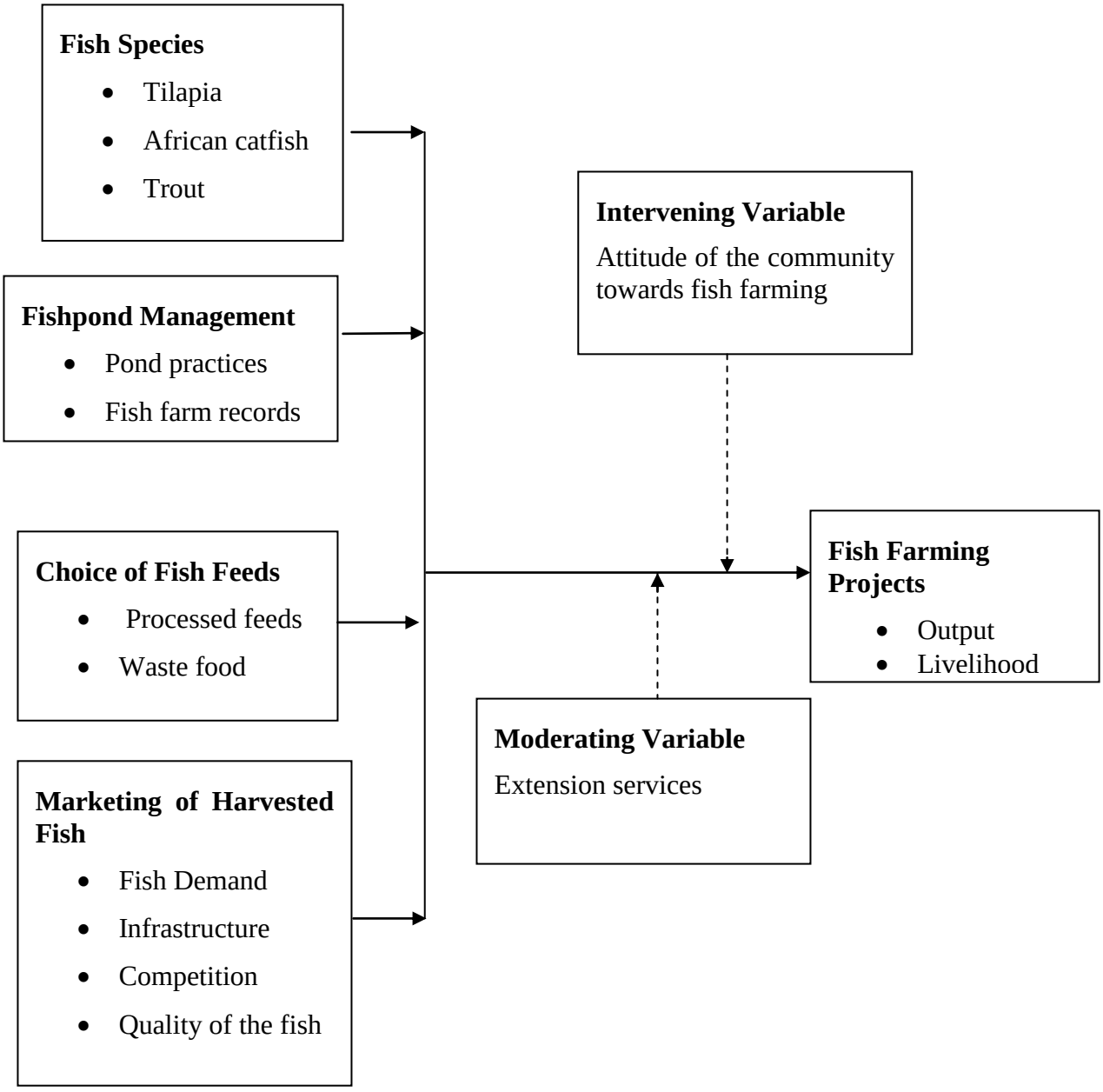

Figure 1: Conceptual framework

Fish farming projects are influenced by independent and intervening variables. These variables include availability of markets and market infrastructure (marketing), technical support and access to information (technical services); cultural practices such as eating habits, income and pond management skills. Other variables such as type of soil and water quality, stocked fish species, feeding, controlling of predators and disease plus the government policy of ESP all influence the success of fish farming projects in Central Imenti Constituency. The combined influence of these factors determines the sustainability of fish farming which should be evident in fish-farming outcomes.

2.9 Summary of Knowledge Gaps

There was a number of knowledge gaps that this research study sought to fill. It is noteworthy that ESP was an intervention by the government to protect the livelihood of the poor and create jobs to the youth (GoK, 2009), especially through supporting farmers in selected Constituencies to start fish farming projects by giving material and financial support to those interested to establish fish ponds on their farms. In view of this intervention, the question lingers whether the beneficiaries of the programme benefitted as envisaged. There are indicators in the literature reviewed that despite initial success of the programme in Central Imenti Constituency, there were concerns that 266 fish ponds were active while 20 were dormant; which translates to 6.9 per cent of fish ponds in the Constituency whose cause of dormancy was not documented. Another area of research interest in this study is whether the programme has sustainably grown 7 years on since its inception in 2009. In this respect, this research sought to find if the original beneficiaries of ESP are still in business of raising fish, or whether they have given up the activity all together. In addition, the research sought to establish the reasons behind performance outcomes that were noted in the field. Such information would constitute valuable knowledge that can be a reference point to government agencies involved in fish farming in the Constituency to provide meaningful interventions so that the objectives of the programme may be optimally achieved. In the event that the programme achieved its objectives optimally, then the projects can serve as a good model of economic intervention.

