Performance of Commercial Aquaculture under the Economic Stimulus Program in Kenya

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Abstract

An emerging trend was emerging where a lot of attention was getting accorded to aquaculture all over the world. However, the various infrastructures to make the enterprise more successful were not put in place. The study therefore sought to establish the performance of the commercial aquaculture project under the Economic stimulus program of Kenya. The staff level and capacities, operational resources and the main challenges were studied and findings presented. A cross sectional survey research design was used for a target population comprised of 21 fisheries officers from across the country. Data collection was mainly by self administered questionnaire and documents analysis.

The study found no relationship between staff capacities, operational resources and the performance of aquaculture. Major challenges to commercial aquaculture identified were, unsuitability of some sites for fish farming, staff shortage, inadequate resources in terms of transport, political interference, shortage of fingerlings and procurement delays. There was need for more transport means to be provided, staff to be employed and sources of fingerlings enhanced.

Key words *Performance, Economic stimulus Program, Operational resources, Staff capacities*

1. Introduction

Fish has always been an important source of protein in the human diet and on a global scale, fish and fish products are the most important source of protein and it is estimated that more than 30% of fish for human consumption comes from aquaculture (Håstein. et al 2006). Over the past three decades, aquaculture has developed to become the fastest growing food-producing sector in the world. A large proportion of fish products come from small-scale producers in developing countries. More than 80% of global aquaculture products are produced in fresh water. From its early development in Asia, aquaculture has undergone huge development and is today highly diversified.

Aquaculture consists of a broad spectrum of systems, from small ponds to large-scale, highly intensified commercial systems. The Food and Agriculture Organization (FAO) of the United Nations has estimated that more than 30% of all fish used for human consumption originates from aquaculture. These fish comprise primarily herbivorous species, such as tilapia and carp. In 2004, the total global production in aquaculture was 17.3 million tonnes of carp (*Cyprinius carpio*), 1.2 million tonnes of tilapia (*Tilapia* spp.), 1.1 million tonnes of salmon, 0.5 million tonnes of rainbow trout (*Oncorhynchus mykiss*), 0.5 million tonnes of shrimp and more than 10 million tonnes of mollusks The production of algae is estimated to be more than 12 million tonnes. The People's Republic of China is, by far, still the largest producer of aquaculture products in the world. Developing countries contribute almost 90% of global aquaculture production which contributes significantly to GDP and foreign exchange earnings in many low-income Asian countries like Bangladesh. In many developing countries, aquaculture has had significant positive effects on rural and urban food supply and on income and employment. However, increasing demand for fish in global markets and the complex networks that affect the supply and price of fish are influencing aquaculture production both at national and local levels. Countries are now faced with challenges to improve their operations towards efficiency and effectiveness. These facts indicate that there are both opportunities and challenges which need to be addressed if poverty and hunger were to be reduced so as to promote overall economic development through promotion of socially and environmentally sustainable aquaculture.

Hetland. (2008) observed that the economic viability of fish farming was becoming widely recognized as observed in countries like Israel where more than half the fish eaten in the country was produced from fish farms. Similarly 25% of fish in China and in India, 11% in USA and 10% in Japan were aquaculture products. In developing countries, fish farms not only improved a nation's diet but brought income to small farmers and created employment particularly in rural areas. Fish culture has proved successful in improving the standard of living of rural farmers in Asia, where fish culture had a long tradition (Edwards 2000). Roderick (*2002),* realized that more recently, a new wave of optimism for aquaculture in Africa had been observed wit*h* several privately funded tilapia farming projects showing promise. These included the Kafue Fish Farm in Zambia, Lake Harvest in Zimbabwe, and several farms in Ghana, Nigeria and Malawi. Despite that progress, the promotion of aquaculture for rural development had a poor record in many developing countries, especially in Africa where insufficient attention had been paid to the role of aquaculture in the livelihood or farming system of the intended beneficiaries the result being poor adoption by one of the intended target groups, the rural poor (FAO 2002). Social, economic and institutional issues remained the greatest constraints to enhanced contributions towards rural development by aquaculture but a more holistic approach towards improved livelihoods and greater household food security was emerging (Halwart and Gupta 2004) Earlier failures in reaching the rural poor prompted a decline in donor support for aquaculture over the last decade (FAO 2002). However, with adequate support, aquaculture could contribute significantly to rural development in countries where it was neither a traditional nor widespread practice (Edwards 2000). Despite the generally poor results achieved in many of the African countries where subsistence aquaculture had been supported, efforts were being made to build on some of the pioneering work which took place during pre-independence days and within UNDP/FAO projects.

In Kenya fish farming began in the 1920s, initially using tilapia species and later including the common carp and the African catfish. In the 1960s Kenya Government popularized rural fish farming with the construction of many small ponds and as a result of this effort, tilapia farming expanded rapidly in

Kenya's Central and Western Provinces. However, the number of productive ponds declined in the 1970s, mainly because of inadequate extension services, a lack of quality fingerlings, and insufficient training for extension workers. Until the mid 1990s, fish farming in Kenya followed a pattern similar to that observed in many African countries, characterized by small ponds, subsistence-level management, and very low levels of production. (Ngugi et al 2007)

Following the renovation of several government fish rearing facilities, the establishment of research programs to determine best practices for pond culture, and an intensive training program for fisheries extension workers, there was renewed interest in fish farming in Kenya of late.

