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Review Article

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The Influence of Resource Mobilization on Aquaculture Production in Kisumu West Constituency

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Abstract

Food and nutrition insecurity is a concern for the Kenyan government. As a result, various policy interventions have over time been implemented to deal with food and nutrition challenges within the country. Economic Stimulus program is one such intervention with specific objectives to create employment opportunities, improve nutritional status of the constituents and contribute towards rural development across the 140 selected constituencies, Kisumu West Constituency being amongst them. Despite the significant investment of resources by government, small holder aquaculture production showed a decline both nationally and within the area of study. Production within area of study was below the national average despite having suitable conditions alongside farmers being trained and capacity built on pond management skills. This awakened the necessity to evaluate the influence of resource mobilization on production of aquaculture production. The study results could inform stakeholders as agents to come up with appropriate corrective measures to address the emerging issues affecting aquaculture performance. A total of 389 farmers were administered with questionnaires in person, through the snowball sampling method from a population of 417 farmers. A descriptive research design was employed through a survey to collect both quantitative and qualitative data. Primary data was collected using questionnaire, key informant interviews and observation. Secondary data was collected from peer-reviewed publications, and journals. Quantitative data generated frequency tables, then analyzed to percentages, mean, Chi-square, and Pearson's correlation coefficient between the variables. Qualitative data was coded to create themes and categories. Thematic analysis was done for themes and contingency tables developed for categories. The analyzed results were then presented using text, tables, pictorials and graphs. Personal-financed farms experienced better production levels and fewer dropout rates compared to those funded by the government. The study recommends that future capitation of the aquaculture smallholder farms should be modelled with a percentage of farmer own contribution towards the enterprise. To realize project effectiveness and efficiency in attaining its core objectives, the stakeholders involved should ensure end to end beneficiary funding and at the right time. The County Government should increase budgetary allocation for aquaculture and enlist extension officers for in-service training on aquaculture professional development and capacity building on resource mobilization skills. The study results would be beneficial to planners and policy makers for management and implementation of future projects and interventions.

1. Introduction

Fish and other aquatic foods have an array of roles in the food systems of Africa including generating revenue and serving as a vital source of micronutrients especially for women and young children [1]. However, the value of fish and aquatic foods in Africa are often overlooked in development of research, policy and investment cycles [2]. Indeed, the vital contribution of fish to food and nutrition security has largely been overlooked in high-level food policy dialog and associated funding portfolios of major international organizations and actors [3]. For instance, between 1968 and 2018, world Bank Investment in capture fisheries and aquaculture accounted for an average of 1.8% of all agricultural funding; although funding has increased to an average of 2.6% (and as high as 5.4% in 2018) over the past decade. Sustainable financing and investment are required to sustain capture fisheries and promote aquaculture expansion in sub-Saharan Africa to shift to aquatic food chain towards healthier diets [2].

This study therefore, sought to determine if the amount of resource that had been mobilized and allocated as funding towards aquaculture production by private entrepreneurs, the national government and the county government of Kisumu was sufficient towards growth of sustainable aquaculture in Kisumu west constituency. state that through supportive government policies and substantial public investments aquaculture production increased rapidly from less than 1000 Mt in 2006 to 24,000 MT in the mid – 2010s [4]. However according to, Pond-based aquaculture production registered depressed performance for the

third consecutive year with total fish output dropping from 24,096 MT in 2014 the maximum recorded production achieved, 15,320 MT in 2018 and 18, 542 MT in 2019 [5].

Data provided by the Department of Fisheries, Kisumu West Sub-county during the pre-visit interview, showed that in the financial year 2016 – 2017, 2,319 Kg of fish was harvested from 47 ponds with an average of 49.34 Kg per pond. In the 2017 – 2018 financial year, 6, 130 Kg were harvested from 48 ponds, giving an average of 127.71 Kg per pond, and in the financial year 2018- 2019, 3,867 Kg of fish was harvested from 53 ponds which is an average of 72.96 Kg per pond. Despite the significant investment of resources by government through ESP, small holder aquaculture results showed a decline both nationally and within the area of study.

Nationally the country experienced declined pond production which was replicated within Nyanza region. Results from research done by shows that wild fish catch registered by beach management units along Lake Victoria shores indicate that Homabay county registered the highest wild fish harvest followed by Migori, Busia, Siaya and Kisumu County respectively [6]. From the results Homabay and Migori counties had a higher quantity of wild fish catch and had access to fish from Tanzania for their market. Siaya county had a higher wild fish catch compared to Kisumu but had a limited market for the fish products. Busia county had a higher wild catch from the Lake Victoria than Kisumu, but also benefited extensively from fish from Uganda. Kisumu county on the other hand had ready market for fish with minimal catch from Lake Victoria compared to neighboring counties.

