

**FACTORS INFLUENCING SUSTAINABILITY OF FISH
FARMING PROJECTS IN MATUNGULU SUB-COUNTY,
MACHAKOS COUNTY, KENYA**

BY

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

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DECLARATION

This research project report is my original work and has not been presented for a degree in any other University.

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DEDICATION

This research project report is dedicated to my wife Esther and my daughters, Agnes and Precious.

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ABBREVIATIONS AND ACRONYMS

ASAL	Arial and semi-arid lands
DFO	District fisheries officer
FAO	Food and Agriculture Organization
FMSP	Fisheries management science programme
IAA	Integrated Agriculture Aquaculture
IPAP	Industrial Policy Action Plan
GOK	Government of Kenya
LDCs	Least Developed Countries
MDGs	Millennium Development Goals
MFD	Ministry of Fisheries and Development
MT	Metric Tones
NEPAD	New Partnerships for Africa's development
NALEP	National Agriculture and Livestock
PMC	Project Management Committee
PRSP	Poverty Reduction Strategy Paper
SPSS	Statistical Package for Social Science
UNDP	United Nation Development Program

ABSTRACT

Kenya is endowed with numerous aquatic resources with aquaculture potential. However, the ever increasing population is not in tandem with the rate of job creation hence slow economic growth and development. Farmers in suitable areas are turning into fish farming as a way of producing high quality food either for their families or for the market, and as a way of earning extra income. Sustainability of pond fish farming is in line with Millennium Development Goal number 1 which calls for reduction of poverty in the world by 50 percent by the year 2015 and also in the government's agenda for National Development. The purpose of this study was to find out factors which influence sustainability of fish farming projects in Matungulu Sub-County an area that is traditionally not a fish farming area. The study sought to examine the influence of the project beneficiary's demographic factors, financial stability, capacity building and land availability on sustainability of fish farming projects in Matungulu Sub-County. The target population of the study was fish farmers and Fisheries' officials in Matungulu Sub-County. The study employed a descriptive survey design. Data was collected using questionnaires and analyzed using the Statistical Package for Social Sciences. From the study, Male who greatly thought that external sources of funds influenced sustainability of fish farming represented 57.6 per cent of the all the respondents. The study also found out that 53.9 per cent of the respondents who had received their initial startup capital from a co-operative society loan perceived external sources greatly influenced sustainability of pond fish farming. The study established that for the project beneficiaries who had employed fish farm attendants, 59.4 per cent noted that training was very useful in sustainability of fish farming and 69.1 per cent said external sources greatly influence sustainability of fish farming. More disaggregation showed that 61.8 per cent of the respondents who had received training through demonstration termed the training as very useful in sustaining fish farming, while 67.9 per cent thought external sources greatly influences sustainability of fish farming. The study further found that 61.8 per cent of the respondents who owned land also thought external sources influence sustainability of fish farming to a great extent and 55.2 per cent viewed training as very useful in sustaining fish farming. The study concluded that sustainability of pond fish farming in Matungulu Sub-County is greatly influenced by demographic factors, financial stability and capacity building of project beneficiaries and not land availability. The study recommends that the Government of Kenya should be more involved in provision of quality training programmes to fish farmers and encourage the youth to engage in fish farming as a way of job creation. The study suggests as an area for further research, that all the factors affecting sustainability of fish farming be investigated within a complete analytical framework, identifying the direct and indirect effects. Also a study should be conducted to access the efficiency of fish farm productivity and its sustainability.

CHAPTER ONE

INTRODUCTION

1.1 Background to the Study

The establishment of subsistence aquaculture has been heralded as a means of achieving economical and social sustainability as it is seen to augment farm livelihoods by supplementing household subsistence needs and improving cash income, a study on perception towards subsistence aquaculture in Tabasco, Mexico, USA by Bennett (2005) reveals.

In china, Zhong and Power (1997) state of world fisheries, there has been an increase in the world per capita fish consumption owing to substantial increase in fish production. China's share in the world fish production has grown from 7 percent in 1961 to 35 percent in 2010. This substantial growth has been driven by growing domestic income and increase in diversity of fish available. Minot (2006) indicates that poverty and food security are common conditions among minority communities in Vietnam's remote northern upland regions. This is because gender roles and division of labor among these communities have been defined and structured over the years, with the task of fishing being a domain and responsibility of men. Women have had very little if any involvement particularly in areas that require decisions about which technology to use, what investment to make or how revenues could be increased.

Fisheries and aquaculture has grown substantially in the last three decades with an average rate of 3.6 per cent per year since 1980. It is estimated that in 2008, 44.9 million people were directly engaged, full time or more frequently part time, in capture fisheries and at least 12 per cent of those were women (Foeken & Owuor, 2008). On average each job holder

provided for three dependants or family members. Thus, the primary and secondary sector support the livelihood of a total of about 540 million people or 8.0 percent of the world population.

In other studies conducted by Ahmed and Lorica (2002), the authors sought to provide a framework for examining fish linkages to food and nutritional securities by highlighting the key role of pond fish farming in the developing countries. Example taken from Asian countries showed that there was steady growth to employment, income and consumption. Clover (2003) reported that an estimated 840 million people lack adequate access to food and about 25 percent of these are in sub Saharan Africa. As population grows and puts more pressure on natural resources, more people will probably become food insecure, lacking access to sufficient amount of safe and nutritious food for normal growth development and an active healthy life (Tirado, Cohen, Aberman, Meerman, & Thompson, 2010).

In Africa, more than 10 million people rely on fisheries as a vital entrepreneurial activity. Over 2.5 million fishers make business opportunities available for many processors, traders, and micro enterprises in relevant industries. To most of them the fishing industry is a good avenue for income generating activity. Of Africa's 800 million people, over 200 million are regular fish eaters. To them fish is an essential aspect of their nutrition, accounting on average for 22 percent of their animal protein intake reaching up to 70 percent in some countries (Ababouch, 2009). Africa is an area of the world where chronic poverty and malnutrition continues to be widespread. Olale and Henson (2013), state that in Africa, there is strong evidence of high increase in poverty levels among fish workers.

In Malawi a study by Dugan, Dey, and Sugunan (2006) on the impact of integrated aquaculture on small scale farms found out that the income of households owning fish ponds was 1.5 times higher than that of households without fish ponds. Dugan *et al.* (2006) also observed that through employment and income generation from aquaculture and subsequent higher purchasing power, fish farming households often manage to improve their diets through increased food security.

Ofuoku, Emah, and Itedjere (2008) argues that majority 68 percent of fish farmers in Nigeria are in the age bracket of 41-50 years of age, while 22.5 percent are in the age bracket of 31-50 years, indicating that few young and old people are involved in fish farming. From the same research, fish farming in Nigeria is dominated by those with tertiary education. This is because fish farming requires a lot of technical and scientific knowledge to be successfully undertaken. Hishamunda, Jolly, and Engle (1998) indicate that aquaculture can provide an important contribution to household financial stability. In Tanzania, between 65 to 90 percent of fish production is sold compared to only 15 percent agricultural produce in same community. Financial stability gives access to other benefits such as education, health services, clothing and other foodstuffs.

According to Oloo (2011), fish farm sizes in Kenya range between 1 and 2 hectares. Those with farm sizes less than 1 hectare are regarded as small scale fish farmers. Those with farm sizes more than 4 hectares are those with some good number of years of experience and have gradually expanded their farms sizes as they make profit. Oloo (2011) argues that demand for fish and fish products increases as population increases. This put pressure to already stressed aquatic ecosystem hence need for governments to introduce fish farming in nontraditional fish farming areas. Pond fish farming began in the 1920's initially using tilapia species and

later including the common carp and the African catfish. In the 1960's rural fish farming was popularized by the Kenya Government through the 'Eat more fish campaign' as a result of this effort, tilapia farming expanded rapidly with the construction of many small ponds especially in Central and Western Provinces (Oloo, 2011).

The Fisheries Act, Cap 378, the Maritime Zones Act, Cap 371 and other subsidiary legislation such as the Exclusive Economic Zone regulations 1990 and the Fish Quality Assurance regulations 2000 are the main legal instruments governing the development, management, exploitation, utilization and conservation of fisheries in Kenya. The government policy for this sub sector has been to maximize production by proper utilization of available resources. The government has continuously promoted aquaculture as an alternative cheap source of protein and income (Gachucha, Njehia, & Mshenga, 2012). Today, following the renovation of several government fish rearing facilities, the establishment of research programs to determine best practices for pond culture, and intensive training program for fisheries extension workers, there is renewed fish farming in Kenya. Farmers in suitable area are utilizing appropriate techniques and good management resulting in high yields and good income (Oweis & Hachum, 2003).

The fisheries sector in Kenya consists of three major sub-sectors namely inland fisheries, marine fisheries and aquaculture. Aquaculture has remained at subsistence level since independence in 1963, but has recently been boosted when the government listed fish farming as one of the key activities in the Economic stimulus programme (Kariuki, 2013). The government hopes that this programme will provide employment, provide income to farmers as well as to provide a source of protein to many Kenyans. The decline of fish stock in the country over the past decade has rekindled efforts geared towards revamping the sector. And

in what is seen as a paradigm shift from over reliance on fresh water fish, the government is now implementing an elaborate programme under the Economic Stimulus Programme (ESP), which aims at increasing aquaculture productivity and raising the income of farmers and other stake holders. Fish farming program under ESP currently has 13,444 fish ponds already constructed. The programme was poised to boost fish production in the country to 7560 MT from the current 4250 MT (Degen, Van Acker, van Zalinge, Thuok, & Vuthy, 2000).

1.2 Statement of the Problem

The Kenya Government in the financial year 2009/2010 under the ESP introduced commercial fish farming in 140 political constituencies (Otieno, 2011). Each constituency benefitted with 200 fish ponds, 15 kilograms of fertilizer and 1,000 fingerlings. In the second phase of the exercise 2011/2012 financial year, 20 additional constituencies were brought on board adding an extra 100 fish ponds for the 140 constituencies and 300 fish ponds for the new constituencies making a total of 50,000 ponds with an estimated cost value of 15 million US dollars. The success of this new Government initiative brought about renewed strength in pond fish farming in Matungulu Sub-County.

The Government under the Economic stimulus program, allocated money for the set up of fish ponds in various constituencies and small processing plants that would serve as nerve centers for aquaculture, value addition and marketing at the constituency level. However this did not go as planned and the fish ponds are faced with a number of problems including water draining out while those fish ponds with water have no fingerings. Other fish ponds are dry or overgrown with weeds. To the best of my knowledge no study has been conducted to ascertain the projects sustainability of this new government initiative.

Matungulu Sub-County is particularly characterized by high level of poverty with poverty index currently standing at 40.38 (Kenya National Bureau of Statistics, 2009) and despite the Government's effort in providing food security and employment, fish farming has not been fully adopted as a means of addressing food security. Out of the 300 fish ponds constructed, only 100 ponds are viable projects. Many farmers have neglected their ponds citing challenges from project planning to implementation. The MOFD has already constructed 300 ponds but most of the ponds are not fitted with liners since majority of the farmers were not able to afford. Other farmers have reported challenges in pond management and marketing of fish products.

Despite all these challenges fish farmers in Matungulu are increasing their production in order to satisfy the demand in the sub-County. This will depend on the extent to which factors that influence sustainability of fish farming in the area are identified and documented so as to achieve sustainable fish farming. What is not known is the extent to which selected factors influence the sustainability of fish farming, a gap this study intends to fill.

1.3 Purpose of the Study

The study intended to investigate the factors that influence the sustainability of fish farming projects in Matungulu Sub-County, Machakos County.

1.4 Objectives of the Study

The study was guided by the following objectives:

- (1) To examine the extent to which demographic characteristics of project beneficiaries influence sustainability of fish farming projects in Matungulu Sub County, Machakos County.

- (2) To establish influence of financial stability of project beneficiaries on sustainability of fish farming projects in Matungulu Sub-County, Machakos County.
- (3) To establish the influence of capacity building of project beneficiaries on sustainability of fish farming projects in Matungulu Sub-County, Machakos County.
- (4) To determine the extent to which land availability for the project beneficiaries influences sustainability of fish farming projects in Matungulu Sub-County, Machakos County.

1.5 Research Questions

The study sought to answer the following questions:

- (1) To what extent do demographic factors of the project beneficiaries influence sustainability of fish farming projects in Matungulu Sub-County, Machakos County?
- (2) How does financial stability of the project beneficiaries influence sustainability of fish farming projects in Matungulu Sub-County, Machakos County?
- (3) How does capacity building of project beneficiaries influence sustainability of fish farming projects in Matungulu Sub-County, Machakos County?
- (4) To what extent does land availability of the project beneficiaries influence sustainability of fish farming projects in Matungulu Sub-County, Machakos County?

1.6 Significance of Study

The study findings will hopefully be of great significance to the **Ministry of Fisheries Development, local community and other stakeholders involved in food security and job creation through fish pond farming**. The study will enable them understand the factors influencing sustainability of fish farming projects. The study will provide information on demographic factors, financial stability, capacity building and land availability in relation to their influence on fish farming projects in Matungulu Sub-County.

It is also hoped that the study findings will provide information to the Government of Kenya and other stakeholders on the need to re-think on policy issues relating to fish farming projects. Further, the study will hopefully provide information to scholars on the factors influencing sustainability of fish farming projects.

1.7 Delimitations of the Study

The study was conducted in Machakos County and focused on some of the factors influencing sustainability of pond fish farming projects in Matungulu Sub County. The geographical location chosen for the study was easily accessed and there were no insecurity problems like border or tribal clashes. The methodology chosen for the study was also well understood by the researcher and with the guidance of the qualified supervisors' interpretation was meaningfully done to arrive at appropriate deductions. The population selected for the study was readily available.

1.8 Limitation of the Study

The study involved Government officials and members of the public in Matungulu Sub-County respondents and language barrier posed a challenge. The researcher used a well trained research assistant who was well versed in the language of their understanding.

Due to variety of respondents involved, there was some extent of suspicion. This was sorted out by acquiring an official letter from relevant ministry with a proper explanation on the purpose of the study. Due to the vastness of the area, gathering information posed a financial challenge in terms of transportation costs. The researcher worked closely with group facilitators and community leaders especially during the open day events so as to be able to reach as many respondents as possible in one place.

1.9 Basic Assumptions of the Study

1. The study assumed that all the respondents gave the correct answers without being bias.
2. The study also assumed that the research instrument provided reliable results
3. The study assumed that all the respondents were honest, cooperative and provided reliable responses.

1.10 Definition of Key Terms

Aquaculture – Entails farming of fish in fish ponds for commercial value.

Aquaculture production- refers to output from aquaculture activities, which are designated for final harvest for human consumption.

A community - refers to a group of fish farmers

Economic Stimulus Programme –government programme designed to counteract weak economic activity with stimulus in form of government spending on infrastructure and other initiatives, tax breaks and subsidies.

Fish farming – refers to an activity involving rising of fish commercially in tanks or enclosures for food.