In the year 2006 alone the fisheries department contributed 0.5% of the Kenyan GDP while in the year 2005 registered a 4.1% sub sector growth. (Mwangi 2008) Owing to its prominence the Kenyan government in the 2009/2010 financial year under the economic stimulus program introduced commercial fish farming in Kenya in 140 political constituencies. Each constituency benefited with funds for 200 fish ponds, 15 kilograms of fertilizer and 1 000 fingerlings. The exercise got into the second phase in the 2011/2012 financial year where an additional 20 constituencies were brought on board adding an extra 100 fish ponds for the first 140 constituencies and 300 fish ponds for the new constituencies making a total of 48 000 ponds costing about 15 million US dollars. The figure notwithstanding the operational cost and cost for 15 kilograms of fertilizer per pond and 1 000 fingerlings per pond among other costs. However despite the enormous amount of resources in use very little had been done to unearth and document the level of success of the first phase, lessons learnt or challenges before going into the subsequent phase.

Therefore although an increasing number of developing countries were turning to aquaculture, its beneficial attributes were often ignored. It was important that its potential benefits and challenges were identified with agricultural and rural development professionals, policy makers as well as with the local farmers.

1.1 Statement of The Problem

Mwangi (2008) observed that aquaculture contributed about 15% of the national fish production with approximately 1 000 metric tons harvested from 7 477 ponds owned by 4 742 fish farmers annually. With an introduction of 48 000 fish ponds at a cost of over 15million US dollars across the country the contribution of aquaculture in fish production and the economy was therefore bound to increase enormously. That notwithstanding very little had been done to establish the performance and challenges of the project as it went into the second phase.

It was against that backdrop that a study was conducted to enable the government, other development partners and farmers get information to enable them make informed decisions as the project expanded.

1.2: Purpose of the Study

The purpose of this study was to establish the performance of commercial aquaculture project under the economic stimulus project, Kenya.

1.3: Objectives of the Study

The study was guided by the following objectives.

- To assess the relationship between technical staff capacities and the performance of commercial aquaculture.

- To determine the influence of operational resource in the performance of commercial aquaculture.
- To establish the main performance challenges of commercial aquaculture.

1.4: Research Questions

The study aimed at addressing the following Research Questions..

- What is the relationship between technical staff capacities and the performance of commercial aquaculture in Kenya?
- To what extent do operational resources influence the performance of commercial aquaculture in Kenya?
- What are the main performance challenges of commercial aquaculture in Kenya?

1.5: Significance of the Study

The study sought to determine the performance of commercial aquaculture project in Kenya and suggest necessary interventions measures.

The study findings could enable policy makers prioritize project implementation in various parts of the country.

The study findings could enable extension service providers refocus their service delivery to farmers.

Potential financiers and farmers would also be able to us the findings to make informed investment decisions.

Researchers and scholars would be able to use the findings as a basis for further research.

1.6: Definition of Significant Terms used in the Study

Performance- This meant the number of fish ponds constructed, the number of fish ponds stocked with fingerlings and the number of fish ponds with mature fish already harveste**d.**

Economic stimulus Program This referred to the national program which financed the commercial aquaculture project under the Ministry of Fisheries Development.

Operational resources-Funds for farmer mobilization, training, project implementation and monitoring

Staff level -The total number of technical staff in a station

Staff capacities**;** Technical academic level that is Degree or Diploma/certificate level. or formal management skills acquired.

2. Literature Review

2.1 Influence of Staff Capacities on Performance of Commercial Aquaculture.

Hishamunda (2001) observed that in rural parts of Côte d'ivoire aquaculture failed because of the separation of ownership of the project and management, with the farmers lacking adequate skills. Satia (1991) reported similar cases of unsuccessful aquaculture as a result of the lack of entrepreneurial dedication by salaried managers. Pre-requisites for commercial aquaculture included bio-technical feasibility and economic viability. Failure of one led to failure of the whole project. Shortage of human capacity and poor technical expertise at both technical and farm level equally contributed to failure of commercial aquaculture projects necessitating the need for assessment and reform of the aquaculture

advisory services at the national, provincial and local level Government to form linkages and ensure technology transfer and support to develop aquaculture at farm levels (Corbin and Young, 1997).

