ST. MARY UNIVERSITY
SCHOOL OF GRADUATE STUDIES
DEPARTMENT OF MASTERS OF BUSINESS ADMINISTRATION

FACTORS OF FISH FARMING PRODUCTIVITY AND SUSTAINABILITY; THE CASE OF AFRICA SUSTAINABLE AQUACULTURE B.V. ETHIOPIAN BRANCH

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JUN, 2020

ADDIS ABABA, ETHIOPIA

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DECLARATION

I, the under signed, declare that this 'Thesis' entitled with "**FACTORS OF FISH FARMING PRODUCTIVITY AND SUSTAINABILITY: THE CASE OF AFRICA SUSTAINABLE AQUACULTURE B.V. ETHIOPIAN BRANCH"**, is my original work, prepared under the guidance of my Advisor Habtamu Mekonnen (PhD). All necessary sources of materials used for the preparation of this 'thesis' have been appropriately acknowledged. Moreover, I want to confirm that the thesis has not been submitted either in part or in full to any other higher learning institution for the purpose of earning any degree.

Name	Signature & Date

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LIST OF ABBREVIATIONS AND ACRONYMS

ADP	Aquaculture Development Program.
ASA	Africa Sustainable Aquaculture
ASPIF	Agricultural Sector Policy and Investment Framework
FAO	Food and Agriculture Organization
EIAR	Ethiopian Institute of Agricultural Research
LVFO	Lake Victoria Fisheries Organization
MDGs	Millennium Development Goal
MoA	Ministry of Agriculture
SSF	Small-Scale Fisheries
SPSS	Statistical Package for the Social Sciences

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ABSTRACT

Aquaculture has become increasingly important in meeting the deficit created by a declining capture fishery worldwide and increasing demand for fish at domestic market.. Previous researches indicate that development of aquaculture in most Eastern Africa countries is constrained by low adoption of appropriate technologies and innovations; weak aquaculture extension services and others. The purpose of this study is therefore to assess the factors that affects fish farming productivity and its sustainability; the case of Africa sustainable aquaculture B.V. Ethiopian branch (ASA). The study followed Mixed Methods approach , where both qualitative and quantitative researches were applied. Closed ended questionnaires and interview were data collection instruments used for this study. An 80% response rate was obtained from the ASA respondents. Data were analyzed by using descriptive statistics focusing on the frequency, mean, standard deviation and percentages and the analysis was processed by using statistical package for the social sciences(SPSS) version 20. To analyze the qualitative data, content analysis was conducted and finally it was triangulated with the quantitative. Study finding showed that there is no strong competitive market for supplying the required inputs for fish farming. Even if, fish farming technology is found on a satisfactory level, the inadequate inputs are the challenges that affect fish farming at ASA. Moreover, cost of adopting fish and the production cost for fish farming is found to be high which has its own negative impact on the sustainability of the business. This study recommended that ASA need to provide the required infrastructure for its commercial aquaculture production to minimize the challenges of aquaculture practice, which helps itself for increasing productivity and profitability in the future.

Key words: Aquaculture, Challenge, Sustainability, Fish, Productivity

CHAPTER ONE:INTRODUCTION

This chapter presents the background of the research, description about Africa Sustainable Aquaculture B.V. Ethiopian Branch, statement of the problem, research objectives, research questions, significance of the study, scope and organization of the study.

1.1. Background of the Study

Ethiopia's key growth strategy is Agricultural Development Led Industrialization (ADLI), recognizing the importance of agriculture as the dominant source of the nation's income. The Agricultural Sector Policy and Investment Framework (ASPIF), 2010-2020, aims to provide a strategic framework for the planning and prioritization of investments for growth and development in the agricultural sector, including "all forms of agriculture, livestock, fisheries, forestry, irrigation and natural resource management" (Kurien, John, Lopez Rios and Javier, 2013)

The Ethiopian government adopted fisheries legislation in 2003 by virtue of the Fisheries Development and Utilization Proclamation No. 315/2003, with a view to ensuring the conservation, development and utilization of fishery resources in the country in a sustainable manner. Following this fishery legislation, the Africa sustainable Aquaculture B.V. ASA Ethiopia is established in Amhara Region, Mechaworeda, kudmikeble in koga irrigation dam in 2015 for the provision of fish product in the region.

According to the Food and Agriculture Organization (FAO) Fisheries Glossary, the fishing industry includes any industry or activity concerned with taking, culturing, processing, preserving, storing, transporting, marketing or selling fish or fish products. Farming implies some sort of intervention in the rearing process to enhance production, such as regular stocking, feeding, protection from predators and it can also include encouraging of accessible market chain. This farming can be ran by individual or corporate ownership for planning of stock being cultivated, sites selection, development and operation of aquaculture systems, providing of facilities and practices, the production and transporting of the products (FAO, 2010).

Aquaculture practice was officially started in Ethiopia after establishment of the former Sebeta Fish Culture Station (the current National Fishery and Aquatic Life Research Center) in 1977 by then Ministry of Agriculture. Since then the center stocked over 8 million fish fingerlings mainly Nile tilapia, Tilapia zilli and common carp mainly to develop extensive aquaculture system in the country (Wakjira, M., Tolemariam, T., Kim, J. D. and Kim, K. R., 2013).

From Ethiopian perspectives, the Ethiopian Institute of Agricultural Research (EIAR) within the MoA is responsible for undertaking research in response to fisheries management and development needs. However, most of the research carried out in the past has been fragmented and academic, with limited relevance for practical fisheries development and management systems (FAO, 2003-2015).

The literature showed that the constraints affecting fish farming include technological as well as institutional challenges. Technological challenges range from unavailability of quality fingerlings (Kaunda, E., Khando, S., Chitsulo, T., Kapondamgaga, P., Jamu, D., Banda, J., Ng'ong'ola, D., Chirwa, B., Moyo, N. and Maluwa, A. (2010), high cost of feed (Shitote, Z., Wakhungu, J. and China, S. (2012) as well as inability to manipulate pond environment to improve fish growth (Russell & Dobson, 2009).

Marketing of fish is also hampered by several factors including lack of proper market infrastructure especially for fresh fish which are highly perishable; poor road network particularly feeder roads in rural areas which normally translates into high transportation costs and inadequate market information system with producers having limited knowledge on quantities required, where and at what price to sell (Wetengere, 2010). In addition, fish farmer organizations tend to be more common in communities where extension service has been active in mobilizing farmers to form clubs or developing income-generating activities, or where there has been external support (Kapanda, Ng'ong', Matiya, Tchale, Jamu and Kaunda, 2003). Whilst some may operate effectively, many have a loose organizational structure, have poor leadership and have limited business. Against this background, the study was conducted in order to examine the challenges affecting the fish farmer organizations in relation to the sustainability of the fish farming at ASA.

To the knowledge of the researcher, there is no previous research has been conducted directly on ASA fishing practice. It would be of special interest to the researcher personal curiosity in this specific area of fish farming to see the practicality of fish production in this private company. This research was focused on the factors that can affect productivity from the sustainability perspectives of the fish production at ASA.

Information on independent variables like cost of inputs, provision of extension services, use of new technologies, and accessibility to market was gathered & investigated to scrutinize their influence on the dependent variable (the sustainability of aquaculture). Therefore, this study investigated the challenges that are influencing the sustainability of fish farming, in the case of Africa sustainable aquaculture B.V. ASA Ethiopia.

1.2. Background of the Firm

Africa sustainable Aquaculture B.V. (Ethiopian Branch) ASA Ethiopia is currently working in a fish farming project in Amhara Region, Mechaworeda, kudmikeble in koga irrigation dam. They initiate and develop commercial and sustainable aquaculture sectors together with local entrepreneurs. The company's focus is on high quality tilapia production for the local market and export, thereby explicitly contributing to food security, employment and capacity building. The company was founded in the year 2015. As a vision the company want to be the leading fish farming company in the countries they operate and to set the benchmark for the sustainable development of the sector. Their goal is to contribute to nutrition security, employment and capacity building by producing high quality tilapia for the local market and export. As a sustainability goal the company bear in mind that employment and better income, alternative protein source for the local people, awareness campaigns on the nutritional value of fish and skill training and education for employees, students, researchers, farmers and entrepreneurs.

Though the company stayed in fish farming for over four years, the project is not performing as per its original expectation & project plan. No other investors have also joined the sector within these five years period. In other words, the sector is being no more attractive enough to catch new competitors' attention. Even the company itself is observed facing challenges

that are influencing the sustainability of aquaculture which was the interest and motivational factor for the current study.

1.3. Statement of the Problem

The current fisheries management system in Ethiopia mainly consists of a fishing licensing system aimed at regulating access to the fishery and some technical conservation measures. In practice, however, fisheries are under open access and the governance framework for fisheries management is inadequate. There is a lack of data and information on most water bodies, low research and development capacities, low participation of fishing communities in fisheries management and the fisheries administration is confronted with a serious lack of human and financial resources to achieve their objectives (Wakjira et al., 2013)

A study by Gakuu (2018) has identified several challenges that are mostly influencing the sustainability of aquaculture. These factors include cost of inputs which need to be readily available, of good quality and require fish farmers to have access to finance and market which need to be broadly available and the farmers to be able to produce adequate to supply continually to meet the high demand for fish.

Gakuu (2018), has also sought to determine how cost of inputs, provision of extension service, accessibility to market and use of technology influence the sustainability of small scale fish farming projects. Accordingly, he observed that the former factor has insignificant influence on the small-scale fish farming sustainability & the latter three factors have been observed to positively influence fish farming sustainability at large; whereby the aforesaid studies were limited to investigate the issue only from their countries perspective.

As a problem the insufficiency in outreaching program and inadequacy in propagation of technology transfer to farmers also play a key role in the backwardness in developing the sector. Many farmers with good land that can be put into fish farming are not even aware of this potential. Poor record keeping by farmers and disorganized statistical data collection has impended information dissemination on fish farming. According to Jacobi (2013), the reasons for slow aquaculture development in Kenya have been: lack of a tradition of fish and water husbandry, numerous political, social and economic limitations that restrict

investment and delay expansion, lack of information on fish farming technology and culture practices.