Food security – Refers to the availability of food for all residents

Livelihood- is made up of capabilities, activities and assets including both material and social resources that contribute to a means of living.

Pond fish farming – Breeding and rearing of fish for consumption and sell in a 300m² area piece of land.

1.11 Organization of the Study

The study was organized into five chapters. These are the introduction, literature review, research methodology, data analysis, interpretations and findings, conclusions and recommendations. Under introduction, the background of study, statement of the problem, purpose of the study, objectives of the study, research questions, and significance of the study, assumptions of the study and definition of key words were described. Chapter two looked at the literature review. Under this chapter, literature on sustainability of fish farming projects was looked at extensively. Chapter three consisted of the research design used, target population, sample size and sampling procedures, research instruments, validity, reliability, data collection procedure, data analysis and presentation procedures and references. Under chapter four, there was data analysis and interpretations. Chapter five comprised of findings, conclusions and recommendations. Appendices entailed questionnaires, research permit, work schedule and research budget.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

This chapter critically assessed various secondary sources that covered aspects of sustainability of pond fish farming projects from a global, regional and local perspective. It also reviewed the relationship between theories and demographic factors, capacity building, financial stability and land availability of project beneficiaries in Matungulu Sub-County. A conceptual frame work for analyzing pond fish farming linkages to these factors was also discussed. An operationalisation of variables' table was included in this chapter as a description of variables, their measures and indicators.

2.2 Overview of the Pond Fish Farming in Matungulu Sub-County

Pond fish farming in Matungulu was rolled out under the ESP, an initiative of the Government of Kenya, to expand economic opportunities in rural areas for employment creation. The programme aimed at improving nutrition and creating employment and income opportunities. The Government through the Ministry of Fisheries Development was in-charge of constructing pond and training young people on fish harvesting, marketing, fish farming and fish business practices. The implementing agency was the MOFD while the fish farmers were to be the co- implementers. For one to qualify for funding the following requirements were to be met; be unemployed Kenyan, fish farmers, women and public institutions; have land falling within the identified potential areas; and be willing to construct a pond not measuring less than 300m².

Labor for pond construction was sourced from the youth within the constituency while the Government was required to supply fingerings and stocking of ponds. However, harvesting,

post harvest handling and marketing of fish was left to the fish farmers under the guidance of competent aquaculture extension officers (Bondad-Reantaso, 2004; Hoza, Mgaya, & Bwathondi, 2005).

2.3 Influence of Demographic Factors of Project Beneficiary on Sustainability of Fish Farming Projects

Understanding the demographic characteristics of farmers is essential in order to answer the question as to whether they are likely to adopt and sustain fish farming in their efforts to ensure food security and income generation. These characteristic may include gender, age, education, household size, household decision making, income, access to land and credit to mention but a few (Onzere, 2013).

Zhong and Power (1997) state of world fisheries and aquaculture indicate that while men are key decision makers in food based projects, women are the main stay of small-scale agriculture. They provide farm labor force and day to day family subsistence yet they encounter more difficulties than men in gaining access to resources such as land, credit and productivity-enhancing inputs. Food security has been defined by FAO as not only access to, availability of food, but also in terms of resource distribution to produce food where it is not produced. Maringa (2003) indicates that food security comprises of vital aspects of human welfare in a society, especially for women in Africa. The implementation and sustaining of food-based agricultural projects has been seen as a women fundamental responsibility if not an obligation to human society and indeed households.

According to Pinstrup-Andersen (2009) food security is when all the people have access to safe and nutritious food at all times. This definition explains why there has been considerable

attention paid to the linkage between the state of women, their food production and security. A study conducted in Australia by Kuntala (2004) shows that involvement of women, youth and minority members of the society in development and food-based projects was very low, and thus persistence of food insecurity in marginalized communities. The researcher intends to investigate whether involving women in the sustainability of fish farming projects would help improve on food security.

According to Medina and Bacongus (2012) participation of women and youth throughout the project life cycle is very important for effective implementation and sustainability of food based projects. The report advocates for women's capacity building, provision of credit, technology development as well as integrating gender of across age in implementing and sustaining the food based projects. The researcher would wish to investigate the extent to which empowering both gender across age would influence sustainability of fish farming projects in Matungulu Sub-County.

Jammiel (2005) found that in Zimbabwe, age distribution had a key role in determining labor distribution and those household with more members adopted fish farming projects introduced by the government as a means of improving food security within the community. The same report established that education had a role to play in encouraging innovation, optimism and tolerance in food related projects. Mwanyumba (2010) in his research conducted in Taita District, Wundanyi location found out that most of the farm workers were women aged between 35 and 60 years, closely followed by women of advanced age group. Some men over 60 years also assisted in the farming equally. Onzere (2013) explains that women make a major contribution to economic production of their communities and that there cannot be societal transformation without their involvement, support and leadership in

development process. Most of the studies reviewed have discovered the significance of involving women and youth in development processes. This study wishes to uncover the possible gap problems on gender and fish farming projects sustainability.

Youth represent 30 percent of Kenya's population and their unemployment is twice the country's average. Almost one third of Kenyans are between 15 and 29 years and that the total reached 11 million people in 2006 compared to 8.5 million in 1999 (Omolo, 2010). Youth in Kenya face serious challenges including high rates of unemployment and underemployment. The government through the ESP fish farming projects, targets this potential energy from the youth, this will consequently improve the living standards of majority of Kenyans hence enabling the government's economic growth for the achievement of millennium development goals and Vision 2030 (Omolo, 2012).

Lack of education and low level of literacy make access to information difficult and commonly undermine the confidence and skills needed to enter public life whether at village, community, local or national level (Hafkin & Taggart, 2001). Ideally, education should contribute to economic development, equalize opportunities between social classes, reduce disparities in the distribution of income and prepare the labor force for a modern economy (Becker, 2009). Provision of adequate education levels will enhance capacity to service actively in community projects (Bennett, 2005). Education levels as brought to light by Van Der Merwe (2002) is key to project implementation. Giving education to young mothers in United Kingdom resulted in their participation in community projects leading to self confidence and self esteem. Michelle (2006) in a study conducted in Senegal, established that non-formal education had a key role in promoting sustainability of community projects.

Macharia (2007), in his study in Kiambu, Kenya, established that the education level of households heads was an important factor influencing what development projects people would initiate collectively, which new farming technologies would be adopted and what farming enterprises to undertake. Education has a tremendous influence on food security status. Mwaura (2008) explains that sustainability of food security projects is associated with level of education of the project beneficiaries. Illiteracy level in the rural areas of Vihiga District leads to poor implementation and sustainability of the agricultural programmes by the donors and also by the government.

Mubichi (2009) while studying factors influencing sustainability of foreign aid projects in Imenti North found out that where members had primary education, the donor funded projects were about 58 times more likely to succeed compared to where the community had no education. The researcher would wish to find out whether empowering fish farmers academically through capacity building would contribute to successful sustainability of fish farming projects.

2.4 Influence of Financial Stability of Project Beneficiary on Sustaining Fish Farming Projects

Gan (2001) study on antipoverty program found out that citizens were well involved in the program due to material gains accruing from the projects. Singh, Jacks, and Bhattacharya (2005) argues that the poor and marginalized felt stigmatized and rarely interacted with others in community projects. Lack of capital has been identified in many studies as a major constraint in sustaining community projects. Macharia (2007) found out that lack of affordable credit was a major impediment to intensify modern farming methods and technology. Deininger and May (2000) did a study on improving project implementation in

agricultural sector in South Africa and delimited his variables to resistance to change, financial sources, capacity development and competition from off- farm activities, from the study, it was established that financial stability is a key issue on sustainability of fish farming projects hence there is need to generate more knowledge.

According to Pretty, Morison, and Hine (2003) sustainability of food based projects in agriculture are influenced by physical access to land, insecure land ownership, limited use of fertilizers and weak support services of research and development. In Kenya, The fish farming projects were aimed at improving nutrition and creating 120,000 employment and income generating opportunities. Over 40,000 fish ponds have been constructed in 140 constituencies at an estimated cost of K.shs. 1.12 billion according to Finance Ministry in 2009. The youth within the benefiting constituencies provided labor whilst the construction of fish ponds and supply of fingerings and nutrition feeds was provided for by the Government, ESP Package page 10. Lack of information and cost of commercially produced feeds and employment of low pond management practices has resulted in stagnation of fish farming leading to household food insecurity and low contributions to livelihoods in Kenya (Kariuki, 2013).

The occupation of different members of a household will affect their income and the availability of labor for agricultural activities. The type of occupation will also determine available savings that can be invested in agricultural activities. However, this will depend on farmer's priorities as some farmers may prefer to invest their money in some non-agricultural activities. Mubichi (2009) concluded that the daily income of the community members was significantly associated with sustainability of projects. Ogola, Nguyo, and Kosgey (2010b) found out that most women engaged in farm activities as men went for off-

farm work. They concluded that for greater success and sustainability, efforts to promote fish farming should therefore mostly target women. This study established the influence of financial stability on sustainability of fish farming projects.

Gichira and Dickson (1987), Stated that among the most recurring problems faced by fish farmers was lack of capital to run fish farming projects. Several reports indicated that low funding from both the Government and the private sector together with lack of continuous flow generally affected the daily activities of the projects. Pretty *et al.* (2003) in his study pointed out that, while lack of capital was a major setback in most food based programs; a lot of resources were held up in unproductive assets or even misappropriated by the management.

There have not been adequate studies on sustainability of fish farming projects for sustainable food security in Matungulu Sub-County and therefore a knowledge gap on the extent to which selected factors influence sustainability of fish farming project exists, thus the need for this study. The researcher also wished to establish whether the financial stability of the farmer, with reference to sources of income and frequency of the income has an influence towards sustaining the fish farming project.

2.5 Influence of Capacity Building of Project Beneficiary on Sustainability on Fish Farming Projects

For fish farming projects to realize the guiding objectives of increased production and incomes, better nutrition and employment opportunities, it was important to take into consideration the relevant intervention strategies and need to generate adequate information which would stimulate farmer's participation in the planning process. Bowman, Ngugi, and

Omolo (2007) explains that capacity development and skills training are determinants of successful agricultural developments and that for a project to realize its objectives, the guidelines of the project life cycle must be vigorously implemented.

Hope (2009) explained that capacity building was regarded as the enhancement of the competency of individuals and local communities to engage in a sustainable manner for positive development, poverty reduction and also meeting the MDGs. Gervais (2004) showed that in order to produce more nutritious food the beneficiaries had to use agricultural knowledge and farming skills which are technical assets. From the study, it was also clear that capacity building was not only a stand- alone training intervention but rather a strategically coordinated set of activities aimed at improving the abilities of skills of individuals for a better performance.

Avolio, Zhu, Koh, and Bhatia (2004) indicated that literature on project success factors have largely ignored the impact of the project manager, and his or her leadership styles and competence, on project success. Edwards (1998), noted that the key constraint to aquaculture development was dissemination of existing knowledge, whether derived from research or indigenous technical knowledge of farmer. Limited capacity of developing country institutions in education, research and development compounded this fundamental failing. He suggested that research should follow farming systems to evaluate and develop both production systems and extension methods that are appropriate to ensure sustainability of projects.

To ensure sustainability of high production of fish in the pond, regular maintenance and monitoring is vital. Daily management includes; checking the water quality (oxygen, Ph,

color, temperature etc. checking the pond for possible water leaks, cleaning the screen of the water inlet and outlet, observing the fish while they feed and removing aquatic weeds because of water quality is vital factor for good health and growth in fish (Adeniji, 2005). In ASIA, an assessment by Kato, Kaplan, Sophal, and Sopheap (2000) shows that in an attempt to provide a sustainable flat-form for Cambodia's future growth, development agencies have adopted an interlinked approach that provides a critical role for local level growth, bottom-up development initiatives in a predominantly rural society that remains largely organized around the village and where rural-urban link are weak.

In Rwanda, a study by Hope and Kempe (2011) the government by 2005 had realized that capacity entailed more than training and to be comprehensively addressed using a multi sector and multi-dimensional approach. The same study reported that one fundamental development change agenda that Rwanda government undertook was the establishment of a Multi-Sector Capacity Building (MSCBP). This programme was designed to guide capacity initiatives in public, private and other organizations in order to make them effective, efficient and transparent in the implementation of their development projects as indicated by Hope and Kempe (2011).

In Kenya a study conducted by Koech (2008) in El-dama Ravine on Kenya green growers projects, indicated that only project leaders and facilitators were given formal education, the rest of the project implementers were taken through demonstrations due to their low levels of education. Kenya is a country is in the era of new technology and for this reason the researcher finds a need to search for more knowledge on the take up of new technologies through capacity building for fish project sustainability (Bowman *et al.*, 2007).

2.6 Influence of Land Availability of Project Beneficiaries on Sustainability of Fish

Farming Projects

Heyneman (2003) report on analysis of implementation of agricultural projects in 73 countries between 1960 and 2000, shows that countries with more equitable initial land distribution were food secure compared to those where land distribution was less equitable. In rural societies, the landless or near landless and those with insecure tenure rights, constitute of the most marginalized and vulnerable groups. Lei (2003) stated that future endeavors to promote new technologies for sustainable food security was to be predicted by farm and wet land availability, which also acted as collateral and thereby influenced people's access to financial services. According to Hargreaves (2002), banks were willing to lend money for the construction of fish ponds but the conditions for the loans were strict and made them suitable mostly for those who were already well established economically. This difficulty in accessing formal credit made majority of farmers resort to informal credit. Most informal credits do not carry interest except for specialized money lenders. Money lenders charge very high interest 50-100 percent and are for short period. Ahmed and Lorica (2002) reported that 69 percent of small scale farmers caught fish from their own ponds. This implies that land ownership is a great factor to consider in sustainability of fish farming projects.

According to Ogola, Nguyo, and Kosgey (2010a), livestock is the world's largest user of land resources, with grazing land and cropland dedicated to the production of feed representing almost 80 percent of all agricultural land. Land is a scarce resource especially in the high agricultural potential areas where crop production is more preferred than fish farming. Land is also used as collaterals to secure loans from financial institutions; therefore fish farming has to compete for the scarce resource. Farm –Africa observed that there is a decline in farm size with each generation inheriting land further decreasing the available household options.

Intensification of crop production may be an option for some farmers but many farm plots used for generations are experiencing declining yields from overuse and if not protected, loss of soil through soil erosion. Farmers are increasingly being pushed to farm land unsuitable for cultivation- at lower altitudes under lower or less reliable rainfall or on steeper slopes unsuitable for cultivation.

Land being the main asset in agricultural production if well utilized can provide food security and job opportunity in many parts of Africa, Kenya included. Kenya has an area of about 587,000 sq kms of which 11000 and 576 sq kms are water and land mass respectively (Kenya National Bureau of Statistics, 2009). Caryle (2000) has focused on the effects of land size and land fragmentation on agricultural yields and productivity and strongly correlates the two. A study done in Bangladesh on land fragmentation and ownership of resources with reference to productivity and technical efficiency in rice production revealed that land fragmentation had a significant detrimental effect on productivity and efficiency.

