ECONOMIC ANALYSIS OF SEMI-INTENSIVE POND TILAPIAFARMING PROJECTS IN BAGAMOYO DISTRICT, TANZANIA

By

Kelvin Elisha Ngondo

A Dissertation Submitted in Partial Fulfillment of the Requirements for the Degree of Master of Science in Project Planning and Management (MSC. PPM) of Mzumbe University

2019

CERTIFICATION

We the undersigned, certify that we have read and hereby recommend for the acceptance by Mzumbe University a dissertation entitled***" Economic analysis of Semi-intensive Pond Tilapia farming projects in Bagamoyo district, Tanzania"***, for partial fulfillment of the requirements for the award of degree of Master of Science in Project planning and project management (MSc. PPM) of Mzumbe University

Signature

_____

Major Supervisor

SIGNATURE

_____

Internal Examiner

Accepted for the Board of Faculty of Social Sciences

SIGNATURE

_____

DEAN, FACULTY OF SOCIAL SCIENCES

DECLARATION

I Kelvin Elisha Ngondo, declare that this dissertation is my own original work and that it has not been presented and will not be presented to any other University for a similar or any other degree award.

Signature _____

Date _____

COPYRIGHT

ACKNOWLEDGEMENT

I would like to extend my sincere gratitude and appreciation to the almighty God through Jesus Christ for giving strength and good health throughout the time of course work and while I was doing this research. For sure his love and affection are immeasurable

I would also love to extend my appreciation and heartfelt gratitude towards my academic supervisor Dr. Proscovia Kamugisha (PhD) for her time, guidance, tolerance and for being patience with me throughout the time when I was doing this work.

Moreover I would also like to extend my gratitude towards my employers for allowing pursue this course, also the district executive director of Bagamoyo district for letting me work on his administrative area. To my friend Mr. Lyoba who is the officer in charge for fishery and aquaculture in Bagamoyo area for his support while I was collecting data.

Nevertheless, gratitude is extended towards all the fish farmers in Bagamoyo district who responded to my research questions notably Dr. Shukuru Kawambwa who is a member of parliament and a well-known fish farmer.

Lastly but not the least, I would also love to give thankful remarks to my family and friends for supporting me through out and to everyone who had his/her input towards completion of this work. May the Almighty God that I believe in bless them enormously

DEDICATION

I dedicate this work to my family and friends, to my employers, my instructors and to all those who believed together with those who did not believe that I could do it. May the Almighty God that I believe in bless you tremendously

LIST OF ABBREVIATIONS

BCR	Benefit cost Ratio
COGS	Cost of Goods sold
FAN	FAO Agriculture network
FAO	Food and agriculture organization
FTA	Food Tech Africa
MALFD	Ministry of livestock and Fishery development
NFP	National fisheries Policy
SPSS	Statistical Package for Social Sciences
TC	Total cost
TR	Total revenue
TZS	Tanzania shillings
UNESCO	United Nations, Educational, Scientific and Cultural organization
NPV	Net present value
ANOVA	Analysis of variance

ABSTRACT

Despite its high potential, fish farming is still facing a lot of problems. It is said that among the problems facing the fish farming sector includes lack of good quality seeds, lack of good quality feeds, few capacity building sessions, high initial costs together with little information regarding the production and economic profitability of fish farming especially in Tanzania.

On that regard, this study has a sole purpose of economic analyzing the profitability of semi intensive pond Tilapia farming in Bagamoyo district. The study involved a sample of 92 semi intensive pond Tilapia farmers and had the following specific objectives(i) To examine the effects of social factors on the profitability of semi intensive pond Tilapia Farming Projects (ii) To examine the effects of operating costs on profitability of semi intensive pond Tilapia farming Projects (iii) To examine the effects of on-farm practices on the Profitability of Semi intensive pond Tilapia Farming Projects (iv) To assess the viability of semi intensive Pond Tilapia farming Projects These objectives were analyzed through the use of Gross margin to find the profitability, multiple regression to find the effects of the mentioned factors on profitability and the NPV to find the viability of Semi intensive pond Tilapia farming in Bagamoyo District.

Gross margin results showed that Tilapia farming in the study area was 35.64% indicating that fish farming in the area was profitable. Furthermore regression results showed that profitability of Pond semi intensive Pond Tilapia farming was affected significantly by the Cost of feeds, size of the seeds and stocking density. NPV results showed that Semi intensive pond Tilapia farming is viable projects with NPV 175,393.11TZS in ten years with discount ratio of 10%.

The study recommends that there is a need of various actions to be taken by the government and all key stakeholders of fish farming and fishery in general. It also gives the limitation of the study together with the recommendations on areas of further studies.

TABLE OF CONTENTS

LIST OF TABLE

LIST OF FIGURE

CHAPTER ONE

1.1 Background

Freshwater Tilapia production national wise was estimated at 1522.80 tons valued at US$ 1327637.30 in 2016, in which almost 80% of it is consumed locally (FAO, 2017). According to MALF, 2016, Tilapia makes an important contribution as it accounts for 11% of the Lake Victoria catch. Fish farming is among the important economic sub sectors of Tanzania economy. The sector provides substantial employment, income, livelihood, foreign earnings and revenue to the country. Fish farming is a source of employment to about 20,000 farmers national wide whose production is dominated (75%) with Tilapia (MLFD, 2016). Moreover, Tilapia farming contributes to food production, especially of animal proteins, and achieving self-sufficiency in aquatic products supplies. It contributes to improvement of human nutrition.

Fish farming is practiced in East Africa especially Tanzania mainly for nutritional needs and to some extent for income generation (Shoko *etal*, 2011). Undoubtedly, Tanzania has a significant potential for growing its contribution of aquaculture, particularly by its extensive lake and river water resources, idyllic temperatures and accessibility to raw materials for feed.

Moreover, freshwater Tilapia is the most favored and most broadly consumed freshwater fish product in Tanzania. Being popular both locally and regionally, the water's edge price of Tilapia is (US$ 3-5) per kg. Being popular than other fishes in the region, the lakeside price of Tilapia (US$ 3-5) per kg is higher than that of Nile perch (US$ 2-2.5) per kg. The high prices have started to bring in imports of Tilapia fillets, with increasing quantities of Tilapia entering Tanzania from China. This shows that Tilapia Farming is having a great potential to succeed (MALF, 2016)

Fresh Tilapia is the preferred and most widely consumed fresh fish product in Tanzania. Due to its high demand from abroad, Tanzania had to ban tilapia Exports as a food security measure (MALF 2016). Tilapia fish are mostly consumed freshly, but there are other forms that are also being used including smoking and salting that

are frequently used by island communities that have no quick means of transportation to the mainland markets.

According to Di Palma (2017), Tanzania increase the availability of tilapia fish in the country bay developing brood stock of higher quality from the native Tilapia. By doing so, Tanzania would have its own source and supply of fingerlings rather than merely depending on non-native specieshenceforthgrowing the production of Tilapia through fish farming.

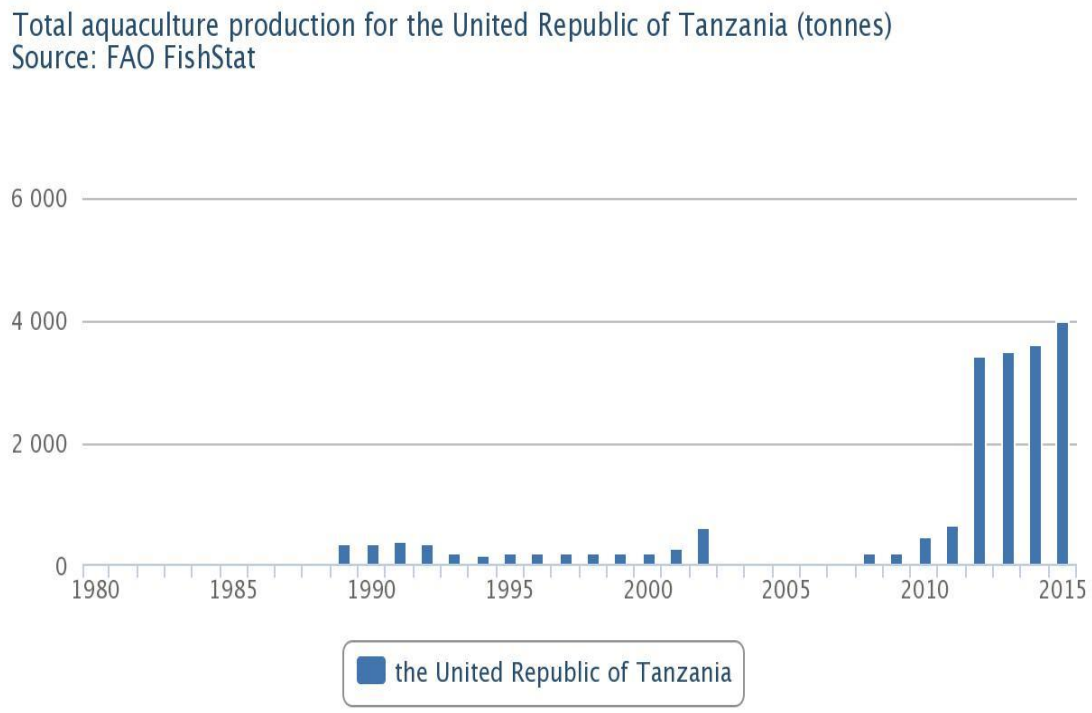
Tilapia fish are predominantly appropriate for fish farming due to their tolerant biological nature. They are able to tolerate various environmental conditions; they have a fast growth rate and have a low system of requirements. That is why in Tanzania they are the most farmed fish, and are second to Carp as the world's most frequently farmed fish (FAO, 2012)

1.2 Sub-Sector Analysis

Tilapia farming is one the most farm practice and one of the most important fish farming around the world. In 2016, Tilapia contributed about 8% of total fish farmed globally (FAO, 2017). World Tilapia farming has grown by 12% annually from less than a half a million in 1990 to over 5 million tons in 2010, world with China being by far the largest producer accounting for more than 40% in 2016,

Egypt is the major producer of Tilapia farming in Africa that contributed about 875.5 metric tons in the world Tilapia production in 2016. Together with Egypt, Uganda and Nigeria make up 95% of total Tilapia production in Africa. Studies show that there is a greater potential of Tilapia farming in Africa than any other part in this world. According to the fisheries division in Tanzania, production of freshwater fish is estimated at 1522.80 tonnesforTilapia,valued at US$ 1327637.30 while the actual productionofrainbow trout was 7.0 tonnes in 2004 worth US$ 18308.63. production figures for seaweed stood at 1500 tonnes of dry weight that were produced in the marine waters mainly for export from which the earnings stood at US$ 209241 where by then 1 US$ equaled to 1147 TZS. Figure 1 shows the production from aquaculture from 1980 to 2015.

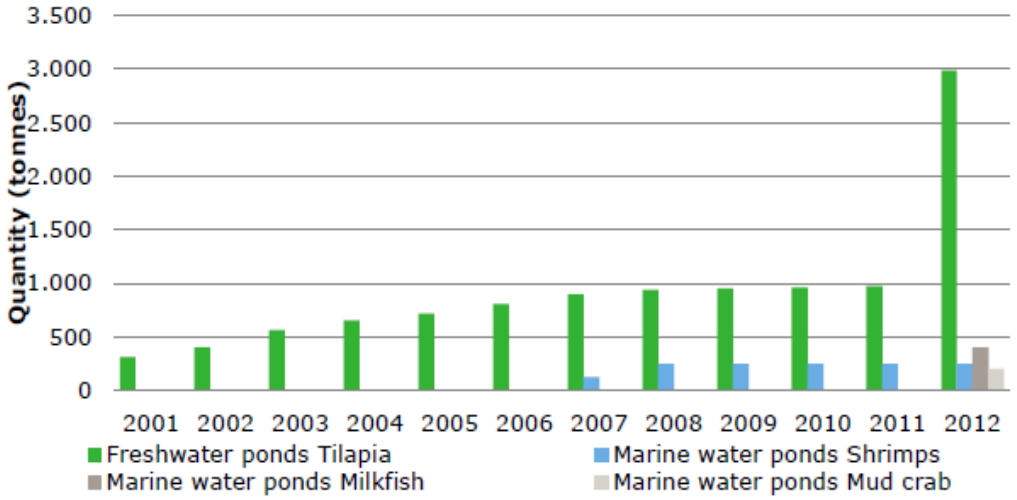
Figure 1.1: Fish farming in Tanzania (1980 – 2015) (Metric tons)



Source: FAO 2016

Tilapia is the most farmed fresh water specie (75%) in Tanzania followed by catfish (Delloite, 2015; MALF, 2016). Tilapia production amounted to about 3,600 tons in 2016 (FAN, 2016). Tilapia is suitable for farming because it is able to tolerate different environmental conditions and its growth rate is relatively fast and has low system of input requirements (Di Palma, 2018). Figure 2 displays the production trend of Tilapia fish farming by type of water (Marine vs. freshwater) in Tanzania

Figure 1.2 Fish farming production by species 2016



Source: MALF 2016

Tilapia farming is still a subsistence business characterized by family circle ownership. It is widely done in small scale having a stocking density of three to five fingerlings per square meters. The average area of the fish ponds is 300 m2 (15x20 meter). These ponds are able to produce 482 to 826 kg/pond/production cycle for a 6 to 9 months growing period. The average yield is 654kg which is way below the standard of 800kg/pond/production cycle (Kyelu, 2016). The main areas where the fresh water Tilapia is farmed are in the South, especially the Ruvuma (43%), Njombe (14%) and the Iringa (more than 11%) region (FTA, 2014).

The escalating drift of Tilapia importation in the country shows that there is a vacant market of Tilapia fish. It is estimated that the importation of Tilapia has shifted from 3000 metric tons to 6000 metric tons in a period between 2010 to 2015 (MALF, 2016).

Also According to MALF, 2016, the production of Tilapia faces various problems that leads to low production of Tilapia. These problems include lack of good quality fry and the excess demand over the supply resulted to low quality fry with higher levels of mortality. Another constrain is the supply of good quality fish feed. This increases the costs of production and reduces the return as most fish had stunted growth.

Moreover, the rapid increase in population of the world has resulted in a huge increase in the demand for animal protein, which is essentially higher in quality than plant protein (Awoyemi, 2011). According to the studies done by scientists from FAO in 2015, 29% of the world fish species are currently on the collapse due to fishing pressure. The study that was done projects that; all major commercial fisheries will collapse in the next 50 years if the trend is not reversed. There comes the need for fish farming where Tilapia is one of the most cultured specie.

