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Capacity Building Influence on Sustainability of Fish Farming in Matungulu Sub-County, Machakos County

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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 study sought to examine the influence of the project beneficiary's capacity building 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. The study established that 59.4 per cent noted that training was very useful in 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. The study further found that 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 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.
Key Words: Aquaculture production, Sustainability, Capacity building, Pond fish farming

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I. 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 [6] reveals.

In china, [48] 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. [33] 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 [13]. 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 [3], 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. [9] 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 [46].

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 [1]. Africa is an area of the world where chronic poverty and malnutrition continues to be widespread. [39], state that in Africa, there is strong evidence of high increase in poverty levels among fish workers.

In Malawi a study by [11] 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. [11] 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.

[38] 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. [18] 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 [40] 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. [40] 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 [40].

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 [14]. 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 [44].

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 [23]. 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 [10].

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 [43]. 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 [25] 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 Objective of the Study

The objective of this study was to establish the influence of capacity building on sustainability of fish farming projects in Matungulu Sub-County, Machakos County.

II. LITERATURE REVIEW

2.1 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 $300m^2$.

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 [7, 21].

2.2 Influence of Capacity Building 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. [8] 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.

[19] 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. [16] 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.

[4] 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 [12], 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 [2]. In ASIA, an assessment by [24] 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 [20] 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 [20].

In Kenya a study conducted by [26] 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 [8].

[48] 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. [30] 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 [45] 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 [28] 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.

According to [31] 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.

[22] 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. [36] 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. [42] 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.

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 [41]. 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 [41].

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 [17]. 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 [5]. Provision of adequate education levels will enhance capacity to service actively in community projects [6]. Education levels as brought to light by [47] 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. [32] in a study conducted in Senegal, established that non-formal education had a key role in promoting sustainability of community projects.

[29] 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. [37] 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.

[34] 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.

2.3 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.

2.3.1 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.

III. RESEARCH METHODOLOGY

3.1 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. The design enabled the researcher to conduct research among fish farmers and government officials in order to find out the influence of capacity building on sustainability of fish farming projects in Matungulu Sub-County.

3.2 Target Population

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. The target population for this study was 305, comprising of 300 fish farmers and 5 extension officers.

3.3 Sample Size and Sampling Procedure

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 [35]. [27] sample size table is universally accredited and provides a reasonable sample size depending on the size of the population on the study [27]. Therefore, out of the population of 305 target population, the sample size was 165 fish farmers and 3 MOFD Matungulu Sub County officials.

3.4 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 [15].

3.5 Data Analysis Techniques

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).

IV. DATA ANALYSIS AND DISCUSSION OF FINDINGS

4.1 Gender of the Respondents

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 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.

4.2 Age of the respondents

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 [38] 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 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.

4.3 Marital Status of the Respondents

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 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.

4.4 Level of Education of the Respondents

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 [38] 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 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.

The study correlates with that of [29] 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 [37] who found out that sustainability of food security projects was associated with level of education of project beneficiaries.

4.5 Type and Size of Family of the Respondents

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 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.

4.6 Ways of Raising Initial Capital

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 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.

4.7 Fish Farming as the Main Source of Income

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 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.

4.8 Involvement in Fish Farming

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 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.

4.9 Fish Farmers' Income

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 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.

4.10 Method of Training

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 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.

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.

4.11 Frequency of Training

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 Frequency of Training in Relation to Usefulness of Training

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

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 [26] 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 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.

4.12 Land Ownership

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 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.

4.13 Availability of Land

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 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.

4.14 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.

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.

V. CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusions

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

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.

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.

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 [38] 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 [38] 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.

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.

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. 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.

5.2 Recommendations

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) 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.
(iii) 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.
(iv) There is need for replicating the study of fish farming to the entire country to access the efficiency of fish farm productivity and its sustainability.

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