According to Henry (2012) development of aquaculture in most Eastern Africa countries, however, is constrained by low adoption of appropriate technologies including biotechnology and bio-safety; inadequate investment into research to generate and disseminate aquaculture productivity enhancing technologies and innovations; weak aquaculture extension services, inadequate aquaculture extension services, low capacity in fish disease diagnosis, inadequate expertise, insufficient infrastructure, poor culture management and unavailability of quality fish seeds and feeds.

The overall experience to date indicates a lack of effective management actions, as a result of limited accessibility and application of scientific information, poor dissemination of management information, inappropriate and un harmonized fishery laws and regulations, inadequate enforcement of existing laws and regulations, weak institutions and institutional processes, and inadequate funds for implementing fishery programmes.

This research covered the main challenges on the sustainability of fish farming at ASA, Ethiopia. Similar issues have been addressed by earlier researcher, Gakuu (2018) University of Nairobi; whereby it has shown "Factors Influencing Sustainability of Small Scale Fish Farming Projects in Kenyan, perspective only; and has sought how the variables such as: cost of inputs, provision of extension service, accessibility to market & use of technology influence the sustainability of small scale fish farming projects. Accordingly, he observed that the stated factors have distinct influences on fish farming sustainability.

Likewise, the preliminary focus group discussion with ASA, Ethiopia, is showing that they are facing challenges that are influencing the sustainability of aquaculture. Due to many unknown reasons the sustainability of aquaculture is being apparently challenged in the company. As a result, there are significant variations between the company's budget & actual performance time after time. The company's management also is not new to entertain such budget variations. It's normal to see declines in the farm's productivity at random moment in time. The company's fish farming needs to demonstrate sound operations by

overcoming challenges that are influencing sustainability of fish farming & realize higher performance, customer satisfaction, and higher returns on investment & appear competitive.

Thus, this study assessed the challenges that are confronting the company's productivity & aquaculture sustainability. For that matter, the study attempted a review of the past four years secondary data maintained in the organization. Furthermore, the study incorporated 1st hand information that was secured from the target groups (the fish farming management & employees) through questionnaire & interview.

1.4. Basic Research Questions

As part of fish farming sustainability assessment, the study has formulated and attempted to answers the following basic research questions :

I. What are the basic fish farming factors of productivity and how practices are being conducted in the company?
II. What are the major challenges hindering the productivity of fish farming in ASA Ethiopia?
III. Does fish farming project attain its sustainability goal and what strategies did they use for sustainability?

1.5. Objectives of the Study

1.5.1 General Objectives

The general objective of this study is to investigate the major factors that are influencing fish farming sustainability in Africa Sustainable Aquaculture B.V. Ethiopian Branch.

1.5.2 Specific Objectives

The specific objectives of the study was to:

I. Investigate the basic fish farming factors of productivity and how practices are being conducted in the company?
II. Identify the major challenges hindering the productivity of fish farming in ASA Ethiopia

III. Explore whether the fish farming project has attained its sustainability goal or not and the strategies used for sustainability

1.6. Significance of the Study

Since the sector itself is relatively new to the country and polices are devised based on theories rather than empirical facts on the ground, the study has its own a paramount contribution. When it comes to practice, things may bear their own challenges in implementation. Thus, policy makers at large would make use of the study findings as an empirical guide for making sound & informed decision. Besides this fact, the study will also contribute the following important points:

i. To improve fish farming sustainability & solve practical societal or nutritional problems
ii. It provides information for users and other decision makers to act accordingly
iii. It fills knowledge gap that may exist & contributes to the context of knowledge.
iv. It initiates and encourages other researchers to conduct comprehensive studies in this regard.
v. It helps the regional government, the Company under study, the national government and other stakeholders to use the information in fiscal planning, management and any other decision relevant makings.
vi. By doing this research the research can contribute by giving information to potential investors about the actual information related to fish farming in Ethiopia and actual problem that ASA faces. Hope it will help for getting information & foresee opportunities and challenges in the sector.
vii. It will also enable the governing body, specifically the managements, the higher responsible body, and public at large to be aware of the importance & use of aquaculture to ensure food security especially in developing countries like Ethiopia, as well as gives insight how they manage the sector most efficiency. It teaches other student researchers about theoretical and new practical methods.

Finally, it proposed significant values to ASA Ethiopia & help to see the overall challenges influencing the actual performance and enable them use the study recommendations for their next appropriate actions & farm improvement decisions.

1.7. Scope of the Study

The boundary of the study is limited to the case of aquaculture project in Ethiopia particularly in Amhara Region, Mechaworeda, kudmikeble in koga irrigation dam. It was focused on the investigation of factors influencing the fish farming sustainability, the case of ASA Ethiopia fish farming project only. The target group of this study was comprised from the population of interest, which were all employees of the ASA. For collection of qualitative and quantitative data this study employed a Convergent Parallel Mixed Methods Design as a strategy. In this study, both theoretical and empirical findings were reviewed, from which a conceptual frame work is derived to lead the research.

1.8. Limitation of the Study

Since there is limited enterprise focused on production of fish in Ethiopia and due to lack of prior research studies on the topic, there was a problem in getting reliable data from other practitioners and this potentially limit the scope of the study analysis. This further can have a significant obstacle in finding a trend and a meaningful relationship between the dependent and the independent variable. Secondly, as the study applied a descriptive studies it is simply tried to describe the data on one or more characteristics of a group of individuals as a result there is a limitation of establishing relationships between variables. Moreover, it is clear that a statistical tests require a larger sample size to ensure a representative distribution of the population, but due to small size of the sample taken in the study there is an observable limitation on finding a significant relationship from the data. Moreover, data was collected using closed and open ended questionnaire and interview only. To some extent these gathered data inhibited to conduct a thorough analysis of the results it would be better to include observational data collection. In this study it was observed that open-ended questions get fewer and shallow responses, even some are hard to interpret and was difficult to categorize. This signifies there is a need in future research to revise the specific method for gathering data.

The above constraints appeared to affect the best performance of the study. The student researcher is aware of the above factors that may influence the outcome of the study among the most important limiting factors in this study. Since the researcher is unable to obtain

1.9. Organization of the Paper

The study is organized in five chapters including the present one. Chapter one introduces the study, giving an overview idea on the notion of aquaculture and spells out the statement of the problem, objectives, significance of the study, scope, and limitations of the study. Chapter two consists the review relevant literatures on empirical studies of fish farming projects as well as related topics. The methodology part together with research design, data collecting tools, research procedures and data analysis technique is presented in Chapter three. Chapter four will present the results of analysis done and discussions on the findings. Chapter five will finally present drawn conclusions from the empirical findings and suggests recommendations.

1.10. Definition of Terms /(Conceptual or Operational)

Aquaculture:- Aquaculture also known as aqua farming, is the farming of fish, crustaceans, mollusks, aquatic plants, algae, and other organisms. (http.//en.wikipedia.org)

Aquaponics :- refers to any system that combines conventional aquaculture (raising aquatic animals such as snails, fish, crayfish or prawns in tanks) with hydroponics (cultivating plants in water) in a symbiotic environment.(http.//en.wikipedia.org)

CHAPTER TWO: REVIEW OF RELATED LITERATURE

2.1 Theoretical Literature Review

2.1.1. Theory of Production

According to a study by Cobb and Douglas (1928) the theory of production attempts to explain the effect of cost of inputs on sustainability of small-scale fish farming projects. Theory of production answers the question "how to produce" which further discusses the supply side of the product prices which depends on cost of production. Cost of production depends on the physical relationships between inputs and outputs as well as prices of inputs. This implies that the amount of production in fish farming projects depends on the cost of input (Kagiri, 2016).

Some of these inputs include the invested capital to a fish farming project and the day-to-day running cost of the project meaning that the lower the cost of inputs, the lower the cost of production hence high level of production. This therefore, means that fish farming projects are making profits and hence sustainable in the long run. Hence, the cost of inputs is vital in the sustainability of fish farming projects. This theory therefore is important to this study since it highlights the influence of cost in puts in the sustainability of fish business enterprise.

2.1.2. Diffusion of Innovation (DOI) Theory

Adoption of new technologies process studied for the past few decades with Rogers's book Diffusion of innovation being the most popular (Rogers, 1995).This theory is appropriate for the study for investigating the adoption of innovation in fish farming. An innovation is any idea, practice or any object seen as new Rogers, (1995) by farmers while diffusion is the stages or processes of communicating these innovations using different channels over a certain period of time. DOI looks at the how, why and at what rate new ideas and technology spread through cultures (Oliveria and Martins, 2011).

According to Rogers, (1995) DOI theory stresses on importance of communication and stakeholder net working with in the adoption process. Rogers distinguished adopters of innovation in five categories namely; innovator; the technology enthusiasts; early adopter;

the visionaries, role models of the technology; early majority; the pragmatists, opinion leaders; late majority; the conservatives who were technology shy and required bullet proof solutions and laggards; the Skeptical ways maintain their status quo. This theory is a good example of how fish farmers adopt technology.

Some farmers have managed to increase the level of adoption in fish farming by changing perception from subsistence to commercial and sustainable farming practices (Roseline 2007) by incorporating simple improved fish production technologies. This theory proposed five stages of adoption process: awareness stage; where the farmers is exposed to innovation/new technology but does not have adequate information; interest stage; the farmers gains interests in the new idea and look for more information; decision/evaluation stage; the farmer decides to either try or not ; trial stage; where the farmer implements the new idea on trial bases and adoption stage; on this stage the farmer decides to fully utilize the innovation/technology (Spring 2011). DOI theory is important for small scale fish farmers as it benefits the targets of change by ensuring involvement to fall stakeholders with strong strategies for implementing innovative change.

Aquaculture (fish Farming) is the cultivation of aquatic animal & plants specially fish, shellfish and seaweed in natural as well as controlled marine or fresh water environments; underwater agriculture. Fish Farming involves raising fish commercially in tanks or enclosures such as fish ponds, usually for food. It is the principal form of aquaculture, while other methods may fall under Mari culture. A facility that releases juvenile fish into the wild for recreational fishing, or to supplement the species' natural numbers is generally referred to as a fish hatchery. Worldwide, the most important fish species produced in fish farming are carp, tilapia, salmon, and catfish (Jonathan, 2014).