Bamba and Assouhan(2000).indicated that, a missing link between fish farmers and researchers and the lack of aquaculture expertise among extension agents highly affected commercial aquaculture. A combination of climatic, technical, political, cultural and economic factors were said to have caused the failure of many of the subsistence fish culture projects supported through two USAID programs in Guatemala and Panama in the 1980s (Lovshin 1999). The studies however did not clearly establish how the various factors contributed to the project failures. Edwards (2000) also noted that researcher-driven, on-station technologies had seldom fitted the diverse and resource-limited contexts of most poor farming households. He noted that the majority of providers of services to aquaculture, and most aquaculture professionals, focused on maximizing yield rather than meeting local objectives, on high-value species rather than low-cost food fish, and on commodities rather than communities**.** Production of fish or fisheries products required a different set of technical and managerial skills than other agricultural activities. Before a would-be aqua-culturist could successfully grow aquatic organisms, he needed specialized training in water quality management, aquatic weed control, parasite and disease control, nutrition and feeds, cultural techniques, marketing, and processing skills. Although an informed aqua - culturist can minimize the potential risks associated with raising aquatic organisms; the untrained fish farmer continually faced the possibility of unpredictable failure.

Mwangi (2008) had also observed inadequate technical skills by extension staff occasioned by low staff levels with limited practical aquaculture skills as the main constraint to commercial aquaculture in Kenya. Ngugi et al (2007) similarly observed the same challenges as a stumbling block towards commercial fish farming in Kenya. The two studies however did not expressly highlight how significant the factors were in influencing adoption of commercial aquaculture.

2.2 Influence of Operation Resources on the Performance of Commercial Aquaculture

Key problems identified to fish farming in Lagos state Nigeria included inappropriate pond construction techniques occasioned by poor supervision and training by poorly resourced extension service providers.(Hishamunda 2001). However the study never indicated the type of resources the extension staff lacked and how significant they were in influencing adoption of commercial aquaculture. Commercial aquaculture similarly failed in other parts of Africa due to little or no pre-stocking preparation of ponds occasioned by poorly resourced extension agents.

Mwangi et al (2008) observed that in Kenya the government support towards aquaculture extension services was inadequate and mostly led to poor performance at all levels from pond preparation, stocking, harvesting to marketing. Ngugi et al (2007) had observed similar causes of poor performance of aquaculture in Kenya. However the two studies did not indicate the significance level of the influence of funding level on the performance of aquaculture in Kenya. With constituencies receiving uniform support in terms of resources for the implementation of the commercial aquaculture program under the economic stimulus programs it was necessary that the influence of the operational resources on the performance of aquaculture was established..

2.4 Challenges of Commercial Aquaculture

Challenges to commercial aquaculture observed have been enormous depending on the area and the farmers involved. Lack of government commitment and where commitment existed, policy implementation failures have been observed as a main challenge to commercial aquaculture in many

countries. Lack of awareness amongst development professionals and policy makers on the enormous potential of aquaculture also contributed to poor attention accorded to commercial aquaculture. (Edwards 2000)

Insecure access to water and water bodies; locally limited supplies of 'seed' fish, mass poaching, where insufficient members of the community were involved in aquaculture also posed a threat to the industry.

Feed and fingerlings availability also represent significant cost components in the commercial aquaculture. The cost of feed alone is estimated to represent between 40% and 70% of the cost of producing the fish. Intensive fish farming is a major commitment, requiring considerable financial and physical resources, as well as a keen business sense. Inappropriate pond construction techniques and poor soils affected performance. Poor feeds obtained from agro-industrial by-product have also been observed as a hindrance to Commercial aquaculture. (Fakoya et al 2001)

Capital is an essential tool for investment and is necessary for the commercialization and intensification of aquaculture (Brummet, 1995), particularly, capital expenses in aquaculture tend to be relatively high and may require long term financing arrangement,

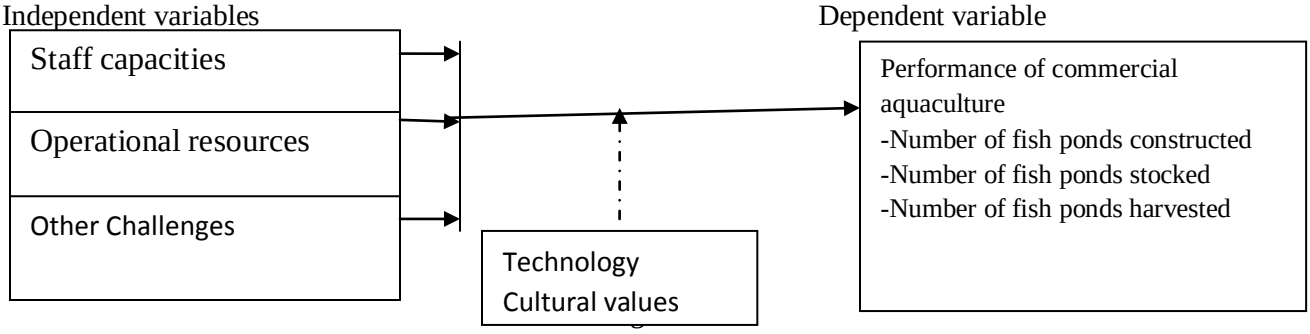
Ogunlaru (2000) highlighted the absence of a legal framework for the aquaculture sub-sector in the country as a challenge to aquaculture.. Balarin (1985) opined that in African countries where aquaculture was not protected by law, legislations governing other activities which impact one way or the other on aquaculture tend to hinder its development.