CHAPTER THREE
RESEARCH METHODOLOGY

3.1 Introduction

This chapter covers the overall methodological framework. Specifically, it covers the research design, target population, sample and sampling procedures, research instruments and data collection, validity, reliability and data analysis. The chapter describes the research methodology that the researcher adopted in gathering the research data and the research instruments used to analyze the data to obtain the research findings.

3.2 Research design

To achieve the objectives of the study, the researcher adopted a descriptive survey design, which was a combination of both qualitative and quantitative data collection and analysis techniques. Quantitative data was derived from the questionnaires while qualitative data was generated from an interview schedule. Descriptive survey determines the relationship that exists between specific events (Orodho2009). Descriptive survey designs are used in preliminary and exploratory studies to allow researchers to gather information, summarize, present and interpret data for the purpose of clarification (Orodho, 2008).

The design allowed the researcher to describe, explain and examine facts, trends and patterns that emerge from the study. Using descriptive survey design, large population can be studied with only a portion of that population being used to provide the data. The design was appropriate to gather information on factors affecting performance of fish farming projects in Imenti central constituency by describing the state of fish farming, as it exists on the ground. In this study, fish species, availability of the market, fish feeds, and the management of fish ponds were researched.

3.3 Target population

The research targeted a population of 274 fish farmers who benefitted from ESP programme in Central Imenti Constituency.

3.4 Sampling procedure and sample size

A sample size representative of the study population was selected using simple random sampling and purposive sampling. Representative sample, according to Gall et al (1996) gives results that can be generalized to the study population from which the sample was selected. The list of the farmers was obtained from the Ministry of Fisheries Development in Imenti Central fisheries office. Mugenda and Mugenda (1999) suggest that for descriptive studies 10%, or above of the accessible population is enough for the study. From the targeted population of 274 respondents, the researcher employed scientific method $\{\mathbf{N} = \mathbf{pqz2/e2}\}$developed by Saunders (2009) and obtained a sample size of 274 respondents for the current study. Where **N** was the sample population, $\mathbf{P}= 1 - q$ (represents the probability), $\mathbf{Z_{a/2}}$ was the Continuous Density Function (CDF) of normal distribution while e was the error term and thus $\mathbf{Z}_{a/2}$= 1.96 and$\boldsymbol{\varepsilon}$ = 0.95.

3.5 Methods of data collection

Methods of data collection were comprised of the tools or research instruments used by a researcher to acquire the required information for a study. For this study, the tools consisted of a questionnaire and an interview schedule, which focused on identified variables that were researched in the field.

3.5.1 Questionnaire

Questionnaires were used to collect data from farmers with fishponds. McMillan and Schumacher (2001) recommend a questionnaire if the researcher knows that the respondents were in a position to answer the questionnaire. Open ended and Likert-scaled items were carefully used to generate information of influence. Largely, the scaled items obtain accurate assessment of opinions according to Macmillan and Schumacher (2001). Similarly, a questionnaire has the ability to solicit information from several respondents within a short time (Gupta, 2004).

3.5.2 Interview Guide

Face to face, interviews were carried out on the District Fisheries Officers (DFOs). The interview schedule was designed in a way that got more specific and truthful answers. These helped capture information, not provided by the questionnaires. Kothari (2004) preferred this method because of its flexibility and ability to provide new ideas on the subject.

3.6 Validity of the research instruments

Mugenda & Mugenda (1999) define validity as the accuracy and meaningfulness of inferences based on the research results. It is hence the ability of instruments to measure what they are intended to measure. To enhance content validity, the researcher had the research instruments appraised by the research supervisors. Instruments validity was ensured through piloting of instruments and split-half statistical method. A test of validity where $r \geq 0.7$ is acceptable.

3.6.1 Reliability of the research instruments

For reliability analysis, Cronbach's alpha coefficient was used which simply provides an overall reliability coefficient for a set of variables. Cronbach's alpha is the most common measure of internal consistency ("reliability"). It is most commonly used when you have multiple Likert questions in a survey/questionnaire that form a scale, and you wish to determine if the scale is reliable (Lund, 2013). Inter-item correlation and covariance matrices were generated to see which items correlated well and which ones were redundant. A level of alpha of 0.7 or higher was deemed acceptable.

3.6.2 Data collection procedure

The survey instrument has five sections: a section that collected data on general household characteristics and other demographic information, a section on fish species farmed, a section on fish feed practices, a section on marketing of harvested fish, and a section that solicited for specific information relating to perceptions on performance of fish farming projects in Imenti central constituency.

3.7 Methods of data analysis

Data analysis refers to the examining of what has been collected in a survey or experiment in making deductions and inferences. It involves uncovering underlying structure, extraction of important variables, detecting any anomalies and testing any underlying assumptions. It also involves scrutinizing the acquired information and making of inferences (Kombo& Tromp, 2006). The researcher first edited collected data, and then entered it into SPSS. The collected data was analyzed quantitatively using Statistical Package for Social Science (SPSS). The computed data was analyzed using regression analysis for inferential analysis while demographic data was presented using descriptive statistics such frequencies, means, and percentages.