Thomson (2001) analyzed causal of land subdivisions as land distribution schemes, inheritance, dowry/ customs, land purchase and sale, population density and excessive investment emphasis on land. Jammiel (2005) found out that in Zimbabwe the gender of the household held an important implication in relation to access to land and other production resources. Their women could not claim inheritance to land which gave them limited access to land and therefore only very few women were involved in agricultural projects.

A research study in Vihiga District, Kenya by Mwaura (2008), indicated that agricultural productivity had been affected by scarcity of productive land. Much of the available land had been subdivided into small segments which could only support horticultural crops to serve

the season. Due to lack of land availability for implementation of agricultural programmes by the community, the District remained vulnerable to both hunger and poverty.

Traditionally, family land has been owned by men. Title deeds are used to secure loans from some financial institutions. Ngari (2007) found out that 98 percent of Kenyan women work full time in the agrarian sector but only 5 percent of these have land ownership. This study only established ownership in terms of gender but did not establish legal ownership of land. The researcher found a need to conduct a study on sustainability of fish farming projects to ascertain other researchers' findings and come up with new knowledge on how to cope with land scarcity for sustainable food security.

2.7 Theoretical framework

Several theories were established to be related to the study. These included theory of community development, theory of decentralization and Citizen Participation theory. The citizen participation theory was found more applicable compared to other related theories. Hence the citizen participation theory was specifically used to guide the study.

2.7.1 Citizen Participation Theory

Citizen participation theory states that participation is a desired and necessary part of all community development activities. Citizen participation is the process that can meaningfully tie programs to people by enhancing ownership. Citizen participation is a process that provides individuals with an opportunity to influence public decision and has long been a component of the democratic decision making process. The Kenyan government has borrowed much of this theory with an aim of eradicating hunger and poverty through involving the community in project implementation and sustainability. Through the fish

farming projects the government aimed at improving development and food security status in Matungulu Sub-County community by actively involving the community in the implementation and sustainability of fish farming projects thus enhancing community ownership of the programme for sustainable food security.

The theory is again applicable to this study on factors that influence sustainability of fish farming projects in Matungulu Sub-County, because according to Millennium Development Goal Number 1, there is universal need to reduce poverty level by 50 percent before 2015. In Kenya, fish projects under the Economic stimulus programme are expected to provide income to fish farmers as well as create employment, thus contributing towards poverty reduction and good nutrition for its citizens.

2.8 Conceptual Framework

Conceptual framework is defined as a set of broad ideas and principles taken from relevant fields of inquiry and used to structure a subsequent presentation (Smyth, 2004). Figure 2.1 is a conceptual framework showing the relationship between selected factors and sustainability of fish farming projects. The independent variables are grouped together on the left side but not in any order of significance. The dependent variable is placed on right connected with an arrow as a sign of direct relationship.

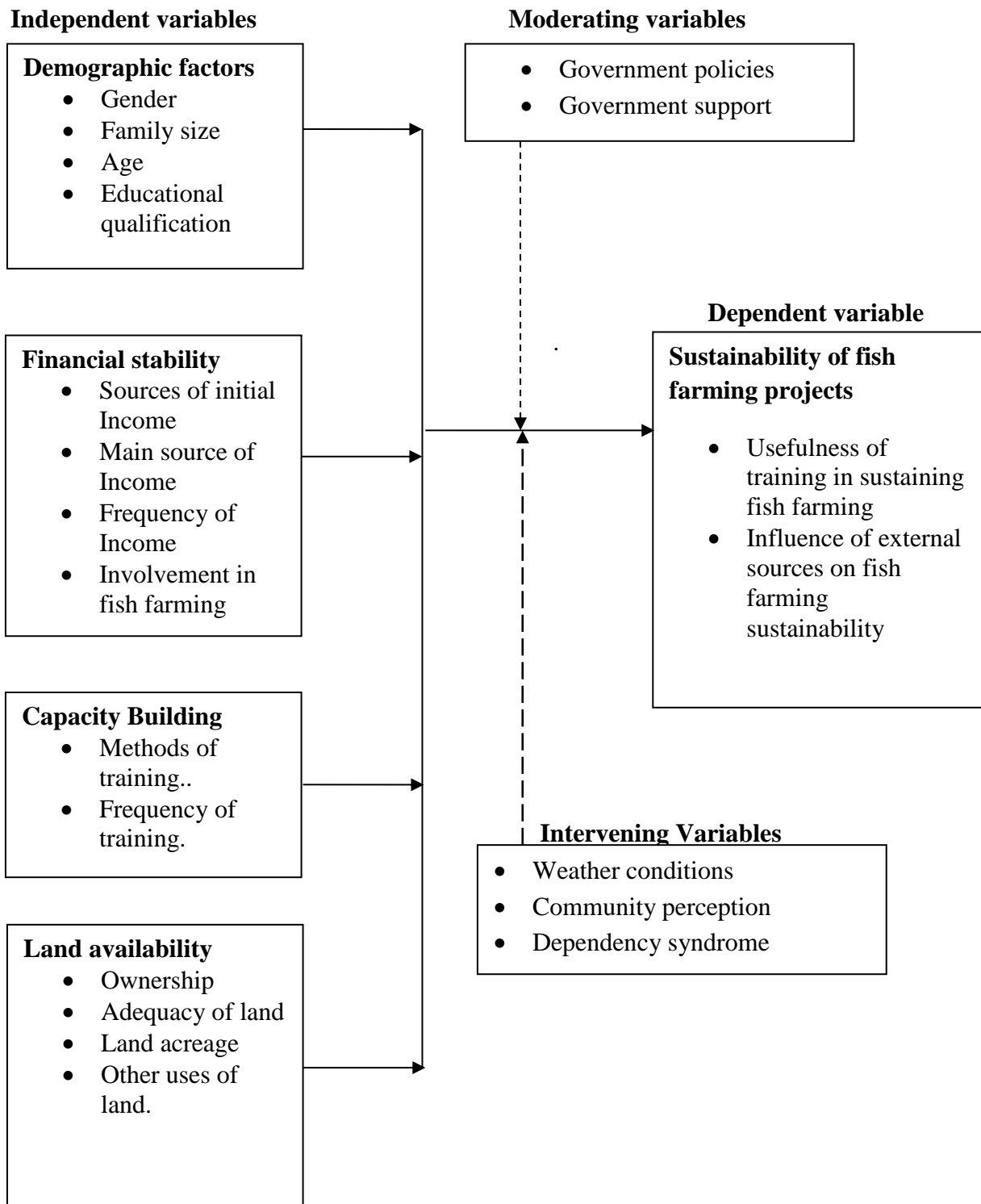


Figure 1: Conceptual Framework factors influencing sustainability of Fish farming projects

2.9 Summary of Literature Review

The main function reviewing related literature was to examine how other factors with possible influence on the sustainability of fish farming project are interrelated. The literature reviewed was intended to help the researcher identify gaps in knowledge in order to create a framework and a direction for other new research studies. In the literature reviewed, the factors and their influence to projects sustainability have been investigated. These studies have highlighted on the influence of gender, land size and land availability capacity development and community empowerment.

Other studies reviewed have discovered the importance of integrating women in development process to avoid human waste. Such studies have concluded that low performance of women in project sustainability was tied to the type of project activities undertaken. The researcher intended to establish the extent to which gender influences sustainability of projects based on food security. Education level of the project beneficiaries has been cited in the reviewed studies as an indicator of project sustainability. Educated beneficiaries are able to comprehend the importance of owning community projects by being actively involved. Other studies have concluded that capacity building of the community equally contributed to peoples' reception to community projects. The researcher wanted to find out the relevance of training offered to the sustainability of fish farming projects undertaken.

Sustainability of food based projects has been hampered by land scarcity as concluded by most studies on sustainability of food security projects. Fish farming project being an agricultural project requires reasonable amount of land and therefore the researcher intended to conduct a study on the sustainability of the projects to ascertain other researchers' findings and help generate knowledge on how to cope with land issues to ensure sustainable food security.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction

This chapter covered research methodology employed by the study. It describes the research design that was used, target population studied, sample size and sampling procedures that was applied, research instrument, instrument validity, instrument reliability, data collection procedures and analysis techniques that were used in the study as well as ethical consideration and operationalization of variables.

3.2 Research Design

This study employed a descriptive survey design, a design used in preliminary and exploratory studies to allow researchers gather information, summarize, present, and interpret for the purpose of clarification. Descriptive studies are more formalized and typically structured with clearly stated investigative questions. It serves a variety of research objectives such as descriptions of phenomenon or characteristics associated with a subject population, estimates of proportion of population that have similar characteristics (Orodho, 2003b). The design enabled the researcher to conduct research among fish farmers and government officials in order to find out factors influencing the sustainability of fish farming projects in Matungulu Sub-County.

3.3 Target Population

Mugenda and Mugenda (2003) define population as an entire group of individuals, events or objects having common observable characteristics. Matungulu Sub-County has a total population about 300 fish farmers, the major economic activity being subsistence farming, MOFD Matungulu. The unit of analysis in this study was fish farming projects in Matungulu

Sub-County. Borg and Gall (1989) define target population as all members of a real or hypothetical set of people, events or subjects to which a researcher wishes to generalize the results of the research study. The target population for this study was 305, comprising of 300 fish farmers and 5 extension officers.

3.4 Sample Size and Sampling Procedure

A sample size is a sub-set of the total population that is used to give the general view of the target population (Kothari 2004). It must be a representative of the population on which the researcher would wish to generalize the research findings. Simple random sampling technique was used to select the respondents. In addition the information from the fish project officers was purposively sampled. This technique allowed the researcher to use respondents who had the required information with respect to objectives of the study (Mugenda & Mugenda, 2003). Krejcie and Morgan sample size table is universally accredited and provides a reasonable sample size depending on the size of the population on the study (Krejcie & Morgan, 1970). Therefore, out of the population of 305 target population, the sample size was 165 fish farmers and 3 MOFD Matungulu Sub County officials (Appendix iv).

3.5 Research Instruments

This study employed individual fish farmer's questionnaire and officials in fisheries department questionnaire, for data collection. This is because the questionnaire offered a considerable advantage in administration and provided an even stimulus to large numbers of people simultaneously. A questionnaire also provided the investigator with a convenient way of data collection, giving respondents' freedom to answer the closed ended questions without fear or favor; and also made independent suggestions in the open ended questions. The

questionnaire, being anonymous assisted in producing more candid answers than it could have been possible in an interview set up. (Gay, 1976).

The farmer`s questionnaire had four sections. Section A gathered demographic information, section B sought information on capacity building, section C had items to measure financial stability of the fish farmer while, and section D gathered information on the availability of land of the fish farmer. The extension officers` questionnaire gathered information on frequency of capacity building workshops and turn-up rate of farmers during the workshops.

3.5.1 Piloting of the Instruments

Orodho (2003a) describes pilot testing as a smaller version of a larger study that is conducted to prepare for the study or to field test the survey to provide a rationale for the design. It involved pre-testing the instrument to determine their validity and reliability. The researcher conducted pilot test of the instruments by using a different group from a different sub-county then made necessary adjustments. The researcher used simple random sampling for fish farmers from Mwala Sub-County. The researcher used simple random sampling to select 17 fish farmers` equivalent to 10 percent of the study sample size of 168 subjects. According to Mugenda and Mugenda (2003), a sample equivalent to 10% of the study is enough for piloting the research instrument. After responding to the instruments, necessary corrections and adjustments of the instruments were made to increase their validity.

3.5.2 Validity of the Instruments

Validity is the degree to which results obtained from an analysis of data actually represent the phenomenon under investigation (Orodho, 2006; Ogola *et al.*, 2010b). The researcher tested content validity of the questionnaires. Content validity according to Kothari (2004) is the

extent to which a measuring instrument provides adequate coverage of the topic under study. Content validity ensures that the instruments cover the subject matter of the study as intended by the researcher. To ensure content validity of the instruments, the researcher closely consulted research experts and the peer members. They assisted in assessing the variables to be measured by the instruments, and helped in determining whether the set of items were accurately representing the variables under study.

3.5.3 Reliability of the Research Instruments

Orodho (2006) defines instrument reliability as the degree to which a particular measuring procedure gives similar results over a number of repeated trials. Pre-testing was carried out to ensure reliability of the instrument. The reliability of the instruments was estimated through a repeated measurement which involved the split half method. The questionnaires from the pilot testing group were assigned scores. The scores obtained were then keyed into the SPSS software through spearman brown prophecy formula a correlation coefficient of 0.8 was established and was deemed adequate and reliable since according to Mbwesa (2006), if the correlation of the instrument fall above + 0.6, the instrument is taken as reliable and therefore suitable for data collection.

3.6 Data Collection Procedure

An introduction letter to the National Council of Science, Technology and Innovation (NACOSTI) was obtained from the University of Nairobi. A research permit was obtained from NACOSTI. Further request for data collection was sought from the County Commissioner Machakos. The researcher employed the services of a trained research assistant to aid in administration of the questionnaires to the fish farmers and fisheries officials.

3.7 Data Analysis Techniques

Analysis refers to examining the coded data critically and making inferences (Orodho, 2003b). The raw data obtained from the study was organized and converted into numerical codes representing variables. The organized and well coded data was then analyzed through descriptive statistics, which according to Frankel and Wallen (2008), is a technique that enables researchers to meaningfully describe data with numerical indices or graphs. Qualitative data was analyzed thematically to complement and substantiate the quantitative data analysis. The quantitative data was analyzed and presented using percentages and frequency distribution tables. Calculations were computed using the statistical package for social sciences (SPSS).

3.8 Ethical Issues

The research assistant ensured that the respondents understood what was required of them. The respondents were assured of confidentiality when dealing with their responses and so provided them with envelopes to put in their completed questionnaires. The research assistant collected the responses for data analysis and the researcher verified the questionnaires to ensure that they were duly completed.