In Nigeria strategies to promote aquaculture were in the National Agricultural Policy and also articulated in the Native Agricultural Policy (Dada, 2003). Likewise, aquaculture plans existed at the state and national levels. However, inconsistencies in policies and in implementations of plans coupled with a lack of will to follow through in a determined manner affected the aquaculture industry.

Mwangi et al(2008) identified the main challenges to aquaculture growth in Kenya as uncoordinated promotion of aquaculture through the various stakeholders, research institutions, universities and ministries.. Inadequate certified quality fingerlings, research programs which were not demand driven, inadequate training programs for farmers and extension staff as critical causes of poor performance of aquaculture. Low funding of the sub sector, inadequate outreach programs and inefficiency in dissemination of technology transfer to farmers also ranked high among key challenges of aquaculture in Kenya. The government of Kenya being in the initial stages of implementing a well funded aquaculture project it was necessary that the challenges were observed early for remedial action to be put in place for enhanced performance.

2.5: Conceptual Framework

Figure 1.1 Conceptual frame woek



Three independent variables defined the study that is staff level and capacities, operation resources and the other challenges. The dependent variable was the performance of commercial aquaculture in terms of the total number of ponds constructed, total number of fish ponds stocked and the total number of fish ponds harvested.

The number of ponds constructed, stocked or harvested was influenced by the three independent variable notably the staff capacities, operation resources or other challenges. That is, where staff was well trained technically and on management skills and in adequate number commensurate with the demand, performance was expected to be enhanced. Likewise adequate availability of operational resources was expected to trigger an enhanced performance. However, other challenges despite availability of adequate resources and well trained staff would adversely affect performance Technological advancement of both staff and farmers could also influence the performance since information could be accessed and shared at low costs. Cultural values were indicated as factors able to influence performance. Cultural values also have been identified as possible sources of either enhanced or poor aquaculture programs. Where the community was a fish eating community apart from providing the market for the project could also catalyze participation compared to a community where fish was not a delicacy.

3. Research Methodology

3.1: Research Design

The study adopted a cross sectional survey research design as used by Mwamuye (2010) while on an adoption survey of dairy technologies in Coastal Kenya. Mugenda, O. M and Mugenda, A. G (2003).recommended a survey design where current status of a population was to be determined.. Both qualitative and quantitative data was collected for complementation and triangulation.

3.2: Target Population

The target population was 21 Principal Fisheries officers from across the country attending senior management course at Government Training Institute, Mombasa. The provinces represented in the study were Western, Nyanza, Rift valley, Eastern, Central and Coast province where the Economic stimulus aquaculture program started in the 2009/2010 financial year of Kenya. Only two province, that is North eastern and Nairobi province were not sampled since the project was not yet operational in those provinces.

3.4: Sampling Procedure and Sample Size

The following sampling procedure was used so as to come up with a representative sample size as indicated below.

3.4.1: Sampling Procedure

Purposive sampling was used for gathering information on the performance of the commercial aquaculture program under the economic stimulus program.

3.4.2: Sample Size

The study had a sampling frame of 21 principal fisheries officers from six provinces of Kenya. From the sample frame of 21 principal fisheries officers a sample of 13 officers was achieved which was about 62% of the target population. The sample size was based on those who were able to fill the questionnaire and return on time.

Table 1.1 Target population for the study

population	Total number of staff	Sample size
Coast	4	1
Eastern	2	2
Rift valley	2	2
North eastern	1	0
Nairobi	2	0
Western	4	3
Nyanza	4	3
Central	2	2
Total	21	13

3.6: Data Collection Instruments

The data collection instrument used was a questionnaire and document analysis.

3.6.1: Questionnaires

The main data collection instrument used was a questionnaire. A structured questionnaire was used for ease of interpretation and also gathering a wide range of data. One questionnaire was used for the target population.

3.6.2: Document Analysis

Reports for the implementation of the economic stimulus program were analyzed for enriching the final report and also triangulation of the provided data from the questionnaire.

3.7: Data collection Procedures

Self-administered questionnaire was used in the survey, however clarification was provided where respondents needed some clarification. The data collection procedure was chosen as recommended by (Mugenda, O. M and Mugenda, A. G 2003) for respondents who can read and write and can easily understand the set of questions and respond within the stipulated time

The questionnaire was pre-tested with a sample of two staff from the ministry of fisheries development that was not part of the target population. The questionnaire was then refined and administered.

3.8: Data Analysis Techniques

The data collected was analyzed using a Statistical package for social scientists (SPSS). The computation of mean was used for descriptive statistics while Correlation(r) was used to find if any relationship existed between the variables under study where the error permissible was 0.05 (α).

4. Data Presentation, Analysis and Interpretation

4.1 Response Rate

The study had a target population of 21 Principal fisheries officers from across the country but was able to get response from 13 officers accounting about 62% of the targeted population.

The high response rate was achieved as there was good coordination in distribution of the questionnaire to all principal fisheries officers attending the course. However there were some stations with more than one principal fisheries officer thus not all could be interviewed since the information was going to be similar. Also staff from provincial headquarters was left out of the survey since the project implementation was at constituency level.