3.8 Operational definition of variables

Table 3.1: Operationalization of variables

Research objective	Variable	Indicators	Measure	Scale	Data collection	Type of analysis	Level of analysis
To determine the influence of fish feeds on fish farming projects in Central Imenti Constituency	Fish feeds	-Training in types of feeds -Fingerlings Feeds -Market sources and Access	-frequency -brand names -No. of contacts -No. of orders	Nominal /Ordinal/scale	Open and closed ended questions	Descriptive/ Inferential statistics	/Inferential
To ascertain the influence of fishpond management on fish farming projects in Central Imenti Constituency	Fishpond management	-Specific budget allocation - specific designated staff - consistent Routine maintenance -Capacity building programme	-annual amount of money in Ksh. -No. of personnel - proof of maintenance schedule - training frequency counts	Nominal /Ordinal/scale	Open and closed ended questions	Descriptive/ Inferential statistics	/Inferential
To assess the influence of fish species on fish farming projects in Central Imenti Constituency	Fish species farmed	- common type of fish - Training in Identification of Physical & Biological characteristics -Identification of existing sources of type of fish species -Adaptation to	-types of fish stocked -No. of trainings -No. of sources -name of the fish species farmed -No. of fish harvested vs. No. stocked	Nominal /Ordinal/scale	Open and closed ended questions	Descriptive/ Inferential statistics	/Inferential

		pond-type1/fish farming/warm water -variety and survival rates					
To examine the influence of marketing of harvested fish on fish farming projects in Central Imenti Constituency	Marketing of harvested fish	-Transport preference -Access to market -Cost benefit analysis -Size of market penetration	-count of available means of transport - proof of co-operatives -proof of bookkeeping - quantities sold in Kilos	Nominal /Ordinal/scale	open and closed ended questions	Descriptive/ Inferential statistics	/Inferential
To determine the factors influencing fish farming projects in Central Imenti Constituency	Fish farming projects	-Fish yields - No. of ponds constructed, - No. of ponds stocked, - No. of ponds harvested -Actual Quantity of fish harvested per project	- volume in tons -total No. of ponds stocked -total No. of ponds harvested -total No. of fish harvested in Central Imenti Constituency	Nominal /Ordinal/scale	Descriptive /Inferential statistics		

3.9 Ethical issues

As this study requires the participation of human respondents, certain ethical issues were addressed. The consideration of these ethical issues was essential for ensuring the privacy as well as the safety of the participants. Consent and confidentiality are among the significant ethical issues that were considered in the research procedure. In order to secure the consent of the selected respondents, the researcher relayed all-important details of the study, including the objective and purpose of the research. By explaining these important details, the respondents were able to understand the importance of their role in the completion of the research. The respondents also advised that they can withdraw from the study even during the process. With this, the respondents were not forced to participate in the research. The confidentiality of the respondents was also assured by not disclosing their names or personal information in the research. Only relevant details that helped in answering the research questions were included.

CHAPTER FOUR
DATA ANALYSIS, PRESENTATION AND INTERPRETATION

4.1 Introduction

This chapter discusses the interpretation and presentation of the findings. This chapter presents analysis of the data on the influence of selected factors on fish farming projects in Central Imenti Constituency of Meru County. The chapter also provides the major findings and results of the study.

4.1.1 Response Rate

The study targeted a sample size of 274 respondents from whom240 filled in and returned the questionnaires making a response rate of 87.59%. This response rate was good and representative and conforms to Mugenda and Mugenda (1999) stipulation that a response rate of 50% is adequate for analysis and reporting; a rate of 60% is good and a response rate of 70% and over is excellent.

4.2 Demographic Characteristics

The researcher sought to establish the background information of the respondents including respondents' gender, age, marital status, level of education, fish farming duration, fish pond establishment and employment.

4.2.1: Gender of the respondents

The respondents were asked to indicate their gender. The responses received were as shown in Table 4.1.

Table 4.1 : Gender of the respondents

	Frequency	**Percent**
Male	169	70.4
Female	71	29.6
Total	**240**	**100.0**

From the findings shown above, 70.4% of the respondents indicated that they were male while 29.6% indicated they were female. Clearly, most of the fish farmers were male.

4.2.2 Age of the respondents

The respondents were further asked to indicate their age. The responses received were as shown in Table 4.2.

Table 4.2 : Age Bracket

	Frequency	Percent
18-24 years	56	23.3
25 – 31 years	88	36.7
32 – 38 years	39	16.3
39–45 years	24	10.0
Above 46 years	33	13.8
Total	**240**	**100.0**

According to the findings, 36.7% of the respondents indicated that they were aged between 25 and 31 years, 23.3% indicated between 18 and 24 years, 16.3% indicated between 32 and 38 years,13.8% indicated above 46 years while 10.0% indicated between 39 and 45 years. From these findings we can infer that most of the fish farmers were the youth aged between 25 and 31 years.

4.2.3 Marital status

The respondents were also asked to indicate their marital status. Their responses were as shown in Table 4.3.

Table 4.3: Marital status

	Frequency	Percent
Married	180	75.0
Single	60	25.0
Total	**240**	**100.0**

From the findings tabled above, 75% of the respondents indicated that they were married while 25% indicated that they were single. From these findings we can deduce that most of the fish farmers were married, and fish farming was a source of family livelihood.

4.2.4 Highest level of education

The respondents were additionally requested to indicate the highest level of education. Their responses were as shown in Table 4.4.