2.1.3. Sustainability of Small Scale Fish Farming Projects

Sustainability is without doubt one of the most important challenges in today's time and immediate future. This is because most donors funded projects die as soon as the donor pulls out. According to Wetenegere, (2010) sustainability as a concept of development is one that meets the need of the present without compromising on the future generation to meet their needs. Sustainability is very crucial and must be addressed as a requirement in any projects

during its planning and design stages. Azimi & S.L, (2012). Sustainability involves balancing or harmonizing social, environmental, and economic interests considering the full life cycle of any project. Economic sustainability has been defined as effectively and efficiently using available resources to ensure that the business continues return profit over several years. According to Christian, (2016) there are many ways to look at economic sustainability nevertheless: In his article "sustainable aquaculture" there are three main economical areas that fish farming can be of help. The areas include growth, trade as well as standards of living. However his article does not elaborate as to how aquaculture has done this or would do this. Further, it also does not comment on whether fish farming has offered any benefits and who the benefits have gone to. Lastly, looking into the future the article does not comment on who this benefit will go to. According to Bernard, H.R., Wutich, A. and Ryan, G.W., (2016) the final product quality and the individual task times are the major components of sustainability.

Fish production and consumption are characterized by very significant regional disparities. In South East Asia, while many countries have significant SSF, aquaculture is becoming increasingly important. By contrast, production in Africa from both SSF and aquaculture is relatively low, with the notable exceptions of Egypt and, to a lesser degree, Nigeria. Over the past decade, per capita fish consumption has increased in most developing countries in East and Southeast Asia, whereas in India and in most of Africa it has remained low (Rogers, 1995).

2.1.4. Cost of Inputs and Sustainability of Small Scale Fish Farming

One of the biggest constraints to aquaculture development in Kenya has been lack of quality fish seed (Mary Opiyo, H.C k 2017). According to NARDTC (2014) seed production plays a key role in fish farming and it's important for fish farmers to use good quality seed. Quality seed guarantees fast growth, high yields and good survival rate. Prior years, provision and distribution of fingerlings depended on government; this did not help the farmers as expected due to poor infrastructure and low production level. However the government initiated two national fish selective breeding programs for Nile tilapia and African Catfish at the National Aquaculture Research Development and Training Center together with Kenya

Marine and Fisheries Research Institute in Sagana in collaboration with other development partners, to develop national breeding nuclei with multiplication centers and hatcheries to distribute quality brood stock to hatcheries have tried to increase fish production in fish farming by promoting fish seed production through genetic improvement and hormonal manipulation to produce appropriate fish seed/fingerling (mono sex) that is resilience to the Kenya climatic conditions. Production of mono sex tilapia fingerlings should ensure that a minimum of 95 per cent are male (NARDTC G. a., 2014). Despite all efforts to promote production of quality fingerlings some farmers still feel that the cost of mono sex fish seed is still very high & lack that knowledge of where to get this quality fingerlings and end up buying mixed sex that does not give them maximum output.

2.1.5. Provision of Extension Services to Fish Farming

Providing extension services to rural communities to improve their fish farming skills and capacity to increase their farming efficiency is very important in any project. by providing this services to the farmers it provides them with information on production, value addition, access to finance, marketing etc. Therefore provision of extension services plays an important role in the development of aquaculture (Chrstian, 2016). According FAO reports aquaculture extension services have played an important role in the development of aquaculture; nevertheless, more is expected in the future. At grass root level efficient extension services are required to promote the existing farmers and potential farmers for effective promotion of equitable and sustainable development of aquaculture sector. In Kenya fish farming was popularized in the 1960s by the government through targeted “Eat More Fish” campaigns to promote consumption especially in the eastern and central parts of the country (Charles, 2007).

A report by KEPSA, (2013), indicates that in Kenya the effectiveness of extension services has declined over the last two decades due to a sharp reduction in operational budgets and human resource in the sector ministries. According to (FAO, 2004) one of the key problem in extension services is low level of support to field technician, those front line staff in direct contact with farmers. Further Charles and Manyala, (2004), in their study on Aquaculture extension services in Kenya shows extension services to be one of the major problems

facing aquaculture sector development in the country mainly due to inadequate extension officers provided by the department of fisheries. A report by Sharma, (2004), indicates that government need to provide support services tailored to enable small scale farmers take up commercial farming through sustainable practices.

In his research Bernard (2016) also emphasized on the need to radically restructure extension services to make technology dissemination responsive to small farmers. Moreover it is stated that capacity building and skills training determine the success of agricultural development to realize a projects objectives and for this to be fully achieved the guideline for life of the project must be strongly implemented. Research conducted by Hope (2009) found that to be engaging in a sustainable manner to develop positively and reduce poverty as well as meet all the MDGs, extension should be regarded as the key enhancement of competency of farmers and local communities.

2.1.6. Sustainability of Small Scale Fish Farming

Based on research conducted by FAO, (2004) Aquaculture extension in sub-Saharan Africa, extension agents gain important training in both technology and participation. However, one of the lessons learnt from this study was that "quality extension" does not simply mean that technicians have adequate technical training. In Kenya, aquaculture systems are characterized by high cost of inputs, inadequate extension services and lack of markets all leading to low fish production in the country. Despite the National and County government being aware of the inadequate extension services in the counties, a lot of government and donor funded projects are being implemented before addressing the issue of inadequate and trained extension workers.

An assessment done by Rogers, (1995), in Asia attempting to provide a sustainable flat-form for future growth in Cambodia's future growth, international development agencies have adopted an interlinked approach showing the critical role for growth on the local level, bottom up growth inactive predominantly in rural societies that remain largely organized around rural-urban weak link and surrounding villages. In conclusion, prior year's aquaculture extension services have been seen to target commercial fish farmers. This has slowly changes and studies show that small scale fish farming can also contribute to poverty

reduction provided the extension approaches are appropriate and flexible. Extension approaches that are currently being used in aquaculture and agriculture in general are considered inappropriate for majority of small scale fish farmers. The existing aquaculture extension services are under-resourced hence seen to suffer many of the commercial/large extension problems. To be able to have a more appropriate extension approach that will develop small scale fish farming a participatory extension approach would be appropriate. Fish farmers and extension workers need to be equal partners in the development process. Accessibility of market and sustainability of small scale fish farming.

In Kenya, development of aquaculture has been occurring in recent years and marketing of aquaculture productshasbeenanareaofconcernwithmanyfarmersdesiringtoattractinternational and regional markets (Mary.etal,2017).

KEPSA (2013) report on the Kenya National Business Agenda II 2013-2018 states that while Kenya's agriculture is better developed than that of most countries in sub-Saharan Africa, the domestic market is poorly organized to take advantage of the regional market. Further, a report by FAO(2016) indicated that fish market in Kenya is classified according to target markets: local and international market, where local fish is largely sold fresh while international market involves high quality standards during handling, processing and storage.

Reports by AAK (2015), indicated that super markets, hotels, schools, fish out let center (establish through the Kenya productivity and agribusiness programme) are some of the main markets where small scale farmers sell their fish. According to Heinemann (2002), farmers in the rural areas in Africa, high light access to market as one of the greatest challenge to improvement of their living standards. That notwithstanding, accessibility to fish markets in Kenya has been a teething problem due to low production. Daniel &. Mungai, (2015) have showed fish farmers training manual advised fish farmers to embrace cluster production and marketing approaches through cooperative societies to benefit from economies of scale. Daniel &. Mungai, (2015) continue to state that fish production should be linked to market demand and fish farmers must ensure that they produce products demanded by the market. Several interventions have been made by development partners to promote competitiveness and access to market of farmed fish and fisheries products.

Dorward, A., Kydd, J. and Poulton, C., (1998) in their studies on small scale agriculture marketing found that there are many challenges linked to access to market such as price risk and uncertainty, lack of organized small scale producers which increases the cost of putting together sparsely dispersed quantities of produce and also lack of meeting the required market standards. In Kenya for example, small scale fish farmers are geographically dispersed, roads are impassable, and farmers notable to meet the market demand.

AAK(2014) confirm this by stating that in the previous years, marketing of fish for small scale fish farming was a major challenge due to farmers dispersed geographically and not well organized. In South Africa, a study by Senyolo & Chaminuka (2009) showed that most emerging farmers emanate from groups of smallholder farmers who were previously excluded from main stream economy. However, accessibility and use of market by the group are two main factors that determine the development of these groups of farmers. AAK (2016) report says that fish in Kenya have formed cooperatives to help them market their fish. Commercial fish farmers in Kenya have also been keen to forming mutually beneficial alliance with the small scale farmers to supply market able products at an agreed price (AAK, 2016).

2.1.7. Use of New Technology and Sustainability of Small Scale Fish Farming

Technologies are increasingly being developed in a global market for farm level application with an impact on the sustainability beyond the farm. Adoption and use of technology for sustainable fish farming systems is a multi-disciplinary approach taking into account a wide range of objective geared towards sustainable aquaculture.

According to FAO (2017) over the last five years the system and technology used in aquaculture has developed rapidly. Similarly, research by El-Gayar, (2001) showed that recent advances in information technology have had profound impact on all walks of life and aquaculture is no exception. He continues to state that the growing importance of aquaculture as an alternative source for food protein has further emphasized the need to adapt and develop advanced IT for the better management of aquaculture facilities as well as the regional planning for aquaculture development. According to Wetengere, (2009) improving farm production through integrated modern technologies into the existing

farming systems is essential for the enhancement of household food and income security. His study recommended that technology developers should strive to improve the profitability of fish farming through the reduction of the rash of losing fish, shortening culture cycle to target market size fish, use of low cost inputs and/ or integrating fish farming with the existing farming systems and access tour ban market. According to Olatunji and Ogunremi (2016) findings on awareness of fish farming technologies by fish farmers they found out that lack of awareness, lack of knowledge of effects of recommended technology or negative attitude to the innovation may be responsible for non-adoption among farmers. Being a technology era in Kenya researchers such as Bowman et al, (2007) have found the need to search form or e knowledge on the use and up take of new technologies through extension to ensure sustainability of small scale fish farming projects.