Table 1.1: Estimated Fish consumption in Tanzania from 2010-2015 (000')

Category	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**
Population size	40,000	40,000	44,929	44,929	44,929	44,929
Imports of fish/fish products for direct human consumption(kg)	2,759.8	3,216.7	4,885.7	6,642.7	6,792.3	6,326.7
National fisheries production(kg) (capture production)	347,157	341,066	373,214	375,160,	365,974,	362,645
Aquaculture production (Tilapia&others)	-	222	3,628.5	2,977.5	3,809	3,632.9
Export of fish/fish production in kg	39,771.8	37,996.4	41,394.3	38,573.6	43,283.6	40,541
% of aquaculture to total capture	-	0.07%	1%	0.8%	1%	1%
National fish consumption (kg)	310,144.9	306,228.2	340,217.5	346,066.4	333,220.9	332,063.8
Per capital fish consumption (kg)	**7.8**	**7.7**	**7.57**	**7.7**	**7.4**	**7.39**

Source: MALF (2010-2015)

Data from Table 1 indicates that as days go by number of people increases in Tanzania resulting to high demand of fish and fish products. The imports of fish are seen to be increasing reaching to around 6 million tons in 2015. Fish from capture fishery has also been seen to decrease steadily leaving fish farming as the essential practice to cover the demand of fish so as to increase the per capital fish consumption from 7.39kg to 18kg as recommended by FAO.

The United Republic of Tanzania has made efforts to ensure that fish farming is profitable and sustainable in Tanzania. Several institutions responsible for fisheries research, education and training have been formed.

The Tanzania Fisheries Research Institute (TAFIRI) has overall responsibility for all the research on fisheries; it was established by the act of parliament No. 6 of 1980 to

promote, conduct and co-ordinate fisheries research in Tanzania. The institute has four centers and one Substation. Mwanza centre and Sota Substation in Lake Victoria, Kigoma centre on Lake Tanganyika, Kyela centre on Lake Nyasa and Dar essalaam centre on the Indian ocean. Currently TAFIRI is under the ministry of Livestock and Fisheries.

Establishment of the college of agricultural science and fisheries and fisheries Technology in 2015 formerly known as the faculty of Aquatic sciences and technology in the university of Dar es salaam that is responsible for facilitating programs for the undergraduate and post graduate, teaching the non-degree programs, research and public service in basic and applied aquatic sciences in which fish farming is one of them.

Establishment of department of Animal, Aquaculture and Range sciences at the Sokoine University of Agriculture. The department was established in 1970 as Department of Animal science and Production (DASP) under the then faculty of agriculture of university of Dar es salaam and retained its name with the establishment of Sokoine University of Agriculture in 1984. It was then renamed Department of Animal, aquaculture and Range science (DAARS) following university wide restructuring in 2015. The Department is actively involved in teaching, research,, outreach and production in fields of animal husbandry, range management and aquaculture in which fish farming s one of them.

Establishment of Fisheries education and training agency (FETA) by merging the two fisheries institutions that is the Mbegani fisheries development center and Nyegezi fisheries institution (NFFI) in line with the Fisheries master plan (URT) the two institutions are under the ministry of livestock development and fisheries and are fully accredited by the national Technical education aimed at providing education, training and research on matters concerning fisheries and aquaculture

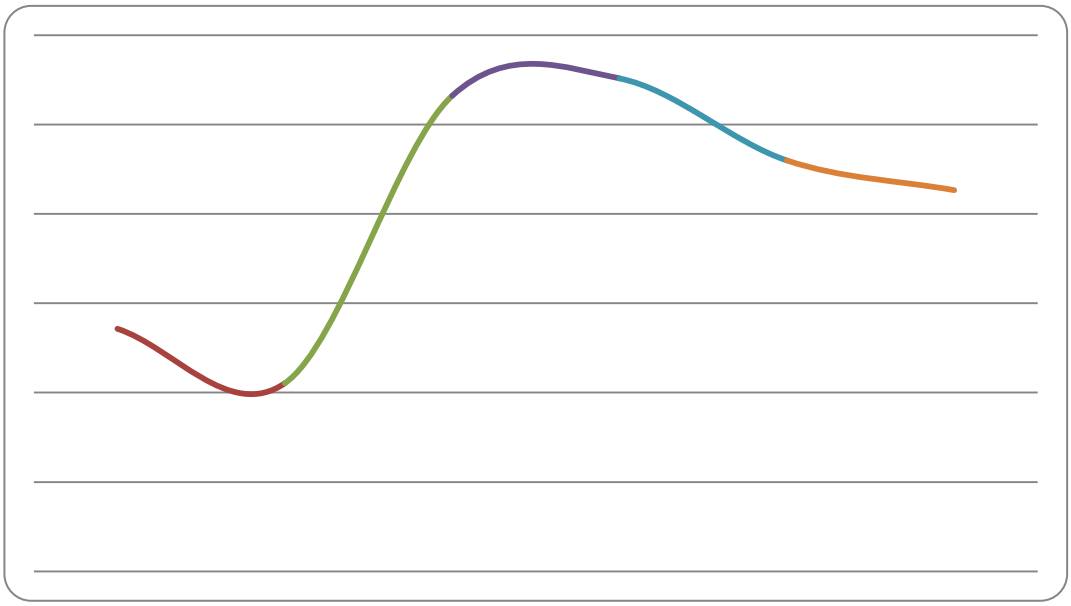
Clearly, Tanzania has considerable potential for increasing the contribution of aquaculture, given the extensive lake and river water resources, ideal temperatures and availability of raw materials for feed. Until now, despite the latter mentioned efforts by the Government, and considerable investments, the Government has

struggled to establish the right policy and better environment for private sector investment in Fish Farming to take off. (MALFD 2016)

1.3 Problem Statement

Fisheries production has been on decline state as shown in figure 1.3. In that respect, fish farming development has become vital to meet the production gap in order to supply the nation with fish protein and generate economic benefits through responsible and production of fish, in which Tilapia is appropriate. Despite having a huge potential of being a profitable business, yet its contribution to the economy of the country is less than 2% in other words, it can be said that fish farming is facing a stunted growth.

Figure 1. 3: National fisheries production 000' (kg) (capture production)



Source: MALF 2016

Several studies have been conducted in the Tanzania about matters related to Tilapia farming, but most empirical studies such as Kyelu (2016), Mwenesi (2016), and Chenyambugaetal (2014) have been done on Tilapia in various aspects. Kyelu (2016) analyzed socio-economic and environmental effects of Tilapia urbanfarming .Mwenesi (2016) conducted a research on the determinants of performance in Tilapia farming Projects in Dar es Salaam while Chenyambuga *etal* (2014) conducted a

research on productivity and marketing of Nile Tilapia cultured in ponds small scale farmers in Mvomero and Mbarali districts, Tanzania.

Despite all these studies being done, yet there is currently insufficient knowledge and few documented studies about the value chain, interlinkages of the value chain among sectors, potential for sustainable fish farming development, the business opportunity in Tilapia fish farming and inadequate sensitization to fish farming investors on opportunities in Tilapia Fish Farming. Before embarking on improvement of productivity of fish farming, it is important to assess the production performance and economic profitability of Tilapia (Chenyambuga*etal*, 2014). Therefore, this study was conducted with the aim of economic analyzing profitability of semi intensive pond Tilapia Farming in Tanzania, taking Bagamoyo District as a case study area.

1.4 General Objective

The study aims at economic analyzing profitability in semi intensive pond Tilapia farming Projects in Bagamoyo District.

1.5 Specific Objectives

i. To examine the effects of social factors on the profitability of semi intensive pond Tilapia Farming Projects

ii. To examine the effects of operating costs on profitability of semi intensive pond Tilapia farming Projects

iii. To examine the effects of on-farm practices on the Profitability of Semi intensive pond Tilapia Farming Projects

iv. To assess the viability of semi intensive Pond Tilapia farming Projects.

1.6 Hypothesis/Research Questions

By linking the concepts from theoretical literature review, empirical literature review and conceptual framework, hypotheses are developed. Hypotheses are important in

testing the validity of variables of the conceptual framework. This study tested the following hypotheses;

1.6.1 Hypotheses

H_{o1} Social factors do not affect profitability of semi intensive pond Tilapia farming.

Ho_2 Operating costs do not affect profitability of semi intensive pond Tilapia farming.

H_{o3} On-farm practices do not affect profitability of semi intensive pond Tilapia farming.

H_{o4} Semi-intensive pond Tilapia farming is not a viable enterprise

1.7 Significance of the Study

This study has a focus on the economic analyzing factors affecting profitability of semi intensive pond Tilapia Farming in Tanzania, a case of Bagamoyo District. The study findings and recommendations shall help both farmers and governments to implement policies that can revitalize fish production and encourage other stake holders 'participation on food security initiatives. Moreover the results showing the factors affecting profitability of semi intensive fish farming shall identify areas where the Government can intervene so as to reduce the costs of production by providing subsidy.

Information on profitability and economic viability of Tilapia farming is crucial for investors when assessing the feasibility of fish farming investments. Unfortunately, such information has been scarce in Tanzania

1.8 Scope and Limitation of the Study

Economic analyzing factors affecting profitability of semi intensive pond Tilapia farming has a great impact on improvement of Tilapia fish farming of in the particular area and in Tanzania as a whole. The study would enable the farmers to know their level of investment together with the areas in which the stakeholders should concentrate in so as to improve fish farming industry.

The study covers the semi intensive pond Tilapia farmers in Bagamoyo District. The farmers in question are those culturing the Tilapia since those species are the ones that are widely farmed in Tanzania. Information collected includes the factors grouped into, on farm practices, economic costs and social aspects of the farmers.

1.9 Organization of the Report

This Report is made of five chapters, chapter one provides background information about profitability of Tilapia farming starting with the global level, Africa, country level and the study area level. The chapter also provides information about significance of the proposed study and scope of the study.

Chapter two contains detailed information about Tilapia Farming in Tanzania and proposed study area; it also provides detailed review from various studies by other authors about the proposed study. It also gives details on the theories related to the study together with the conceptual framework.

Chapter three is about the methodology used in the study. It gives the details of study design, description of the study area, sampling and the sampling techniques, data collection and the methods applied. Chapter three also gives information in detail about how the data were analyzed, presented and the adherence to the ethical issues in the course of conducting this study.

Chapter four is concerned with data analysis and presentation of the study findings; it gives detailed information about type and analysis conducted as well as various tests on the set hypothesis, together with the detailed discussion regarding the findings of the study.

Chapter five gives details on the conclusions based on the research findings, it also gives recommendations basing on the results together with the policy implications. Moreover it gives the limitations of the study and the recommendations on the areas for further studies

CHAPTER TWO

2.1 Literature review

This chapter gives and critical review from different literature in order to provide framework the problem to be studied. Moreover, an analysis from different writings which include journals, books, articles, previous studies and different reports shall be used to focus on the factors that affect production in semi-intensive pond Tilapia Farming.

Literature review is used to find similarities and difference in arguments together with the recommendations from other writers regarding the problem under this study. This section has theoretical part that gives the theoretical perspective of other writers and the empirical part that gives critical analysis which is to be found from other writings.

2.2 Definition of Key Terminologies

2.2.1 Fish Farming (Aquaculture)

Aquaculture means the practice of breeding and raising aquatic organisms in a controlled aquatic environment (NFP, 2015). In other words, fish farming is the art and science of raising fish in a confined environment while providing them with the necessary conditions for their growth.

2.2.2 Semi-Intensive

This is the type of fish farming practice that uses moderate levels of inputs in fish production. It may also include the use of fertilizers and/or supplemental feeds. This means higher labor and food costs but higher fish yields more than compensate for this usually. (Tunde*et al*, 2015). This culture involves raising fish at a stocking density of 1-2 kg per square meter. It also involves the use of natural and formulated feeds.

2.2.3 Tilapia

According to Sea food fact organization (2017), Tilapia is the name that is comm. on toabout a hundred species of cichlid fish from the tilapiine cichlid tribe.Majority of Tilapia are from freshwater bodies living in shallow streams, ponds, rivers and lakes

and rarely found in the water that is brackish. Historically Tilapia have been and has been of major importance in fishery and fish farming in Africa and still it has an increasing importance in fish farming.

Nile Tilapia

Figure 2.1 Tilapia

Source: Wikipedia

2.2.4 The Concept of Profitability

According to Hofstrand (2009) Profitability is the primary and the main goal for any business venture. Without being profitable the business will not survive in a long run. Therefore it is important to measure the current and the past profits and profitability if the business in line with the projection of the future profitability.

Therefore the profitability is measured by using the business incurred expenses which are the cost of the resources used up or consumed by the business activities and the returns in terms of income that comes from the sales.

2.2.5 Reasons for Computing Profitability

According to Hofstrand (2009) whether one is recording profitability for the current or past periods, projecting profitability for the coming period, is important measure for the business to be successful. Any business that is not profitable cannot survive.

Increasing profitability is one of the most important tasks of fish farmers. It is important to find out if Fish farming makes profit enough for the financial institution to support them by providing support to the farmers. Moreover for the business to grow, it has to be able to make enough profit for it to expand.

2.3 Theoretical framework

2.3.1Catch-and-hold theory

According to FAO (2012), this is the version of origin of fish farming as developed by Rabanal in 1988. It relates the beginning of fish farming. Since way back, fishes and other products from aquatic sector have always been of high esteem for the big empires.

At the same time, it was accustomed to build water areas as source of water, recreation or a means of defense around castles. Such areas were not really intended for rearing fish but some rulers demanded fish, regardless of the season. Therefore the responsible officers around them had to provide the means to supply them with fish even in winter.

Due to that necessity, the practice has developed to stock fish caught from the wild into the constructed areas around the castles and communities. It turned out that some fish stocked were able to survive and others perished. In the course of time the species that survived and grow were selected for this catch-and-hold system of providing fish.

As a further development, stocking the right amount and kind of fish and feeding them when necessary also developed resulting in the actual fish farming. This theory provides a historical overview on how fish farming activities emerged and points out the opportunities and challenges which were faced. The theory equips farm managers with good experience and technical knowledge of the Fish farming activities

2.3.2 Innovations Theory of Profit

This theory of profits explains that economic profit arises because of successful innovations introduced by the entrepreneurs. As it was explained by Joseph Schumpeter (1934) that the main functions of the entrepreneur is to introduce innovations in the economy, profits are the reward for performing those actions. Profits emerge due to successful innovations, either costs fall below the prevailing price or the entrepreneur is able to sell more and at a better price than before. If laws and policies allow the fish farmer in this case is able to get his new innovations, he will continue to earn profit for a longer period.

This theory has been subjected to the criticism on the following grounds that this theory concentrates only on the innovations for occurring profits. But there are so many other factors that may influence profits in addition to innovations. Moreover according to the theory, it is the capitalists that are the risk bearer, but in real sense it the entrepreneur who bears the risks. Also the theory takes a narrow view of the functions of the entrepreneur. The function of the entrepreneur is not merely to introduce innovations, but he is equally responsible for the proper organization of the business.