Table 4.4: Level of education

	Frequency	Percent
Primary level	60	25.0
Secondary level	39	16.3
College level	98	40.8
University level	43	17.9
Total	**240**	**100.0**

According to the findings, 40.8% of the respondents indicated that their academic qualification was the college level, 25% indicated the primary level, 17.9% indicated University level while 16.3% indicated secondary level. From these findings we can infer that most of the fish farmers had highest level of education at the college level, probably indicating that college level of education equips one with the rights kills and attitudes for fish farming projects.

4.2.5 Employment

The respondents were additionally asked to indicate their employment status. Their responses were as shown in Table 4.5.

Table 4.5 : Employment

	Frequency	Percent
Self	112	46.7
Casual	84	35.0
Permanent employee	44	18.3
Total	**240**	**100.0**

From the data shown in Table 4.5, 46.7% of the respondents indicated that they were self-employed, 35% indicated they were casual employees while 18.3% indicated they were permanent employees. From these findings we can deduce that most fish farmers were self-employed, and they were the owners and the managers of their fish farming projects. We can also infer from the percentages of casual and permanent employees indicated in the table that Fish farming projects were a significant source of employment.

4.3 Fish Pond Management

The study further sought to ascertain the influence of fish pond management on fish farming projects in Central Imenti Constituency. The results obtained are shown below.

4.3.1 Fish farming duration

The respondents were additionally requested to indicate the duration of time they have been doing fish farming. Their responses were as shown in Table 4.6.

Table 4.6 : Fish farming duration

	Frequency	Percent
Less than 1 year	35	14.6
1 – 2 years	42	17.5
2 - 4 years	43	17.9
5 – 7 years	81	33.8
Total	**240**	**100.0**

From the findings in Table 4.6, 33.8% of the respondents indicated that they had been conducting fish farming for a period of between 5 to 7 years, 17.9% indicated a period of between 2 to 4 years, 17.5% indicated a period of between 1 and 2 years while 14.6% indicated a period of less than a year. From these findings, we can infer that most fish farmers had been practicing fish farming for a period of between 5 to 7 years.

4.3.2 Fish pond establishment

The respondents were also asked to indicate whether they established their fish pond with assistance from the government through ESP funding. The results were as shown in Table 4.7.

Table 4.7: Fish pond establishment

	Frequency	**Percent**
Yes	140	58.3
No	100	41.7
Total	**240**	**100.0**

According to the findings in Table 4.7, 58.3% of the respondents indicated that they established their fish pond with assistance from the government through ESP funding while 41.7% indicated they did not. From these findings we can infer that the fish farmers established their fish pond with assistance from the government through ESP funding. We can also infer from the table that ESP played a significant role in establishing fish farming projects in Central Imenti Constituency.

4.3.3 Fishpond Management Practices

The study further sought to establish the extent to which various aspects of fishpond management influence Fish Farming Projects in Central Imenti Constituency.

Table 4.8: Extent that various aspects of fishpond management influence Fish Farming Projects.

	Mean	Std. Deviation
Pond practices	4.2104	1.01102
Fish farm records	3.7597	.71522

From the findings, majority of the respondents indicated that pond practices and fish farm records influence fish farming projects to a great extent as shown by a mean score of 4.2104 and 3.7597 respectively as indicated in Table 4.8.

4.4 Influence of fish species farmed on Fish Farming Projects

The study sought to determine the influence of fish species on fish farming projects in Central Imenti Constituency. Results obtained were as shown in subsequent sections.

4.4.1 Tilapia type of fish (Oreochromisniloticus)

The respondents were queried on whether they kept Tilapia type of fish. Their responses were as shown in Table 4.9.

Table 4.9 : Tilapia type of fish

	Frequency	Percent
Yes	160	66.7
No	80	33.3
Total	**240**	**100.0**

According to the findings in Table 4.9, 66.7% of the respondents indicated that they kept Tilapia fish while 33.3% indicated they did not. From these findings we can infer that the fish farmers farmed most was Tilapia.

4.4.2 Other types of fish apart from tilapia

The respondents were further requested to indicate whether or not they kept other types of fish apart from Tilapia. Their responses were as shown in Table 4.10.

Table 4.10 : Other types of fish apart from tilapia

	Frequency	Percent
Yes	130	54.2
No	110	45.8
Total	**240**	**100.0**

According to the findings in Table 4.10, 54.2% of the respondents indicated that they kept other types of fish apart from Tilapia while 45.8% indicated they did not. From these findings we can deduce that the fish farmers kept other types of fish apart from Tilapia.

4.4.3 Statements on fish farming

The respondents were further requested to indicate their level of agreement with the following statements on fish farming. The results were as shown in Table 4.11.

Table 4.11: Statements on fish farming

	Mean	Std. Deviation
The type of fish species influences the performance of fish farming projects.	4.4716	0.56106
Availability of fish species influences the performance of fish farming projects.	4.1373	0.63552
Availability of fingerlings influences the performance of fish farming projects.	4.4925	0.68253
The ambient temperature influences the performance of fish farming projects.	3.9763	1.05353

According to the findings in Table 4.11, the respondents strongly agreed that availability of fingerlings influences fish farming projects as shown by a mean score of 4.4925. Further, the respondents agreed that the type of fish species influences fish farming projects as shown by a mean score of 4.4716. Additionally, the respondents agreed that availability of fish species influences fish farming projects as shown by a mean score of 4.1373. Lastly, the respondents agreed that the ambient temperature influences fish farming projects as shown by a mean score of 3.9763.