4.2: Demographic Characteristics

4.2.1 Demographic Characteristic by Location and Sex is provided in this Section.

All constituencies had an average of 2.92 technical staff of which an average of 2.31 was male and 0.62 female. An average of 1.69 of all staff in all constituencies had degree level of education and above of who 1.46 were male and 0.23 were female. A total of 1.54 numbers of staff in the constituencies had a diploma or certificate level of education of who male comprised of 0.85 and women 0.69. An average of 1.38 staff had managerial skills in all constituencies of which men accounted 1.08 and female 0.31.

Following the funding in the 2009/2010 financial year, each of the constituencies had been supported with funds for 200 fish ponds. However on average each constituency had constructed 190 fish ponds which were about 95% of the total and stocked 140 which was about 70% of the total. On average every constituency had harvested an average of 14 ponds accounting for about 7% of its fish ponds

On operational resources every constituency had received an average of 4538 US dollars for the financial year.

4.3 Influence of Staff Capacities on Performance of Commercial Aquaculture

The influence of staff levels on the performance of commercial aquaculture is highlighted on table 3.1 and explainaned below. The influence of staff eductation level on the performance of aquaculture is indicated on table 4.1 and explainantion below, while that for managerial skill is on table 5.1 and also explained below it.

The Pearson correlation coefficient between the total number of staff in a station and the total number of ponds constructed was -0.201 with a p value of 0.51. Therefore at $p<0.05$ there is no significant relationship between the total number of staff in a station and the total number of ponds constructed.

The Pearson correlation coefficient between the total number of staff in a station and the total number of ponds stocked was -0.24 with a p value of 0.43. Therefore at $p<0.05$ there is no significant relationship between the total number of staff in a station and the total number of ponds stocked.

The Pearson correlation coefficient between the total number of staff in a station and the total number of ponds harvested was -0.006 with a p value of 0.984. Therefore at $p<0.05$ there is no significant relationship between the total number of staff in a station and the total number of ponds harvested.

The Pearson correlation coefficient between the total number of male staff in a station and the total number of ponds constructed was 0.274 with a p value of 0.366. Therefore at $p<0.05$ there is no significant relationship between the total number of male staff in a station and the total number of ponds constructed.

The Pearson correlation coefficient between the total number of male staff in a station and the total number of ponds stocked was 0.212 with a p value of 0.426. Therefore at $p<0.05$ there is no significant relationship between the total number of male staff in a station and the total number of ponds stocked.

The Pearson correlation coefficient between the total number of male staff in a station and the total number of ponds harvested was 0.057 with a p value of 0.852. Therefore at $p<0.05$ there is no significant relationship between the total number of male staff in a station and the total number of ponds harvested.

The Pearson correlation coefficient between the total number of female staff in a station and the total number of ponds constructed was 0.207 with a p value of 0.496. Therefore at $p<0.05$ there is no significant relationship between the total number of female staff in a station and the total number of ponds constructed.

The Pearson correlation coefficient between the total number of female staff in a station and the total number of ponds stocked was 0.055 with a p value of 0.858. Therefore at $p<0.05$ there is no significant relationship between the total number of female staff in a station and the total number of ponds stocked.

The Pearson correlation coefficient between the total number of female staff in a station and the total number of ponds harvested was -0.105 with a p value of 0.733. Therefore at $p<0.05$ there is no significant relationship between the total number of female staff in a station and the total number of ponds harvested.

The Pearson correlation coefficient between the total number of staff in a station with a Bachelors degree and above and the total number of ponds constructed was -0.118 with a p value of 0.7. Therefore at $p<0.05$ there is no significant relationship between the total number of staff in a station with a bachelors degree and above and the total number of ponds constructed.

The Pearson correlation coefficient between the total number of staff in a station with a Bachelors degree and above and the total number of ponds stocked was -0.199 with a p value of 0.514. Therefore at $p<0.05$ there is no significant relationship between the total number of staff in a station with a Bachelors degree and above and the total number of ponds stocked.

The Pearson correlation coefficient between the total number of staff in a station with a Bachelors degree and above and the total number of ponds harvested was 0.391 with a p value of 0.186. Therefore at $p<0.05$ there is no significant relationship between the total number of staff in a station with a bachelors degree and above and the total number of ponds harvested.

The Pearson correlation coefficient between the total number of staff in a station with a certificate or diploma and the total number of ponds constructed was 0.112 with a p value of 0.715. Therefore at $p<0.05$ there is no significant relationship between the total number of staff in a station with a certificate or diploma and the total number of ponds constructed.

The Pearson correlation coefficient between the total number of staff in a station with a certificate or diploma and the total number of ponds stocked was 0.058 with a p value of 0.851. Therefore at $p<0.05$ there is no significant relationship between the total number of staff in a station with a certificate or diploma and the total number of ponds stocked.