Relating to this research, Semi intensive pond fish farmers are required to consider new innovations in pond fish farming and also adapt to other farming systems for them to benefit more. Considering the biological factors, the species selected for fish farming should be well selected and maintained. The farmer should also ensure other factors such as competitors' behavior, innovations, consumers' behavior (like taste, an type of fishes etc.), government policy interventions, wage and labor policies, income of people, movement of prices, technological changes, natural disturbances are also be considered so as fish farming becomes sustainable and profitable.

2.3.3 Theory of Performance

The Theory of performance (ToP) develops and relates six fundamental concepts to form a framework that can be used to explain performance as well as performance improvements. To perform is to produce valued results. A performer can be an individual or a group of people engaging in a collaborative effort. Developing

performance is a journey, and level of performance describes location in the journey. Current level of performance depends holistically on six components I.e. context, level of knowledge, level of skills, and level of identity, personal factors, and fixed factors. Three axioms are proposed for effective performance improvements. These involve a performer mindset, immersion in enriching environment, and engagement in reflective practice (Elger, 2008)

Relating to this research the theory of performance gives a guide on how the semi intensive Tilapia pond fish farmers should equip themselves in order to achieve valued results. When the farms perform better, it also increases the chances of obtaining higher profits and thus making fish farming viable. Moreover by considering the six factors mentioned above, it makes it easy for the farmers to identify the factors that affect the profitability of his farm thus working on them accordingly

2.3.4 Production Theory

Production is basically an activity of transformation which connects factors of production known as inputs to get outputs. Inputs are things that a firm employs for use in its production process. On the other hand, output is what comes out of a production process. Therefore production theory explains the relationship between the inputs and the outputs.

Justification and rationale of production theory to this study comes in the way factors of fish production (inputs) such as cost of seeds, cost of feed, cost of labor, cost of fertilizers, affect fish farming hence also affecting profitability in semi intensive fish farming.

2.4 Production Function

A production function is the link between levels of input usage and attainable levels of output. The production function formally describes the relation between physical rates of output and physical rates of input usage. With a given state of technology, the attainable quantity of output depends on the quantities of the various inputs employed in production. (Thomas and Maurice, 2013)

A production function is a mathematical calculation which shows the level of output that can be produced from a given combination of inputs. Is a tool of analysis used in explaining the relationship of inputs and outputs. It holds that production of a given commodity depends on certain inputs. Moreover it explains the maximum amount of output that can be produced from any specified set of inputs, given the existing technology.

Besanko and Braeutigam, (2012) defines inputs as resources, such as labor, capital equipment, and raw materials that are combined to produce finished goods. They also define factors of production as resources that are used to produce a good and Output the amount of a good or service produced by a firm.

In this study, the production function is explained mathematically in the following form Y=f (K, L), where Y refers production, given in terms of percentage and f (K, L) refers to function of inputs which are socio economic costs that leads to fish production. It is through the production of fish, where the Profitability of Fish farming would be obtained.

The study will focus on analyzing the profitability of Tilapia fish farming by identifying social economic costs for production of Tilapia in farms and the revenue obtained so as to check if fish farming enterprise is a making profit. Therefore in this perspective, the inputs will independently relate to Tilapia production (output).

2.5 Empirical Literature Reviews

2.5.1Profitability and Viability of Semi Intensive Pond TilapiaFarming

The researches on profitability and viability for semi intensive Tilapia farming in Africa are widely documented. Osondu and Ijioma, (2014) conducted research on analysis of profitability and production determinants offish farming in Umuahia Capital Territory ofAbia State, Nigeria. Specifically the study examines Cost and return analysis of fish farming in UmuahiaCapital Territory and factors influencing production of fishes. The result shows that, Annual gross margin and net return from fish production was US $ 265,760.11 and US $225, 791.98 respectively. Fish farming had a BCR of 2.20 and RORCI of 90%.

Also according to Tunde*et al* (2015) conducted research on economic analyze of Costs and Return of Fish Farming in Saki-East Local Government Area of Oyo State, Nigeria. The study examined economic analysis of fish farming in Saki-East Local Government Area (LGA) of Oyo State, describe the socio demographic characteristics of fish farmers in the study area, determine the cost, profitability and viability of fish farming and lastly to determine the factors influencing fish production. The results of a Cost and Return Analysis of the fish farming in the study area showed that the total revenues was US $ 672.90per cycle, whereas total cost was US $ 356.27 per cycle. This implies that fish farming was profitable and is expected to continue to operate. In addition, Benefit Cost Ratio (BCR) was 1.9, the fish farming is therefore considered to be profitable. The rate of Return on Investment was 0.9.

Also, Olaoye, *et al* (2012), conducted research on profitability And Viability Of Fish Farming Enterprises using Government Credit Agency Loan In Ogun State Of Nigeria. Specifically focused on describe the socio-economic characteristics of the fish farmers in Ogun State, to determine and compare the profitability level of beneficiaries and non-beneficiaries of NACRDB loan. Highlight constraints militating against fish production in the study area. The cost and return analysis indicated that, total variable cost was US $ 3845.84, while the total revenue was US $ 9490.48, which gives a net farm income of US $ 1184.74. The profitability ratio gives a benefit cost ratio of 1.14. This indicates profitability ofsmall scale fish farming in the study area. The regression analysis showed that the best fitted model is the doublelog function which recorded a coefficient of determination (R2) of 0.39. Constraints hindering fish farming in thestudy area include high cost of feeding, poor marketing channel and inadequate capital. It is recommended thatfarmers should group themselves together as cooperators so as to have access to credits and inputs at cost.

Additionally, Kyelu (2016) conducted research on analysis of socio-economic and environmental effects ofurban fish farming in Dar essalaam. The aims of the paper was to analyze the profitability of urban fish farming, determine the contribution of urban fish farming on household income, analyze the effect of urban fish farming on

employment creation and last is to determine the effect of urban fish farming on household food security. In conclusion, urban fish farming in general face a number of constraints that hinder the development of sustainable and profitable fish farming. Results indicate that urban fish farming are operating profitably. The gross margin obtained by Tilapia farmers ranges from TZS 658 000/= to 2 515 350/= per pond per production cycle.

2.5.2 Socio-Demographic Characteristics of in Semi Intensive Pond Tilapia Farmers

There are various researches that have been conducted on the socio-demographic characteristics in Africa. According to Adewuyi (2010), descriptive analysis of socio economic characteristics of respondents in Ogun State, when analyzing profitability of fish farming in Nigeria, it was evident that male fish farmers constituted about 87.7% as compared to the female farmers that represent 12.3%, indicating the dominance of men in fish production in the study area. The fish farmers whose age falls between 31 – 40 years constituted the majority. On the whole, 96.3% fall into the economically active group of 20 – 50 years. The result of the marital status shows that majority 63.7% of the fish farmers were married. It is also evident that most of the respondents (71.9%) were part time fish farmers. A large proportion (68%) of them fish farmer had formal (tertiary) education and finances their fish production through personal savings. The farmers can therefore be said to be literate since only small proportion of them had no formal education. The distribution of the household size indicates that the household size ranged from 2 to 13 while the average fish pond size was found to be 355m^2.

Moreover, According to Issa*et al*, (2010), who conducted research on analysis of Profitability of Fish Farming in Ogun State.The study describes the socioeconomic status of fish farmers, determine the profitability of fish farming and examine the determinants of fish output in the study area. Based on the value of benefit indicators, it can be concluded that fish production in the study area. The study recommends that Government participation in fish farming is required to boost the quantity of fish available for consumption and females need to be encouraged to

participate in fish farming in the area as a means of augmenting their income and improve their standard of living.

Also Bukenya and Hyuha on their study in the Market Assessment and Profitability Analysis of Aquaculture Enterprises in Uganda, found that Only 36 percent (n=72) of the farmers interviewed had fish farming as their main source of income. The other 64 percent (n=128) farms had a wide range of other livelihood activities. Although some of the farmers interviewed had been involved with fish farming for many generations, there appeared to be an increasing number of people who were starting to practice aquaculture. Although many farmers regarded it as source of income, it is not regarded as important as other sources of income, rather one that could be used sporadically. More farms cultured Tilapia and catfish compared with any other fish species. When asked to indicate the species grown for their last harvest, the majority (82 percent) reported Tilapia. The majority (61 percent) of the farms solicited additional labor (1 to 5 people) during harvest and most of this additional help was paid labor.

2.5.3 FactorsAffecting Profitability in Semi Intensive Pond TilapiaFarming

There are researches that had been done on the factors affecting the profitability of semi intensive Tilapia farming in Africa. Zech (2014) conducted research on competitiveness of Tilapia and catfish farming in Mbale sub region. The regression analysis revealed a number of factors that were significant and positively influencing the competitiveness of both Tilapia and catfish as years of experience, level of education, number of extension visits, pond size and membership to farmer groups. Provision of better performing fish breeds, increased extension service delivery, easy access to quality feed, improved access to markets, farmers' operation as farmer groups could increase fish farming competitiveness as an enterprise

Moreover, Okpeke*et al* (2015) focused on the Profitability of Fish Farming in Warri South Local Government Area of Delta State, Nigeria. Specifically the study focused on describe the socio-economic characteristics of the fish farmers, identification predominant types of fish pond structures and type of culturing systems, to determine the costs and returns of fish farming in the area and lastly is to identify constraints

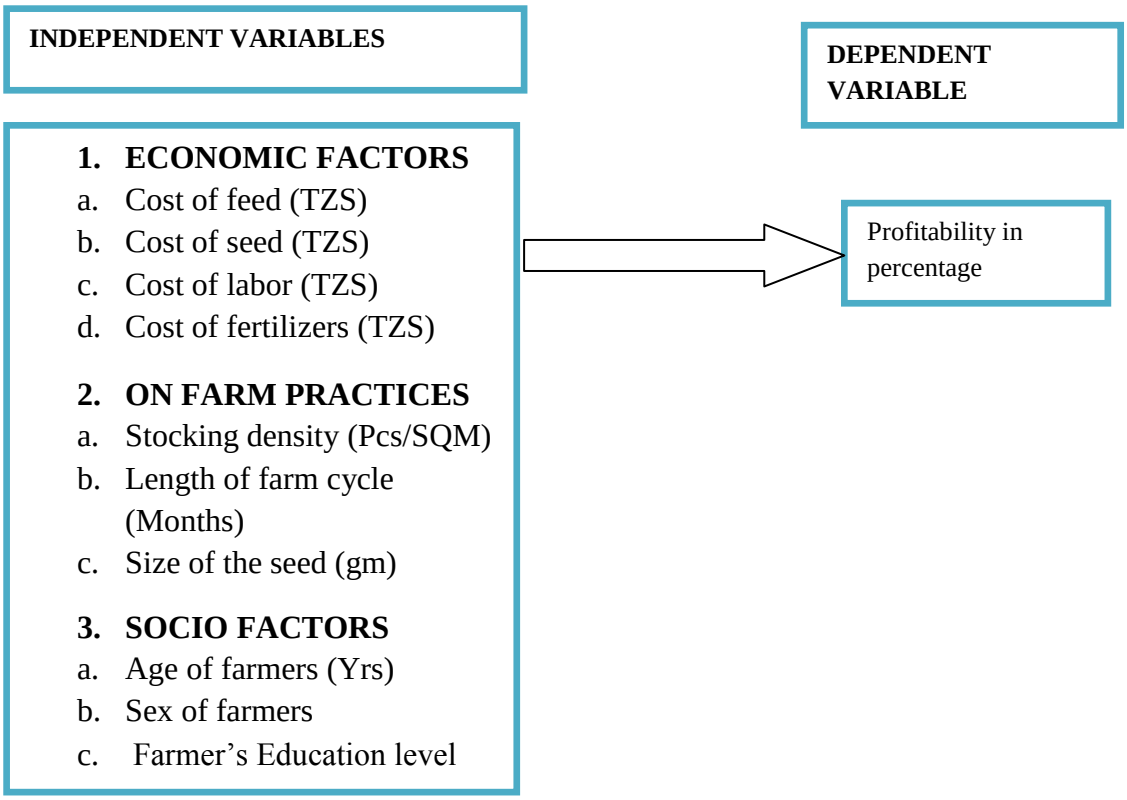
affecting fish farming in the study area. The rate of returns on fish farming was 0.92. This indicates that for every N1.00 invested, 92 kobo was gained by the respondent and an operating ratio of 0.44, fixed ratio of 0.16 and gross ratio of 0.61 which was positive and less than one, which implies that fish farming, was highly profitable in the study area. The study recommend that, the high cost of fish feed has been corroborated by previous findings of divers study on fish farming and production. The cost of pond construction was another great limitation which the government could intervene by training more extension agents on sourcing least cost pond construction materials and also to acquire competence and skill in the construction of ponds.

Nevertheless Mwenesi(2015) conducted research on the determinants of performance in semi intensive Tilapia aquaculture projects. Specifically the study examine enterprise budget Analysis of 600 m2 ponds (as a base case scenario) in one year of operation, Breakeven Analysis of 600 m2 ponds (as a base case scenario) in one year of operation; to assess the effect of net returns per one cubic meter and breakeven above total cost of varying feed prices, to assess the effect of net returns per one cubic meter and breakeven above total cost of varying survival rates and to assess the effect of net returns per one cubic meter and breakeven above total cost of varying farm size. The research findings revealed that the feed prices, survival rate, and farm size have a significant effect on performance of SITA projects and therefore should be optimized in order to attain a profitable and sustainable SITA projects. A higher feed prices decrease net returns and increases the breakeven price per kilogram. It was also evidenced that, the higher the survival rate the higher the net returns and the lower the breakeven prices per kilogram. The study recommends that SITA farmers should conduct a detailed financial plan prior to establishing SITA projects, farmers should establish good quality fish feeds sources with reasonable prices prior to establishment of the farm, farmers should be conversant of all the biological aspects of Tilapia farming in order to increase survival rate of his/her stock and lastly farmers should locate the farm in the area where there is a potential of enlarging his/her farm in future.

2.6 Conceptual Framework

Based on the reviewed literature different factors have been identified to have effects on Tilapia farming profitability. These factors have been categorize into three aspects that include the following, social factors; in social factors age, sex an education level of the farmer, would be looked at how do they affect profitability of semi intensive Tilapia pond fish farming. Secondly, the economic factors that are, the cost of feed, cost of seed, cost of fertilizers and cost of labor would also be analyzed. Third group is the on farm practices that are the length of the farm cycle, the stocking density and size of the seed.

Figure 2.2 Conceptual framework



Source: Researcher's model 2018

From the figure (2.1), fish productivity was termed as a dependent variable with economic factors, on farm practices and social factors as the independent variables. These relations are explained as follows,

2.6.1 Fish Profitability:

This was conceptualized as a dependent variable related to various independent variables. The relation between them was tested using the regression analysis basing on the hypotheses set.