A research by Jacobi (2013) indicates that one of the reasons for slow aqua culture development in Kenya has been use of traditional fish and water husbandry, political, social and economic constrains that restrict investment and delay expansion and lack of information on fish farming technology. In his study Henriet (2011) contend that adoption of fish farming technology is more likely to bead opted by the younger farmers.

In regards to the use of technology Rajan (2013) research found out that feed management, selection and management of seed are some of the important technological components in fish farming. In his study Onzere,(2013) found that communities still used traditional methods of fish farming, harvesting and preservation. In her research Kagiri, (2016) stated that lack of technology has led to reduced output as well losses since the fish harvested cannot be stored for long period that would enable fish farmers market their produce at a later date or even transport to a different location for sale. Wetenegere, (2010) states that fish farming has very high potential which can be fully utilized if only technology was adopted.

According to Singas and Manus,(2014) farmers adopt fish farming technologies if they are assured that fish farming is a profitable venture. In his study Wetenegere, (2010) implies that importance of the recommended technology related to existing practices must be clearly demonstrated to farmers. To ensure that the small scale farmers get the desired benefit, low

cost technologies appropriate to the farmers needs to be extended widely. Constant in formation on new innovations made by research institutions like KMFRI can also help in drawing benefits from the innovations.

In conclusion technology adoption and use is quite broad and is affected by development, dissemination and application of the technologies at farm level especially farm capital and other inputs. It's also affected by extension, advice and information which form the basis of farmer knowledge as well as technologies and practices in the overall agri-food sector that have an impact at the farm level. Fish farmers have always looked at new aquaculture technology as a way of reducing cost of production a clear indication that demand driven adoption and use of technology. Fish farmers invest in sustainable technology and farm practice if they expect the investment to be profitable, have the right education, information and motivation.

2.1.8. Status of Aquaculture in Ethiopia

A potential for . Even though the country has high potential and wide environmental condition for aquaculture farming; it was existing as small-scale, subsistence-oriented and only to a certain degree commercial. It is estimated that there are more than 1300 subsistence fish farmers in Ethiopia with a pond size of about 100–300 m² (Abera, 2017).

2.2 Empirical Review

It is highly probable that future developments in this field will rely on microorganisms, but greater funding and further research is needed to overcome the lack of knowledge in this field. In 2016, aquaculture was the source of 96.5 percent by volume of the total 31.2 million tons of wild-collected and cultivated aquatic plants combined. Global production of farmed aquatic plants, overwhelmingly dominated by seaweeds, grew in output volume from 13.5 million tons in 1995 to just over 30 million tons in 2016. The farming of fish is the most common form of aquaculture. It involves raising fish commercially in tanks, fish ponds, or ocean enclosures, usually for food. A facility that releases juvenile fish into the wild for recreational fishing or to supplement a species' natural numbers is generally referred to as a fish hatchery. Worldwide, the most important fish species used in fish farming are, in order, carp, salmon, tilapia, and catfish.

In the Mediterranean, young blue fin tuna are netted at sea and towed slowly towards the shore. They are then interned in offshore pens (sometimes made from floating HDPE pipe) where they are further grown for the market. In 2009, researchers in Australia managed for the first time to coax southern blue fin tuna to breed in landlocked tanks. Southern blue fin tuna are also caught in the wild and fattened in grow-out sea cages in southern Spencer Gulf, South Australia.

A similar process is used in the salmon-farming section of this industry; juveniles are taken from hatcheries and a variety of methods are used to aid them in their maturation. For example, as stated above, some of the most important fish species in the industry, salmon can be grown using a cage system. This is done by having netted cages, preferably in open water that has a strong flow, and feeding the salmon a special food mixture that aids their growth. This process allows for year-round growth of the fish, thus a higher harvest during the correct seasons. An additional method, known sometimes as sea ranching, has also been used within the industry. Sea ranching involves raising fish in a hatchery for a brief time and then releasing them into marine waters for further development, whereupon the fish are recaptured when they have matured. Commercial shrimp farming began in the 1970s, and production grew steeply thereafter. Global production reached more than 1.6 million tons in 2003, worth about US$9 billion. About 75% of farmed shrimp is produced in Asia, in particular in China and Thailand. The other 25% is produced mainly in Latin America, where Brazil is the largest producer. Thailand is the largest exporter.

Shrimp farming has changed from its traditional, small-scale form in Southeast Asia into a global industry. Technological advances have led to ever higher densities per unit area, and brood stock is shipped worldwide. Virtually all farmed shrimp are penaeids (i.e., shrimp of the family Penaeidae), and just two species of shrimp, the Pacific white shrimp and the giant tiger prawn, account for about 80% of all farmed shrimp. These industrial monocultures are very susceptible to disease, which has decimated shrimp populations across entire regions. Increasing ecological problems, repeated disease outbreaks, and pressure and criticism from both nongovernmental organizations and consumer countries led to changes in the industry in the late 1990s and generally stronger regulations. In 1999, governments, industry

representatives, and environmental organizations initiated a program aimed at developing and promoting more sustainable farming practices through the Seafood Watch program.

Freshwater prawn farming shares many characteristics with, including many problems with, marine shrimp farming. Unique problems are introduced by the developmental lifecycle of the main species, the giant river prawn.

The global annual production of freshwater prawns (excluding crayfish and crabs) in 2007 was about 460,000 tones, exceeding 1.86 billion dollars. Additionally, China produced about 370,000 tons of Chinese river crab.

2.3 Conceptual Framework

In this study the conceptual frame work is considered as a way of structuring ideas together with the aim of achieving the search objectives. It is designed to shows how the independent variables are linked with the dependent variable. Therefore the designed conceptual framework showed that how the hypothesized factors such as cost of inputs, provision of extension services, accessibility of market and use of technology influence sustainability of small scale fish farming projects.

Independent Variable

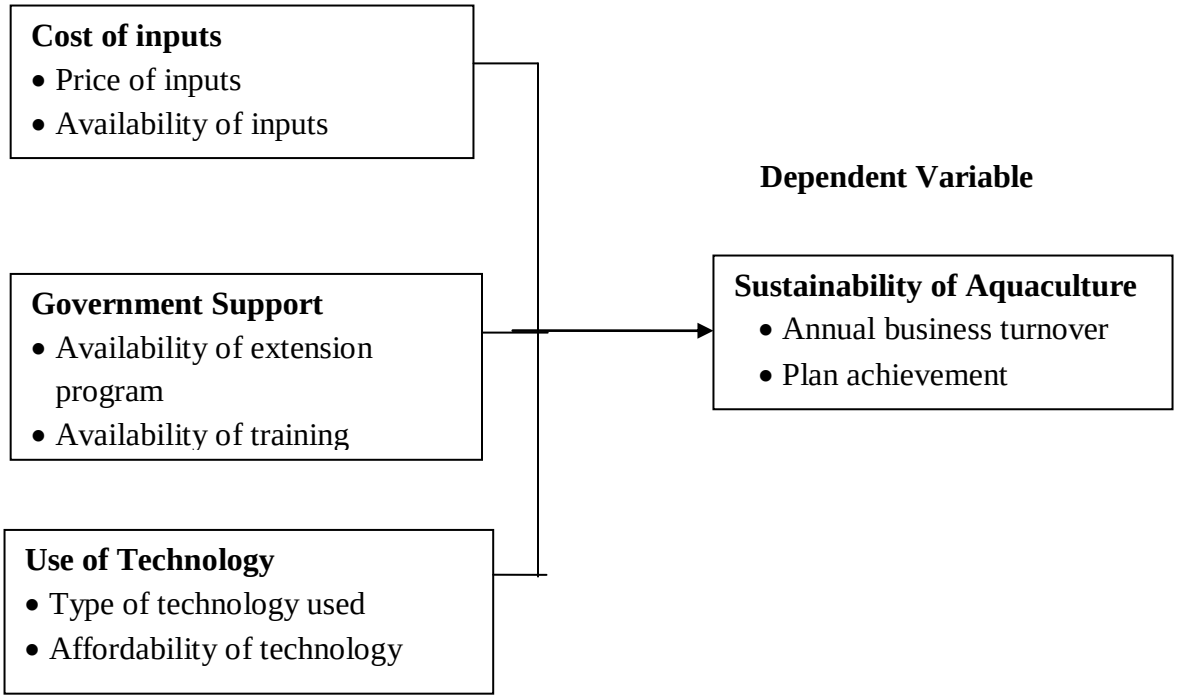

Figure 2.3.1 Illustration of the Conceptual Frame Work for the Study.

CHAPTER THREE: RESEARCH METHODOLOGY

3.1 Introduction

This chapter outlines the methods to be followed in this study to meet the objectives of the study set at the beginning of the research process. It gives the roadmap towards exploring the practical issues influencing aquaculture sustainability as it's observed in ASA Ethiopia. The chapter includes research design, selection of research participants, sampling technique and sample size, methods of data collection and instruments, method of data analysis and presentation.

3.2 Research Design and Approach

According to Johnson BR, Onwuegbuzie AJ, Turner LA. (2007, p. 123) mixed methods research is the type of research in which a researcher or team of researchers combines elements of qualitative and quantitative research approaches (e. g., use of qualitative and quantitative viewpoints, data collection, analysis, inference techniques) for the broad purposes of breadth and depth of understanding and corroboration. This study employed a Convergent Parallel Mixed Methods Design. According to (Creswell & Poth, 2017) the convergent mixed methods approach is probably the most familiar of the basic and advanced mixed methods strategies. In this approach, a researcher collects both quantitative and qualitative data, analyzes them separately, and then compares the results to see if the findings confirm or disconfirm each other. The key assumption of this approach is that both qualitative and quantitative data provide different types of information.

The identified research questions and objectives of this study was explicitly answered by combining qualitative and quantitative research components, which further helped to expand and strengthen the validity of the research result and the study's conclusions. This was achieved through triangulation through the usage of convergence of results from different methods.

Creswell & Poth, (2017) recommend that qualitative researchers choose from among the possibilities, such as narrative, phenomenology, ethnography, case study, and grounded theory. The researcher intentions is trying to assess the factors that can affect fish farming

productivity and aquaculture sustainability and also focused on the underlining reasons behind the practice. Therefore in this research, a case study approach was used as it involves an up-close, in-depth, and detailed examination of a subject of study as well as its related contextual conditions in research method.