The Pearson correlation coefficient between the total number of staff in a station with a certificate or diploma and the total number of ponds harvested was -0.107 with a p value of 0.729. Therefore at $p<0.05$ there is no significant relationship between the total number of staff in a station with a certificate or diploma and the total number of ponds harvested.

The Pearson correlation coefficient between the total number of staff in a station with management skills and the total number of ponds constructed was -0.018 with a p value of 0.954. Therefore at $p<0.05$ there is no significant relationship between the total number of staff with management skills and the total number of ponds constructed.

The Pearson correlation coefficient between the total number of staff in a station with management skills and the total number of ponds stocked was 0.145 with a p value of 0.636. Therefore at $p<0.05$ there is no significant relationship between the total number of staff with management skills and the total number of ponds stocked.

The Pearson correlation coefficient between the total number of staff in a station with management skills and the total number of ponds harvested was 0.24 with a p value of 0.43. Therefore at $p<0.05$ there is no significant relationship between the total number of staff with management skills and the total number of ponds harvested.

The Pearson correlation coefficient between the total number of male staff in a station with management skills and the total number of ponds constructed was 0.064 with a p value of 0.837. Therefore at $p<0.05$ there is no significant relationship between the total number of male staff with management skills and the total number of ponds constructed.

The Pearson correlation coefficient between the total number of male staff in a station with management skills and the total number of ponds stocked was 0.065 with a p value of 0.832. Therefore at $p<0.05$ there is no significant relationship between the total number of male staff with management skills and the total number of ponds stocked.

The Pearson correlation coefficient between the total number of male staff in a station with management skills and the total number of ponds harvested was 0.109 with a p value of 0.723. Therefore at $p<0.05$ there is no significant relationship between the total number of male staff with management skills and the total number of ponds harvested.

The Pearson correlation coefficient between the total number of female staff in a station with management skills and the total number of ponds constructed was -0.12 with a p value of 0.696. Therefore at $p<0.05$ there is no significant relationship between the total number of female staff with management skills and the total number of ponds constructed.

The Pearson correlation coefficient between the total number of female staff in a station with management skills and the total number of ponds stocked was 0.203 with a p value of 0.505. Therefore at $p<0.05$ there is no significant relationship between the total number of female staff with management skills and the total number of ponds stocked.

The Pearson correlation coefficient between the total number of female staff in a station with management skills and the total number of ponds harvested was 0.335 with a p value of 0.264. Therefore at $p<0.05$ there is no significant relationship between the total number of female staff with management skills and the total number of ponds harvested..

4.5 Influence of operation resources on the performance of commercial aquaculture.

The influence of the operational fund level and the performance of commercial aquaculture is highlighted on table 6.1 and explained below.

The Pearson correlation coefficient between the total funds for operations and the total number of ponds constructed was -0.268 with a p value of 0.377. Therefore at $p<0.05$ there is no significant relationship between the amount of funds for operations and the number of ponds constructed.

The Pearson correlation coefficient between the total funds for operations and the total number of pods stocked with fingerlings was -0.099 with a p value of 0.749. Therefore at $p<0.05$ there is no significant

relationship between the amount of funds for operations and the number of ponds stocked with fingerlings..

The Pearson correlation coefficient between the total funds for operations and the total number of pods harvested was 0.271 with a p value of 0.37. Therefore at $p<0.05$ there is no significant relationship between the amount of funds for operations and the number of ponds harvest.

4.6 Challenges of commercial aquaculture.

The main challenges to commercial aquaculture are as highlighted on table 7.1 and explained below.

Main challenge of the economic stimulus commercial fish farming project was unsuitability of some of the areas selected for the project.

Political interference also played a key role in influencing the implementation thus affecting output.

Inadequate resources for sensitization of farmers and supervision was a major handicap especially when coupled with unreliability in transport in most stations.

Shortage of fingerlings was also a major handicap since the project was executed simultaneously across the country thus the fingerlings breeding centers were overwhelmed by the demand leading to implementation delays

5.0: Summary of Findings, Conclusions and Recommendations

5.1: Summary of Findings

The study aimed at determining the performance of commercial aquaculture under the economic stimulus program in Kenya. This was out of the fact that despite a lot of government and other stakeholder support to farmers in aquaculture very little had been done to unveil the status of the project. Due to increasing population pressure and need for intensive agricultural production systems the study focused on the staff capacities, operational resources and the various other challenges.

The study sought to address the following three research questions;

- What is the relationship between staff level and technical capacities on the performance of commercial aquaculture in Kenya?
- How do the operation resources influence the performance of commercial aquaculture in Kenya?
- What are the other challenges to the performance of commercial aquaculture in Kenya?

Literature on the area of study has reported various challenges to performance of aquaculture. On staff capacities a lot of literature reviewed had indicated on the importance of the availability of practically trained extension service providers as a major challenge to aquaculture. Managerial and entrepreneurial skills were also variously identified as influencing performance of aquaculture. However the significance of the influence was not easy to come by.

On operational resources most literature reviewed never distinguished between technical staff know-how and their ability to reach farmers. However, other studies highlighted on how poor government funding on aquaculture affected performance.