2.6.2 Economic Factors;

These are the independent variables that have economic effects on the fish farming practices. They are the variables that are easily put into money's worth. These factors include the amount of money used to pay for the feed, seed, labor and fertilizers. All these factors were put in Tanzanian shillings (TZS) as the unit of measure.

2.6.3 On Farm Practices

These are the ways into which a farmer goes through when doing fish farming. They are the practices that are deemed to have effects on the production of fish thus affecting the profitability in general. These include the following;

a. **Stocking density**; in this research, stocking density is referred to as the number of fish stocked per square meter of the pond at the beginning of the farm cycle.

b. **Length of the farm cycle**; this is referred to as the time (months) taken from the beginning of the farm cycle to the time of harvesting.

c. **Size of the seed**; this is the weight in grams of the fingerlings that the farmer is using at the beginning of the farm cycle.

2.6.4 Socio Factors

These socio factors comprises of the age of the farmers, sex of the farmers and the farmers education level, and are elaborated as follows

a. **Age of the farmers**: age of respondent is defined as the number of years one had lived as at last birthday by making reference to the census night (URT, 2013). Therefore this is the age of the farmer by the time he was answering to the questionnaire given by the researcher.

b. **Sex of the farmer**: this is the state of being a male or female

c. **Farmers education level**; These are the education programs that can be grouped into an ordered series of categories which represent broad steps of educational progression in terms of the complexity of educational content (UNESCO, 2011). That means the more advanced the programs, the higher the level of education (William, 2017). In this study the levels of education that were in question included, those who hadn't gone to school, primary level, secondary level, certificate level, diploma level and graduate level.

2.7 Analytical Technique

This research would make use of production function to analyze the factors affecting the profitability of Tilapia fish farming. by the use of Regression technique data would be analyzed to identify the factors affecting the profitability of Tilapia pond fish farming in the study area, using the formula and codes as follows;

$$Y=f(X1, X2, X3 \dots X10, U) \quad (1)$$

Where;

Y=Profitability of a farm in %

X1= cost of seed in TZS

X2=Cost of labor in TZS

X3=Cost of fertilizer in TZS

X4=cost of feed in TZS

X5=Age of farmers in years

X6=Sex of farmers

X7=Farmers education level

X8=Length of farm cycle in months

X9=stocking density in pcs/sqm

X10=Size of the seed in grams

U= Error Term

These factors are expected to have an effect in the profitability of fish farming either significant or insignificant effect. Economic factors are expected to have a negative influence on the profitability of fish farming as they are adding to the costs of operations, while the social factors are expected to have a positive influence on the fish farming. Good fish farming practices that carry the on farm practices are expected to have a positive influence on the profitability of semi intensive pond Tilapia farming**.**

CHAPTER THREE

RESEARCH METHODOLOGY

3.1. Introduction

This chapter gives an overview of various steps and methods that were used by the researcher on course of conducting this research. It describes the research design which is used, the study area, target population, sample and sampling procedures, validity and reliability of the instruments for data collection procedures together with the data analysis.

3.2 Research Design

According to Msabila and Nalaila, 2013, Research design is a plan on how a study will be conducted or a detailed outline of how an investigation will take place. It provides a series of sign posts to keep one in the right direction. Kothari (2004) points out that the descriptive survey design assists the researcher in collecting data from relatively larger number of case at a particular time. The descriptive survey designed in this study has helped to answer the questions like who,what, where and how on describing the phenomenon on the study.

Profitability analysis of semi intensive Tilapia pond fish farming in Bagamoyo district was conducted by cross-sectional survey by using primary data obtained directly from semi-intensive fish farmers. Cross sectional survey was chosen due to the fact that is quick to obtain data, cheap and easy to perform

3.3 Area of the Study

The research took place inBagamoyo District that is in Coastal Region and is being divided into 25 villages.According to projections by the National Bureau of statistics (NBS) basing on the 2012 national census, the Council had a population of 311,740 with an average house hold size of 4.2.

Bagamoyoexperiences a modified type of tropical climate. It is warm and temperate throughout the year with an average temperature of 26.60 ºC. The highest

temperature is experienced in January with average of 28.4 ºC and lowest in July where it averages 24.4 ºC. These conditions are favorable for Tilapia farming.

Figure 3.1 Area of the study

Source: Wikipedia

3.3.1 Target Population

Population refers to a complete set of elements (Persons or objects) that possess common characteristics defined by the sampling criteria established by the researcher (Msabila and Nalaila, 2013). Target population is the group of people where the researcher obtained the information regarding the study in question. In this study, the target population is the Semi-intensive PondTilapia farmers in Bagamoyo district.

3.4 Unit of Analysis

The research included only farmers that engage themselves in Tilapia farming. This is due to the fact that it is through these farmers where the information required to complete the study could be obtained.

3.5 Sample Size and Sampling Procedure

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

3.5.1 Sample Size

According to Kothari (2004), sample size is defined as the number of items to be selected from the universe to constitute a sample. The sample size shall be obtained by using the formula developed by Yamane (1967) that is given by:

$$n \frac{\mathbf{N}}{\mathbf{1+N(e2)}} \quad \text{... ... ...(2)}$$

Where,

n=sample size

N=total number of respondents

E= standard error

Using the data obtained from the aquaculture department of the ministry of fishery and livestock development in 2016, the number of Tilapia farmers in Bagamoyo were 120. Assuming 95% confidence interval, the sample was found to be

n= 120/ (1+120(.05^2)), therefore, n= 92

From the above formula, 92Tilapia farmers were used in this research taking time and budget constraint into consideration. Moreover having 92 correspondents coincide with the Bailey (1994), that 30 cases can be used as minimum requirement for the statistical data analysis to be done.

3.6 Sampling Techniques

Kothari (2004) defines a sample design as a definite plan that is used for obtaining a sample from a given population. It additionally refers back to the technique or the process the researcher might adopt in choosing objects for the sample.

In this research, the non-probability sampling was used. Non-probability sampling is the sampling technique where by the researcher does not give allthe individuals in the population equal chances of being selected. (Msabila and Nalaila, 2013).In non-probability sampling there is no random selection; selection is based on accessibility and personal judgment of the researcher.

Snowballing and convenience types of Non-probability sampling techniques were also used in this research. According to Msabila and Nalaila, (2013), snowballing technique involves a researcher asking the initial subject to nominate another person with the same trait, while in convenience technique subjects are selected basing on convenience, accessibility and proximity to the researcher.

Therefore, the researcher looked for fish farmers by asking the first who found by using the directives from the officer responsible from the municipal office, and on his convenience, the researcher found other farmers to reach the intended sample size.

3.7 Method of Data Collection

A structured questionnaire was used to collect data from respondents. The questionnaire had both close ended and open ended questions (see appendix 1) and alsowas translated into Swahili language for those who are not conversant in English language. For those who cannot read and write, interview was used. Interview is the process involving collection of information through oral or verbal communication or face to face communication between the interviewer and interviewee.

3.8 Validity of Questionnaire

In the validation of data collection instruments the issues of validity and reliability were taken into consideration. Validity refers to the extent to which a test measures what we actually wish to measure (Kothari, 2004). To test the validity researcher

piloted the questionnaire to 5 farmers. The answers from the pilot study helped in the amendment of the questionnaire. The amended questionnaire was be used in the study

3.9 Reliability

Reliability is chiefly concerned with making sure the method of data gathering leads to consistent results. Reliability has to do with the accuracy and precision of a measurement procedure (Kothari, 2004). It can be measured by having different researchers follow the same methods to see if results can be duplicated. If results are similar then it is likely the method of data gathering is reliable. Assuring research can be replicated and can produce similar results is an important element of the scientific research method. To ensure reliability, questionnaires were tested basing on the Test-retest method to see if the farmers can give the same consistent answers.

3.10 Data Entry and Management

Data entry and management was done by using SPSS and EXCEL software, this is due to the fact that SPSS and EXCEL are suitable software for data entry and management, together with the researchers familiarity with the mentioned software.

3.11 Dependent Variable

The dependent variable applied in this study is Semi intensive Pond Tilapia farming Profitability that was conceptually linked with some of selected socio economic factors termed as independent variables.

3.12 Independent Variables

Independent variables are those variable which influence the dependent variable, in this study the researcher included Ten independent variables that were categorized into three aspects that are: Economic costs associated with Semi intensive Pond Tilapia farming that included, cost of seed, cost of feed, cost of fertilizers and costs of labor. The other aspect included the on farm practices that included the stocking density, length of the farm cycle and the size of the seed. The last aspect was the socio factors that included the age of the farmer, the education level of the farmer and the Sex (Gender) of the farmer.

3.13 Data Processing and Analysis

Data analysis is defined as ordering of data into constituent parts in order to obtain answers to research questions. Data were collected and analyzed in a way that enables to answer the research questions and to meet the objective of the study, by using the following analytical tools techniques

a. Gross margin analysis

Gross margin is the total sales of an enterprise minus its cost goods sold (COGS), divided by total sales revenue expressed as percentage. The gross margin represents the total sales revenue that the fish farmer retains after incurring the direct costs associated with producing the goods and services it sales. The higher the percentage the more fish farmer makes profit.

$$Gross\ margin\ (\%) = \frac{\text{revenue from sales} - \text{cost of goods sold}}{\text{revenue}} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots (3)$$

b. Descriptive analysis including frequency and percentage were used to describe the social demographic factors of the fish farmers

c. Regression technique was used to identify the factors affecting the profitability of Tilapia pond fish farming in the study area

d. The Net Present Value (NPV)

This is a major discounted cash flow technique of measuring project viability. This is defined as the present worth of the income stream generated by an investment.It measures the size of benefits generated by the project

Computation

1st: Is given as the difference between the total project's costs and gross benefits in each year of the project's life discounted at a given discount rate.

2nd: Finding the difference between the present worth of the benefit streams less the present worth of the cost stream.

NPV can be written formally as:Type equation here.

NPV $=(\sum Bt \div (1+r)t) - (\sum Ct \div (1+r)t)$……(4)

r = a rate of discount

t = number of years from the base year

Bt and Ct are total benefits and total costs in year t.

At the end of data collection all completed questionnaires from the farmers were thoroughly examined by the researcher to check for missing data, coded, clean and analyzed. Data analysis was performed in order to achieve the research objectives. Cleaned data were entered in the computer and later analyzed using the Statistical Package for Social Science (SPSS) software and EXCEL

3.14 Data Presentation and Analysis

3.14.1 Introduction

The essence of data presentation and analysis was to help the researcher to provide interpretation about what was collected from the field. The process involved data coding, data editing and analysis to be in a meaningful sense.

3.14.2 Data Analysis

Data analysis in the study involved both qualitative and quantitative data collected. The analysis based on two types of analysis which are descriptive statistics and inferential statistics and employed EXCEL and SPSS software. Descriptive statistics involved different measures such as frequencies, percentages, means and standard deviations. Inferential statistics was conducted by using the simple linear regression model.

3.14.3 Data Processing

Kothari, (2004) provides the meaning of data processing as preparing data for analysis and that it includes editing, coding, classification, tabulation and using percentages. This process had two stages which were data cleaning and data

reduction. The process included detecting for abnormalities, errors, omission, accuracy and consistent answering of the questions. In order to reduce the quantity of data, some numeric and symbols were assigned to reduce the responses into few categories or classes with common characteristics. Thereafter tabulation and graphs were used to summarize raw data and then displayed for further interpretation.

3.14.4 Econometric Model Specification and Hypothesis

Model specification refers to the determined relationship between variables (independent and dependent) in the model. It tells which independent variables should be included in or excluded from a regression equation. In general, model specification of a regression model is supposed to the theoretical considerations rather than empirical or methodological ones (William, 2017). In this study the researcher used the profitability model (Gross Margin) and regression model to test the relationship between the dependent and the independent variables.

Moreover discounted measure of project worthiness using NPV (Net Present Value) was also used to measure the projects viability using the data obtained and forecasted in ten years of the projects operation.

3.14.4.1 Steps Used

The first step was to find the Socio-Demographic Characteristics of the Fish farmers in the study area. Here factors including age of the farmers, level of education, marital status, primary occupation and age of the farmers were analyzed using descriptive statistics that is mean, median and mode

Second step of this study was to find the profitability of the semi intensive pond Tilapia farming by using the Goss Margin Profitability model. As stated by Lazzari(2019), Gross margin is generally important because it is the starting point towards achieving a healthy net profit. A high Gross margin indicates that a project is in abetter position to have a strong operating profit margin and strong net income. Therefore the higher profit margin indicates that the project is in the position to break even faster thus high chance of being viable.

The profit margin function was expressed as follows:-

Gross margin is the total sales of an enterprise minus its cost goods sold (COGS), divided by total sales revenue expressed as percentage. The gross margin represents the total sales revenue that the fish farmer retains after incurring the direct costs associated with producing the goods and services it sales. The higher the percentage the more fish farmer makes profit.

$$\text{Gross margin}(\%) = \frac{\text{Revenue} - \text{cost of goods sold}}{\text{revenue}} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots(5)$$

Whereby;

Gross margin (%) = Profitability

Revenue (TZS) = Amount received from sales of Fish

Cost of goods sold (TZS) = Cost of Farming the fish including the costs of seed, feed, water, labor and fertilizers

Gross margin is given in terms of percentage (Lazzari, 2019). Therefore the projects should try to keep the project margin as high as possible so as to be in a stable position.

In third step, the Factors affecting profitability of Semi intensive Tilapia Farming projects were modeled by using simple linear regression, where by profitability was dependent variable and factors affecting profitability of semi intensive Pond Tilapia farming were the independent variables and thus the model became as follows:-

Y= f (X1, X2, X3…X10, U)……(6)

Where:

Y = Profitability of Semi intensive pond Tilapia projects

X1 = Cost of seeds (TZS)

X2 = Cost of feeds (TZS)

X3 = Cost of fertilizers (TZS)

X4 = Cost of labor (TZS)

X5 = Length of the farm Cycle (Months)

X6 = Size of the seed (gms)

X7 = Stocking Density (Pcs/sqm)

X8 = Sex of the farmers (Dummy: 1 = male, 0 = female)

X9 = Age of the farmer (Years)

X10 = Farmers Education Level (1 for not gone to school, 2 for primary education, 3 for secondary education, 4 for certificate, 5 for Diploma and 6 for Graduates)

U = error term assume to have a zero mean and constant variance.