3.9 Operationalisation Table of Variables

Table 3.1: Operational Definition of Variables

OBJECTIVES	TYPE OF VARIABLES	INDICATORS	MEASURING LEVELS	TOOLS OF DATA COLLECTIONS	TOOLS OF ANALYSIS
To examine the extent at which demographic characteristics influence sustainability of fish farming projects in Matungulu	Independent variable Demographic characteristics	Gender of fish farmers	Normal	Questionnaire	Percentage and frequencies
		Age group of fish farmers	Ordinal	Questionnaire	Percentage and frequencies mode
		Family size of the fish farmers	Ordinal	Questionnaire	Percentage and frequencies
		Marital status	Nominal	Questionnaire	Percentage and frequencies
		Education level	Ordinal	Questionnaire	Percentage, and frequencies
To establish how financial stability influences sustainability of fish farming project in Matungulu District	Independent variable Level of income of the fish farmers	Source of Income	Nominal	Questionnaire	Percentage and frequencies
		Rate of income	Ordinal	Questionnaire	Percentage and frequencies
		Frequency of the Income	Ordinal	Questionnaire	Percentage and frequencies
		Number of times trained	Ratio	Questionnaire	Percentage and frequencies
		Frequency of training	Interval	Questionnaire	Percentage and frequencies
		Relevance of training	Ordinal	Questionnaire	Percentage and frequencies
Usefulness of training	Nominal	Questionnaire	Percentage and frequencies		

OBJECTIVES	TYPE OF VARIABLES	INDICATORS	MEASUREMENT	MEASURING LEVELS	TOOLS OF DATA COLLECTIONS	TOOLS OF ANALYSIS	
Capacity Building	Independent variable	Number of farmers trained on the fish farming projects		Ratio	Questionnaire	Percentage and frequencies	
		Number of times trained		Ratio	Questionnaire	Percentage and frequencies	
		Frequency of training		Nominal	Questionnaire	Percentage and frequencies	
		Relevance of training		Ordinal	Questionnaire		
		Usefulness of training		Nominal	Questionnaire	Percentage and frequencies	
To determine the extent to which land accessibility by fish farmers influences sustainability of fish farming projects	Independent variable	Ownership	Ownership	Nominal	Questionnaire	Percentage and frequencies	
		Size of land					
		Fish farming acreage	Farm under fish farming	Land size	Ordinal	Quantitative	Percentage and frequencies
		Other crop farming	Farm under cultivation	Land size	Ordinal	Questionnaire	Percentage and frequencies
	Other livestock kept	Other Livestock kept	Livestock types		Questionnaire	Percentage and frequencies	
Sustainability of fish farming projects	Dependent variable	Usefulness of training in sustaining		Nominal	Questionnaire	Percentage and frequencies	
		Extend of external sources influencing sustainability		Ordinal	Quantitative	Percentage and frequencies	

CHAPTER FOUR

DATA ANALYSIS, PRESENTATION AND INTERPRETATION OF FINDINGS

4.1 Introduction

This chapter provides an analysis, presentation, interpretation and discussions of the findings. Descriptive analysis technique was utilized which involved use of descriptive statistics and tabulations. Descriptive statistics used included frequencies, percentages and tables.

4.2 Questionnaire Return Rate

The study targeted 168 respondents in the fish farming projects out of which 165 questionnaires were returned representing a 98 per cent return rate. The study also targeted five project officials, three of which returned the duly completed questionnaires. This represented a 60 per cent response rate.

4.3 Demographic Characteristics of Project Beneficiaries in Matungulu Sub-County

This section looked at the demographic characteristics of the respondents, its relation to usefulness of training and the extent to which external sources influenced sustainability of fish farming. The demographic characteristics included gender of the respondents, their age, marital status, level of education, and size and type of family.

4.3.1 Gender of the Respondents

The gender of the respondents is presented in tables 4.1 a, b and c.

Table 4.1 (a) Gender

	Frequency	Percentage
Males	109	66.1
Females	56	33.9
Total	165	100

Disaggregation of the respondents by gender revealed that males were the majority, 109 (66.1 per cent) while females comprised 56 (33.9 per cent).

Table 4.1 (b) Gender in Relation to Usefulness of Training

	Very useful	Moderately useful	Total
Males	80 (48.5%)	29 (17.6%)	109 (66.1%)
Females	51 (30.9%)	5 (3%)	56 (33.9%)
Total	131 (79.4%)	34 (20.6%)	165 (100%)

Regarding the extent in which training was useful to sustaining fish farming, 131 (79.4 per cent) of the respondents mentioned that training was very useful. In addition 34 (20.6 per cent) reported that training was moderately useful in sustenance of fish farming in Matungulu sub-County. The males and females who regarded training as being very useful for sustaining fish farming were 80 (48.5 per cent) and 51 (30.9 per cent) respectively. Similarly, those who believed the training was moderately useful represented 29 (17.6 per cent) and 5 (3.0 per cent) in that order. This denotes that most of the fish farmers are males and that training is regarded as very useful for sustaining fish farming. Moreover, the one-third representation of gender in employment opportunities was exhibited in pond fish farming in Matungulu sub-County.

Table 4.1 (c) Gender in Relation to Extent of External Sources Influence

	Great extent	Low extent	No extent	Total
Males	95 (57.6%)	12 (7.3%)	2 (1.2%)	109 (66.1%)
Females	48 (29.1%)	6 (3.6%)	2 (1.2%)	56 (33.9%)
Total	143 (86.7%)	18 (10.9%)	4 (2.4%)	165 (100%)

The males who greatly thought external sources influenced sustainability of fish farming comprised 95 (57.6 per cent) of all the respondents while the females with that perception of great influence represented 48 (29.1 per cent) of the total. Similarly, the respondents who said external sources had low influence on sustainability were 12 (7.3 per cent) and six (3.6 per cent) males and females respectively. An equal proportion of two (1.2 per cent) for both male and females noted that there was no influence of external sources on fish farming sustainability. The study findings pointed to the fact that external sources greatly influenced sustainability of fish farming in Matungulu sub-County. This indicated that pond fish farming is not financially self sustainable without reliance on other external sources of finance. The study findings also concur with observations made by the WORLD BANK (2007), which stated that in Kenya men were the key decision makers in farming while women played a bigger role towards sustaining food based community projects.

4.3.2 Age of the respondents

Age distribution of the respondents is shown in table 4.2 a, b and c.

Table 4.2(a) Age

	Frequency	Percentage
30 years and below	18	10.9
31 to 40 years	40	24.2
41 to 50 years	40	24.2
51 to 60 years	41	24.8
Above 60 years	26	15.8
Total	165	100

The respondents included in the study who were aged 30 years and below were 18 (10.9 per cent). An equal number 40 (24.2 per cent) were in the age bracket 31-40 and 41-50 years old. Those aged 51-60 years were 41 (24.8 per cent) while the respondents aged above 60 years comprised 26 (15.8 per cent). Hence majority of the fish farmers were in the age bracket of 51-60 years old, while those aged above 50 years were 40.6 per cent and those aged 30 years and below were only 10.9 per cent. This implied that the youths represented a small proportion of all the fish farmers. Hence, similar to the findings in a study by Ofuoku *et al.* (2008) in Nigeria, where majority of the fish farmers were in the age bracket of 41-50 years of age, few young people are involved in fish farming compared to old people.

Table 4.2 (b) Age in Relation to Usefulness of Training

	Very useful	Moderately useful	Total
30 years and below	14 (8.5%)	4 (2.4%)	18 (10.9%)
31 to 40 years	26 (15.8%)	14 (8.5%)	40 (24.2%)
41 to 50 years	35 (21.2%)	5 (3.0%)	40 (24.2%)
51 to 60 years	35 (21.2%)	6 (3.6%)	41 (24.8%)
above 60 years	21 (12.7%)	5 (3.0%)	26 (15.8%)
Total	131 (79.4%)	34 (20.6%)	165 (100%)

The respondents aged 30 years and below, who regarded training as very useful in sustainability fish farming were 14 representing 8.5 per cent of all the respondents. Those aged 31 to 40 years and regard training as very useful in sustainability fish farming were 26 representing 15.8 per cent of the total. The respondents regarding training as very useful in sustainability fish farming and aged 41 to 50 years were 35 representing 21.2 per cent of the total. An equal number, were aged 51 to 60 years and regarded training as very useful in sustainability fish farming. The respondents aged above 60 years and regarded training as very useful in sustainability fish farming were 21 representing 12.7 per cent of all the respondents. However, it is noteworthy that 14 respondents aged 31 to 40 years, regarded training as moderately useful in sustainability fish farming.

Table 4.2 (c) Age in Relation to Extent of External Sources Influence

	Great extent	Low extent	No extent	Total
30 years and below	16 (9.7%)	2 (1.2%)	0 (.0%)	18 (10.9%)
31 to 40 years	31 (18.8%)	8 (4.8%)	1 (.6%)	40 (24.2%)
41 to 50 years	35 (21.2%)	5 (3.0%)	0 (.0%)	40 (24.2%)
51 to 60 years	37 (22.4%)	3 (1.8%)	1 (.6%)	41 (24.8%)
above 60 years	24 (14.5%)	0 (.0%)	2 (1.2%)	26 (15.8%)
Total	143 (86.7%)	18 (10.9%)	4 (2.4%)	165 (100%)

The respondents who were aged 30 years and below, and thought external sources, greatly influences sustainability of fish farming were 16 representing 9.7 per cent of all the respondents. Those aged 31 to 40 years with that perception of great influence were 31 representing 18.8 per cent of the total. The respondents with the perception of great influence and aged 41 to 50 years were 35 representing 21.2 per cent of the total. In addition, those aged 51 to 60 years and perceived external sources to have great influence to sustainability were 37 representing 22.4 per cent. The respondents aged above 60 years and thought external sources, had great influence on sustainability of fish farming were 24 representing 14.5 per cent of all the respondents. The study is in agreement with the findings of Mwanyumba (2010), in Taita Taveta County which established that most of the farm workers were aged between 35 and 60 years.

4.3.3 Marital Status of the Respondents

The respondents marital status is tabulated in tables 4.3 a, b and c

Table 4.3 (a) Marital Status

	Frequency	Percentage
Single	9	5.5
Married	144	87.8
Widowed	11	6.7
Total	165	100.0

Marital status of the respondents unveiled that most of them 144 (87.8 per cent) were married, 11 (6.7 per cent) were widowed while singles represented nine (5.5 per cent).

Table 4.3 (b) Marital Status in Relation to Usefulness of Training

	Very useful	Moderately useful	Total
Single	6 (3.7%)	3 (1.8%)	9 (5.5%)
Married	116 (70.7%)	28 (17.1%)	144 (87.8%)
Widowed	8 (4.9%)	3 (1.8%)	11 (6.7%)
Total	131 (79.4%)	34 (20.6%)	165 (100%)

The respondents who were single, and regarded training as very useful in sustainability of fish farming were six representing 3.7 per cent of all the respondents. Those married and regarded training as very useful in sustainability fish farming were 116 representing 70.7 per cent of the total. The respondents regarding training as very useful in sustainability fish farming and widowed were eight representing 4.9 per cent of the total. However, it is

noteworthy that 28 married respondents, regarded training as moderately useful in sustainability fish farming.

Table 4.3 (c) Marital Status in Relation to Extent of External Sources Influence

	Great extent	Low extent	No extent	Total
Single	7 (4.3%)	2 (1.2%)	0 (.0%)	9 (5.5%)
Married	127 (77.4%)	15 (9.1%)	2 (1.2%)	144 (87.8%)
Widowed	8 (4.9%)	1 (.6%)	2 (1.2%)	11 (6.7%)
Total	143 (86.7%)	18 (10.9%)	4 (2.4%)	165 (100%)

The respondents who were single and thought external sources, greatly influenced sustainability of fish farming were seven representing 4.3 per cent of all the respondents. Those who were married with that perception of great influence were 127 representing 77.4 per cent of the total. The respondents with the perception of great influence and widowed were eight representing 4.9 per cent of the total. In addition, respondents who were single and thought external sources, had low influence on sustainability of fish farming were only two representing 1.2 per cent of all the respondents. Those who were married with that perception of low influence were 15 representing 9.1 per cent of the total. The respondent with the perception of low influence and widowed was only one representing 0.6 per cent of the total. Only two respondents, who were either married or widowed thought external sources, had no influence on sustainability of fish farming. The study showed that married families are prominent in the society and with many members to provide for and thus the need to embrace fish farming for food security, nutrition and earn extra income for the families.

4.3.4 Level of Education of the Respondents

The highest attained education level of the respondents is shown in tables 4.4 a, b, and c

Table 4.4 (a) Level of Education

	Frequency	Percentage
Primary	8	4.8
Secondary	41	24.8
College	84	50.9
University	32	19.4
Total	165	100.0

The respondents interviewed who had primary education as the highest attained level were eight (4.8 per cent). Those who had attained secondary level of education were 41 (24.8 per cent) with 84 (50.9 per cent) having achieved college education. University level entrants comprised 32 (19.4 per cent) of those interviewed. This indicated that majority of the fish farmers had attained college education which was in line with the findings by Ofuoku *et al.* (2008), where fish farming in Nigeria was established to be dominated by those with tertiary education. This is because fish farming requires a lot of technical and scientific knowledge to be successfully undertaken. All the respondents interviewed were involved in fish farming projects.

Table 4.4 (b) Level of Education in Relation to Usefulness of Training

	Very useful	Moderately useful	Total
Primary	3 (1.8%)	5 (3.0%)	8 (4.8%)
Secondary	35 (21.2%)	6 (3.6%)	41 (24.8%)
College	67 (40.6%)	17 (10.3%)	84 (50.9%)
University	26 (15.8%)	6 (3.6%)	32 (19.4%)
Total	131 (79.4%)	34 (20.6%)	165 (100%)

The respondents who had attained secondary level of education, and regarded training as very useful in sustainability fish farming were 35 representing 21.2 per cent of all the respondents. Those with college education and regarded training as very useful in sustainability fish farming were 67 representing 40.6 per cent of the total. The respondents regarding training as very useful in sustainability fish farming and had attained university education were 26 representing 15.8 per cent of the total. Noteworthy 17 respondents who had attained college education, regarded training as moderately useful in sustainability fish farming.

Table 4.4 (c) Level of Education in Relation to Extent of External Sources Influence

	Great extent	Low extent	No extent	Total
Primary	5 (3.0%)	2 (1.2%)	1 (.6%)	8 (4.8%)
Secondary	35 (21.2%)	6 (3.6%)	0 (.0%)	41 (24.8%)
College	72 (43.6%)	9 (5.5%)	3 (1.8%)	84 (50.9%)
University	31 (18.8%)	1 (.6%)	0 (.0%)	32 (19.4%)
Total	143 (86.7%)	18 (10.9%)	4 (2.4%)	165 (100%)

The respondents who had attained primary level of education and also thought external sources, greatly influences sustainability of fish farming were only five representing 3.0 per cent of all the respondents. Those who had attained secondary education with that perception of great influence were 35 representing 21.2 per cent of the total. The respondents with the perception of great influence and had attained college education were 72 representing 43.6 per cent of the total. In addition, those who had attained university level of education and perceived external sources to have great influence to sustainability were 31 representing 18.8 per cent. The respondents who had attained primary level of education and thought external sources, had low influence on sustainability of fish farming were only two representing 1.2 per cent of all the respondents. Those who had attained secondary education with that perception of low influence were only six representing 3.6 per cent of the total. The respondents with the perception of low influence and had attained college education were nine representing 5.5 per cent of the total. In addition, those who had attained university level of education and perceived external sources to have low influence to sustainability was only one representing 0.6 per cent. Only one respondent, who had attained primary level of education thought external sources, had no influence on sustainability of fish farming. Similarly, only three respondents perceived external sources had no influence and had attained college education.

The study correlates with that of Macharia (2007) in Kiambu, which established that the educational level of household heads was an important factor influencing what development projects people would initiate and also that of Mwaura (2008), who found out that sustainability of food security projects was associated with level of education of project beneficiaries.