3.3 Population, Sample Size and Sampling Technique

3.3.1. Population and Sample Size

To describe what factors influencing fish farming in Ethiopia, data was collected from the totality of the target groups. The target population for this study was composed from the management & employees of ASA aquaculture company which was made up the totality of population for the purpose of conducting this study. The population for this study was 40 and all of them were included as targeted groups..

3.3.2. Sampling Technique

All members of the population were taken as a sample. Therefore, this research was employed a census, which is complete enumeration of the given population to provide information that can be used to draw conclusions about the topic of interest.

3.4 Procedure of Data Collection

Both primary & secondary sources of data were used for the purpose of this study. The use of secondary data is highly encouraged in situations where existence of secondary data is adequate & conveniently accessible. Hence, this study applied a documentary review method to obtain secondary data, which were includes books, personal sources, journal, website and government record like Proclamation. To revise these documents the researcher kept in mid that the documents were from academic database as well as trusted sources focusing on the area of aquaculture and sustainability which had been written in a relatively straightforward English language. This strategy helped the researcher to avoid bias in collecting data and to produce more information than can be had through a primary data collection exercise, as well as it is found that it was by far economical to collect secondary data than to obtain primary data. Moreover, the secondary documents assisted the researcher to conceptualize the theory and to relate the dependent and the independent variables behind aquaculture sustainability.

In addition, both closed and open- ended questionnaires and semi structured interviews were employed as a primary data collection to get quantitative and qualitative data from the respondents. These data had been collected and analyzed separately, and then an interpretation was done to check whether they support or contradict one another. The researcher took the advantage of open ended questions to survey the targeted small group of ASA respondents as there is no need for complex statistical analysis. Beside this, more valuable inputs were obtained from each respondents due to the qualitative nature of the targeted question.

Semi Structured interview questions were administered only to five managing director of the fish farming company as a primary data source. This is because that it provided a clear set of instructions for the researcher and provided reliable, comparable qualitative data as well as allowed the respondents to express their view in their own terms. Data for the independent variables such as inputs, technological issues, cost, market and service perspectives were collected in the form of closed ended questions, which helped to assess the challenges that hinder the productivity of fish farming in ASA. While to explore whether the fish farming project has attained its sustainability goal, data were collected in both closed ended and open ended questions. Additionally to get an in-depth investigation the major factors that are influencing fish farming sustainability a semi structure interview was employed.

3.5Methods of Data Analysis

After clearing non response rate, the collected raw data was organized, coded to suitable formats, filled on SPSS, labeled, defined and then descriptively processed to meaningful information. In connection to quantitative data, descriptive statistics SPSS version 20 was used to aid in analyzing frequencies, means, validity tests, tables and standard deviations of the collected data and analysis was made.

For qualitative research (Creswell & Creswell, 2017) has explained a step wise data analysis in qualitative research. Therefore, in this study this approach had been employed.

Step 1. Organize and prepare the data for analysis. This involves transcribing interviews, typing up field notes and sorting and arranging the data into different types depending on the sources of information.

Step 2. Read or look at all the data. This first step provides a general sense of the information and an opportunity to reflect on its overall meaning. What general ideas were participants saying? What was the tone of the ideas? What was the impression of the overall depth, credibility, and use of the information?

Step 3. Start coding all of the data. Coding is the process of organizing the data by bracketing chunks and writing a word representing a category in the margins. In this regard the interviewed ASA respondents were coded (ASA 1, ASA 2, ASA 3, ASA 4, ASA 5)

Step 4. Use the coding process to generate a description of the setting or people as well as categories or themes for analysis.

Step 5. Advance how the description and themes was represented in the qualitative narrative. In this study a narrative passage was used to convey the findings of the analysis.
Step 6. A final step in data analysis involves making an interpretation in qualitative research of the findings or results. Therefore, for the qualitative data the analysis was conducted on the base of narrative analysis and content analysis.

The Convergent Parallel Mixed Methods Design allows the quantitative and qualitative databases to be analyzed separately and then brought together. To merge the two data base a side-by-side comparison was conducted. These comparisons is explained in the discussion part of this research. The researcher had reported the quantitative statistical results and then discussed the qualitative findings that either confirm or disconfirm the statistical results. Well-structured tables used to show the results of key factors influencing the sustainability of aquaculture at ASA, Ethiopia.

3.6 Validity and Reliability of Measurement

3.6.1 Validity

To validate this research work, the research instruments and its findings were examined for further evaluation by peers, who have an expertise in the subject area. Therefore, to check

for an internal validity of the research methods the peers have analyzed how the research is designed, structured and encompasses all of the steps of the scientific research method. In the same way, possible causal relationships between the independent and the dependent variables were examined for checking the external validity of the research work. Therefore the relationship between the dependent variables and the dependent variable was explicitly explained and expressed by the intervening variables.

There are other strategies to dress internal and external validity than you have suggested.

3.6.2 Reliability

Reliability is an indicator of a measure's internal consistency. Consistency is the key to understanding reliability. A measure is reliable when different attempts at measuring something converge on the same result. Thus, reliability refers to the consistency and dependability of a measuring instrument; using it repeatedly should give us the same or similar results every time. The techniques applied to assess the reliability of data collection instrument in this study is Cronbach Coefficient Alpha, the most commonly used and can test reliability with various item formats. Cronbach's alpha reflects that the extent to which the items in questionnaire are related to each other. Cronbach's coefficient alpha normally range between 0-1 values, which indicate the higher the values the higher degree of internal consistency. Although, different author accept different values of this tests to reach on internal reliability of the instrument, the most commonly accepted value is equal to or greater than 0.70 to reach on reliability of acceptable instrument. To assure this rule, the researcher distributed 10 questionnaires for non-sampled selected respondents.

Table 3.6.2.1 Case Processing Summary and Reliability Statistics for Pilot-Test for understanding Fish Farming Practice in ASA.

Case Processing Summary			
		N	%
Cases	Valid	9	90.0
	Excluded[a]	1	10.0
	Total	10	100.0

a. Listwise deletion based on all variables in the procedure.	
Reliability Statistics	
Cronbach's Alpha	N of Items
.868	10

Source: Data collected by the researcher through Questionnaire, 2020

The Crobnach alpha value for the test under Part Two of the questionnaire, which is focused to understanding the fish farming practice in ASA is calculated as 0.868 as it is calculated on Table 3.6.2.1. This indicates that there is a high internal consistency among the data.

Secondly, for Part Three of the questionnaire which focused understanding the challenges that hinder the productivity of fish farming in ASA was calculated as 0.748 as indicated in Table 3.6.2.2, which also indicates that there is internal consistency among the data.

Table 3.6.2.2 Case Processing Summary and Reliability Statistics for Pilot-Test for understanding the challenges in fish farming at ASA.

Case Processing Summary			
		N	%
Cases	Valid	10	100.0
	Excluded[a]	0	.0
	Total	10	100.0
a. Listwise deletion based on all variables in the procedure.			
Reliability Statistics			
Cronbach's Alpha	N of Items		
.748	6		

Source: Data collected by the researcher through Questionnaire, 2020

To assure the reliability of qualitative data, records have been checked thoroughly by the researcher so ad to make sure that they do not contain obvious mistakes made during transcription and make sure that there is no drift in the definition of codes, a shift in the meaning of the codes during the process of coding. This was done by constantly comparing data with the codes and by writing memos about the codes and their definitions.

3.7 Ethical consideration

The study went deep to take into consideration that holds certain beliefs about the nature of the study should not turn out intentionally or unintentionally influence the outcome of the study in a way that favors the expected outcome. These terms refer to the documented phenomenon that researchers' expectations (rather than the experimental manipulation) can bias the outcome of study by influencing the behavior of their participants. Therefore, the student researcher was made the participants of the study by far understood this aspect and go deep to manage it so that their expectation should not guide the outcome of the study. In as much as possible way, the study has been designed in a way it considers the ethical consideration expectations in researches.

CHAPTER FOUR: RESULT AND INTERPRETATION

4.1. Response Rate

A total of 34 (Male=27, Female=7) persons were participated in the study. The response rate was 85% from a population size of 40.

4.2. Demographic Characteristics of Respondents

Thus, Table 4.2.1 below represent the profile of the research participant from Africa Sustainable Aquaculture B.V. Ethiopian Branch in terms of sex, age, educational qualification and years of experience in their current working positions as well as their total work experiences.

Table 4.2.1 Profile of the Respondents

No.	Variables		Frequency	Valid Percent
1	Sex	Male	27	79.4
		Female	7	20.6
2	Age	18-25	4	11.8
		26-30	14	41.2
		31-35	3	11.8
		36-40	3	8.8
		41-45	3	8.8
		>46	6	17.6
3	Education	Below 12	1	2.9
		Diploma	6	17.6
		Degree	17	50.0
		MSc / MA	10	29.4
4	Service Year	0-5 years	28	82.4
		6-10 years	4	11.8
		>15 years	2	5.9

Source: Data collected by the researcher through Questionnaire, 2020

Results on Table 4.2.1 explain that majority of the individuals involved in ASA fish production projects were males comprising of 79.4% of the respondent while 20.6 % were females. This was mainly due to the nature of the job that requires more physical activities. Interms of the age structure at ASA, 25(73.6%) of the respondents were below 35 years of age while 9(26.4 %) were above 35 years. This meant that the projects are managed by young and energetic people to achieve project objectives. From the respondents, about 27(79.4%) of the employees at ASA had tertiary education, which tells that there are

adequate number of intellectuals in the company for which the employees could work in a professional manner to contribute for enhanced fish productivity as they acquire more knowledge and skills in organizational governance.

4.3. Analysis of Data Collected for the Study

4.3.1. Existing Fish Farming Practice

Table 4.3.1.1 Existing Fish Farming Practice in Africa Sustainable Aquaculture B.V. Ethiopian Branch.