Then the function was transformed to a formula that is;

$$Y= b0 + b1X1 + b2\ X2 + b3X3 + b4X4 + b5X5 + b6X6 + b7X7 + b8X8 + b9X9 + b10X10$$

The next step was to find the viability of semi intensive pond tilapia farming by using the discounted measure of the project worthiness where NPV was selected. This is a major discounted cash flow technique of measuring project viability. This is defined as the present worth of the income stream generated by an investment. It measures the size of benefits generated by the project

Computation

1st: Is given as the difference between the total project's costs and gross benefits in each year of the project's life discounted at a given discount rate.

2nd: Finding the difference between the present worth of the benefit streams less the present worth of the cost stream.

NPV can be written formally as:

NPV = $(\sum Bt \div (1+r)t) - (\sum Ct \div (1+r)t)$.....(7)

r = a rate of discount

t = number of years from the base year

Bt and Ct are total benefits and total costs in year t.

Therefore the average profit obtained from all the projects were run to find the NPV after Ten years of operation, then the NPV obtained determined the viability of Semi intensive pond Tilapia Projects in Bagamoyo District.

The study tested the following hypotheses in determining the operational of the specific model functional form and variables applied:

The first Null hypothesis (H0) Operating costs do not affect profitability of semi intensive pond Tilapia farming and the alternative Hypothesis (H1) Operating costs affect profitability of semi intensive pond Tilapia farming.. This hypothesis aimed at finding out the operating costs that how the operating costs significantly affects the profitability of semi intensive pond Tilapia farming.

The second hypothesis tested the chosen model if it was correctly specified and the Null hypothesis (Ho) socio factors do not affect profitability of semi intensive pond Tilapiaand the alternative hypothesis (H2) was Social factors affect profitability of semi intensive pond Tilapia farming. This hypothesis aimed at seeing how the on farm practices affect the profitability of semi intensive Tilapia farming in the study area.

The third null hypothesis states that On-farm practices do not affect profitability of semi intensive pond Tilapia farming; its alternative hypothesis states On-farm practices affect profitability of semi intensive pond Tilapia farming. This test is aimed at achieving the objective number three that is to see how the on farm practices affect the profitability of the semi intensive Tilapia pond Tilapia farming.

The fourth null hypothesis states that Semi-intensive pond Tilapia farming is not a viable project in the study area, its alternative hypotheses states that Semi intensive

pond tilapia farming is viable projects in the study area. This test aimed at achieving specific objective number four that states that“To assess the viability of semi intensive Pond Tilapia farming Projects.”

3.15 Ethical Issues

The study reflected on the ethical issues such as valuing the respondents, doing no harm to the respondents no matter what happened, selecting the respondents basin on the method selected, keeping confidentiality of information provided by respondents so as to ensure privacy and dignity of research participants.

CHAPTER FOUR

DATA ANALYSIS AND PRESENTATION OF FINDINGS

4.1 Introduction

This chapter is concerned with presentation of results for the analysis carried out using the data collected from 92 semi intensive Tilapia Fish farmers in Bagamoyo District. The analysis is mainly divided into two sections which are descriptive analysis and the inferential analysis.

4.2 Descriptive results

This part includes descriptive results for both the socio economic characteristics of semi intensive pond tilapia farmers and the variables used to determine Profitability of Semi intensive Pond tilapia farming in the study area. Results for variables that affect profitability of semi intensive pond tilapia farming include age of respondents, education level, sex, costs of feed, cost of seed, cost of fertilizers cost of labor, household size and marital status.

4.3 Fish farming practice in the area

4.3.1 Types of Ponds Used

There are about 160 farmers around the area that are currently active, that according to the report by MALF 2018. Among the 96 selected, In this study it was found out that the study about 73.9% fish farmers had concrete ponds while the rest, 26.1% had earthen ponds in their vicinities.

Table 4.1 types of ponds used

Type of ponds	Frequency	Percent (%)
Earthen ponds	24	26.1
Concrete ponds	68	73.9
Total	92	100.0

4.3.2 Type of Water Used

In Bagamoyo district availability of water is not an issue of difficulty. Water is abundant and is available through the Ruvu River that runs through the district to Indian Ocean, the seasonal dams around the areas and the water table is high for well drilling. According to the ministry of water (2017), Ruvuriver is the source of water for domestic use for the whole coastal region, where Bagamoyo district is the part of it. In this study it was found that 71% of fish farmers use water from the drilled wells while the rest (26% and 3%) use water from the rivers and seasonal dams respectively.

Table 4.2 Types of water used

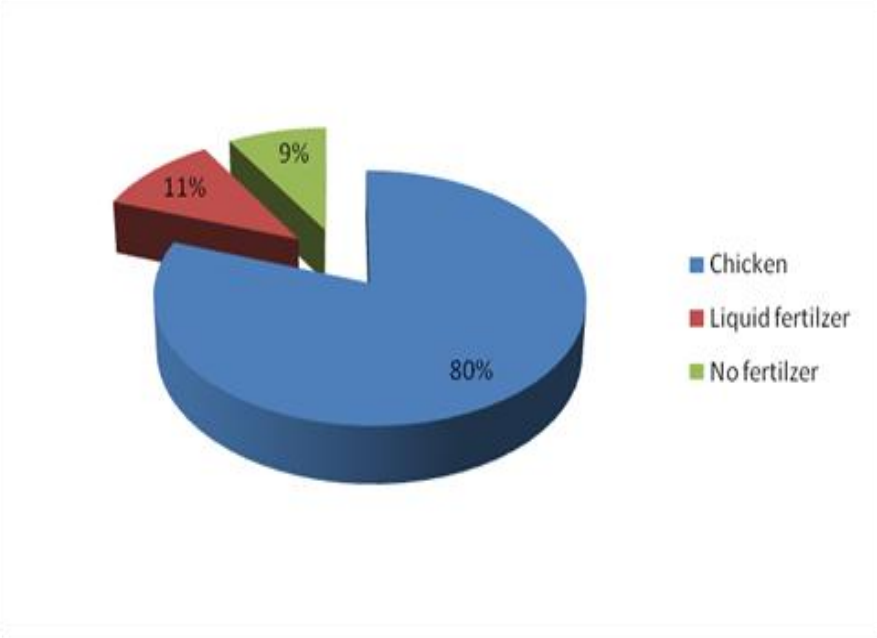
Type of water source	Frequency	Percentage (%)	Cumulative Percentage
Dam	3	3	3
River	24	26	29
Well	65	71	100
Total	92	100.0	

Source: Survey Results 2019

4.3.3 Type of Fertilizers Used

80% fish farmers in the area use chicken manure to fertilize their ponds as it is cheap and readily available in the area. Moreover the chicken manure is said to be efficient as it decomposes easily as it contains more retained nutrients. The other fish farmers 11% used the liquid manufactured fertilizers and 9% of the fish famers did not use any type of fertilizers

Figure 4.1 A Chart showing the type of fertilizers used by percentage



Source: Survey Results 2019

4.4 Socio economic characteristics of the respondents

4.4.1 Gender

Sex of respondent was categorized as males and females; the variable sex was predicted to involve more males than females in fish farming. Results indicate that female headed households were only 16.3% while male headed households were 83.7%.

Table 4.3 Gender of farmers

	Frequency	Percent	Cumulative Percent
Male	77	83.7	83.7
Female	15	16.3	100.0
Total	92	100.0	

Source: Survey Results 2019

4.4.2 Age

Age of respondent (the head of the household) is one of the important factors that were included in the study. The results from this study indicated that the age of

respondents ranged between 23 to 72 years and the overall mean age of respondents was 39.84 indicating that the households‟ head who are involved in fish farming in the study area are relatively middle aged ones.

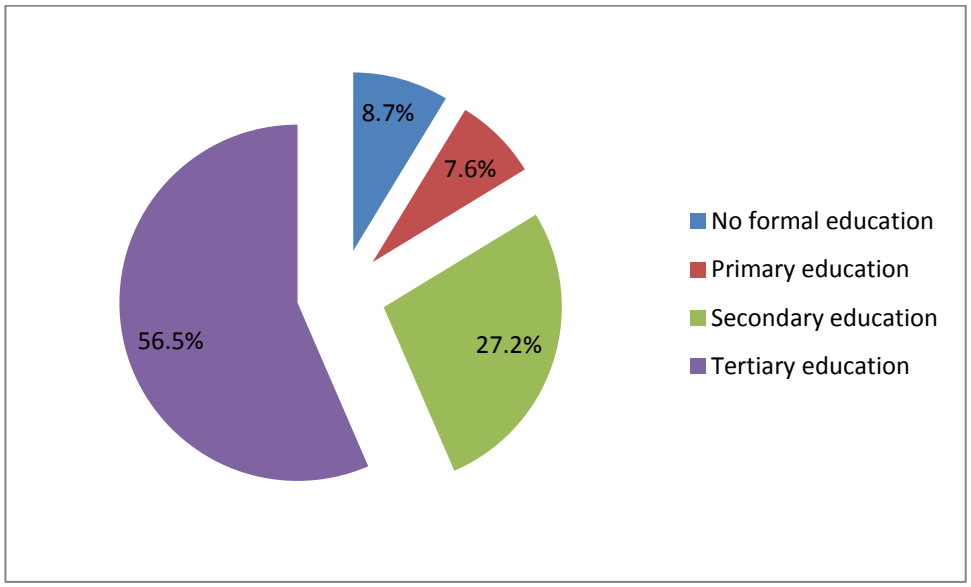
Figure 4.2 A chart for age Description of the fish farmers

Source: Survey Results 2019

4.4.3 Educational Level

Education level of respondent in this study was classified into six dummy categories: those who have informal education, primary education, secondary education and tertiary education. Those who had no formal education accounted 8.7 percent while those with formal education account 91.3 percent of total semi intensive fish farmers who responded. Farmers who had formal education were as follows who completed primary education were 7 which makes 7.6%, those with secondary education were 25 making 27.2%, and 56.5 of the respondents of the total number of respondents in the study area had tertiary education

Figure 4.3 Graph Showing the Education Level of Respondents



Source: Survey Results 2019

4.4.4 Primary occupation

Primary occupation of respondent in this study was classified into five dummy categories: permanently employed, temporarily employed, casual labor, self-employed and fish farming. Those who are permanently employed were 21 making 22.8% while those who are temporarily employed were 19 accounting to 20.7% of total semi intensive fish farmers who responded. Farmers who are self-employed were 27 making 29.3% of the respondents. Casual labors were 2 accounting to 2.2% of the total number of respondents. Those who were only involved in fish farming were 23 making 25% of the total number of respondents. This is shown in the table 4.3

Table 4.4 Primary occupation of fish farmers

	Frequency	Percent	Cumulative Percent
Permanently employed	21	22.8	22.8
	19	20.7	43.5
Self employed	27	29.3	72.8
Casual labor	2	2.2	75.0
Fish farming	23	25.0	100.0
Total	92	100.0	

4.4.5 Marital status

Marital status of the respondent in this study was classified into four dummy categories: single, divorced, widow or widower and separated. Married respondent dominated on the marital status aspect, Married respondent were 56 accounting to 60.9% while single respondents were 30 accounting to 32.6 percent of total semi intensive fish farmers who responded. Divorced respondents were 3 making 3.3 %, lastly widow or widower were 3 comprising 3.3% of the total number of respondents as shown in the Table 4.3

Table 4.5 Marital Status

	Frequency	Percent	Cumulative Percent
Single	30	32.6	32.6
Married	56	60.9	93.5
Widow	3	3.3	96.7
Divorced	3	3.3	100.0
Total	92	100.0	

Source: Survey Results 2019

4.4.6 House hold size

The average household size of farmers in the study area was 7 members. The large proportion of farmers included households with members between 6 and 7 members while the small proportion of respondent included households with 1, 2 and 3 family members, this is due to the fact that families with many members is ensured with enough labour for different farming activities such as cultivation, weeding, pesticide application, weeding and harvest compared to families with few members.

Table 4.6 house hold size

	Range	Minimum	Maximum	Mean		Std. Deviation	Variance
	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic	Statistic
House hold size	7.00	1.00	8.00	4.0521	.17447	1.70948	2.922

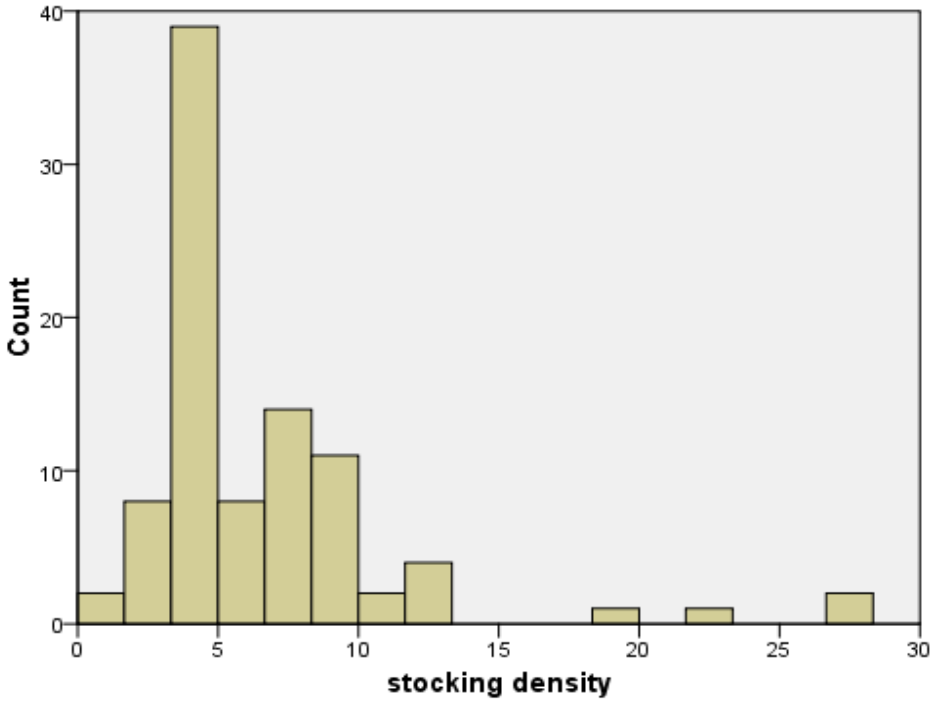
Source: Survey Results 2019

4.5 On farm practices

4.5.1 Stocking density

In the study, the stocking density averaged at 6.54, with 3 as minimum and 60 as the maximum stocking density obtained from the study site. Majority of farmers amounting to 41.7% had 5 as their stocking density, 21.9% had 4 as their stocking density and 3.1% had 3 as their stocking density.