4.3.5 Type and Size of Family of the Respondents

The type and size of family of the respondents is shown in table 4.5 a, b and c.

Table 4.5 (a) Type and Size of Family

	Frequency	Percentage
Female headed	16	9.7
Male headed	149	90.3
Total	165	100.0
1-5	137	83.0
6-10	28	17.0
Total	165	100.0

Pertaining the type of family, most of the families 149 (90.3 per cent) who practiced fish farming were male-headed while 16 (9.7 per cent) were headed by females. On carrying out the tabulation of family size, it was evident that most 137 (83.0 per cent) of the respondents composed of 1-5 members. The remaining 28 (17.0 per cent) of the respondents consisted of households with 6-10 family members. This shows that majority of the fish farmers came from small households.

Table 4.5 (b) Type and size of family in Relation to Usefulness of Training

	Very useful	Moderately useful	Total
Female headed	15 (9.1%)	1 (.6%)	16 (9.7%)
Male headed	116 (70.3%)	33 (20.0%)	149 (90.3%)
Total	131 (79.4%)	34 (20.6%)	165 (100%)
1-5	106 (64.2%)	31 (18.8%)	137 (83.0%)
6-10	25 (15.2%)	3 (1.8%)	28 (17.0%)
Total	131 (79.4%)	34 (20.6%)	165 (100%)

The respondents whose families were female headed, and regarded training as very useful in sustainability fish farming were 15 representing 9.1 per cent of all the respondents. Those with male headed households and regard training as very useful in sustainability fish farming were 116 representing 70.3 per cent of the total. The respondents regarding training as moderately useful in sustainability fish farming and came from male headed families were 33 representing 20.0 per cent of the total. The respondents whose families household size was 1-5, and regarded training as very useful in sustainability fish farming were 106 representing 64.2 per cent of all the respondents. Those with household size of 6-10 and regard training as very useful in sustainability fish farming were 25 representing 15.2 per cent of the total. The respondents regarding training as moderately useful in sustainability fish farming and came from family size of 1-5 were 31 representing 18.8 per cent of the total.

Table 4.5 (c) Type and Size of Family in Relation to Extent of External Sources Influence

	Great extent	Low extent	No extent	Total
Female headed	13 (7.9%)	2 (1.2%)	1 (.6%)	16 (9.7%)
Male headed	130 (78.8%)	16 (9.7%)	3 (1.8%)	149 (90.3%)
Total	143 (86.7%)	18 (10.9%)	4 (2.4%)	165 (100%)
1-5	117 (70.9%)	17 (10.3%)	3 (1.8%)	137 (83.0%)
6-10	26 (15.8%)	1 (.6%)	1 (.6%)	28 (17.0%)
Total	143 (86.7%)	18 (10.9%)	4 (2.4%)	165 (100%)

The respondents whose families were female headed and also thought external sources, greatly influences sustainability of fish farming were 13 representing 7.9 per cent of all the respondents. Those who came from male headed families with that perception of great influence were 130 representing 78.8 per cent of the total. The respondents with the perception of low influence and came from female headed families were only two representing 1.2 per cent of the total. In addition, those who came from male headed families and perceived external sources to have low influence to sustainability were 16 representing 9.7 per cent. Similarly, only one respondent said that external sources had no influence on sustainability and came from female headed family. Only three respondents representing 1.8 per cent came from male headed families and also noted that, there was no influence of external sources on fish farming sustainability.

The respondents whose families had 1-5 individuals and also thought external sources, greatly influences sustainability of fish farming were 117 representing 70.9 per cent of all the respondents. Those who came from families with 6-10 individuals with that perception of great influence were 26 representing 15.8 per cent of the total. The respondents with the

perception of low influence and came from families with household size of 1-5 were 17 representing 10.3 per cent of the total. In addition, those who came from 6-10 sized families and perceived external sources to have low influence to sustainability was only one representing 0.6 per cent. Similarly, only three respondents said that external sources had no influence on sustainability and came from families with household size of 1-5. Only one respondent representing 0.6 per cent came from families with 6-10 household size and also noted that, there was no influence of external sources on fish farming sustainability. From the study most fish farmer's families were of size 1-5 indicating their involvement into fish was as a result of effort to generate more income to meet household needs.

4.4 Influence of Financial Stability of Project Beneficiaries on Sustainability of Fish Farming Projects in Matungulu Sub- County

This section looked at the financial stability of project beneficiaries, its relation to usefulness of training and extent of external sources influence in sustaining fish farming. Financial stability was discussed through the various ways of raising initial capital, the main source of income, involvement of fish farmers and their income.

4.4.1 Ways of Raising Initial Capital

The ways of raising initial capital by the respondents is shown in table 4.6 a, b and c.

Table 4.6 (a) Ways of Raising Initial Capital

	Frequency	Percentage
Own money	33	21.7
Bank loan	33	21.7
Cooperative society loan	86	56.6
Total	165	100.0

The respondents raised their money for starting fish farming through different ways. However out of the 165 respondents interviewed 152 (92.12 per cent) provided their different sources of initial capital. The sources include loans from cooperatives which were provided by 86 (56.6 per cent) respondents. Starting capital from own money and bank loan were equivalent 33 (21.7 per cent) each. Thus majority of the fish farmers sourced their starting capital from cooperative society loans.

Table 4.6 (b) Ways of Raising Initial Capital in Relation to Usefulness of Training

	Very useful	Moderately useful	Total
Own money	28 (18.4%)	5 (3.3%)	33 (21.7%)
Bank loan	26 (17.1%)	7 (4.6%)	33 (21.7%)
Cooperative society loan	68 (44.7%)	18 (11.8%)	86 (56.6%)
Total	131 (79.4%)	34 (20.6%)	165 (100%)

The respondents who raised their own money, and regarded training as very useful in sustainability of fish farming were 28 representing 18.4 per cent of all the respondents. Those who obtained startup capital from bank loan and regard training as very useful in sustainability of fish farming were 26 representing 17.1 per cent of the total. The respondents regarding training as moderately useful in sustainability of fish farming and raised their initial capital through cooperative society loan were 68 representing 44.7 per cent of the total. In addition, 18 respondents raised their capital through cooperative society loan though they regarded training as moderately useful in sustainability of fish farming.

Table 4.6 (c) Ways of Raising Initial Capital in Relation to Extent of External Sources Influence

	Great extent	Low extent	No extent	Total
Own money	26 (17.1%)	5 (3.3%)	2 (1.3%)	33 (21.7%)
Bank loan	29 (19.1%)	3 (2.0%)	1 (.7%)	33 (21.7%)
Cooperative society loan	82 (53.9%)	3 (2.0%)	1 (.7%)	86 (56.6%)
Total	143 (86.7%)	18 (10.9%)	4 (2.4%)	165 (100%)

The respondents who raised their own money to start fish farming and also thought external sources, greatly influenced sustainability of fish farming were 26 representing 17.1 per cent of all the respondents. Those who raised their money to start fish farming by bank loan with that perception of great influence were 29 and represented 19.1 per cent of the total. The respondents who got a cooperative society loan with the perception of great influence were 82 representing 53.9 per cent of the total. In addition, those raised their own money and perceived external sources to have low influence to sustainability were five representing 3.3 per cent. Similarly, the respondents who said external sources had low influence on sustainability and got a bank loan to raise their startup capital were three representing 2.0 per cent. An equal number raised their money through a cooperative society loan. Only two respondents representing 1.3 per cent raised their own money and also noted that, there was no influence of external sources on fish farming sustainability. Similarly, only one respondent with this perception raised their startup capital through either a bank loan or cooperative society loan. The research findings agree with Lei (2003), whose finding concluded that success of agricultural technologies for sustainable food security depends on availability of farm land which also acts as a collateral and there for influences peoples access to financial services.

4.4.2 Fish Farming as the Main Source of Income

Fish farming as the main source of income of the respondents is shown in table 4.7 a, b and c.

Table 4.7 (a) Fish Farming as the Main Source of Income

	Frequency	Percentage
Yes	12	7.3
No	153	92.7
Total	165	100.0

The main source of income according to 12 (7.3 per cent) of the respondents was fish farming. Majority 153 (92.7 per cent) reported that they had other main sources of income including business, employment, crop production and livestock keeping. Some of the animals kept consisted of dairy and poultry farming. The crops produced comprised of coffee, cereals, vegetable and fruits farming.

Table 4.7 (b) Fish Farming as the Main Source of Income in Relation to Usefulness of Training

	Very useful	Moderately useful	Total
Yes	8 (4.8%)	4 (2.4%)	12 (7.3%)
No	123 (74.5%)	30 (18.2%)	153 (92.7%)
Total	131 (79.4%)	34 (20.6%)	165 (100%)

The respondents who said fish farming is their main source of income and regarded training as very useful in sustainability fish farming were eight representing 4.8 per cent of all the respondents. Those who said fish farming is not their main source of income and regard training as very useful in sustainability of fish farming were 123 representing 74.5 per cent of

the total. The respondents regarding training as moderately useful in sustainability of fish farming and said fish farming is not their main source of income were 30 representing 18.2 per cent of the total.

Table 4.7 (c) Fish Farming as the Main Source of Income in Relation to Extent of External Sources Influence

	Great extent	Low extent	No extent	Total
Yes	8 (4.8%)	4 (2.4%)	0 (.0%)	12 (7.3%)
No	135 (81.8%)	14 (8.5%)	4 (2.4%)	153 (92.7%)
Total	143 (86.7%)	18 (10.9%)	4 (2.4%)	165 (100%)

The respondents who said that fish farming is their main source of income and also thought external sources, greatly influences sustainability of fish farming were eight representing 4.8 per cent of all the respondents. Those who said that fish farming wasn't their main source of income with that perception of great influence were 135 and represented 81.8 per cent of the total. In addition, those who said that fish farming wasn't their main source of income and perceived external sources to have low influence to sustainability of fish farming were four representing 2.4 per cent. Similarly, the respondents who said external sources had low influence on sustainability were 14 representing 8.5 per cent, of those who said that fish farming wasn't their main source of income. Only four respondents representing 2.4 per cent felt that fish farming wasn't their main source of income and also noted that, there were no influences of external sources on fish farming sustainability.

4.4.3 Involvement in Fish Farming

Involvement in fish farming of the respondents is shown in table 4.8 a, b and c.

Table 4.8 (a) Involvement in Fish Farming

	Frequency	Percentage
Run operation myself	4	2.4
My family assists	36	21.8
I have employed fish farm attendants	125	75.8
Total	165	100.0

About three quarters 125 (75.8 per cent) of the respondents said they have employed fish farm attendants, 36 (21.8 per cent) reported they are assisted by their families in carrying out the fish farming while only four (2.4 per cent) operate the project on their own. The respondents who had employed fish attendants were adding costs to the already constrained operating costs. However, this could have been due to the reason that the fish farmers were experimenting with fish farming before fully engaging in it. Hence, the possible reason for most of the fish farmers having their main source of income being other activities aside from fish farming.

Table 4.8 (b) Involvement in Fish Farming in Relation to Usefulness of Training

	Very useful	Moderately useful	Total
Run operation myself	2 (1.2%)	2 (1.2%)	4 (2.4%)
My family assists	31 (18.8%)	5 (3.0%)	36 (21.8%)
I have employed fish farm attendants	98 (59.4%)	27 (16.4%)	125 (75.8%)
Total	131 (79.4%)	34 (20.6%)	165 (100%)

The respondents who operated the fish farming on their own and regarded training as very useful in sustaining fish farming were two representing 1.2 per cent of all the respondents. Those who were assisted by their family and regard training as very useful in sustaining fish farming were 31 representing 18.8 per cent of the total. The respondents regarding training as very useful in sustainability of fish farming and had employed fish farm attendants were 98 representing 59.4 per cent of the total. However, 27 respondents representing 16.4 per cent, who had employed fish farm attendants, regarded training as moderately useful in sustaining fish farming.

Table 4.8 (c) Involvement in Fish Farming in Relation to Extent of External Sources Influence

	Great extent	Low extent	No extent	Total
Run operation myself	4 (2.4%)	0 (.0%)	0 (.0%)	4 (2.4%)
My family assists	25 (15.2%)	10 (6.1%)	1 (.6%)	36 (21.8%)
I have employed fish farm attendants	114 (69.1%)	8 (4.8%)	3 (1.8%)	125 (75.8%)
Total	143 (86.7%)	18 (10.9%)	4 (2.4%)	165 (100%)

The respondents who run the operation on their own and also thought external sources greatly influenced sustainability of fish farming comprised four (2.4 per cent) of all the respondents, while those who were assisted by the family with that perception of great influence represented 25 (15.2 per cent) of the total. In addition, those who had employed fish farm attendants and perceived external sources to greatly influence sustainability were 114 representing 69.1 per cent. Similarly, the respondents who said external sources had low influence on sustainability were 10 and eight representing 6.1 per cent and 4.8 per cent respectively for those assisted by family and employed fish farm attendants respectively.

Only one and three respondents representing 0.6 per cent and 1.8 per cent respectively were assisted by family and employed fish farm attendants and noted that, there was no influence of external sources on fish farming sustainability.

4.4.4 Fish Farmers' Income

Fish farmers' income of the respondents is shown in table 4.9 a, b and c.

Table 4.9 (a) Fish Farmers' Income

		Frequency	Percentage
Frequency of your income	Daily	10	6.1
	Weekly	1	0.6
	Monthly	78	47.3
	Erratic	76	46.1
Monthly income from fish farming	1001-5000	12	7.3
	5001-10000	107	64.8
	Above 10000	46	27.9
Monthly income from other external sources	Below 1000	1	0.6
	1001-5000	3	1.8
	5001-10000	36	21.8
	Above 10000	125	75.8
Total		165	100.0

An analysis of the frequency of income from the fish farming revealed that 78 (47.3 per cent) had been done monthly while the income from 76 (46.1 per cent) of the respondents was erratic. Ten (6.1 per cent) of the respondents earned their income on daily basis and only one

(0.6 per cent) realized the income weekly. The income generated per month from fish farming activities varied. Twelve (7.3 per cent) realized an income of Kshs. 1001-5000 every month, 107 (64.8 per cent) reported their monthly income from fish farming was Kshs. 5001-10000. The remaining 46 (27.9 per cent) of the respondents reported that their income each month was above Kshs. 10000.