Item	Statement		Frequency	Valid Percent
1	We have conducted soil testing to select farm site	Yes	24	80
		No	6	20
2	We have consulted the Aquaculture Development Program for pond construction	Yes	19	63.3
		No	10	33.3
3	We have stock the pond based only on the specifications by the Aquaculture Development Program.	Yes	15	45.5
		No	18	54.5
4	We feed the fish according to Aquaculture Development Program recommendations alone	Yes	14	43.8
		No	17	53.1
5	We use the chilled holding recommended by the Aquaculture Development Program	Yes	18	56.3
		No	14	43.8
6	We have installed water inlet and outlet devices in the pond	Yes	31	93.93
		No	2	6.06
7	We transport fingerlings in plastic bags alone?	Yes	3	8.8
		No	31	91.2
8	We check the walls of the pond quarterly	Yes	29	87.9
		No	4	12.1

Source: Data collected by the researcher through Questionnaire, 2020

The responses of the employees to the existing fish practice at ASA are analyzed on Table 4.3.1.1. The result shows that 24(80%) of the respondents have claimed that they are conducting soil testing to select farm site before establishing the fishery production. This indicates that they have tested the color of the soil to determine the drainage condition of the soil, tested the texture and the structure of the soil for understanding the soil particles. Moreover, the test might also include studying the permeability of the soil, which tells them the rate at which water seeps down vertically. Many of the open ended response replied that the first activity to be performed at fish farming is soil testing. This also evident that the

company is conducting soil test fish farming appropriately. The result also indicates that they have consulted and used the specification supplied by the Aqua Culture Development Program for their fishing practice at ASA. In addition, the respondents explained in the open ended response that ASA apply this standard in conjunction with the European Standards on fishery practice.

Majority of the respondents 31(91%) were asserted to a larger extent that there is an installed water inlet and outlet devices in the pond to make the water system as fresh as possible, which can have high contribution for the health of the growing fish. With respect to transporting fingerling, the result showed that 31(91.2%) of the respondents indicated that they do not use plastic bags alone for the transportation of fingerlings. In relation to this idea, all of the interviewed response showed that they collected the fingerling with a nylon or cotton dragnet, which helps them to be packed under oxygen pressure and keep it cool.

With regard to checking the pond wall 29 (87.9%) of the respondents were explained that they perform checking of the walls of the pond quarterly for the cleanness purpose. This shows that they are dedicated to protect the health and wellbeing of their fish.

4.3.2. Challenge in Fish Farming Practice at ASA

Table 4.3.2.1 Challenges from Input Perspectives

Item	Statement		Strongly Disagree	Disagree	Average	Agree	Strongly Agree	Mean
1	It is easy to get necessary market inputs for fish farming	Frequency	9	7	17	1	0	
		Valid Percent	26.5	20.6	50	2.9		2.29
2	I can get different fish varieties for my farming	Frequency	1	25	1	0	4	
		Valid Percent	3.2	80.6	3.2	0	12.9	2.39
3	There is good government support for fish farming	Frequency	1	4	22	5	2	
		Valid Percent	2.9	11.8	64.7	17.7	5.9	3.09
4	There is good provision of extension services/training	Frequency	6	6	15	7	0	
		Valid Percent	17.6	17.6	44.1	20.6	0	2.68
5	There is a continuous improvement of my own technical expertise	Frequency	0	0	7	18	9	
		Valid Percent	0	0	20.6	52.9	26.5	4.06

Source: Data collected by the researcher through Questionnaire, 2020

Regarding to challenges from input perspectives on the fish practice at ASA are analyzed on Table 4.3.2.1. About 16(47.1%) of the respondents claimed that they disagreed and strongly disagreed that it is not easy to get necessary market inputs for fish farming. This finding is also supported by the interviewee respondent of ASA by saying that:

"There is no strong and competitive market for supplying the required inputs for fish farming and even the existing few supplier of this inputs are not able to continually supply as required." (Respondent ASA 1, Male, Degree level)

From the analyzed data, it can be inferred that 27(79.4%) of the respondents showed that there was an indication that managers received training in a regular fashion, which can help them for continuous improvement of their technical expertise.

Table 4.3.2.2 Challenge from Technology Perspectives

Item	Statement		Strongly Disagree	Disa gree	Aver age	Agre e	Strongly Agree	Mean
1	The farmer can easily adopt fish farming technology	Frequency		5	22	3	4	
		Valid Percent		14.7	64.7	8.8	11.8	3.18
2	The technology helps to improve in quality and quantity of fish produced	Frequency			3	25	6	
		Valid Percent			8.8	73.5	17.6	4.09
3	There is introduction of new technique(s) for fish farming practice	Frequency		5	9	13	6	
		Valid Percent		15.2	27.3	39.4	18.2	3.61

Source: Data collected by the researcher through Questionnaire, 2020

The responses of the employees regarding to challenges from technological issues on the fish practice at ASA are analyzed on Table 4.3.2. The result indicates that 22(64.7%) of the respondents have asserted that the farmer can adopt fish farming technology at ASA at a satisfactory level. In relation to this the open ended response has reflected that the technologies used by the project are: own feed formulation, use of manure and use of nets for protection against predators.

Technological perspective, 31(91%) respondents have asserted to a great extent that the technology they employed helped them to improve the fish production both in quality and

quantity. On top of the employed technology, the introduction of new techniques for fish farming practice at ASA fish production system is found to be on a satisfactory level.

Table 4.3.2.3. Challenge from Cost Perspectives

Item	Statement		Strongly Disagree	Disagree	Average	Agree	Strongly Agree	Mean
1	The cost for adopting the fish technology is reasonable	Frequency	8	14	8	4		2.29
		Valid Percent	23.5	41.2	23.5	11.8		
2	Currently your production cost for fish farming is high	Frequency		1	6	9	18	4.29
		Valid Percent		2.9	17.6	26.5	52.9	

Source: Data collected by the researcher through Questionnaire, 2020

Result on Table 4.3.2.3 shows that the cost for adopting fish technology is not reasonable as well as the production cost for fish farming is high. One of the interview respondent has suggested that:

> " In fish farming industry specially at ASA there are a lot of input that is required for growth of fish. Some of the inputs can be brought from local market but other cannot be easily accessible. Therefore we are bought them in hard currency and it makes the cost sky rocketing. This is still a problem at ASA" (Respondent ASA 1, Male, Degree)

Table 4.3.2.4. Challenges from Market Perspectives

Item	Statement		Strongly Disagree	Disagree	Average	Agree	Strongly Agree	Mean
1	There is good access to market for fish product	Frequency	3	5	14	10	1	3.03
		Valid Percent	9.1	15.2	42.4	30.3	3	
2	The price for fish market is attractive	Frequency	5	11	12	5		2.52
		Valid Percent	15.2	33.3	36.4	15.2		
3	I earn an optimum profit from fish production	Frequency		19	8	6		2.61
		Valid Percent		57.6	24.2	18.2		

Source: Data collected by the researcher through Questionnaire, 2020

The result showed that access to market for fish product is found at a satisfactory level, and it can be explained that this is not a serious challenge from market perspectives even if the price for fish market is not attractive. One of the interview respondent has emphasized that:

> " The stable food for the local people who are found around Mechaworeda is teff, cereals and beef, and for this reason our fish market is negligible and we are transporting our product to main town around Bahiradar. Had the local people bought our product, we can generate reasonable revenue without expending transport cost" (Respondent ASA 2, Female, MA)

Table 4.3.2.5. Challenges from Service Provision Perspectives

Item	Statement		Strongly Disagree	Disa gree	Average	Agree	Strongly Agree	Mean
1	I have standards and good practices in my fish farming practice	Frequency			7	15	12	
		Valid Percent			20.6	44.1	35.3	4.15
2	I can offer an on time fish products for my customers	Frequency	6		12	12	4	
		Valid Percent	17.6		35.3	35.3	11.8	3.24
3	I usually face serious fish disease problem	Frequency	17	12	5			
		Valid Percent	50	35.3	14.7			1.65
4	I have achieved my objectives as planned	Frequency	2	8	14	10		
		Valid Percent	5.9	23.5	41.2	29.4		2.94

Source: Data collected by the researcher through Questionnaire, 2020

The result described that 27(79.4%) respondents had acknowledged that they agreed and strongly agreed that there is good farming practice from utilization of standards in the sector at ASA as well as 29(85.3%) of the respondents had indicated that they do not face a serious fish disease problem in the area.

4.3.3. Existing Project Situation at ASA

Table 4.3.3.1 Assessment of Project Goal

Item	Statement		Strongly Disagree	Disagree	Average	Agree	Strongly Disagree	Mean
1	The project management has directed and managed the fish project work effectively	Frequency	5		11	14	4	3.35
		Valid Percent	14.7		32.4	41.2	11.8	
2	The project has good project time management in its overall activities.	Frequency	6	5	12	1	10	3.12
		Valid Percent	17.6	14.7	35.3	2.9	29.4	
3	The project has good project risk analysis in the fish production	Frequency	6		16	11	1	3.03
		Valid Percent	17.6		47.1	32.4	2.9	
4	The project has good project resource management	Frequency			9	16	9	4
		Valid Percent			26.5	47.1	26.5	
5	The management of the fish farming has communicated effectively with all the stakeholders	Frequency	6		3	11	14	3.79
		Valid Percent	17.6		8.8	32.4	41.2	
6	The project has good project procurement plan in the fish farming industry.	Frequency		3	9	13	8	3.97
		Valid Percent		9.1	27.3	39.4	24.2	
7	The project has proper cost management in the fish farming practice	Frequency		1	8	16	9	3.76
		Valid Percent		2.9	23.5	47.1	26.5	
8	The project has good data management system in the fish farming process	Frequency		7	6	14	7	3.62
		Valid Percent		20.6	17.6	41.2	20.6	
Grand Average Mean Value								3.17

Source: Data collected by the researcher through Questionnaire, 2020

Results on Table 4.3.3.1 showed that 18(53%) of the respondents have agreed and strongly agreed that the fish project work is effectively managed and directed. This finding is also supported by the interviewee respondent of ASA by saying that:

" Project work is satisfactorily planned and most of the plan achieved on time and even if it needs some improvement for the future." (Respondent ASA 1, Male, Degree level)

The two findings are complementing each other and it can be said that there is an effective project management at ASA. Regarding to time management, it is reflected that there is a satisfactory level of time management at the ASA project environment.