Figure 4.4 Stocking Density

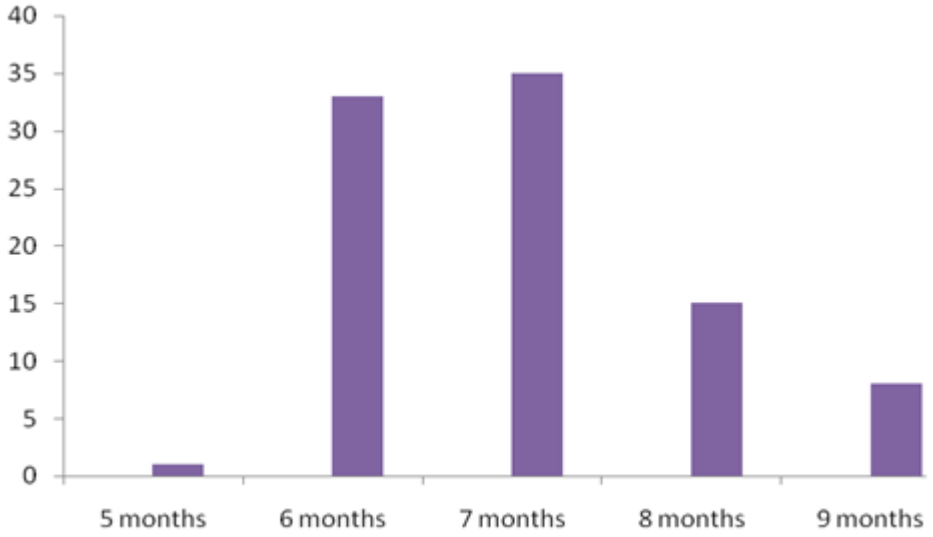


Source: Survey Results 2019

4.5.2 Length of the farm cycle

Length of the farm cycle is the time taken from planting the seeds to the time of harvesting. In the study are majority (73%) of fish farmers took 6 and 7 months as the length of their farming cycle where by both had 36.5% of respondents.

Figure 4.5 Length of the farm cycle



4.5.3 Size of the seed

Size of the seed refers to the size of the fingerling that is used when planting. The minimum size obtained was 1g and the maximum size was 6g, while on average the size that is used is 2.54g

Table 4.7 Description of the size of the seed

	Mean	Std. Deviation	Minimum	Maximum
size of the seed in gm	2.54	6	1	6

Source: Survey Results 2019

4.6 Economic costs associated with fish farming

As shown in the Table 4.7, Fish farming costs in this study are referred to as the cost incurred from the time of planting the seed to the time of harvesting. Those costs include the cost of seed, cost of water filling to the pond, cost of labor and cost of fertilizers

Cost of seed averaged 668468.75 TZS and it ranged from 40,000TZS to 10,000,000 TZS for the investment in buying seeds per annum. As far price of seed is concerned, semi intensive fish farmers pay around 150 TZS up to 300 TZS per piece of seed used in small scale Pond Tilapia farming in the study area. Cost of the seed had no statistical significance in the profitability of semi intensive pond tilapia farming though it has a positive relationship with it meaning that as it increases, the profitability of fish farming also increases. This is due to the fact that when seeds of a higher quality are being sold at a higher price that is mono sex tilapia that are being sold at around 300 TZS. This mono sex tilapia has a higher growth potential than the mixed sex tilapia that are being sold at around 100 to 150 TZS.

Cost of feed averaged 2,385,886.98 TZS per cycle and it ranged from 40,000 TZS to 15,000,000 TZS for a full farming cycle. This variable was determined by size and number of ponds that a farmer has together with the type of feed that was used by the farmer. As far as quality of feed is concerned, Semi intensive pond Tilapia farmers in the study area used formulated feed that is sold at the average of 3,000 TZS per Kg.

Cost of labor averaged 114273.68 TZS per cycle and it ranged from 0 TZS to 480,000 TZS. The amount paid for labor was found to be way below the expected value due to various reasons including the fact that owners are the ones dealing with the ponds with no employees. Moreover a significant proportion of owners of the fish farms (90%) have employed workers that do not specialize in fish farming but also in other farming activities.

Cost of fertilizers averaged 25318.75 TZS per cycle and it ranged from 0 to 120,000 TZS, the zero cost for fertilizers indicates that the farmer does not use any type of fertilizers.

Table 4.8 Cost Description in fish farming

	Mean	Std. Deviation	Minimum	maximum
cost of fertilizers	25,297.92	24,879.601		24,879.601
cost of seed	556,651.04	1,090,283.47		1,090,283.467
cost of feed	2,058,328.65	2,305,784.678		2,305,784.678
cost of labor	116,718.75	85,737.752		85,737.752

Source: Survey Results 2019

4.7 Profitability analysis of tilapia farming

The average profit obtained in the study area was found to be 1,392,205.7292 Tshs. This minimum profit obtained was found to be -9,278,000 Tshs with 9,655,000 Tshs as the maximum profit obtained with about 14 farms being operating on losses.

4.7.1 Gross margin

The gross margin obtained in the study was found to range from 49.77% to 83.22%, with 36.4% as the average profit margin of Tilapia Pond fish farming in the study area. This GM was not far from the results obtained by Kyelu (2015) who had 31.68% as the GM for Tilapia farming. This variation in GM can be due to several factors such as availability of needed inputs (i.e. fertilizers, lime, fingerlings and fish feeds), availability of suitable water, access to quality fish farming technical advice, disease/parasites, design and construction of fishpond, flooding resulting from excessive rain, and stealing.

Table 4.9 Profitability description in fish farming

1. Revenue	Minimum	Contribution to variable costs(%)	Maximum	Contribution to variable costs (%)
Yield per cycle	144		217	
Farm get price	5000		120000	
Revenue	**720000**		**26000000**	
2. Variable Costs				
cost of labor	270,000	6%	300000	1.5%
cost of feed	3480000	80%	15796000	80%
cost of seed	600,000	14%	3529000	17.9%
cost of fertilizers	0	0%	120000	0.6%
Total variable cost	**4350000**		**19745000**	
Average Profit	-3630000		6255000	
Gross margin	**-49.77**		**83.22**	

Source: Survey Results 2019

4.8 Factors Affecting Profitability of Semi Intensive Pond Tilapia Farming

4.8.1 Testing Violation of OLS Assumptions

In finding the factors that affect the profitability of semi intensive pond Tilapia Faming, Multiple regressions were used. Though OLS does not require that error term follows a normal distribution to produce unbiased estimates with minimum variance, it is satisfying that assumptions not to be violated so as to perform a statistical hypothesis testing and generate a reliable confidence interval

4.8.1.1 Normality Test

The Shapiro-wilk test was used to determine the normality of the data used. According to Ghasemi (2012), the Shapiro-wilk test is based on the correlation between the data and the corresponding normal scores. The Shapiro-wilk test provides a better power than the K-S test**.**

Table 4.10 Tests of Normality

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	Df	Sig.	Statistic	df	Sig.
profitability	.146	92	.009	.929	92	.80

In testing the distribution of the Data, the null hypothesis was that the "Data are normally distributed". At 0.05 level of significance, the Shapiro-Wilk test gave the value 0.80 that is greater than 0.05 indicating that there is no statistical significance, thus we fail to reject the null hypothesis.

4.8.1.2 Test for Multicollinearity

This is the phenomenon in which one predictor variable in multiple regression model can be linearly be predicted from the others with a substantial degree of accuracy.In this study, the Variance inflation factor (VIF) was used to test for the Multicollinearity.

Table 4.11 Tests for Multicollinearity

Model		Collinearity Statistics	
		Tolerance	VIF
	Gender of farmers	.858	1.166
	education level	.833	1.200
	age of a farmer	.894	1.118
	primary occupation	.797	1.255
	cost of labor	.633	1.580
	planting size	.847	1.181
	cost of fertilizers	.771	1.297
	stocking density	.313	3.192
	cost of seed	.232	4.311
	cost of feed	.327	3.059

With profitability as a dependent variable it was found out that none of the variable had the VIF more than 10 indicating that there are no Multicollinearity between the data used

4.8.1.3 Presence of Outliers

According to Maddalla (1992) outliers are the data points that differ significantly from the other observations. This difference may be due to variability of measures or

the due to experimental errors. The data used in this study was made to ensure that there are no outliers so as not to violate the OLS assumptions

Figure 4.6 Presence of Outliers

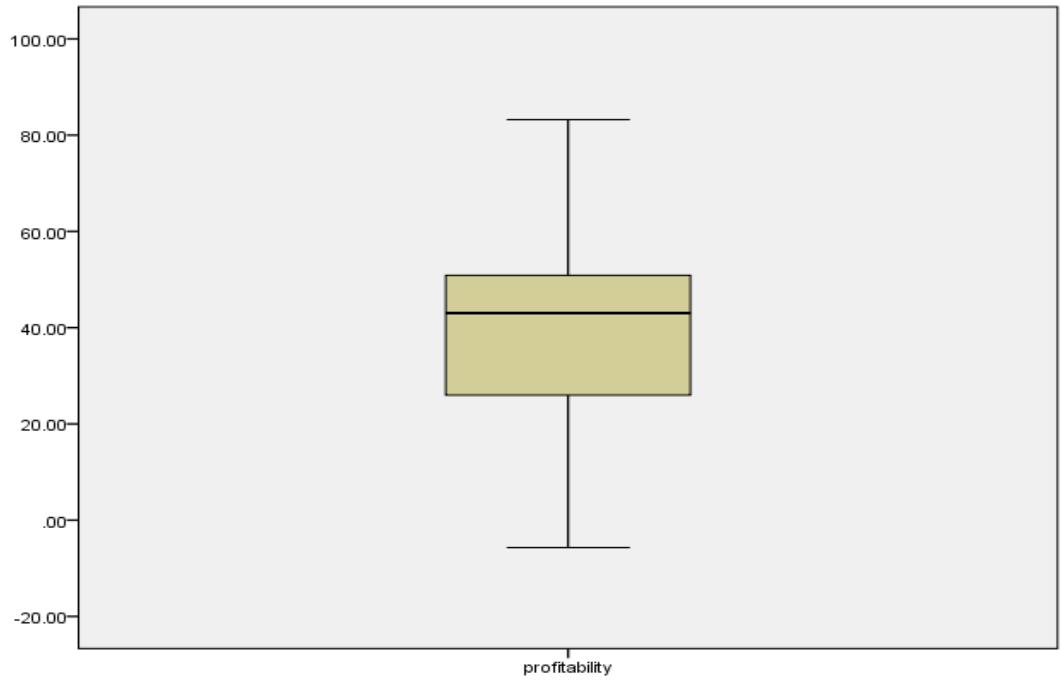


Table 4.12: Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.573[a]	.328	.249	75.29656

Source: Survey Results 2019

From Table 4.12 shows the model summary which shows the model fit, the results indicate that, the value of R-square was 0.328 This means that, 32.8 percent of the dependent variable (profitability) is explained by all independent variable in the model namely size of the seed, education level, cost of labor, Gender of farmers, cost of seed, length of farm cycle, age of a farmer, stocking density, cost of fertilizers and cost of feed.

Alternatively R-square sometimes is called the coefficient of determination which is given as the ratio of variations explained by the model to the total variations present

in Y. Note that the coefficient of determination ranges between 0 and 1. R-square value is interpreted as the proportion of variation in Y that is explained by the model. The result of R-square indicates that the model explains the variability in dependent variable (profitability) by 32.8 percent.

Table 4.13: ANOVA table

Model	Sum of Squares	Df	Mean Square	F	Sig.
Regression	235008.890	10	23500.889	4.145	.000[b]
Residual	481913.626	81	5669.572		
Total	716922.516	91			

Source: Survey Results 2019

From ANOVA Table 4.13, a result indicates that, the p-value (0.000) is lower than the alpha level of .05, so we reject the null hypothesis and the alternative hypothesis can be accepted. This implies that, there is statistically significant different at 1 percent or statistical association or correlation between dependent variable and independent/ explanatory variables.

Table 4.14: Coefficients table

Model	Unstandardized Coefficients		Standardized Coefficients	T	Sig.	95.0% Confidence Interval for B	
	B	Std. Error	Beta			Lower Bound	Upper Bound
(Constant)	136.683	72.379		1.888	.062	-7.225	280.591
Gender of farmers	6.666	21.253	.029	.314	.755	-35.590	48.922
education level	3.710	5.600	.063	.662	.509	-7.425	14.845
age of a farmer	-.370	.831	-.043	-.446	.657	-2.023	1.282
cost of seed	8.687E-006	.000	.116	.855	.395	.000	.000
cost of feed*	-1.156E-005	.000	-.351	-2.350	.021	.000	.000
cost of labor	.000	.000	-.131	-1.348	.181	.000	.000
cost of fertilizers	.000	.000	-.058	-.531	.597	-.001	.001
stocking density*	-4.501	1.391	-.322	-3.235	.002	-7.267	-1.735
length of farm cycle	-2.147	8.497	-.024	-.253	.801	-19.043	14.748
size of the seed*	-14.328	7.830	-.180	-1.830	.071	-29.896	1.241

Source: Survey Results 2019

From Table 4.14 shows that, only three variables are statistically significance. The famers costs of feed is statistically at 5 percent level of significance and conclude

that, a unit increase in cost of feed is associated to decrease in farmer profitability by -1.156E-005 Tanzania shillings at ceteris paribus. The results of this finding is consistence with Mwenesi (2015) on his study revealed that the feed prices, have a significant effect on performance of Semi Intensive Tilapia Aquaculture (SITA) projects. A higher feed prices decrease net returns and increases the breakeven price per kilogram.

Moreover, a variable stocking density is statistically at 1% level of significance and conclude that, a unit change in stocking density is associated decrease the profitability by -4.501 Tanzanian shillings at ceteris paribus. This coincide with the study done by Ntanzi et al (2014) that concluded that increasing the stocking density significantly affect the growth and survival of the fish.

Finally size of the seed is statistically significance at 10% level of significance and concludes that a unit increase in size of the seed tend to decrease farmer profitability by -14.328 at ceteris paribus.

4.8.1.4 Viability of fish farming

In finding the viability of Tilapia pond fish farming, NPV was used. The mean value from the profit obtained was discounted to 10% discount rate while taking the construction costs at year Zero as the investment cost, and ten years of operation as the mean life of the fish farming projects as it was obtained from the details given by the respondents. NPV was found to be 175,393.11 Tzs

Table 4.15 Viability analysis of fish farming

Discount rate	Years	Profit	Discount factor	Present Value
10%	0	(10,000,000.00)	1.00	(10,000,000.00)
	1	1,655,998.37	0.91	1,505,453.06
	2	1,655,998.37	0.83	1,368,593.69
	3	1,655,998.37	0.75	1,244,176.09
	4	1,655,998.37	0.68	1,131,069.17
	5	1,655,998.37	0.62	1,028,244.70
	6	1,655,998.37	0.56	934,767.91
	7	1,655,998.37	0.51	849,789.01
	8	1,655,998.37	0.47	772,535.46
	9	1,655,998.37	0.42	702,304.96
	10	1,655,998.37	0.39	638,459.06
			NPV	**175,393.11**

Source: Survey Results 2019

From table 4.14 shows that, only three variables are statistically significance. The famers costs of feed is statistically at 5 percent level of significance and conclude that, a unit increase in cost of feed is associated to decrease in farmer profitability by -1.156E-005 Tanzania shillings at ceteris paribus. The results of finding is consistence with Mwenesi (2015) on his study revealed that the feed prices, have a significant effect on performance of Semi Intensive Tilapia Aquaculture (SITA) projects. A higher feed prices decrease net returns and increases the breakeven price per kilogram.