Table 4.9 (b) Fish Farmers' Incomes in Relation to Usefulness of Training

		Very useful	Moderately useful	Total
Frequency of your income	Daily	8 (4.8%)	2 (1.2%)	10 (6.1%)
	Weekly	1 (.6%)	0 (.0%)	1 (.6%)
	Monthly	63 (38.2%)	15 (9.1%)	78 (47.3%)
	Erratic	59 (35.8%)	17 (10.3%)	76 (46.1%)
Monthly income from fish farming	1001-5000	9 (5.5%)	3 (1.8%)	12 (7.3%)
	5001-10000	83 (50.3%)	24 (14.5%)	107(64.8%)
	Above 10000	39 (23.6%)	7 (4.2%)	46 (27.9%)
Monthly income from other external sources	Below 1000	0 (.0%)	1 (.6%)	1 (.6%)
	1001-5000	2 (1.2%)	1 (.6%)	3 (1.8%)
	5001-10000	30 (18.2%)	6 (3.6%)	36 (21.8%)
	Above 10000	99 (60.0%)	26 (15.8%)	125 (75.8%)
Total		131 (79.4%)	34 (20.6%)	165 (100%)

Information disclosed by 125 (75.8 per cent) of the respondents showed that income from external sources other than fish farming were above Kshs. 10000. Furthermore 36 (21.8 per cent) stated that external sources of income generated Kshs 5001-10000 monthly, while the rest of the respondents, one (0.6 per cent) and three (1.8 per cent) revealed a monthly income

of less than Kshs 1000 and Kshs 1001-5000 respectively from sources other than fish farming.

The respondents who earned their income on monthly basis and regarded training as very useful in sustaining fish farming were 63 representing 38.2 per cent of all the respondents. Those whose income were erratic and regard training as very useful in sustaining fish farming were 59 representing 35.8 per cent of the total. The respondents regarding training as very useful in sustainability of fish farming and earned income daily were eight representing 4.8 per cent of the total. However, 15 and 17 respondents representing 9.1 and 10.3 per cent respectively earned income monthly and in an erratic way, regarded training as moderately useful in sustaining fish farming.

The realized monthly income from fish farming according to 50.3 per cent respondents who regarded training as very useful in sustaining fish farming was Kshs 5001 to 10,000, while it was above Kshs 10,000 for 23.6 per cent of the respondents who said the training was very useful. However, 24 respondents representing 14.5 per cent of the total earned monthly income ranging Kshs 5001 to 10,000 and regarded the training as moderately useful.

Table 4.9 (c) Fish Farmers' Income in Relation to Extent of External Sources Influence

		Great extent	Low extent	No extent	Total
Frequency of your income	Daily	4 (2.4%)	2 (1.2%)	4 (2.4%)	10 (6.1%)
	Weekly	1 (.6%)	0 (.0%)	0 (.0%)	1 (.6%)
	Monthly	74 (44.8%)	4 (2.4%)	0 (.0%)	78 (47.3%)
	Erratic	64 (38.8%)	12 (7.3%)	0 (.0%)	76 (46.1%)
Monthly income from fish farming	1001-5000	11 (6.7%)	0 (.0%)	1 (.6%)	12 (7.3%)
	5001-10000	102 (61.8%)	5 (3.0%)	0 (.0%)	107(64.8%)
	Above 10000	30 (18.2%)	13 (7.9%)	3 (1.8%)	46 (27.9%)
Monthly income from other external sources	Below 1000	0 (.0%)	0 (.0%)	1 (.6%)	1 (.6%)
	1001-5000	1 (.6%)	2 (1.2%)	0 (.0%)	3 (1.8%)
	5001-10000	33 (20.0%)	3 (1.8%)	0 (.0%)	36 (21.8%)
	Above 10000	109 (66.1%)	13 (7.9%)	3 (1.8%)	125 (75.8%)
Total		143 (86.7%)	18 (10.9%)	4 (2.4%)	165 (100%)

In regards to the extent in which external sources of finance influence sustainability of fish farming, 143 (86.7 per cent) of the respondents said that the external sources of finance affects fish farming sustainability in a great extent. Moreover, 18 (10.9 per cent) noted that the influence is to a low extent while four (2.4 per cent) said that external sources does not influence sustainability of fish farming in Matungulu sub-County. A comparative analysis of the income from fish farming and other external sources clearly shows that external sources of income exceeds fish farming for most of the respondents, hence justifying the multi tasking nature of the fish farmers in income generation. Moreover, the respondents reported external sources of finance contributes greatly to sustainability of fish farming.

The respondents interviewed were of the idea that the fish farmers' level of income influenced the sustainability of their projects.

The fish projects officers said that access to financial stability influences sustainability of fish farming projects. Similar findings emanated from studies by Macharia (2007) who found out that lack of affordable credit was a major impediment and Deininger and May (2000) in South Africa established that financial stability is a key issue on sustainability of fish farming projects.

4.5 Influence of the Level at Which Capacity Building of Project Beneficiaries on Sustainability of Fish Farming Projects in Matungulu Sub-County

This section looked at the capacity building of project beneficiaries, its relation to usefulness of training and extent of external sources influence in sustaining fish farming. The various aspects of capacity building of the project beneficiaries examined include method of training and frequency of training.

4.5.1 Method of Training

The method of training of the respondents is shown in table 4.10 a, b and c.

Table 4.10 (a) Method of Training

	Frequency	Percentage
Demonstration	132	80.0
workshop/seminar	33	20.0
Total	165	100.0

The method of training commonly used by the respondents was demonstration, based on 132 (80.0 per cent) of those interviewed with the rest 33 (20.0 per cent) utilizing workshop or seminar.

Table 4.10 (b) Method of Training in Relation to Usefulness of Training

	Very useful	Moderately useful	Total
Demonstration	102 (61.8%)	30 (18.2%)	132 (80.0%)
workshop/seminar	29 (17.6%)	4 (2.4%)	33 (20.0%)
Total	131 (79.4%)	34 (20.6%)	165 (100%)

The respondents were asked if they had attended any training organized by the Ministry of fisheries and other service providers. All of them disclosed that they had attended training for capacity building and that 131 (79.4 per cent) of the respondents termed the training offered as very useful for sustaining fish farming. The remaining 34 (20.6 per cent) considered the training offered to be moderately useful for sustaining fish farming in Matungulu sub-County.

More disaggregation showed that 102 (61.8 per cent) received training through demonstration and termed the training as very useful in sustaining fish farming. Additionally 30 (18.2 per cent) were trained using demonstration and noted the training was moderately useful in sustaining fish fishing. Respondents trained by means of workshop or seminar who argued that the training was very useful in sustaining fish farming were 29 (17.6 per cent). Only four (2.4 per cent) of the respondents reported that workshop or seminar was the method used for training and that the training was moderately useful in fish farming sustainability.

Table 4.10 (c) Method of Training in Relation to Extent of External Sources Influence

	Great extent	Low extent	No extent	Total
Demonstration	112 (67.9%)	17(10.3%)	3 (1.8%)	132 (80.0%)
Workshop/seminar	31 (18.8%)	1 (.6%)	1 (.6%)	33 (20.0%)
Total	143 (86.7%)	18 (10.9%)	4 (2.4%)	165 (100%)

The respondents who were trained through demonstration method and also thought external sources greatly influences sustainability of fish farming comprised 112 (67.9 per cent) of all the respondents, while those who were trained using workshop or seminar with that perception of great influence represented 31 (18.8 per cent) of the total. Similarly, the respondents who said external sources had low influence on sustainability were 17 (10.3 per cent) and one (0.6 per cent) respectively for those who were training using the method of demonstration and workshop or seminars respectively. Only three (1.8 per cent) and one (0.6 per cent) for those trained via the method of demonstration and workshops or seminars respectively, noted that there was no influence of external sources on fish farming sustainability.

The intensity of training is crucial as demonstrated by the high number of respondents who were trained on fish farming using demonstration in which the fish farmers are given practical illustrations on quality aspects in handling the fish farming project.

4.5.2 Frequency of Training

The frequency of training of the respondents is shown in table 4.11 a, b and c.

Table 4.11 (a) Frequency of Training

		Frequency	Percentage
Times attended training	1-5	146	88.5
	6-10	19	11.5
Total		165	100.0
Number of trainings received last year	1	1	0.6
	2	70	43.8
	3	51	31.9
	4	37	23.1
	5	1	0.6
Total		165	100.0

On acknowledging that the respondents received training, 146 (88.5 per cent) said they were trained 1-5 times while 19 (11.5 per cent) received training for 6-10 times. The analysis disclosed that 70 (43.8 per cent) of the respondents received two trainings last year. This was followed by 51 (31.9 per cent) with three trainings and 37 (23.1 per cent) who had four trainings in the previous year. Only one (0.6 per cent) respondent received either one or five trainings the last year.

Table 4.11 (b) Frequency of Training in Relation to Usefulness of Training

		Very useful	Moderately useful	Total
Times attended	1-5	117 (70.9%)	29 (17.6%)	146 (88.5%)
training	6-10	14 (8.5%)	5 (3.0%)	19 (11.5%)
Total		131 (79.4%)	34 (20.6%)	165 (100%)
	1	0 (.0%)	1 (.6%)	1 (.6%)
Number of	2	64 (40.0%)	6 (3.8%)	70 (43.8%)
trainings	3	35 (21.9%)	16 (10.0%)	51 (31.9%)
received last year	4	27 (16.9%)	10 (6.3%)	37 (23.1%)
	5	0 (.0%)	1 (.6%)	1 (.6%)
Total		131 (79.4%)	34 (20.6%)	165 (100%)

Further analysis showed that those who had been trained for 1-5 times and also viewed training as being very useful in sustaining fish farming were 117 (70.9 per cent). The respondents who reported they were both trained for 1-5 times and perceived the training to have been moderately useful for fish farming sustainability comprised 29 (17.6 per cent) of all interviewed. Fourteen (8.5 per cent) and five (3.0 per cent) of the respondents were both trained for 6-10 times and suggested the training was very useful and moderately useful for sustaining fish farming respectively. This denotes that the frequency of training though useful is not a key determinant to sustainability of fish farming. Only one (0.6 per cent) respondent received either one or five trainings the last year and they perceived the trainings as moderately useful in the sustenance of fish farming.

Table 4.11 (c) Frequency of Training in Relation to Extent of External Sources Influence

		Great extent	Low extent	No extent	Total
Times attended	1-5	126 (76.4%)	17 (10.3%)	3 (1.8%)	146 (88.5%)
training	6-10	17 (10.3%)	1 (.6%)	1 (.6%)	19 (11.5%)
Total		143 (86.7%)	18 (10.9%)	4 (2.4%)	165 (100%)
Number of trainings received last year	1	1 (.6%)	0 (.0%)	0 (.0%)	1 (.6%)
	2	68 (42.5%)	1 (.6%)	1 (.6%)	70 (43.8%)
	3	43 (26.9%)	6 (3.8%)	2 (1.3%)	51 (31.9%)
	4	29 (18.1%)	8 (5.0%)	0 (.0%)	37 (23.1%)
	5	1 (.6%)	0 (.0%)	0 (.0%)	1 (.6%)
Total		143 (86.7%)	18 (10.9%)	4 (2.4%)	165 (100%)

The respondents who had attended training for 1-5 times and also thought external sources greatly influences sustainability of fish farming comprised 126 (76.4 per cent) of all the respondents, while the those who had attended 6-10 times with that perception of great influence represented 17 (10.3 per cent) of the total. Similarly, the respondents who said external sources had low influence on sustainability were 17 (10.3 per cent) and one (0.6 per cent) respectively for those who had attended training 1-5 and 6-10 times respectively. Only three (1.8 per cent) and one (0.6 per cent) for those who had attended training 1-5 and 6-10 times respectively, noted that there was no influence of external sources on fish farming sustainability.

All the respondents interviewed opined that training and capacity building influences sustainability of fish farming in Matungulu sub-County. Sentiments pertaining to the value of training, fish farmers received toward sustainability of fish farming projects were echoed by

the project officers. One of them reported that the *'farmers get new skills and techniques which are essentially required to run any project'*. A study conducted by Koech (2008) in Eldama Ravine Kenya on the take up of new technologies through capacity building for fish project sustainability established the same findings. *'The farmers are enlightened on pond management in addition to gaining more knowledge about fish farming'* another officer added.

Pertaining the influence of training offered to the fish farmers on the sustainability of fish farming projects, one of the project officers stated that *'knowledge is power'* with another acknowledging that *'farmers gain more knowledge about fish farming and pond management'*. Another officer was explicit enough to reveal that *'new farmers are recruited in the trainings'* hence ensuring perpetual nature of the projects.

The study concurs with that of Njuguna (2011) on implementation of fish projects in Embakasi Constituency. The study established that regardless of low education qualification of project beneficiaries, the skills and knowledge gained during training enabled farmers to have more exposure and thus get actively involved in implementing and sustaining the community projects.

4.6 The Extent to Which Land Availability of the Project Beneficiaries Influences Sustainability of Fish Farming Projects in Matungulu Sub-County

This section looked at the land availability of the project beneficiaries, its relation to usefulness of training and extent of external sources influence in sustaining fish farming. The availability of land is in relation to land ownership, availability of land, and other usage of land.

4.6.1 Land Ownership

Land ownership of the respondents is shown in table 4.12 a, b and c.

Table 4.12 (a) Land Ownership

	Frequency	Percentage
Family land	52	31.5
Own land	113	68.5
Total	165	100.0

Analysis of ownership of the land tenure on which the fish farmers did fish farming revealed that majority 113 (68.5 per cent) of the respondents did fish farming on own land, while 52 (31.5 per cent) of the respondents used family land to do fish farming. The fact that no rental or leased land is reportedly being used for fish farming is a plus for reducing the initial and operating costs of fish farming.

Table 4.12 (b) Land Ownership in Relation to Usefulness of Training

	Very useful	Moderately useful	Total
Family land	40 (24.2%)	12 (7.3%)	52 (31.5%)
Own land	91 (55.2%)	22 (13.3%)	113 (68.5%)
Total	131 (79.4%)	34 (20.6%)	165 (100%)

Forty (24.2 per cent) of the respondents said that the fish farmers used family land for fish farming and that training is very useful in sustaining fish farming. However, 12 (7.3 per cent) reported that training is moderately useful in sustaining fish farming even though the farmers utilized family land. Further disaggregation shows that 91 (55.2 per cent) of all the

respondents owned land and also indicated that training is very useful in sustaining fish farming, while 22 (13.3 per cent) reported that training is moderately useful in sustaining fish farming and used own land for carrying out fish farming.

Table 4.12 (c) Land Ownership in Relation to Extent of External Sources Influence

	Great extent	Low extent	No extent	Total
Family land	41 (24.8%)	11 (6.7%)	0 (.0%)	52 (31.5%)
Own land	102 (61.8%)	7 (4.2%)	4 (2.4%)	113 (68.5%)
Total	143 (86.7%)	18 (10.9%)	4 (2.4%)	165 (100%)

The respondents who used family land and also thought external sources greatly influenced sustainability of fish farming comprised 41 (24.8 per cent) of all the respondents, while those who owned land with that perception of great influence represented 102 (61.8 per cent) of the total. Similarly, the respondents who said external sources had low influence on sustainability were 11 (6.7 per cent) and seven (4.2 per cent) respectively for those who on family land and own land. None of those who used family land noted that there was no influence of external sources on fish farming sustainability with only four (2.4 per cent) of those using own land giving the view of no influence.

4.6.2 Availability of Land

Availability of land by the respondents is shown in table 4.13 a, b and c.