4.5 Influence of Fish Feeds on Fish Farming Projects

The study further sought to assess the influence of fish feeds on fish farming projects in Central Imenti Constituency. Results were as shown in the following sections.

4.5.1 Regular feeding of fish

The respondents were further requested to indicate whether or not they regularly fed their fish, their responses were as shown in Table 4.12.

Table 4.12: Regular feeding of fish

	Frequency	Percent
Yes	186	77.5
No	54	22.5
Total	**240**	**100.0**

According to the findings above, 77.5% of the respondents indicated that they regularly fed their fish while 22.5% indicated they did not. From these findings we can establish that the fish farmers regularly fed their fish.

4.5.2 Commercially processed fish

The respondents were further asked to indicate whether they specifically use commercially processed fish feeds. Their responses were as shown in Table 4.13.

Table 4.13: Commercially processed fish

	Frequency	Percent
Yes	157	65.4
No	83	34.6
Total	**240**	**100.0**

According to the findings in Table 4.13, 65.4% of the respondents indicated that they specifically use commercially processed fish feeds while 34.6% indicated they did not. From these findings we can infer that the fish farmers specifically use commercially processed fish feeds.

4.5.3 Fish Farming Projects

Further, the respondents were further asked to indicate the extent to which the following influenced fish farming projects. The results obtained were as show in Table 4.14.

Table 4.14: Influence of selected factors on Fish Farming Projects

	Mean	Std. Deviation
Availability of Fish feeds	3.5716	.56106
Availability of Fingerling feeds	3.5373	.63552
Extension Support on fish feeds	3.5925	.68253
Fish feeds variety	3.9424	.97424
Storage facilities for fish feeds	3.8142	1.0492

According to the findings tabled above, the study established that fish feeds variety influence fish farming projects to a great extent as shown by a mean score of 3.9424. Further, the study found that storage facilities for fish feeds influence fish farming projects to a great extent as shown by a mean score of 3.8142. As well, the study established that extension Support on fish feeds influence fish farming projects to a great extent as shown by a mean score of 3.5925. Moreover, the study found that availability of Fish feeds influence fish farming projects to a great extent as shown by a mean score of 3.5716. Lastly, the study

established that availability of Fingerling feeds influence fish farming projects to a great extent as shown by a mean score of 3.5373.

4.6Influence of Market Openings on Fish Farming Projects

The study also sought to establish how marketing of harvested fish influenced fish farming projects in Central Imenti Constituency. The results were as shown in the following sections.

4.6.1 Number of fish harvested

The respondents were also requested to indicate whether or not they were satisfied with the number of fish that they harvest from their ponds. The results were as shown in Table 4.15.

Table 4.15: Number of fish harvested

	Frequency	Percent
Yes	171	71.3
No	69	28.8
Total	**240**	**100.0**

According to the findings above, 71.3% of the respondents indicated that they were satisfied with the number of fish that they harvest from their pond while 28.8% indicated they were not. From these findings we can infer that the fish farmers were satisfied with the number of fish that they harvest from their ponds.

4.6.2 Harvested fish

In addition, the respondents were asked to indicate what they do with the most of the fish that they harvest from their fish ponds. The results were as seen in Table 4.16.

Table 4.16: Harvested fish

	Frequency	Percent
Sell	142	59.2
Eat	98	40.8
Total	**240**	**100.0**

According to the findings in Table 4.16, 59.2% of the respondents indicated that they sold fish that they harvested from their ponds while 40.8% indicated they ate the fish. From these findings we can infer that a majority of fish farmers sold fish that they harvested from their ponds.

4.6.3 Fish farming projects

Additionally, the respondents were further asked to indicate the extent to which the following influenced fish farming projects. The results obtained were as show in Table 4.17.

Table 4.17:Fish farming projects

	Mean	Std. Deviation
Transport to markets influences fish farming projects.	3.6866	.49875
The ease of access to market influences fish farming projects.	3.6418	.51745
Availability of cold storage influences fish farming projects.	4.3166	.59548
Availability of packaging materials and facilities influence fish farming projects.	3.6754	.83525

According to Table 4.17, the respondents indicated that availability of cold storage influences fish farming projects to a great extent as shown by a mean score of 4.3166. Further, the respondents indicated that transport to markets influences fish farming projects to a great extent as shown by a mean score of 3.6866. In the same way, the respondents indicated that availability of packaging materials and facilities influence fish farming

projects to a great extent as shown by a mean score of 3.6754. Lastly, the respondents indicated that the ease of access to market influences fish farming projects to a great extent as shown by a mean score of 3.6418.

4.7Fish Farming Projects

The purpose of this study was to establish the influence of selected factors onfish farming projects in Central Imenti Constituency of Meru County. Results are as shown in the following sub-section.

4.7.1 Performance of Fish farming projects

The respondents were further queried on whether fish farming projects were a success. The results were as seen in the following sections.

Table 4.18 : Fish farming performance

	Frequency	**Percent**
Yes	156	65.0
No	84	35.0
Total	**240**	**100.0**

According to the findings in Table 4.18, 65% of the respondents indicated that fish farming projects were a success while 35% indicated they were not. From these findings we can establish that fish farming projects were a success.