Moreover, a variable stocking density is statistically at 1% level of significance and conclude that, a unit change in stocking density is associated decrease the profitability by -4.501 Tanzanian shillings at ceteris paribus. Finally size of the seed is statistically significance at 10% level of significance and concludes that a unit increase in size of the seed tend to decrease farmer profitability by -14.328 at ceteris paribus.

Furthermore a remaining variable such as education level of famers, cost of labor, gender of farmers, length of farm cycle, age of a farmer, cost of fertilizers and cost of seed are statistically insignificant and study conclude that, those variable has no influence in the profitability of famers.

4.9 Hypothesis testing

The first Null hypothesis (H0) Operating costs do not affect profitability of semi intensive pond Tilapia farming. In this study it was found out that cost of feed was statistically significant at 5% level of significance in its effect on the profitability of Semi intensive pond Tilapia farming, hence the null hypothesis was rejected.

The second hypothesis was Null hypothesis (Ho) socio factors do not affect profitability of semi intensive pond Tilapia and it was found out that none of the socio factors had effects on the profitability of the semi intensive pond tilapia farming hence we failed to reject the null hypothesis.

The third null hypothesis states that On-farm practices do not affect profitability of semi intensive pond Tilapia farming. in this study it was found out that stocking density and the size of the seed were statistically significant at 1% and 10% respectively. Therefore the null hypothesis was rejected

The fourth null hypothesis states that Semi-intensive pond Tilapia farming is not a viable projects in the study area. Using NPV to test the viability of the semi intensive Pond tilapia farming in the study area, Negative NPV was obtained indicating that these projects are not viable. By so saying, we failed to reject the null hypothesis

CHAPTER FIVE

DISCUSSION OF THE FINDINGS

5.1 Introduction

This chapter discussed in details the findings obtained in the previous chapter. The detailed discussion starts with descriptive results followed by profitability results, and finally factors affecting profitability of semi intensive pond tilapia farming form the linear Regression results.

5.2 Descriptive Results

This part includes descriptive results for both the socio economic characteristics of semi intensive pond tilapia farmers and the variables used to determine Profitability of Semi intensive Pond tilapia farming in the study area. Results for variables that affect profitability of semi intensive pond tilapia farming include age of respondents, education level, sex, costs of feed, cost of seed, cost of fertilizers cost of labor, household size and marital status.

5.3 Social Factors

5.3.1Marital Status

The large percentage of married respondents explains two scenarios. The first one is the dependency of the labor force in fish farming activities. The married respondents are assured of the large number of the family members that can be used as the labor force in the semi intensive Tilapia fish farming. The other scenario is the need for food. As mentioned before that the married respondents do have a large number of households, therefore the need for food arise. In order to cutter with that need fish farming takes its toll to ensure a reliable availability of food especially protein. This was also explained by Adeqeye*et al*(2008) when he was accessing the technical efficiency of the small scale fish farmers.

5.3.2 Primary Occupation

These results show that the population of fish farmers in the area is mainly self-employed indicating that they also use fish farming as their means of being employed. This results does not coincide with that of Tunde*et al* (2015) who had

34% of the respondents doing fish farming as their primary occupation and it was the highest percentage same as this study. Therefore it shows that, the fish farmer's population in the area does not depend on fish farming as their main source of income.

5.3.3 Gender

Male dominance may be due to the fact that fish farming communities have minimal facilities for child and health care, education etc., meaning that, females are regarded as the nurses of the families. Therefore women have a significant role to facilitate day to day activities rather than being involved in fish farming.But according to Ayanboye et al (2017), fish farming is being hindered by gender inequality since women are the ones having a greater potential in production are not fully involved due to the factors like limited access to resources such as land, capital and income, together with family responsibilities. Therefore intervention is needed in order to strengthen women and also remove the hinder women participation.

5.3.4 Age

The results from this study indicated that the age of respondents ranged between 23 to 72 years and the overall mean age of respondents was 39.84 indicating that the households‟ head who are involved in fish farming in the study area are relatively middle aged ones. Fish farming like any other entrepreneurship activity, requires energy and the courage to take risks. Therefore age of the farmer who is a decision maker is an important factor. In this study, it is found that on average of 39.84 which shows that these fish farmers are the energetic age so make those decisions. This is also shown by Kyelu (2016) who had 41 as the mean age for the Fish farmers, showing that most of the fish farmers are in their energetic age which is expected to have a positive impact in Tilapia farming.

5.3.5 Educational Level

From the study, it was found out that 56.5 of the total respondents had tertiaty education that coincides with the research results done by Tunde*et al* (2015). Since education status is an important factor in changing attitudes and in motivation(FAO 2015), it is shown that virtually the literate part has come forward to participate in

Fish farming. Work has to be done to the illiterate part to do the same. According to Tunde*et al* (2015) who had 54% of his respondents having tertiary qualification, level of education cannot be unconnected with the profitability of semi intensive tilapia farming; this is due to the fact that many of these educated farmers have either primary occupation making it difficult to follow through the fish farming process in a proper manner. Moreover most of these educated farmers do what we call a telephone fish farming where by the owner of the farm rarely visit the farmer and only give directives through the phone and thus making.

Though Level of education is an important factor in changing attitudes and in motivation, in this study are it is seen that virtually all level of education have come forward and adopted fish farming which leaves fish farming in a good prospect.

5.3.6 House hold size

As shown in the Table 4.6, the average household size was found to be 4.05. It was found out that, 8 was the maximum number of individuals and 1 as the minimum number of individuals. The study showed that house holds in the area are having a reasonable number of individuals. This ensures that the fish obtained from fish farming can be enough for food and even when sold the income obtained can cutter for the daily needs of the family

5.4 On Farm Practices

5.4.1 Stocking Density

The stocking density of 3-5 is the one recommended for the Semi intensive pond tilapia farming. A fish pond is capable of carrying about 2 kg per square meter. Therefore having a large number of fingerlings makes the fish have small size. Therefore by having 3-5 fingerlings per square meter ensures that the fish harvested would be of large size reaching up to 500gms.

Moreover according to FAO (2014) semi intensive Tilapia farming is done at high yield with 3-5 stocking density. Having 6.64 stocking density is way beyond the recommended one.

5.4.2 Length of the Farm Cycle

In the study majority that is 75%) of the farmers take 7 months as the length of their farming cycle that had 38% of respondents. The recommended length of the farm cycle according FAO (2012) is 6-9 month. The period of 6-9 month is recommended as it is the time that a fish reaches its maturity and is expected to have a table size, ready for consumption. There it depends with the farmers' choice of what size to sell, beyond 9 months it becomes uneconomical for fish farming as the fish start to have a negative increase in terms of growth.

Increase in length of the farm cycle leads to the increase in the operating cost especially the costs of feed. So having 6-7 as the average length of the farm cycle farmers in the study area are in the right path in terms of semi intensive pond Tilapia farming. This implies that, either costs of farming influence the farming period; or high education levels possessed by most respondents (83.7% attaining tertiary education) may attribute to proper fish farming practices.

5.4.3 Size of the Seed

Size of 2.54g indicates that fish farmers in the study area use the large sized fish fingerlings. The size recommended by FAO, 2015 is 0.4g that can be transported easily. Large sized fingerlings affect the survival of the fish at the early stages of their growth as it was reported by the farmers that, there were on average 2% death rate among the fish fingerlings plated

5.5 Profitability Analysis of Tilapia Farming

In this study it was found out that, the yield from the fish farms averaged at 405kg/pond/production cycle. The selling price of these fish was averaged at 5542 TZS with 5000 TZS as the minimum price and 12,000 TZS as the maximum price. The average profit obtained in the study area was found to be 1,655,998.37TZS. This minimum profit obtained was found to be -3,630,000TZS with 6,255,000 TZS as the maximum profit obtained with about 9 farms being operating on losses that is by having a negative profitability (GM)

5.6 Gross Margin

The falsetto variation in the growth margin is because of several factors that include the availability of inputs such as fertilizers, fingerlings, feeds, suitable water, and access to quality fish farming techniques, diseases, pond designs, flooding and fish being stolen.

Gross margin of 36.42% means that these projects are making enough profits for them to be sustainable. Olaoye*et al* (2012) obtained a profit margin of 89%,this difference from the research done is due to high operational costs especially the cost feeds, these operational costs make it look like that the selling price of the fish and fish products are being underpriced.

5.7 Factors affecting profitability semi-intensive pond tilapia farming

According to Boliver et al (2004), survival rate of the Tilapia is significantly affected by the size of the fingerlings and that higher survival rate is obtained by the bigger sized fingerlings thus higher survival rate results to higher profit. But this is contrary different to the results found in this study that shows as you increase the size of the fingerlings, results to the decrease in the profitability of the fish farming project.

This results are due to the fact that, The farmers in the study site have only grow out ponds in their vicinities, they all depend on the fingerlings that are being produced by the hatcheries in different areas around Dar es Salaam and Ruvu areas. Thus the fingerlings have to be transported to the farm site. As recommended by FAO the size for transporting Tilapia fingerlings within 24 hours is size 22’ that is about 0.4g. But the data obtained from the fish farmers is that the average size of the fingerlings used is 2.54g that is for away beyond the recommend size meaning that the survival of the fingerlings was low leading to low profitability

Moreover the reasons for the lager sized fingerlings to decrease profitability off the Semi intensive tilapia farming is that the larger sized tilapia fingerlings are being sold at a higher price. This is due to the fact that producers spend a lot in terms of feed, electricity or gas for aeration to grow out the fingerlings to a size required by the costumers thus they are being sold at a higher price meaning higher operating

cost of the fish farming. According to Bolive*et al*(2015) the initial stocking density has no effects on the final weight of the fish. Therefore the decrease in profitability obtained by the size of the seed is justified.

On testing the third null hypothesis states that On-farm practices do not affect profitability of semi intensive pond Tilapia farming. On this study it was found out that stocking density and the size of the seed were statistically significant at 1% and 10% respectively. Therefore the null hypothesis was rejected

Furthermore a remaining variable such as education level of famers, cost of labor, gender of farmers, length of farm cycle, age of a farmer, cost of fertilizers and cost of seed are statistically insignificant and study conclude that, those variable has no influence in the profitability of famers.

Age of the famers was not found to have any significance at any level significance despite having negative influence in profitability of semi intensive tilapia farming projects. This result coincides with that of Tunde*et al* in 2015. The negative influence may be the fact that as the famer ages, the energy level of the farmer decreases and that low efforts is being exerted in farming practices leading to low profitability of fish farming.

In this study though gender was not statistically significant, it has appositive influence in semi intensive pond tilapia farming, same as what Tunde et al (2015) found out. This shows a positive relationship between gender and profitability of semi intensive pond tilapia farming, that is to say Male farmers would have a higher profitability than female farmers when other factors are held constant. This male dominance in fish farming could be due to the nature of fish farming itself since it is a labor intensive

On testing second hypothesis that was Null hypothesis (Ho)socio factors do not affect profitability of semi intensive pond Tilapia and it was found out that none of the socio factors had effects on the profitability of the semi intensive pond tilapia farming hence we failed to reject the null hypothesis.

5.8 Viability of Fish Farming

Using the discounted measures of project worthiness (viability) the so called NPV was used. Using NPV it was found out that average NPV of Tilapia fish farming was around 175,393.11 indicating that Semi intensive Tilapia farming was is a viable project. The results is the same as that done by Olaoye*et al*(2012) whoused Benefit cost ratio to find the viability of Fish farming that resulted to having BCR of more than one which indicated that fish farming was viable.

Therefore the study done on profitability of semi intensive pond tilapia farming projects in Bagamoyo district has shown that the projects are worthy undertaking

From the data obtained, we tested the fourth null hypothesis states that Semi-intensive pond Tilapia farming isviable projects in the study area. Using NPV to test the viability of the semi intensive Pond tilapia farming in the study area, positive NPV was obtained indicating that these projects are viable. By so saying, we reject the null hypothesis

CHAPTER SIX
CONCLUSION, POLICY IMPLICATIONS AND RECOMMENDATIONS

6.1 Introduction

This chapter presents the conclusions made from this study by giving a discussion of the study findings basing on the objectives which were at hand. It goes ahead to document the main research finding, study policy implication, limitations and the possible recommendations.

This study based on the general objective of economic analyzing profitability in semi intensive Tilapia farming projects in Bagamoyo district. This objective accompanied with the following specific objectives

a. To examine the effects of social factors on the profitability of semi intensive pond Tilapia Farming projects

b. To examine the effects of operating costs on profitability of semi intensive pond Tilapia farming projects

c. To examine the effects of on farm practices on the profitability of Semi intensive pond tilapia farming projects

d. To assess the viability of Semi intensive pond Tilapia farming projects

6.2 Key Findings on the Study

The gross margin obtained by tilapia farmers in Bagamoyo was found to be 35.64% indicating that pond tilapia farming is a profit making enterprise. This low gross margin is as a result of high operational costs including the cost of feed, cost of seed, cost of water and cost of labor.

Socio factors that included age of the farmers, education level and the sex of the farmers had no significant effects on the profitability of farming. But it was shown that the education level and sex of the farmers had a positive influence on profitability while the age of the farmer had a negative influence on the profitability of fish farming at 0.05 level of significance.

Cost of feed has shown to have a greater contribution to the operational costs amounting to about 80% of the total operational costs followed by the cost seed and cost of labor. The study has found out that cost of feed, stocking density and the size of the seed are the variables that are statistically significant in their effects on the profitability of the semi intensive pond Tilapia farming at 0.1, 0.05 and 0.1 levels of significance respectively.

Size of the seed was found to have an effect on the profitability of tilapia farming projects as the fingerlings used was of bigger size than that recommended. Thou the size of the fish has no effect on the final product, but it was found that the price and the survival of the fingerlings prior to the arrival to the farm site was affecting the final yield thus affecting the profit which was to be obtained as the average price for the fingerlings bought by the farmers averaged at 250 TZS

Despite using the discounted measures of project worthiness due to time value of money, it was found that, as the projects are viable since are having a positive NPV reaching 175,393.11 TZS. This indicates that fish farming is a profitable enterprise and also viable.