Table 4.13 (a) Availability of Land

		Frequency	Percentage
Land adequate	Yes	161	97.6
	No	4	2.4
Total		165	100.0
Land acreage	1-5	72	44.7
	6-10	88	54.7
	Above 10	1	0.6
Total		165	100.0

Following the opinion of the respondents on whether farmers in Matungulu sub-County have adequate land for fish farming, 161 (97.6 per cent) said that the farmers did have adequate land while only four (2.4 per cent) reported that the available land was not adequate for fish farming.

Table 4.13 (b) Availability of Land in Relation to Usefulness of Training

		Very useful	Moderately useful	Total
Adequacy of Land	Yes	127 (77.0%)	34 (20.6%)	161 (97.6%)
	No	4 (2.4%)	0 (.0%)	4 (2.4%)
Total		131 (79.4%)	34 (20.6%)	165 (100%)
Land acreage	1-5	51 (31.7%)	21 (13.0%)	72 (44.7%)
	6-10	75 (46.6%)	13 (8.1%)	88 (54.7%)
	Above 10	1 (.6%)	0 (.0%)	1 (.6%)
Total		131 (79.4%)	34 (20.6%)	165 (100%)

Out of all the respondents interviewed 127 (77.0 per cent) reported that fish farmers had adequate land and also training was very useful in sustaining fish farming. However, four (2.4 per cent) mentioned that training was very useful except that the fish farmers did not have adequate land for fish farming. One of the respondents who stated the land was inadequate said it was because *'the land has been sub-divided due to different types of crop planted'* while another gave the reason *'because the farmers own small pieces of land due to subdivision'*.

All the respondents who viewed training as being moderately useful in sustaining fish farming also said that the fish farmers had adequate land. Thus adequacy of land for fish farming is not a challenge rather the quality and method of trainings be conducted in a manner which can be easily transferred and replicated in Matungulu sub-County.

A cross tabulation of the usefulness of training in sustaining fish farming and size of land acreage utilized for crop farming disclosed that 72 (44.7 per cent) utilized 1-5 acres of land. Eighty-eight (54.7 per cent) of the respondents utilized 6-10 acres of land while only one (0.6 per cent) utilized more than 10 acres of land for crop farming. The latter of the respondents utilizing more than 10 acres regarded training as very useful in sustaining fish farming. The respondents who said training is very useful in sustaining fish farming and utilized 1-5 acres of land for farming were 51 (31.7 per cent), while 75 (46.6 per cent) of the respondents used 6-10 acres of land in crop farming and regarded training as being very useful in sustaining fish farming. Twenty-one (13 per cent) of the respondents reported both training is moderately useful in sustaining fish farming and utilized 1-5 acres of land in crop farming. The remaining 13 (8.1 per cent) who suggested training as being moderately useful in sustaining fish farming utilized 6-10 acres of land in crop farming.

Table 4.13 (c) Availability of Land in Relation to Extent of External Sources Influence

		Great extent	Low extent	No extent	Total
Adequacy of Land	Yes	140 (84.8%)	17 (10.3%)	4 (2.4%)	161 (97.6%)
	No	3 (1.8%)	1 (.6%)	0 (.0%)	4 (2.4%)
Total		143 (86.7%)	18 (10.9%)	4 (2.4%)	165 (100%)
Land acreage	1-5	63 (39.1%)	7 (4.3%)	2 (1.2%)	72 (44.7%)
	6-10	77 (47.8%)	9 (5.6%)	2 (1.2%)	88 (54.7%)
	Above 10	0 (.0%)	1 (.6%)	0 (.0%)	1 (.6%)
Total		143 (86.7%)	18 (10.9%)	4 (2.4%)	165 (100%)

A cross tabulation of the adequacy of land and acreage in relation to extent of external sources influence revealed that 84.8 per cent of the respondents who had adequate land, said external sources influenced sustainability of fish farming to a great extent. In addition, 47.8 per cent of the respondents who had land acreage between 6 to 10 notes that, external sources have a great influence to sustainability of fish farming.

4.6.3 Other Uses of Land

Other uses of land by the respondents is shown in table 4.14 a, b and c.

Table 4.14 (a) Other Uses of Land

		Frequency	Percentage
Prefer animal keeping	Yes	149	91.4
	No	14	8.6
Total		165	100.0

Despite the mixed farming practiced by the fish farmers, 149 (91.4 per cent) preferred to keep dairy cattle, local cattle and local goats rather than fish farming while 14 (8.6 per cent) instead opted to practice fish farming. The relatively small proportion of the respondents who preferred fish farming to other animal keeping could be due to the challenges faced by fish farmers in the study area and hence the non-sustainability of pond fish farming. Some of the suggested challenges in fish farming are *'high initial and operating costs, lack of enough water and also fish farming was introduced recently unlike the other animals which traditionally had been kept'*. These findings confirm those by Gichira and Dickson (1987) who stated that among the most recurring problems faced by fish farmers was lack of capital to run fish farming projects.

Table 4.14 (b) Other Uses of Land in Relation to Usefulness of Training

		Very useful	Moderately useful	Total
Prefer animal keeping	Yes	116 (71.2%)	33 (20.2%)	149 (91.4%)
	No	13 (8.0%)	1 (.6%)	14 (8.6%)
Total		131 (79.4%)	34 (20.6%)	165 (100%)

All the respondents who said training was moderately useful in sustaining fish farming added that farmers preferred to keep the animals to fish farming save for one (0.6 per cent). The results from the data analysis indicates that 116 (71.2 per cent) of the respondents noted that training is very useful for sustaining fish farming also preferred to keep dairy cattle, local cattle and local goats to fish farming. However 13 (8.0 per cent) of the respondents both preferred fish farming to keeping other animals and also argued that training is very useful for sustaining fish farming.

Table 4.14 (c) Other Uses of Land in Relation to Extent of External Sources Influence

		Great extent	Low extent	No extent	Total
Prefer animal keeping	Yes	135 (82.8%)	13 (8.0%)	1 (.6%)	149 (91.4%)
	No	6 (3.7%)	5 (3.1%)	3 (1.8%)	14 (8.6%)
Total		143 (86.7%)	18 (10.9%)	4 (2.4%)	165 (100%)

The respondents who preferred animal keeping and also thought external sources greatly influences sustainability of fish farming comprised 135 (82.8 per cent) of all the respondents, while the those who did not prefer animal keeping with that perception of great influence represented only six (3.7 per cent) of the total. Similarly, the respondents who said external sources had low influence on sustainability were 13 (8.0 per cent) and five (3.1 per cent) respectively for those who preferred and those who did not prefer animal keeping. Only one (0.6 per cent) and three (1.8 per cent) for those who preferred and those who did not prefer animal keeping, noted that there was no influence of external sources on fish farming sustainability.

Evidence deduced from the data collected shows that maize, beans, vegetables and coffee are crops mostly reportedly planted by all the respondents in addition to fish farming. Moreover 35 (21.21 per cent) of the fish farmers also planted fruits such as bananas, watermelons, mangoes and pawpaw's. Other crops mostly planted by the fish farmers included cassava, peas and sorghum and millet.

Table 4.15: Crops mostly planted by fish farmers

Crops planted	Frequency	Percentage
Maize	165	100.00
Beans	165	100.00
Vegetables	165	100.00
Coffee	165	100.00
Fruits	35	21.21
Cassava	2	1.21
Peas	2	1.21
Sorghum/Millet	1	0.61

The fish farmers also planted maize, beans, vegetables and coffee, in addition to fish farming. Moreover, 35 (21 per cent) reportedly practiced fruits farming, two planted cassava, two also planted peas and only one planted sorghum or millet.

Table 4.16: Other animals kept by the fish farmers

Animals kept	Frequency	Percentage
Dairy Cattle	165	100.00
Local Cattle	165	100.00
Local Goats	165	100.00
Poultry	99	60.00
Pigs	18	10.91
Rabbits	11	6.67
Bees	1	0.61

All the fish farmers reported to keep dairy cattle, local cattle or local goats. Similar findings emanated from a study by Ogola *et al.* (2010b) that livestock is the world's largest user of land resources, with grazing land and cropland dedicated to the production of feed representing almost 80 percent of all agricultural land. Ninety nine (60.0 per cent) noted they practiced poultry keeping, 18 (10.9 per cent) kept pigs, 11 (6.67 per cent) reared rabbits and only one (0.61 per cent) combined fish farming to bees keeping.

4.7 Suggested Contributions of Pond Fish Farming

Most (86.67 per cent) of the respondents agreed that pond fish farming can make an important contribution to poverty alleviation by addressing problems of poverty and food security. An additional 9.70 per cent strongly agreed to the contribution of pond fish farming to poverty alleviation. This indicates that 97.37 per cent of the fish farmers noted pond fish farming contributes to addressing poverty and food security. Similarly 89.70 per cent of the fish farmers made known that pond fishing makes an important contribution in social well-being hence promoting social equity. Furthermore, 97.57 per cent of the fish farmers indicated that fish provides food of high nutritional value for households with an equal number stating pond fish farming offers employment opportunities to many people.

The fish farmers, who said combination of agriculture and aquaculture helped them improve their food supply, increased their income and become self-sustained in farming represented 89.09 per cent of the fish farmers. Almost one half (56.97 per cent) of the fish farmers noted that pond fish farming boosts rural economic development. The fish farmers who acknowledged living near perennial water bodies encourages pond fish farming represented 40.61 per cent of the farmers interviewed. Only 26.06 per cent of the fish farmers affirmed pond fish farming is a major source of foreign exchange to the government.

Table 4.17: Contributions of pond fish farming

Frequency	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
Poverty Alleviation	0	0	4	143	16
Promote Social Equity	0	0	15	104	44
Provides Food	0	0	1	32	129
Improve Food Supply	0	0	16	114	33
Boost Economic	0	5	64	70	24
Encourage Fish Farm	5	72	19	19	48
Foreign Exchange	104	9	7	22	21
Employment Support	0	0	2	139	22
Percentage	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
Poverty Alleviation	0.00	0.00	2.42	86.67	9.70
Promote Social Equity	0.00	0.00	9.09	63.03	26.67
High Nutritional Food	0.00	0.00	0.61	19.39	78.18
Self-Sustained Farmers	0.00	0.00	9.70	69.09	20.00
Boosts Rural Economy	0.00	3.03	38.79	42.42	14.55
Near Perennial Water	3.03	43.64	11.52	11.52	29.09
Foreign Exchange	63.03	5.45	4.24	13.33	12.73
Employment Opportunities	0.00	0.00	1.21	84.24	13.33

Evidence from the data collected shows that all the respondents opined that training and capacity building influences sustainability of fish farming in Matungulu sub-County. This implies that all the fish farmers appreciate the role played by training for improved productivity. Hence, the way training and capacity building is done should be tailor-made to suit and favor fish farmers in each locality.

All the respondents interviewed were of the opinion that fish farming projects are sustainable. Hence, the scale in which fish farming is carried should be able to mitigate some of the suggested challenges facing fish farming. Special mention is on the advantage of economies of scale in cushioning the operating costs borne by the small scale fish farmers.

CHAPTER FIVE

DISCUSSION OF FINDINGS, CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

This chapter presents the summary of the study findings, conclusions and recommendations. The chapter also presents suggestions for further research.

5.2 Summary of Findings

The purpose of this study was to investigate the factors that influence the sustainability of fish farming projects in Matungulu Sub-County, Machakos County. Four research objectives guided the study which included; i) to examine the extent to which demographic characteristics of project beneficiaries influence sustainability of fish farming projects; ii) establish influence of financial stability of project beneficiaries on sustainability of fish farming projects; iii) establish the influence of capacity building of project beneficiaries on sustainability of fish farming projects and iv) to determine the extent to which land availability of the project beneficiaries influences sustainability of fish farming projects in Matungulu Sub-County, Machakos County. The study adopted a descriptive analysis technique. The sample for the study was 165 fish farmers and three extension officers. Data was analyzed by table of frequencies and percentages.

5.3 Discussion of the Study Findings

Based on the data collected all the respondents interviewed were of the opinion that fish farming projects are sustainable and they all appreciated the role played by training for improved productivity, since training and capacity building was noted to influence sustainability of fish farming in Matungulu sub-County, with 131 (79.4 per cent) of the respondents stating that training was very useful.

Majority, 109 (66.1 per cent) of the fish farmers were males. Training was very useful for sustaining fish farming according to 80 (48.5 per cent) and 51 (30.9 per cent) males and females respectively. The males who greatly thought external sources influences sustainability of fish farming comprised 95 (57.6 per cent) of all the respondents while the females with that perception of great influence represented 48 (29.1 per cent) of the total. The study findings point to the fact that external sources greatly influence sustainability of fish farming in Matungulu sub-County. Similar to the findings in a study by Ofuoku *et al.* (2008) in Nigeria, the fish farmers aged above 50 years were 40.6 per cent and those aged 30 years and below were only 10.9 per cent. Most of the fish farmers 144 (87.8 per cent) were married and most of the families 149 (90.3 per cent) who practiced fish farming were male-headed. It was evident that most 137 (83.0 per cent) of the respondents composed of 1-5 members. This shows that majority of the fish farmers came from small households.

Most, 84 (50.9 per cent) of the fish farmers had attained college education which is in line with the findings by Ofuoku *et al.* (2008), were fish farming in Nigeria was established to be dominated by those with tertiary education. This is because fish farming requires a lot of technical and scientific knowledge to be successfully undertaken. The respondents raised their money for starting fish farming through different ways. The sources included loans from cooperatives which were provided by 86 (56.6 per cent) respondents. Starting capital from both own money and bank loan were equivalent 33 (21.7 per cent) each. Thus majority of the fish farmers sourced their starting capital from cooperative society loans. The main source of income according to 12 (7.3 per cent) of the respondents was fish farming. Majority 153 (92.7 per cent) reported that they had other main sources of income including business, employment, crop production and livestock keeping. Some of the animals kept consisted of dairy and poultry farming. The crop farming practiced comprised of coffee, cereals, vegetable

and fruits farming. About three quarters 125 (75.8 per cent) of the respondents said they have employed fish farm attendants. The respondents who have employed fish attendants are adding costs to the already constrained operating costs.

An analysis of the frequency of income from the fish farming revealed that 78 (47.3 per cent) had been done monthly while the income from 76 (46.1 per cent) of the respondents was erratic. The income generated per month from fish farming activities varied. Most, 107 (64.8 per cent) reported their monthly income from fish farming was Kshs 5001-10000 and 46 (27.9 per cent) of the respondents reported that their income each month was above Kshs. 10000. Information disclosed by 125 (75.8 per cent) of the respondents showed that income from external sources other than fish farming were above Kshs 10000 and 143 (86.7 per cent) of the respondents said that external sources of finance affects fish farming sustainability in a great extent.