Other challenges observed included unsuitability of some areas in terms of soil type, terrain and water availability. Political interference, shortage of fingerlings, inadequate resources for implementation

notably transport and allowances. Staff shortage and procurement delays also affected the project implementation.

5.2: Discussions of the Study Findings

The study found no relationship between staff capacity on performance of aquaculture. The results differ with other studies like that of (Leockwood, 1998) who observed that aquaculture failed in North America due to poor entrepreneurial and managerial expertise. However the difference could be due to the target group used since the study focused on the farmers while the current study focused on the technical staff. Hishamunda (2001) had similarly observed in some rural parts of Côte d'ivoire that aquaculture failed because of the separation of ownership and management. Similarly the study never indicated the level of significance of the influence (Satia1991, Mwangi 2008 and Corbin and Young, 1997) had similarly observed that a shortage of human capacity and poor technical expertise at both technical and farm level equally contributed to failure of commercial aquaculture projects. The above studies however focused on the general factors without focusing on the significance level of the relationship.

On operational resources the study found no relationship between the level of operational resources and the performance of aquaculture. Various literatures reviewed observed resources as being influential towards performance of aquaculture. (Hishamunda 2001and Mwangi 2008).observed poor farm supervision occasioned by poor resource availability in Nigeria and Kenya respectively as main challenges to aquaculture. Ngugi (2007) had equally identified poor government funding to aquaculture extension staff as a factor affecting performance of the industry. However, all the above literature never indicated the level of significance of the factors provided.

Most of the challenges to commercial aquaculture are similar especially with small scale farmers and revolved around government policies which put little emphasis to the industry despite its potential.

5.3: Conclusions

Despite almost all the constituencies meeting their target of the ponds to be constructed, the number of ponds harvested was very low and thus benefits had not started getting realized at farm level. That could have been influenced by inadequate fish harvesting gears or knowledge for harvesting. As the staff planned on harvesting trainings, implementation of the second phase could have overwhelmed them. Despite the small numbers of the technical staff per constituency, was able to mobilize farmers for the project to get implemented. However the staff could have worked outside official working hours to ensure the project succeeded. Another contributing factor could be the fact that the workmanship on the pond construction was not up to standard in some constituencies or the pond construction work was contracted to contractors who knew the pond specifications thus reduced the work load of the technical staff.

Staff capacities never influenced performance of aquaculture. However since the work involved at the initial stage was only pond construction and stocking the effect of technical capacities could be established as farmers got into the challenging phases of management, harvesting and marketing.

The operational funds level also never influenced the performance of aquaculture indicating that with proper planning a lot of financial resources might not be a prerequisite to performance. Unsuitability of sites for fish farming posed a threat and that was reflected on the lower number of ponds stocked and very low number of those harvested. Political interference especially on the sitting of fish ponds and identification of beneficiaries greatly affected aquaculture. Shortage of staff in most constituencies posed a challenge and most staff probably worked outside official working hours and days so as to beat deadlines especially where politicians had a lot of interests. Operational resources notably transport was

identified as a major challenge which needed to be addressed for results to be realized on the ground. Suppliers of fingerlings were overwhelmed by the demand and thereby delaying implementation. In certain instances procurement was a challenge which made some constituencies not to achieve the target. .

There was no much difference in terms of pond construction, stocking and harvesting across constituencies and that was an indication that the project faced similar challenges all over the country. However, as the project grew, specific challenges would be able to be identified in specific areas.

5.4: Recommendations of the Study.

Since the technical staff exhibited challenges in technical numbers to cover the areas under their jurisdiction it was necessary for training to be organized so as to come up with community level workers so as to assist farmers in management of the project. Where the number of staff was higher compared to the work load a re-distribution plan should be worked out before more staff was recruited. However the staff also needs to be re trained so as to provide up to date and relevant information to the farmers especially now that farmers started harvesting and marketing.

There was also need for the production of fingerlings to be enhanced so as for the project to be more beneficial to the farmers.

To enhance operations, transport facilities needed to be enhanced so as to ensure better performance of the project.

Researchers and extension service providers need to re examine the suitability of the various agro ecological zones, farming systems and resource base of the farmers for aquaculture.

Cost benefit analysis of the different aquaculture systems in various agro ecological zones need to be evaluated so as to enable farmers make informed decisions on the technologies they adopt. This would also be able to form a basis of advice to various development partners interested in supporting aquaculture projects in Kenya.

Similar studies should be conducted using longitudinal designs so as to determine changes over time since the current study was based on a cross sectional survey design,

The current study focused on the technical staff therefore a similar study should be conducted to cover fish farmers.

More research on effect of income levels on adoption and performance of aquaculture also need to be conducted.