4.7.2 Records of fish farming

The respondents were additionally asked to indicate whether they kept records of their fish farming. Their responses were as shown in Table 4.19.

Table 4.19: Records of fish farming

	Frequency	Percent
Yes	136	56.7
No	104	43.3
Total	**240**	**100.0**

According to the findings in Table 4.19, 56.7% of the respondents indicated that they kept records of their fish farming while 43.3% indicated they did not. From these findings we can establish that fish farmers kept records of their fish farming.

4.7.3 Number of fingerlings

In addition, the respondents were asked to indicate whether or not they had increased the number of fingerlings. Their responses were as indicated in Table 4.20.

Table 4.20: Number of fingerlings

	Frequency	Percent
Yes	163	67.9
No	77	32.1
Total	**240**	**100.0**

According to the findings in Table 4.20, 67.9% of the respondents indicated that they had increased the number of fingerlings while 32.1% indicated had not. From these findings we can establish that fish farmers had increased the number of fingerlings.

4.8 Regression Analysis

In this study, a multiple regression analysis was conducted to test the influence among predictor variables. The research used statistical package for social sciences (SPSS V 21.0) to code, enter and compute the measurements of the multiple regressions

Table 4.21: Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	0.782	0.611	0.604	0.157

R-Squared is a commonly used statistic to evaluate model fit. R-square is 1 minus the ratio of residual variability. The adjusted $R^{2,}$ also called the coefficient of multiple determinations, is the percent of the variance in the dependent explained uniquely or jointly by the independent variables. 60.4% of the changes in fish farming projects could be attributed to the combined effect of the predictor variables.

Table 4.22: **Summary of One-Way ANOVA results**

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	9.223	4	2.306	92.214	0.000
	Residual	5.876	235	0.025		
	Total	15.099	239			

The probability value of 0.000 indicates that the regression relationship was highly significant in predicting how fish species, fishpond management, choice of fish feeds and marketing of harvested fish influenced fish farming projects. The F calculated at 5% level of significance was 92.214 since F calculated is greater than the F critical (value = 2.4472), this shows that the overall model was significant.

Table 4.23: Regression coefficients of the relationship between fish farming projects and the four predictive variables

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	**Std. Error**	**Beta**	**t**	**Sig.**
1	(Constant)	1.053	0.217		2.889	5.31E-03
	Fish species	0.682	0.149	0.613	5.309	1.58E-06
	Fishpond management	0.791	0.181	0.149	3.210	2.10E-03
	Choice of fish feeds	0.599	0.196	0.234	4.255	7.19E-05
	Marketing of harvested fish	0.763	0.091	0.138	3.989	1.78E-04

As per the SPSS generated Table 4.23 above, the equation ($\mathbf{Y = \beta_0 + \beta_1X_1 + \beta_2X_2 + \beta_3X_3 + \beta_4X_4 + \varepsilon}$) becomes:

$Y= 1.053 + 0.682X_1+ 0.791X_2+ 0.599X_3+ 0.763X_4$

The regression equation shown above has established that taking all factors into account (fish species, fishpond management, choice of fish feeds and marketing of harvested fish) constant at zero performance of fish farming projects will be 1.053. The findings presented also show that taking all other independent variables at zero, a unit increase in the fish species would lead to a 0.682 increase in the scores of performance of fish farming projects and a unit increase in the scores of fishpond management would lead to a 0.791 increase in the scores of performance of fish farming projects. Further, the findings show that a unit increases in the scores of choice of fish feeds would lead to a 0.599 increase in the scores of co-performance of fish farming projects. The study also found that a unit increase in the scores of marketing of harvested fish would lead to a 0.763 increase in the scores of performance of fish farming projects. Overall, fishpond management had the greatest effect on fish farming projects, followed by marketing of harvested fish, then fish species while choice of fish feeds had the least influence on fish farming projects funded through economic stimulus programme (ESP) in Central Imenti Constituency. All the variables were significant ($p<0.05$).

CHAPTER FIVE
SUMMARY, DISCUSSIONS, CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

This chapter presented the discussion of key data findings, conclusion drawn from the findings highlighted and recommendation made there-to. The conclusions and recommendations drawn were focused on addressing the objectives of the study.

5.2 Summary of Findings

The study sought to establish the influence of selected factors onfish farming projects in Central Imenti Constituency of Meru County.

5.2.1 Fish Pond Management

The study deduced that pond practices and fish farm influence fish farming projects to a great extent. The study established that most fish farmers had been practicing fish farming for a period of between 5 to 7 years. The study further found that the fish farmers established their fish pond with assistance from the government through ESP funding.

5.2.2Influence of Fish Species on Fish Farming Projects

The study established that fish farmers in Central Imenti Constituency of Meru County kept Tilapia fish. The study further found that fish farmers kept other types of fish apart from Tilapia. Additionally, the study established that availability of fingerlings, the type of fish species, availability of fish species and the ambient temperature influence fish farming projects.

5.2.3 Influence of Fish Feeds on Fish Farming Projects

Further, the study established that the fish farmers regularly feed their fish. Similarly, the study established that fish farmers specifically use commercially processed fish feeds. Moreover, the study revealed that fish feeds variety, storage facilities for fish feeds, extension Support on fish feeds, availability of Fish feeds and availability of Fingerling feeds influence fish farming projects to a great extent.