The respondents interviewed were of the idea that the fish farmers' level of income influenced the sustainability of their projects. One of the project officers elaborated that *'fish farming is a heavy investment and it requires someone to be able to raise enough capital so the level of income should be stable'*. Another officer revealed that *'low income farmers face a lot of challenges as compared to the rich'* and closely linked to that another officer shared the sentiments that *'farmers would wish to farm more after getting income'*. The fish projects officers said that access to financial stability influences sustainability of fish farming projects. These were expressed through their opinions, in which according to one of the officers *'the project requires money to run and if you don't access finances it will fail'*. Another added that *'farmers are able to provide feeds to the fish and manage the fish pond'* and as such *'the number of ponds will depend on financial stability'*

All of the respondents disclosed that they had attended training for capacity building organized by the Ministry of fisheries and other service providers and that 131 (79.4 per cent) of the respondents termed the training offered as very useful for sustaining fish farming. Most 146 (88.5 per cent) of the respondents said they were trained 1-5 times and that 117 (70.9 per cent) who had been trained for 1-5 times also viewed training as being very useful in sustaining fish farming. The method of training commonly used by the respondents was demonstration, based on 132 (80.0 per cent) of those interviewed. More disaggregation showed that 102 (61.8 per cent) received training through demonstration and termed the training as very useful in sustaining fish farming. The analysis disclosed that 70 (43.8 per cent) of the respondents received two trainings last year.

All the respondents interviewed opined that training and capacity building influences sustainability of fish farming in Matungulu sub-County. Sentiments pertaining to the value of training fish farmers received toward sustainability of fish farming projects were echoed by the project officers. Pertaining the influence of training offered to the fish farmers on the sustainability of fish farming projects, one of the project officers stated that *'knowledge is power'* with another acknowledging that *'farmers gain more knowledge about fish farming and pond management'*. Another officer was explicit enough to reveal that *'new farmers are recruited in the trainings'* hence ensuring perpetual nature of the projects.

Majority 113 (68.5 per cent) of the respondents practiced fish farming on own land while 52 (31.5 per cent) of the respondents used family land to do fish farming. The fact that no rental or leased land is used for fish farming is a plus for reducing the initial and operating costs of fish farming. Most 161 (97.6 per cent) of the respondents said that the farmers did have adequate land. Out of all the respondents interviewed 127 (77.0 per cent) reported that fish

farmers had adequate land and also training was very useful in sustaining fish farming. Crops mostly reportedly planted by all the respondents in addition to fish farming are maize, beans, vegetables and coffee. Moreover 35 (21.21 per cent) of the fish farmers also planted fruits such as bananas, watermelons, mangoes and pawpaw's. Other crops mostly planted by the fish farmers included cassava, peas and sorghum and millet. All the fish farmers reported to keep dairy cattle, local cattle and local goats with 99 (60.0 per cent) noting they combined fish farming to poultry keeping. Despite the mixed farming practiced by the fish farmers, 149 (91.4 per cent) preferred to keep dairy cattle, local cattle and local goats rather than fish farming while 14 (8.6 per cent) instead opted to practice fish farming. The results from the data analysis indicates that 116 (71.2 per cent) of the respondents noted that training is very useful for sustaining fish farming also preferred to keep dairy cattle, local cattle and local goats to fish farming.

A cross tabulation of the usefulness of training in sustaining fish farming and size of land acreage utilized for crop farming disclosed that 72 (44.7 per cent) utilized 1-5 acres of land. Eighty-eight (54.7 per cent) of the respondents utilized 6-10 acres of land while only one (0.6 per cent) utilized more than 10 acres of land for crop farming. The latter of the respondents utilizing more than 10 acres regarded training as very useful in sustaining fish farming. The respondents who said training is very useful in sustaining fish farming and utilized 1-5 acres of land for farming were 51 (31.7 per cent) while 75 (46.6 per cent) of the respondents used 6-10 acres of land in crop farming and regarded training as being very useful in sustaining fish farming.

5.4 Conclusions of the Study

Based on the findings of the study, it was concluded that

- (1) Most of the fish farmers are males and training is regarded as very useful for sustaining fish farming. And that few young people are involved in fish farming compared to old people.
- (2) External sources of income exceed fish farming for most of the respondents, hence justifying the multi tasking nature of the fish farmers in income generation. Moreover, the respondents reported external sources of finance contributes greatly to sustainability of fish farming.
- (3) The frequency of training though useful is not a key determinant to sustainability of fish farming. However, the intensity of training is key as established by the high number of respondents who were trained on fish farming using demonstration in which the fish farmers are given practical illustrations on quality aspects in handling the fish farming project. Thus capacity building influences sustainability of fish farming projects in Matungulu sub County.
- (4) Adequacy of land in Matungulu sub-County is not a fish farming challenge.
- (5) Relatively small proportion of the respondents preferred fish farming to other animal keeping possibly due to the challenges faced by fish farmers in the study area such as *'high initial and operating costs, and lack of enough water'*

5.5 Recommendations of the Study

Based on the findings of the study, the following recommendations were made;

- (i) A greater proportion of youths, specifically one-third representation in fish farming should be involved as a way of employment creation.
- (ii) Since majority of the fish farmers sourced their starting capital from cooperative society loans the government ought to provide some form of grant for farmers who want to engage in fish farming especially the youth and women.

- (iii) The quality and method of trainings like demonstration should be conducted in a manner which can easily be transferred and replicated in Matungulu sub-County.
- (iv) Given that about three quarters said they have employed fish farm attendants adding to already constrained operating costs, there is need for those engaging in pond fish farming to practice large scale pond fish farming, to maximize their income and take advantage of economies of scale.

5.6 Suggestions for Further Research

Taking the limitations and delimitations of the study, the following areas were suggested for further research

- (a) All the factors which affect sustainability of fish farming ought to be investigated within a complete analytical framework, identifying all the direct and indirect effects to sustainability.
- (b) There is need for replicating the study of fish farming to the entire country to assess the efficiency of fish farm productivity and its sustainability.

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APPENDICES

APPENDIX I: TRANSMITTAL LETTER

THOMAS MASILA MUTUNGA
P.O. BOX 32 – 90131
TALA.
DATE.....

TO.....

Dear Sir/ Madam,

RE: REQUEST FOR DATA COLLECTION.

I am undertaking a research for my Master of Arts degree in project planning and management of the University of Nairobi. The study is on factors influencing sustainability of pond fishing farming projects in Matungulu Sub County.

Please answer the questions in the questionnaire honestly and completely. The information you give shall be treated with confidentiality and will be used for the purpose of research only.

Your assistance and cooperation will be highly appreciated.

Thank you in advance.

Yours faithfully,

THOMAS M. MUTUNGA
Reg. No: L50/74266/2012

SECTION (B) CAPACITY BUILDING OF PROJECT BENEFICIARIES

8. Have you attended any training organized by the Ministry of fisheries and other service providers?

Yes No

a. If yes please mention the name of training institution.....

b. How many times?

1 – 5 6 – 10 10 and above

c. Method of training used 1. Demonstration 2. Workshop/seminar

3. Other

d. Number of training received last year.....

10. In your opinion do you think the training and capacity building influences Sustainability of fish farming in this area?

Yes No

If yes please explain.....

11. To what extent has the training been useful to the sustain fish farming?

(i) Very useful

(ii) Moderately

(iii) Not at all useful

SECTION (C) FINANCIAL STABILITY OF PROJECT BENEFICIARIES

12. How did you raise money to start your fish farming?

(i) Own money (ii) Bank loan (iii) cooperative society loan

13.(a)Is fish farming your main source of Income?

YES NO

(b) if no lease state if you have other source of income apart from fish farming

.....

14. What is your involvement in the fish farming?

(a) Run the operation myself (b) my family assists me

(c) I have employed fish farm attendants

15. What is the frequency of your income?

- Daily
- Weekly
- Monthly
- Erratic

16. Estimate income per month from fish farming activities

- Below 1000
- 1001
- 5001
- 10001 and above

17. Estimate your income in Kshs. per month from other external sources other than Fish Farming project

- Below 1000
- 1001 – 5000
- 5001 – 10,000
- Above 10001

18. To what extent do you think external sources influences sustainability of fish farming in the area?

- (i) Great extent
- (ii) Low extent
- (iii) No extent

19. What is your opinion on the sustainability of the fish farming projects?

- (i) Sustainable
- (ii) Not sustainable

If not please explain why.....

20. In your opinion do you think the level of income of the fish farmers? influence fish farming sustainability.

Yes No

If yes please explain how.....

SECTION (D) LAND AVAILABILITY FOR PROJECT BENEFICIARIES

21. What is the ownership of the land tenure on which you do fish farming?

(i) Freehold (ii) Family land (iii) leasehold (iv) own land

22. In your opinion, do farmers in Matungulu Sub-County have adequate land for fish farming ?

YES () NO ()

23. If NO please explain.....

.....

24. Please indicate crops mostly planted by farmers

Maize ()

Beans ()

Vegetables ()

Coffee ()

Others (Specify).....

25. What other animals are kept by fish farmers in Matungulu Sub-County?

a) Dairy cattle ()

b) Local cattle ()

c) Local goats ()

d) others specify.....

26. In your opinion, do farmers prefer keeping the above named animals to fish To fish farming ?

YES () NO ()

24. Please explain your answer

.....

25. What size of land in acreage is utilized for crop farming?

1 – 5 6 – 10 11 and above

26. The following are some of the factors influencing pond fish farming, what is your level of agreement? Use a scale where 1-strongly disagree, 2-disagree, 3 – neutral, 4-agree and 5-strongly agree.

	1	2	3	4	5
Factors influencing pond fish farming					
Pond fish farming can make an important contribution to poverty alleviation address the problems of poverty and food security.					
Pond fish farming makes an important contribution in social well-being hence promoting social equity.					
Fish provides food of high nutritional value for households.					
When fish farmers combine agriculture and aquaculture they improve their food supply, increase their income and become self-sustained farmers.					
Pond fish farming boosts rural economic development.					
Living near perennial water bodies encourages pond fish farming.					
Pond fish farming is a major source of foreign exchange to the Government.					
Pond fish farming offers employment opportunities to many people.					

APPENDIX I11: QUESTIONNAIRE FOR THE FISH PROJECT OFFICERS

Kindly spare your time and answer the following questions based on your experience in the sustainability of fish farming projects in Matungulu Sub- County. All information will be confidential and for research purpose only.

1. To what extend have the fish farming projects been successful?

(i) Very successful Not successful

2. If not successful what do you think could have contributed to their failure?

.....

3. In your opinion do you think access to financial stability influences?

Sustainability of fish farming project?

(i) Yes (ii) No

If yes please explain how.....

4. Do you think financial stability can be addressed to ensure food security?

(i) Yes (ii) No

(ii) if yes please explain how.....

.....

5. How often are the fish farmers trained on the project activities?

(i) Weekly (ii) Monthly (iii) Annually

(iv) None of the above

6. What is the turn-up rate of the fish farmers during training session and for field Demonstrations?

(i) High turn up (ii) moderate turn up (iii) Low turn up

7. Do you think training of fish farmers is of any value toward

Sustainability of fish farming project?

(i) Yes (ii) No

(ii) Please explain your answer.....

.....

.....

8. (i) Do you think the training offered to the fish farmers influence the Sustainability of fish farming projects?

Yes

No

(iii) If yes please explain your answer.....

9. To what extent is the training useful to the sustainability of fish farming Projects

(i) Very successful

(ii) Successful

(iii) Not successful

10. (i) From your own assessment, do you think income level of the fish farmers influence sustainability of fish farming projects?

YES

NO

(ii) Kindly explain your assessment.....

Thank you for your time and participation

APPENDIX IV: KREJCIE AND MORGAN TABLE

Table for Determining Sample Size from a Given Population

<i>N</i>	<i>S</i>	<i>N</i>	<i>S</i>	<i>N</i>	<i>S</i>
10	10	220	140	1200	291
15	14	230	144	1300	297
20	19	240	148	1400	302
25	24	250	152	1500	306
30	28	260	155	1600	310
35	32	270	159	1700	313
40	36	280	162	1800	317
45	40	290	165	1900	320
50	44	<u>300</u>	<u>168</u>	2000	322
55	48	320	175	2200	327
60	52	340	181	2400	331
65	56	360	186	2600	335
70	59	380	191	2800	338
75	63	400	196	3000	341
80	66	420	201	3500	346
85	70	440	205	4000	351
90	73	460	210	4500	354
95	76	480	214	5000	357
100	80	500	217	6000	361
110	86	550	226	7000	364
120	92	600	234	8000	367
130	97	650	242	9000	368
140	103	700	248	10000	370
150	108	750	254	15000	375
160	113	800	260	20000	377
170	118	850	265	30000	379
180	123	900	269	40000	380
190	127	950	274	50000	381
200	132	1000	278	75000	382
210	136	1100	285	1000000	384

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

APPENDIX VI: COUNTY COMMISSIONER RESEARCH AUTHORIZATION



THE PRESIDENCY
MINISTRY OF INTERIOR AND COORDINATION
OF NATIONAL GOVERNMENT

Telephone: 21009 and 21983 - 90100
Address: countycommasaku@gmail.com
Fax No. 044-21999

OFFICE OF THE
County Commissioner Email
P.O. Box 1 - 90100
MACHAKOS.

When replying please quote

REF CC ADM 5/9 VOL I /86

27th April 2015

Deputy County Commissioners

MATUNGULU

RE: RESEARCH AUTHORIZATION

This is to confirm that Thomas Masila Mutunga of University of Nairobi has been authorized to carry out a research on "***Factors influencing sustainability of fish farming projects in Matungulu Sub County***" for a period ending 28th August 2015

Kindly accord him the necessary support to enable him achieve his goal.

Thank you


A.G. Kimani
For: County Commissioner,
MACHAKOS

APPENDIX VII: NACOSTI RESEARCH AUTHORISATION



NATIONAL COMMISSION FOR SCIENCE, TECHNOLOGY AND INNOVATION

Telephone: +254-20-2213471,
2241349, 310571, 2219420
Fax: +254-20-318245, 318249
Email: secretary@nacosti.go.ke
Website: www.nacosti.go.ke
When replying please quote

9th Floor, Utalii House
Uhuru Highway
P.O. Box 30623-00100
NAIROBI-KENYA

Ref: No.

Date:

15th April, 2015

NACOSTI/P/15/4701/5563

Thomas Masila Mutunga
University of Nairobi
P.O. Box 30197-00100
NAIROBI.

RE: RESEARCH AUTHORIZATION

Following your application for authority to carry out research on "*Factors influencing sustainability of fish farming projects in Matungulu Sub-County, Machakos County*" I am pleased to inform you that you have been authorized to undertake research in **Machakos County** for a period ending **28th August, 2015**.

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

On completion of the research, you are required to submit **two hard copies and one soft copy in pdf** of the research report/thesis to our office.


DR. M. K. RUGUTT, PhD, HSC.
DIRECTOR-GENERAL/CEO

Copy to:

The County Commissioner
Machakos County.

The County Director of Education
Machakos County.

National Commission for Science, Technology and Innovation is ISO 9001:2008 Certified