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Appendices

Appendix 1. Questionnaire

Date----------

Name of constituency----------

Number of technical staff in constituency by gender; male----------female----------

Academic level of technical staff; degree and above; male----------female----------

Diploma/certificate level; male----------female----------

Number of technical staff with management skills aquired through formal training (short or long management courses); male----------female----------

Total amount of fish ponds construction funds received in the 2009/2010 financialyear----------

Total amount of funds for mobilization, training and monitoring of the project implementation----------

targeted number of fish ponds to be constructed in the 2009/2010 financial year in your constituency----------

Total number of fish ponds constructed in the 2009/2010 financial year----------

Total number of fish ponds constructed in the 2009/2010 financial year which have been stocked with fingerlings----------

Total number of fish ponds constructed in the 2009/2010 financial year and stocked with fingerlings which have been harvested ----------

What are the main challenges in the implementation of the economic stimulus aquaculture project in your constituency?

Appendix 2. Tables of Results

Table 2.1 Descriptive statistics of factors influencing performance of aquaculture

	N	Minimum	Maximum	Mean	Std. Deviation
Male technical staff	13	1	4	2.31	0.855
Female technical staff	13	0	1	0.62	0.506
Total technical staff	13	2	4	2.92	0.641
Male staff with degree and above	13	1	3	1.46	0.66
Female staff with degree and above	13	0	1	0.23	0.439
Total staff with degree and above	13	1	3	1.69	0.63
Male staff with diploma/certificate	13	0	3	0.85	0.899
Female staff with diploma/certificate	13	0	2	0.69	0.63
Total staff with diploma/certificate	13	1	4	1.54	0.967
Male staff with management skills	13	0	3	1.08	0.641
Female staff with management skills	13	0	1	0.31	0.48
Total staff with management skills	13	0	4	1.38	0.961
Total ponds targeted	13	200	200	200	0
Total number of ponds constructed	13	150	200	190.77	18.913
Total number of ponds stocked	13	40	200	140	59.722
Total number of ponds harvested	13	0	40	14.38	12.679
Funds in US dollars for ponds construction	13	62 500	62 500	62500	0
Funds in US dollars for operations	13	1 125	12 500	4 538	3 487
valid n (listwise)	13				

Table 3.1 Correlation between total number of staff and number of ponds constructed, stocked and harvested**.**

		Total number of ponds stocked	Total number of ponds harvested	Total number of Ponds constructed
Total technical staff	Pearson Correlation	-0.24	-0.006	-0.201
	Sig. (2-tailed)	0.43	0.984	0.51
	N	13	13	13
Male technical staff	Pearson Correlation	-0.212	0.057	-0.274
	Sig. (2-tailed)	0.486	0.852	0.366
	N	13	13	13
Female technical staff	Pearson Correlation	0.055	-0.105	0.207
	Sig. (2-tailed)	0.858	0.733	0.496
	N	13	13	13

*. Correlation is significant at the 0.05 level (2-tailed).

** Correlation is significant at the 0.01 level (2-tailed)

Table 4.1 Correlation between staff education level and number of ponds constructed, stocked and harvested.

		Total staff with degree and above	Total staff with diploma/certificate
Total number of ponds stocked	Pearson Correlation	0.199	0.058
	Sig. (2-tailed)	0.514	0.851
	N	13	13
Total number of ponds harvested	Pearson Correlation	0.391	-0.107
	Sig. (2-tailed)	0.186	0.729
	N	13	13
Total number of Ponds constructed	Pearson Correlation	-0.118	0.112
	Sig. (2-tailed)	0.7	0.715
	N	13	13

*. Correlation is significant at the 0.05 level (2-tailed).

Table 5.1 Correlation between staff managerial skills and number of ponds constructed, stocked and harvested.

		Staff with management skills	Male staff with management skills	Female staff with management skills
Total number of ponds stocked	Pearson Correlation	0.145	0.065	0.203
	Sig. (2-tailed)	0.636	0.832	0.505
	N	13	13	13
Total number of ponds harvested	Pearson Correlation	0.24	0.109	0.335
	Sig. (2-tailed)	0.43	0.723	0.264
	N	13	13	13
Total number of Ponds constructed	Pearson Correlation	-0.018	0.064	-0.12
	Sig. (2-tailed)	0.954	0.837	0.696
	N	13	13	13

*. Correlation is significant at the 0.05 level (2-tailed).

** Correlation is significant at the 0.01 level (2-tailed)

Table 2.1 Correlation between operational funds and number of ponds constructed, stocked and harvested.

		Total funds for operations
Total number of ponds stocked	Pearson Correlation	-0.099
	Sig. (2-tailed)	0.749
	N	13
Total number of ponds harvested	Pearson Correlation	0.271
	Sig. (2-tailed)	0.37
	N	13
Total number of ponds constructed	Pearson Correlation	-0.268
	Sig. (2-tailed)	0.377
	N	13

*. Correlation is significant at the 0.05 level (2-tailed).

Table 3.1 Challenges of commercial aquaculture.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Staff shortage	1	7.7	7.7	7.7
	Inadequate operational resources	2	15.4	15.4	23.1
	Political interference	2	15.4	15.4	38.5
	Shortage of fingerlings	2	15.4	15.4	53.8
	Unsuitability of some areas	5	38.5	38.5	92.3
	Procurement delays	1	7.7	7.7	100
	Total	13	100	100	