With respect to risk management the result indicates that 16(47.1%) of the respondents asserted that the project has a satisfactory level of project risk analysis in the fish production. This finding is also supported by the interviewee respondent of ASA by saying that:

"In the future, the project is likely to have some problems, no matter what the problem is, it can be easily removed because they have a good risk management plan." (Respondent ASA 3, Male, MSc)

Regarding to resource management, it is shown that 25(73.6%) of the respondents have agreed and strongly agreed that there is good project resource management at ASA. Moreover, almost all interviewed respondents were also replied that there is a well-established system in managing project resources. In general, this finding showed that there is very good project resource management at ASA.

Furthermore, 25(73.6%) respondents have agreed and strongly agreed that there is an effective communication between the management of ASA and the stakeholders, even though 6(17.6%) of the respondents were strongly disagreed the statement. But, the calculated average mean value (3.79) clearly indicates that there is a good communication with the stakeholders. This finding is also supported by two of the interviewee respondent of ASA by saying that:

> "*We do have a good governance and communication structure and constant communication is ongoing. Language barrier is sometimes difficult but solutions can always be found." (Respondent ASA 5, Female, MSc). Communication was quite good. Most internal and external stakeholders were in support of the project. We do have a good governance and communication structure." (Respondent ASA 2, Female, MA)*"

Generally, these findings showed that the management of the fish farming is communicating in an effective way with all the ASA stakeholders, which is so vital to establish common understanding so as to improve productivity and resolve problem when arise.

Interms of procurement, 21 (63.6%) of the respondents were saying that they are agreed and strongly agreed that the project has good project procurement plan in the fish farming industry. Concerning to cost management 25(73.6%) of the respondents were replied that the project has proper cost management in the fish farming practice. This finding is also highly substantiated by one of the interviewee respondent of ASA by saying that:

"The project has a good cost management system in place and the project is always trying to minimize the cost of production."(Respondent, ASA 5, Female, MSc)

Generally, both findings showed that the project has proper cost management system in the fish farming practice. This indicates that the accounting system and its transaction is auditable and it helps them to know their financial position as required. The reviewed financial document indicates that the company's cash flow is indicating negative value which can have potentially shake the company's financial position to sustain in the market in the future.

Regarding to data management, the result indicates that 21(61.8%) of the respondents were agreed and strongly agreed that there is good data management system in the fish farming process. In line with this finding two of the interviewed respondent of ASA were replied that:

> "*All data are stored in a format for each department and the management take an action based on the information and everybody have information for their specific job related issue." (Respondent ASA 4, Female, MSc). As information is very important for fish production recording data in a daily basis and good communication with the right person." (Respondent ASA 2, Female, MA)* "

Therefore, these findings are obviously showed that there is good data management system at ASA. This data management helps the company to retrieve information in an easy way and assist them for their lesson learning practice.

CHAPTER FIVE: CONCLUSION AND RECOMMENDATIONS

5.1 Summary of Findings

In this section the summary, conclusions and recommendation were derived from the research findings. The main purpose of this study is to investigate the major factors that are influencing fish farming sustainability in Africa Sustainable Aquaculture B.V. Ethiopian Branch. Before going to present the main analysis of the study, a reliability test was administered to check the reliability of data collection instrument. In this regard, all parts of the questionnaires were reliable and acceptable with Cronbach's Alpha result greater than 0.70. In relation to the demographic characteristics of the respondents, it could be inferred that the composition of younger staff and senior management experts from ASA have an adequate experiences and have good intellectual level in their assigned position to practice fish farming in the company for which the employees could work in a professional manner to contribute for enhanced fish productivity,

Farming Practice in Africa Sustainable Aquaculture B.V. Ethiopian Branch.

It was found that practice like stocking the pond, feeding the fish and for chill holding are use and applied based on the recommendation of the Aquaculture Development program in line with the European standards. ASA have also implemented the basic infrastructure for fish farming. Particularly they have installed water inlet and outlet devices in the pond which is very essential for the growth of healthy fish farming. From their finding Russell & Dobson, (2009) found that inability to manipulate appropriate pond environment will challenge the fish farming practice negatively. Therefore it can be inferred that ASA has good fish production practice, which can lead to sustain in the market.

It has been noted in this study that inadequate inputs are the challenges that affect fish farming at ASA. The result figured out that the provision of extension services/training is found on unsatisfactory level. Such kinds of deficiency in extension service is also reported by (FAO, 2010) as it is explained that even if aquaculture extension services have played an important role in the development of aquaculture; more is expected in the future.

In overall, the result from input perspective reflects that there is inadequate outreach program and inefficiency in dissemination of technology transfer from government extension workers, which may play a key role challenging the performance of ASA. The other indicated factor that affected extension services on fish farming was the inadequate resources in terms of inputs such as operational funds and transport for the extension workers to effectively perform their extension roles.

The analysis found evidence that there is no strong competitive market for supplying the required inputs for fish farming and even the existing few supplier of these inputs are not able to continually supply as required. The inadequacy of reliable fish markets can create shortage of necessary market inputs such as fingerings, feed and fertilizer and manure for practicing fish farming in a proper way.

It can be also be summarized that the use of specification supplied by the Aqua Culture Development Program, like stocking the pond, feeding the fish and for chill holding could help the company to broaden and deepen the aquaculture value chains to increase the volume and value of fish and fish products produced and sold.

Result indicates that the ASA do not face a serious fish disease problem in their practice of fish production. This showed that pathogens which can cause fish diseases such as bacterial infections and fungal infections are not common in ASA aqua culture.

Challenge in Fish Farming Practice at ASA

It was found that the fish varieties at ASA is limited and currently, the varieties that is cultivated in ASA are tilapia (Oreochromis Niloticus), this observed constraints seems similar with the constraints to aquaculture development in Kenya, which was lack of quality fish seed as stated by Mary et.al, (2017).

Result indicates that 26(83.9%) of the respondents have disclosed that getting different fish varieties for farming practice is a difficult task. Shortage of necessary market inputs for practicing fish farming in a proper way is one of the pressing challenge that ASA is facing. One of this challenge is lack of cheap and efficient locally available fish feeds, lack of locally selected and certified fish seeds. Similarly absence of licensed fish seed reproduction

centers and lack of institutional capacity in the area of training and development, research and technology transfer also challenging conditions for aquaculture improvement in the company. This finding is in line with the findings of Asaminew (2012) how found that aquaculture activities in Ethiopia have been limited to introduction of both exotic and indigenous freshwater fish to several man-made and natural water bodies. Inadequate financial resources were also the major reason for lack of adequate inputs at ASA.

The findings also exhibited that the provision of extension services/training is not satisfactory. This might indicate that they were not well informed of the project requirements, which could mean they did not get the basic skill and training for practicing the farming which could in turn affect sustainability in fish production at ASA. This might indicates that skills and training on: feeding, harvesting, green house, floating feeds, cage system, grading, slaughtering, fingerlings introduction, cooking, marketing, choice of fingerlings, pond fertilization, breeding control, types of feeds and water management is not adequate as required..

Introduction of fish farming technology is possible area of challenge in fish farming practice even if there is a good stand interms of utilization of new tools and techniques for fishing practice in ASA. This is more positive findings compared to the study conducted by Olatunji and Ogunremi (2016) who was found that awareness of fish farming technologies by fish farmers they found out that lack of awareness, lack of knowledge of effects of recommended technology in Kenya farming practice. Generally this findings indicates that ASA are fairly challenged that much from technological perspectives as indicated in the result.

This study indicates that for adopting fish technology as well as to for producing fish the company incurring unreasonable cost, which has its own impact on the sustainability of the business. These findings are in line with what is suggested by Shitote et al., (2006) who stressed that cost is one of the major constraint that affecting fish farming. Similarly Gakuu (2018), has also sought that how cost of inputs, provision of extension service, accessibility to market and use of technology influence the sustainability of small scale fish farming projects. Generally this indicates that cost is one of the challenge that overwhelming the company for survival and to keep it sustainability in the future.

Selling fish is not an attractive business in the surrounding area this is because the profit margin obtained from fish product is not lucrative like other profitable business. This market inefficiency is also existed in Kenya as explained by KEPSA (2013) report on the Kenya National Business Agenda II 2013-2018, which stated that while Kenya's agriculture is better developed than that of most countries in sub-Saharan Africa, the domestic fish market is poorly organized to take advantage of the regional market.

Therefore, not achieving an extensive market in the surrounding area of ASA and to other cities of the country, profit generation is getting difficult. It can be generalized that this findings indicate that market is a challenging issue for ASA fishing product.

It was observed that adequately project risk identification, measuring the risk impact and probability, and planning mitigation measure is practiced to avoid the negative consequence on fish production. This helps the fish framing practice to sustain the business and reduce cost that may arise from the anticipated risk and danger.

The finding showed that there is an effective project management practice in ASA, which can be explained interms of their project risk analysis, resource management, project procurement plan and data management system. cost management, communication between the management of ASA and the stakeholders. These would assist to achieve a satisfactory level distribution of produced fish to the market in on time manner.

5.2 Conclusion

Like most of East African countries, Ethiopia is riddled with poverty, economic stagnation and environmentally unsustainable practices, all of which pose serious constraints on fisheries development such as obtaining knowledge on pond design and construction, hatchery equipment and other farm inputs such as aerators, cages and hatching incubators.

These findings are self-assertive to conclude that the accessibility of readily available market, financial availability and consistency for project work, access to training, and costs of input for fish farming do affect the sustainability of the project and even challenging the project to meet its profit thresh hold. This conclusion is supported by Wetengere, (2010),

who found that marketing of fish is hampered by several factors including lack of proper market infrastructure especially for fresh fish which are highly perishable.

It can be concluded that there is smaller availability of land sizes, lack of reliable infrastructure (electricity for greenhouses), lack of extension service provision from government institutions are the major challenges in fish farming practice at ASA in comparison to other agricultural enterprises

The result now provides evidence to show that the challenges facing ASA affecting its sustainability includes viable supply of fish meal and fish oil ingredients for fish feed, adequate land size for pond construction. The result demonstrated that constraints such as lack of access to quality and affordable feed, seed, inadequate and inappropriate technical advice/information, and use of inappropriate production systems, information along with access to optimal markets have greatly impacted the sustainability of the fish farming at ASA.