5.2.4Influence of Market Openings on Fish Farming Projects

The study further established that fish farmers were satisfied with the number of fish that they harvest from their ponds. In addition, the study found that the fish farmers sold fish that they harvested from their ponds. The study further established that availability of cold storage, transport to markets, availability of packaging materials and facilities and ease of access to market influences fish farming projects to a great extent.

5.3 Discussion

5.3.1 Fish Pond Management

According to Ngugi, Bowman and Omolo (2007), fishpond management is crucial for optimal performance of a fishpond once all other considerations for fishpond requirements are met. This agrees to the findings thatpond practices and fish farm records influence fish farming projects to a great extent. Granted, the study established that most fish farmers had been practicing fish farming for a period of between 5 to 7 years.

It was evident in a study carried out in the region that implementing the management practices specified in the ESP has positive results, that is, the semi-intensive system of managing fish with limited external inputs (Mwatsuma, 2012). The study further found that the fish farmers established their fish ponds with assistance from the government through ESP funding.

5.3.2 Influence of Fish Species Farmed on Fish Farming Projects

The study established that fish farmers in Central Imenti Constituency of Meru County kept Tilapia fish. The study further found that fish farmers kept other types of fish apart from Tilapia. Additionally, the study established that availability of fingerlings, the type of fish species, availability of fish species and the ambient temperature influence fish farming projects. On this, Imenti North Sub-county fisheries office documents (2014) notes that the desired mono-sex tilapia fingerlings are not readily available, because there are limited breeders and hatcheries.

5.3.3 Influence of Fish Feeds on Fish Farming Projects

Further, the study established that the fish farmers regularly feed their fish.Thodesen et al. (1999) agree, indicating that fish nutrition and feeding are critical for growth, reproduction and health in fish populations. Availability of adequate feeds also greatly influences the response of fish to the physiological environment and to various pathogens.

Again, the study established that fish farmers specifically use commercially processed fish feeds. Moreover, the study revealed that fish feeds variety, storage facilities for fish feeds, extension Support on fish feeds, availability of Fish feeds and availability of Fingerling feeds contribute to performance of fish farming projects to a great extent. According to Hasan and Chakrabarti (2009), Fish farmers in Imenti Central Sub-county feed fish on low quality feeds when they cannot afford to purchase processed fish feeds. It would be interesting to investigate the extent to which the quality of fish feeds affects fish farming projects in Imenti Central Sub-county.

5.3.4 Influence of Market Openings for Harvested fish on Fish Farming Projects

The study further established that fish farmers were satisfied with the number of fish that they harvest from their ponds. Also, the study found that the fish farmers sold fish that they harvested from their ponds. In her research study, Njoroge (2011) found that the majority of fish farmers preferred to sell fish and other fish products directly to consumers.

The study further established that availability of cold storage, transport to markets, availability of packaging materials and facilities and ease of access to market influences the performance of fish farming projects contributes to performance of fish farming projects to a great extent. According to Ngugi et al. (2007), marketing involves all the activities associated with getting fish to the consumers in the desired form, such as processing, packaging, transporting, storing, and other functions.

5.3.5 Performance of Fish Farming Projects

The study found that fish farming was a success and that fish farmers kept records of their fish farming. Despite that progress, the promotion of aquaculture for rural development had

a poor record in many developing countries, especially in Africa where insufficient attention had been paid to the role of aquaculture in the livelihood or farming system of the intended beneficiaries the result being poor adoption by the intended target groups, the rural poor (FAO, 2002). It was also revealed that fish farmers had increased the number of fingerlings. The Food and Agriculture Organization (FAO) of the United Nations has estimated that more than 30% of all fish used for human consumption originates from aquaculture.

5.4 Conclusion

From the findings, the study concludes that fish pond management influences fish farming projects in Imenti Central Constituency mainly through pond practices and fish farm records. Fishpond management had the greatest influence on fish farming projects, followed by marketing of harvested fish, then fish species while the variety of fish feeds had the least influence on fish farming projects funded through economic stimulus programme (ESP) in Central Imenti Constituency.

5.5 Recommendations

1. Funding of fish farming projects at Constituency level should be continued to support fish farming extension services. Both the National and County governments should set aside increased financial resources to help build the capacity of fish farmers for them to farm fish competitively for local and overseas markets.
2. The County government should take the initiative to provide fish farmers with mono-sex tilapia fingerlings at subsidized prices to boost fish farming returns on the investment.
3. The Central government should subsidize fish feeds so that more farmers can access them for increased fish harvests.
4. The County government should develop a programme to provide the infrastructure and equipment needed for sustainable fish farming, harvesting, processing, storage and marketing at strategic fish farming locations.
5. The Central government should provide incentives to encourage more financial institutions to offer loans to fish farmers so that they can expand their projects even further.

5.6 Suggestions for further studies

Following this study, other studies should be carried out to investigate:

1. The causes of the failure of 43.3% of the respondents to keep records of their fish farming projects.
2. The causes of low adoption of other species of fish as only 33.3% of the respondents showed they did not farm tilapia fish.

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APPENDICES

Appendix I: Letter of Transmittal

P.O. BOX 1168-60200

MERU

June 2015

Dear Respondent,

RE: LETTER OF INTRODUCTION

This is to inform you that I am carrying out a research study leading to the award of Master of Arts degree in project planning and management of the University of Nairobi.

The study focuses on selected factors influencing fish farming projects in Central Imenti Constituency. All the information provided will strictly be handled in confidentiality.