6.3 Recommendations

Basing on the Researchers finding, the recommendations put forward had been categorized into three aspects including the following;

6.3.1 Recommendations on Financial Facilitators (Stakeholders)

This study has identified the potential of Semi Intensive Pond Tilapia Farming especially along the Ruvu River. The fish farmers along the area face a financial constrain in finding capitals to venture into fish farming as the projects themselves need a high investment cost. Therefore, to ensure that these projects are sustained, it is high time the Banks provided the loans with simple payment plans and low interest to the farmers. Also the Non-Governmental institutions should also put more emphasis on educating the fish farmers so that they can be more familiar and get to know the new interventions and methods of fish farming so as to get more profits

6.3.2 Recommendations to Fish Farmers

For the development and sustainability of fish farming the fish farmers should do the following;

a. For the large projects and enterprises, the farmers should ensure that the project write up is in place including the financial lay out, business plan, management plan, tax payment plan and risk assessment are in place so as to avoid inconveniences of fish farming

b. The farmers are recommended to use good quality feeds, seeds, follow the recommended pond construction directives and use a better stocking density so as to have a higher yield thus high profit.

c. The farmers are recommended to get acquainted to the biological aspects of the specie in concern, that is a specie one want to raise, also he should get a proper knowledge on fish farming prior to the inauguration of his project. This is due to the fact that knowing the biological aspects of fish farming would enable the fish farmers do well by providing the necessary care to the fish as fish do show various behaviors in response to any change on the bodies and environment. Moreover the farmers living far from their farms are reminded to make regular visits to their farms and avoid telephone farming.

d. From this study, though fish farming is seen viable enterprise, it takes a long time to reach maturity, due to low profit margin made by these projects. Therefore it is recommended that the fish farmers should also try to switch to other farming methods like cage fish farming and recalculating aquaculture systems that are so inn these days.

e. While conducting the study, it was found out that most of the farmers do not keep records of their farming activities, purchases, timings etc. it is highly advised that the farmers should keep their records always.

6.3.3 Recommendations for Government Policy Makers

Government policies and regulations are the one to make fish farming environment conducive for sustainable semi intensive pond tilapia farming and fish farming in

general. Therefore the following should be done by the government to ensure profitability, viability and sustainability of fish farming;

a. Create favorable conditions and policies that would allow large scale investors in fish farming so as to cut down the deficit in fish and fish products in Tanzania together with the provision of employment to the people. As now fish faring through fish cages have been in practice in Tanzania through Lake Victoria
b. Ensure that capacity building programs are being conducted on regular basis so as to ensure that farmers and the fish farming experts are being up to date on the issues concerned. These issues include proper pond construction, feed preparation, adoption to new fish farming technologies like the use of all males fingerlings in semi intensive pond tilapia farming that ensures the higher growth of fish in a short time that would increase fish farming profitability
c. The government should provide subsidy to fish farmers in areas like, fish feed, fish seed and the fish farming materials like fish nets etc. thiswill help in cutting down the production costs and thus fish farmers be able to make profit.
d. Fish farming among the household in the area are facing a challenge of limited resources that hinder individual's entry in the fish farming and the adoption into the improved fish farming technologies and new management practice. Among these resources, includes the availability of the initial capital, operating resources and the reasonable prices for the fish andfish products. Many governments and individuals' project are highly concentrated on increasing the availability of fish which does not necessarily mean increasing the fish farming profitability. Therefore the government is advised facilitate researches and projects that would identify the models and ways of fish farming to ensure the profitability of these fish farming projects a despite being profitable, the NPV suggests that there is a doubt in the in terms of its sustainability.

6.4 Limitations of the Study

Farmers in the study area do not keep records of their farming activities, therefore the information used in this study may be over or under valued. Farmers could not give accurate records of purchases and sales of fish from their farms. Moreover, there is a lack or a few necessary economic data and information on fish farming in Tanzania as a whole

The study was also limited to the yield data provided by the semi intensive pond tilapia farmers from the year 2018 and to the time provided after completing the course work.

6.5 Areas for Further Studies

From the study of Semi intensive Pond tilapia farming in Bagamoyo, it was seen that these projects are viable due to the reasons mentioned. This study therefore recommends other studies to be done on the profitability of other fish farming methods, like Cage fish farming and recalculating aquaculture systems (RAS). Moreover it is recommended that other studies to be done on the innovations and creations of fish feed at the lower price but with good efficiency in fish growth.

REFERENCES

Ayandiji A and Oke N (2016), determinants of factors affecting awareness of modern technologies in fish farming in Lagos state, Nigeria, in the agricultural research journalvol 6(11), pp 275-280, ISSN: 2026-6073

Census Report (2012). Basic Demographic and Socio-Economic Profile Statistical Tables; Tanzania Mainland and Zanzibar

Chenyambuga S W, Mwandya A, Lamtane H A and Madalla N A 2014: Productivity and marketing of Nile Tilapia (*Oreochromisniloticus*) cultured in ponds of small-scale farmers in Mvomero and Mbarali districts, Tanzania. *Livestock Research for Rural Development.Volume 26, Article #43.*Retrieved December 2, 2018, from http://www.lrrd.org/lrrd26/3/chen26043.htm

Damilola and Oluwenimo O (2013), "social economic and policy issue determining suitable fish farming in Nigeria, in the international journal of livestock production, Vol.4(1), PP 1-8, ISSN 2141-2448

Deloitte (2015), Market study on the aquaculture sector in East Africa

FAO (1996) Fisheries Technical Paper, Rome

FAO (2007), Aquaculture in Kenya: Status, Challenges and Opportunities, Fishery Country Profile.

FAO (2018), the state of world fisheries and aquaculture

Food and agriculture organization (2012), World review of fisheries and aquaculture

Food and agriculture organization (2017), socio-economic performance of Tilapiafarming in Africa, FIAA/c1130, ISSN 2070-6065

Food and agriculture organization (2018), overview of fish farming in Tanzania

FTA (2014), adding value to the East African aquaculture sector

Håstein, T.B., A. Hjeltnes, J. Lillehaug, U. Skåre, M. Berntssen and A.K. Lundebye, (2006)Food safety hazards that occur during the production stage: challenges for fish farming and the fishing industry.

Honfonga BG, TOgnom IA and Chikon A (2017), "profitability and sustanablity of modern fish farming in Benin: an on-farm experimental appraisal of two production system of clariagariepinus in journal of development and agriculutural economics Vol (9), PP 243-249

Issa F, KeziDM,Dare JS and Umar R (2014) " profitability analysis of small scale catfish farming in Kaduna state Nigeria, in journal of agricultural extension and rural development, Vol 6(8), PP 267-273, ISSN 2141-2170

Kothari C.R. (2010), Research Methodology, new techno press-New Delhi

Kothari, C.R. (2004). *Research Methodology*, 2nd edition, New Age International (P) Ltd, New Delhi, India.

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

Kyelu (2016) "analysis of socio-economic and environmental effects of /urban fish farming in Dar es salaam, Tanzania, a dissertation submitted in partial fulfillment of requirements for the degree of master of science in environmental resource economics of Sokoine university of agriculture, Morogoro, Tanzania

MALF (2015), National fisheries policy

MALF(2016), Aquaculture production by region

Ministry of livestock and Fisheries development (2016), The Tanzania fisheries sector, challenges and opportunities

Msabila D and Nalaila S (2013) towards effective researching and dissertation writing, research proposal and dissertation writing, principles and practice, NyambaliNyangwine Publishers, Dsm, Tanzania

Mwenesi NL (2015) “The determinants of performance in semi intensive Tilapia aquaculture projects in Dar es salaam

National fisheries policy, Tanzania (2015)

Njiru M, Mkumbo OC, Martin V (2010) “ some possible factors leading to decline in fish species in Lake Victoria in Aquatic ecosystem Health and Management.

Olaoye, Jacob &George, Francisca and Abdul, Waidi and Adelaja, Olusumbo and Ashley-Dejo, S. &Salako, A (2012) Profitability and Viability of fish farming enterprises using government credit agency loan in Ogun State of Nigeria. Nigerian Journal of Fisheries. 9.460-468

Olasunkanmi JB (2012) “Economic analysis of Fish farming in Osun state, South-western Nigeria, Tanzania proceeding, IIFET

Peter M and singas s (2014) “determinants of adoption of pond fish farming innovations in Salamanca of Morobe province in Paoua New guinea, south pacific studies, vol 35, No.1

Remedios B. Bolivar, Eddie Boy T. Jimenez Jun Rey A. Sugue and Christopher L. Brown (2004), effect of stocking sizes on the yield and survival of nile Tilapia (Oreochromisniloticus) On-grown in ponds,Freshwater Aquaculture Center, Central Luzon State University, Science City of Muñoz, Nueva Ecija 3120, Philippines Marine Biology Program, College of Arts and Sciences, Florida International University North Miami, Florida, USA

Ronald N, Gladys B, Gasper E (2014) The Effects of Stocking Density on the Growth and Survival of Nile Tilapia (Oreochromisniloticus) Fry at Son Fish Farm, Uganda. J Aquac Res Development 5:222. doi: 10.4172/2155-9546.1000222

Schumpeter J.A, 1934(2008), the theory of economic development, an inquiry into profits, capital, credits and interest

Shoko AP, Getabu A, Mwayuli G and Mgand YD (2011) " growth performance, yield and economic benefits of nileTilapiaoreochromisNiloticus and kale Brassica oleracea culture aunder vegetable fish culture intergration

Singh K (2007) Economics and determinants of fish production and its effects on family income inequality in west Tripura district of Tripura. In india Journal of agricultural economics, Jan-March, Vol. 62, No.1

Taiwo TA(2011) "analysis of fosh farming among women in osun state Nigeria,in the journal of economics and sustainable development, Vol 2, no.4, ISSN 2222-1700

Thomas and Maurice (2013): Managerial Economics: Foundations of Business Analysis and Strategies, McGraw-Hill, New York

Tunde AB, KuntonMP,Oladipo AA and Olasunkanmi LK (2015). "economicsanalyse of costs and returns of fish farming in Saki-East local government area of Oyo-state, Nigeria" in the Journal of Aquaculture research development, 6.2, DOI:10.4172/2155-9546.1000306

Zech HG (2014), Acomperative analysis of the competitiveness of Tilapia and catfish enterprise in Mbele sub Region, eastern Uganda

APPENDICES

QUESTIONNAIRE

PROFITABILITY ANALYSIS OF SEMI INTENSIVE POND TILAPIA FISH PRODUCTION IN SONGEA MUNICIPAL

Dear respondent,

I am Kelvin Elisha Ngondo, a student at Mzumbe University in Morogoro, Tanzania, I am conducting a research on **Economic analysis of semi intensive pond Tilapia farming Projects in Bagamoyo District**. You are kindly requested to provide honest participation so as to facilitate the completion of the latter mentioned academic study. Information provided shall forever remain confidential.

Thank you

SECTION A: GENERAL INFORMATION

1. Region:……
2. District:……
3. Ward:……...
4. Village:……...
5. Village chairperson:……..
6. Farmers name:…….
7. Date……. Month……Year:……
8. Household size

Age(Yrs)	0-2	3-5	6-10	11-18	18+
Males					
Females					

SECTION B: POND FISH FARMERS CHARACTERISTICS

Please tick where appropriate,

Sex	1	Male	
	2	Female	
Education level	1	None	
	2	Primary	
	3	Secondary	
	4	Certificate	
	5	Diploma	
	6	Higher education	
Marital status	1	Single	
	2	Married	
	3	Widowed	
	4	Separated	
Primary occupation	1	Permanently employed	
	2	Temporarily employed	
	3	Self employed	
	4	casual labor	
	5	Fish farming	
Age of farmers	1	18-30	
	2	31-40	
	3	41-50	
	4	51-60	
	5	60+	

Section C: Fish farm information

1. How many ponds do you have?.....
2. Is the farm personally owned or rented?.....

3. If owned or rented how much does it cost to construct or rent the ponds you have?.....

4. Did you sell fish from the last cycle? Yes……NO…….

5. If you sold fish, for how much did you sell?

6. If you did not sell, give reason……

Section D: Information on the profitability of fish farming

1. How many fingerlings do you stock in your fish pond? .....

2. How much you pay for each fingerling? .....

3. What size of the fingerling do you stock? ……

4. What do you do before stocking the fingerlings?
   ……
   ……
   ……
   …….

5. Do you fertilize your fish pond? Yes…..No……

6. If yes, what type of fertilizers do you use? .....

7. How many kilograms of fertilizers do use for a full cycle? .....

8. How much do you pay for a kilo of fertilizer? .....

9. How many people are working on your fish pond? .....

10. How much do you pay each of them? .....

11. If you are the only one working on the farm, how much would you have be willing to be paid for you to work on the farm?

12. How many times do you feed your fish?

13. For how many months do you raise your fish?

14. How many kilograms of feed per week

    a. At fingerling stage (1 month old fish)……
    b. At Juvenile stage (2-3 month old)……..
    c. At Grow out stage (4 months old and above)……

15. How much do you pay for a kilogram of fish feed?

    a. Starter……
    b. Grower……
    c. Finisher……

16. What size of fish do you get when harvesting? …….

17. How much do you sell for a single fish? .....

18. How much do you sell your fish per kilogram? …….

19. How much did it cost for you to construct your fish pond? .....

20. What other costs do you incur? Name them including the value

    a. ……..
    b. …….
    c. ……..
    d. ……
    e. ……
    f. ……
    g. ……

Section E: Information on fish farming Costs

S/NO	INCOME/COSTS	AMOUNT(KG/TZS)
1	Fish harvested (kg)	
2	Pond construction costs	
3	Price per Kg	
4	Cost of labor	
5	Cost of feed	
6	Cost of seed	
7	Cost of Fertilizer	

Section F: On farm practices: cycle the correct answer

1. At what size do you stock your seeds?
    a. 1-3 gm
    b. 4-6 gm
    c. 6-8 gm
    d. 8-10 gm
    e. 10+ gm
2. For how long do you keep your fish?
    a. 5 months
    b. 6 months
    c. 7 months
    d. 8 months
    e. 9 months
    f. 9+ months

3. How many fingerlings do you stock per square meter?

    a. 2 Pcs

    b. 3 Pcs

    c. 4 Pcs

    d. 5 Pcs

    e. 6+ Pcs

Section F: information on fish farming operations

Pond	Size	Stoking Density	Fertilizers used per cycle(Kg)	Ownership	Construction costs	Revenue obtained in the last cycle
1						
2						
3						
4						
5						

Section G: information on ponds performance

	Pond 1	Pond 2	Pond 3	Pond 4	Pond 5
Costs incurred in the last cycle					
Fingerlings planted					
Kg of Feeds used					
Size of fish harvested					

What are the challenges facing Tilapia fish farming in accordance to your experience?

……
……
……
……
……
……..

What should be done to overcome those challenges?

……
……
……
……
……
……
……
……