Lack of good infrastructure leads to poor domestic markets with little or no room for special or temporal integration, low prices and weak international competitiveness. In the ASA fish production area there is poor road condition, high transport cost and market distance were identified as factors that hinder improved market access for aquaculture farmers which has also contributed to failing input market.

It can be concluded that there is lack of good information flow, which can create problem interms of information track, store, manipulate and distribute the information when necessary. Therefore the management of ASSA need to focus on the necessity of more communication to make certain that decisions are consistent across the organization.

The low financial status had subsequent negative effect on implementation of fish farming activities such as pond construction and pond management. It was noted that inadequate inputs invested into fish farming resulted in the reduction of fish produced. Moreover, the findings confirmed that the increasingly irregular and unpredictable climate has its own environmental impacts on water resources. Therefore, it can be concluded that global warming and the consequent increase in water temperature are already impacting significantly and negatively on aquaculture in the region.

Achieving an improvement in fishing techniques, technology transfer to fishers, training of fishery management personnel, attraction of financial capital to the industry and fish value chain improvement, helps to achieve a sustainable aquaculture production in the country and to ASA in particular. The combination of those efforts can all result to increased fish production and overall economic development of the country. Therefore aquaculture subsidizes to the livelihoods of the society through improved food supply, employment opportunities, and income generation. In the same way, it can also provide a viable socio-economic alternative to capture fisheries. Or this mean aquaculture is carried out not only for increasing the availability of fish for food but also to conserve the natural stock and thereby protect the biodiversity.

5.3 Recommendation

Recommendation to ASA

This study recommends that ASA need to adopt an innovative technologies, which can make use of semi intensive farming, greenhouse, predator traps/nylon strings, feed formulation, poly culture (mixed species), growing of worms and algae and improvised bio filtration. Furthermore, ASA needs to adopt strategies so as to improve fish farming sustainability through the use of aquaponics, improving extension services and train on feed formulation through developing an on-farm feeding strategies and practices to cope up with the continually increasing fish feed prices and to reduce the effects and dependence on imported feedstuffs.

It is recommended that ASA need to provide the required infrastructure for its commercial aquaculture production to minimize the challenges of quality seed and feed, technical guidance and marketing, which helps itself for increasing productivity and profitability. There is a need to create a multi sectorial approach which can coordinate and harmonize different stakeholder so as to transform the rate of aquaculture development in Ethiopia, this has to be performed in a collaborative efforts from all different stakeholders including ASA. Therefore a major future task is to increase engagement and involvement of manufacturers and relevant public authorities in the provision and administration of aquatic resources and land uses.

To develop a sustainable aquaculture strategy ASA need to recognize it earns a fair reward from farming through implementing appropriate technology that minimize cost of production, strict follow up on project activities and work hand in hand with the local government for their extension services in fish farming. Moreover, to make aquaculture more effective and efficient, implementing development of hatchery and cheap fish feed can play an important role to solve the shortage of fingerling at a time of demand and to intensifying aquaculture at ASA.

Recommendation to Policy Makers

It is recommended that the local government of Amhara Regional state need to recognize the constraints hindering aquaculture growth and need to exert their support and promote the enterprise, which could play an important role in poverty reduction and economic growth through the provision of high-protein food, reduction of fishing pressure in natural, creating jobs and generating income. Moreover, the Amhara regional Government need to be more involved in lowering the costs of input in fish farming and also play a key role in ensuring that ASA get quality inputs so as to have better harvest and thus sustain the projects. Apart from this, adequate extension officers need to be availed so as to disseminate information on the new technologies. Government should ensure that the cost of acquiring these technologies is affordable to the farming company's like ASA.

It is recommended that the local as well as the federal government need to make regional collaboration and integration in shared fisheries and aquaculture resources management. Also the need to take the roles and responsibilities to provide appropriate guidance on how to implement reforms for fisheries and aquaculture development, facilitate approval and /or adoption of appropriate provisions in international fisheries management instruments, as well as facilitate advocacy for increased investment in the fisheries and aquaculture sector.

Government policy makers are advised to formulate policy that encourage extension services so that new techniques and application would be adopted for fish farming sector. There is also a need for government to consider in its policy to promote and subsidized some of the commercial inputs and encourage the establishment of producers' union that will assist the private farmers to purchase inputs in a sustainable manner and improved marketing

distribution channels. Other areas of concern are the government need to create education on the establishment of fish farms with conducive environment and with technical support facilities. (FAO, 2010) also asserted that the Ethiopian government has identified aquaculture as one of the strategic areas of intervention to address the problem of food insecurity and poverty in the rural areas. It is considered as an important economic activity that supports diversification, integration and improvement in rural livelihoods.

Recommendations for Further Studies

Thus by considering the numerous multifaceted and dynamic issues that surround the topic of fish productivity additional research should be carried out in order to improve the current study and increase information and understanding on the relationships of factor of productivity and sustainability of fish farming.

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ANNEX

Annex 1: Questionnaire

ST. MARY UNIVERSITY
SCHOOL OF GRADUATE STUDIES
DEPARTMENT OF MASTERS OF BUSINESS ADMINISTRATION

Dear Respondent:

My name is Mrs. Mekedes Teka, a graduate student at St. Mary University department of Business Administration. The main purpose of this study is a graduation fulfillment Degree of Master's of Art in Business Management and any misuse of the data, if it is observed I will be accountable. I have designed this questionnaire to collect information and to study the Factors of Fish Farming Productivity and its Sustainability; the Case of Africa Sustainable Aquaculture B.V. Ethiopian Branch. I would kindly ask participants in all regard to fill the questionnaire carefully and honestly at the best your knowledge. The accuracy of information you provide can determines the outcome of the study.

Note: Your answers will be strictly confidential and will only be used for academic purposes. Contact Address: Mekdes Teka Shiferaw Tel:- +251 929906574 /0911887968

Thank you in advance for your cooperation and timely response!

Part One: Demographical Information - Please put 'X' in the box

1.1 Your Sex :

Male		Female	

1.2 Your Age Group:

18-25	26-30	31-35	36-40	41-45	>46

1.3 Your Educational Status:

Less than grade 12		Grade 12 Complete		Diploma		Degree		MSc/MA	

1.4 Your service year in the organization/ business you are working in?

0-5 Years		6-10Years		11-15Years		>15 Year	

Part II.

This part focuses on the existing fish farming practice in Africa Sustainable Aquaculture B.V. Ethiopian Branch. Please rate your response as Yes or No for the following statement.

No.	Practice	Yes	No
1	We have conducted soil testing to select farm site		
2	We have consulted the Aquaculture Development Program for pond construction		
3	We have stock the pond based only on the specifications by the Aquaculture Development Program.		
4	We feed the fish according to Aquaculture Development Program recommendations alone		
5	We use the chilled holding recommended by the Aquaculture Development Program		
6	We have installed water inlet and outlet devices in the pond		
7	We transport fingerlings in plastic bags alone?		
8	We check the walls of the pond quarterly		

PART III.

This part focuses on the *major challenges hindering the productivity of fish farming* in ASA Ethiopia.
Please rate your response as follows: 1= Strongly Disagree, 2=Disagree, 3=Average 4=Agree, 5=Strongly Agree

No.	**Statement**	**Rating**				
	From Input Perspectives	**1**	**2**	**3**	**4**	**5**
1	It is easy to get necessary market inputs for fish farming					
2	I can get different fish varieties for my farming					
3	There is good government support for fish farming					
4	There is good provision of extension services/training					
5	There is a continuous improvement of my own technical expertise					
	From Technology Perspectives	**1**	**2**	**3**	**4**	**5**
6	The farmers can easily adopt fish farming technology					
7	The technology use helps to improve in quality and quantity of fish produced					
8	There is introduction of new technique(s) for fish farming practice					
	From Cost Perspectives	**1**	**2**	**3**	**4**	**5**

9	The cost for adopting the fish technology is reasonable					
10	There is high production cost for fish farming					
	From Market Perspectives	**1**	**2**	**3**	**4**	**5**
11	There is good access to market for fish product					
12	The price for fish market is attractive					
13	I earn an optimum profit from fish production					
	From Service Provision Perspectives	**1**	**2**	**3**	**4**	**5**
14	I have standards and good practices in my fish farming practice					
15	I can offer an on time fish products for my customers					
16	I usually face serious fish disease problem					
17	I have achieved my objectives as planned					

PART IV.

This part is intended to assess whether the project has met its goal in the past four years period or not.
Please rate your response as follows: 1= Strongly Disagree, 2=Disagree, 3=Average, 4=Agree, 5=Strongly Agree

No.	Statement	1	2	3	4	5
1	The project management has directed and managed the fish project work effectively					
2	The project has good project time management in its overall activities.					
3	The project has good project risk analysis in the fish production					
4	The project has good project resource management					
5	The management of the fish farming has communicated effectively with all the stakeholders					
6	The project has good project procurement plan in the fish farming industry.					
7	The project has proper cost management in the fish farming practice					
8	The project has good plan for schedule management in the fish farming practice					
9	The project has good data management system in the fish farming process					

Interview Questions

1. What do you say about your company
   1.1. How it is established?
   _____
   _____

   1.2. For what purpose it is established?
   _____
   _____

   1.3. By whom it is established?
   _____
   _____

   1.4. What are the short- and long-term objectives?
   _____
   _____

   1.5. What human and materials resources do they have?
   _____
   _____

   1.6. What do they have achieved so far?
   _____
   _____

2. How do you explain the fish farming practice in your company from standard fish farming
   practice?_____
   _____
   _____
3. What kind of support you get from government for your fish production?
   _____
   _____
4. How do you explain the productivity and sustainability of fish farming in your company?

   _____
   _____
   _____

5. What are the administrative and technical issues that challenges your fish farming?

_____
_____
_____

6. What are the major constraints in fish production in your company?

_____
_____

How do you explain you fish project status from

6.1 Project planning management

_____
_____

6.2 Project resource management

_____
_____

6.3 Project cost management

_____
_____

6.4 Project risk management

_____
_____

6.5 Project data and information management

_____
_____

6.6 Project communication management

_____
_____

7. Do you have anything to add?

_____
_____
____

Thank you