When the research is successfully completed, the results will be useful to policy makers in the ministry of fisheries, business partners in fisheries industry and fish farming households. It is for this reason that I kindly request you to fill in the attached questionnaire honestly and objectively. Do not write your name anywhere in the questionnaire.

Please cooperate with my research assistants when filling in the questionnaire.

Thank you.

PETER MUTWIRI KIRIMI

Appendix II: Questionnaire

INSTRUCTIONS

Kindly read these instructions and answer the questions appropriately.

Do not write your name on the questionnaire. Answer all the questions to the best of your knowledge. There is no right or wrong answers to these questions. Indicate with a tick in the space provided against the choice of your answer in this questionnaire.

Where you are required to give your views, please be brief. Any information given will be handled confidentially.

Section A: Demographics and Performance of Fish Farming Projects

1) Gender

   Female [ ] Male [ ]

2) Which age bracket are you in?

   Below 18 – 24 years [ ] 25 – 31 years [ ] 32 – 38 years [ ] 39–45years [ ]

   Above 46 years [ ]

3). Please indicate your marital status

   Single [ ] Married [ ] Others [ ]

4) Which is your highest level of education?

   Primary level [ ] Secondary level [ ]

   College level [ ] University level [ ]

   None of the above [ ]

5) Please indicate your fish farming duration

   Less than 1 year [ ] 1 – 2 years [ ] 2 - 4 years [ ]

   5 – 7 years [ ] 8 – 10 years [ ]

6) Did you establish your fish pond with assistance from the government through ESP funding? yes [ ] no [ ]

7) Employment

   Self [ ] Casual [ ] Permanent employee [ ]

SECTION B: Fish Species Farmed and Performance of Fish Farming Projects

8) Do you keep Tilapia type of fish?

Yes ☐ No ☐

9) Do you keep other types of fish apart from tilapia?

Yes [ ] No [ ]

10) If you keep a type of fish other than Tilapia, please specify the type that you keep:

.....

Please tick the numeric value corresponding to your personal opinion for each statement.

	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
a. The type of fish species influences the performance of fish farming projects.	1	2	3	4	5
b. Availability of fish species influences the performance fish farming projects.	1	2	3	4	5
c. Availability of fingerlings influences the performance fish farming projects.	1	2	3	4	5
d. The ambient temperature influences the performance of fish farming projects.	1	2	3	4	5

SECTION C: Fish Feeds and Performance of Fish Farming Projects

11) Do you regularly feed your fish?

Yes ☐ No ☐

12) Do you specifically use commercially processed fish feeds?

Yes [ ] No [ ]

13) If you use specific type of fish feeds please specify the types' that you use:

i. .....

ii……

14) In your opinion, to what extent has the following contributed to the Performance of Fish Farming Projects

	To a Very Great Extent	Much Extent	Not Much	Rarely	Never
a. Availability of Fish feeds					
b. Availability of Fingerling feeds					
c. Extension Support on fish feeds					
d. Fish feeds variety					
e. Storage facilities for fish feeds					
f. Training on Fish feeds					

Section D: Market Openings of Harvested fish and Performance of Fish Farming Projects

15). Are you satisfied with the number of fish that you harvest from your pond?

Yes ☐ No ☐

16) What do you do with the most of the fish that you harvest from your fish pond?

Eat [ ] Sell [ ]

17). If you sell your harvested fish, please specify your regular market outlets.

i. .....

ii……

18) In your opinion, to what extent has the following contributed to the Performance of Fish Farming Projects

	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
b. Transport to markets influences the performance of fish farming projects.	1	2	3	4	5
b. The ease of access to market influences the performance of fish farming projects.	1	2	3	4	5
c. Availability of cold storage influences the performance of fish farming projects.	1	2	3	4	5
d. Availability of packaging materials and facilities influence the performance of fish farming projects.	1	2	3	4	5

Section E: Performance of Fish Farming Projects

19) Is fish farming a success? Yes ☐ No ☐

20) Do you keep records of your fish farming? Yes ☐ No ☐

21) Have you increased the number of fingerlings? Yes ☐ No ☐

22) If your answer to the above question is yes, how many? 10-50 ☐

51-100 ☐ 101-200 ☐ 201-300 ☐ 301 and above) ☐

23) Give the number of fishponds constructed on your farm. ☐

24) Give the number of your fishponds that are active ☐

25) What is the production cycle per year in your farm**?** ☐

Thank you

Appendix III: Interview Schedule

Date…….

1. What number of technical staff do you currently have in Imenti central fisheries office?

Male ☐

Female ☐

2. What number of your technical staff is assigned to extension services?

☐ One ☐ Two ☐ Three ☐ Over Three

4. Number of technical staff with fish farming skills acquired through formal training (short or long management courses)

One ☐ Two ☐ Three ☐ Over ☐ Three

5. Total amount of fishpond construction funds received to date in Imenti constituency under ESP.

Kshs.

6. Total amount of funds used for mobilization, training and monitoring of the fish farming projects in the Constituency.

Kshs.

7. Number of fishponds targeted for construction in the Constituency during the fish farming project cycle.

8. Total number of fishponds so far constructed in the Constituency.

9. Total number of fishponds that have been stocked with fingerlings in the Constituency.

10. Total number of fishponds stocked with fingerlings and harvested in the Constituency.

11. What would you say are the main factors affecting the performance of fish farming projects in the Constituency?

Thank you