According to, thirteen fish breeding grounds on Lake Victoria in Kisumu County were demarcated to curb fish kills [7]. This article classifies Kisumu county shores as predominantly a fish breeding zone. Kisumu East Constituency though with a ready market for fish the soil type is not very supportive for pond farming while Kisumu central is largely an urban area. Kisumu West Constituency on the other hand had an established fingerlings production farm. The area had suitable soils for pond establishment coupled with the availability of both seasonal and permanent rivers as a source of water for the ponds. Though these basic requirements for commercial fish farming exist, the study evaluated how pond management skills would influence the farm's state of activity and ability to develop into a commercialized enterprise.

2. Literature Review

Global aquaculture production (including aquatic plants) in 2016 was 110.2 million tons with the first sale value estimated at USD 243.5 billion, of which 80.0 million tons of food fish (USD 231.6 billion) this accounted for 5.8 percent growth during the period 2001 – 2016 [8]. aquaculture production is rising rapidly and by 2030 is estimated that aquaculture production will be close to that of capture production [9]. This is against the backdrop that many inland fisheries are threatened by climate change which has direct effects through reduced precipitation and greater evaporation and indirect effects when more water is used for irrigation through loss of cultured stock, increased production costs due to low water quality and availability for aquaculture during droughts [10]. The studies however do not show programs put in place to mitigate on pond water quality management. These impacts are likely to be felt most strongly by the poorest aquaculture farmers whose typically small ponds retain less water and dry up faster.

ESP on the other hand provided sufficient resources to the farmers in the program to acquire pond liners. Pond farming was intended to reach many rural farmers, to improve the rural economy through provision of food and both direct and indirect employment at the farms. This would achieve the objective of poverty alleviation. Participatory approach in learning and project initiation are key to attaining the project's key objectives. The study sought to find out if the beneficiary farmers needs were established before and during project implementation in terms of resources to actualize the sustainable fish farms. Although aquaculture continues to be the world's fastest growing and most diverse food production sector, the production of fish within the developing countries is highly dependent upon the local manufacture of aquaculture feeds composed of mainly imported feed ingredient sources, it, therefore, follows that future aquaculture feed industry and government efforts should be focused on the increased use of locally available nonfood grade feed resources [8].

In Egypt, pond-based aquaculture of tilapia was highly profitable which resulted in private sector investment and total aquaculture production grew from only 19 thousand tons per year in 1980 to 340 thousand tons per year in 2000, reaching an estimated total of 1.137 million tons per year in 2014. Aquaculture represented 77 per cent of total Egyptian fish production in 2014 compared to only 54 per cent in 2004 [11]. The studies have clearly indicated the growth of production however, they are silent on the level of resource mobilized in terms of skilled or unskilled labour to realize the attained pond production. Fish ponds in Kenya range from small dug holes to designed ponds with inlet channels and outlet channels and harvest basins yielding approximately 1 – 2 tons per hectare per year under competent management [6,12].

Aquaculture production in Kenya between 1970 – 2006 oscillated between 1000 – 4000 MT. In 2007 about 4, 250 MT of fish was produced by 2,742 farmers countrywide from 7,477 ponds covering 217 Ha, 301 dams and reservoirs (497 Ha) and 248 tanks and raceways [13]. Data provided by the Department of Fisheries, Kisumu West Sub-county during the pre-visit interview, showed that in the financial year 2016 – 2017, 2,319 Kg of fish was harvested from 47 ponds with an average of 49.34 Kg per pond. In the 2017 – 2018 financial year, 6, 130 Kg were harvested from 48 ponds, giving an average of 127.71 Kg per pond, and in the financial year 2018- 2019, 3,867 Kg of fish was harvested from 53 ponds which is an average of 72.96 Kg per pond. From 2009 – 2013 the Government of Kenya in its commitment to revitalize the economy introduced and implemented a large-scale subsidy program called the Economic Stimulus Program (ESP) under which aquaculture was identified as a key pillar in the agriculture production sector [6].

The number of farmers increased tremendously to 49,050 with an estimated 69,998 ponds occupying 2,063 Ha at the peak of the subsidy in 2012 [13]. Despite the increase in the number of ponds under production in 2012, the current research sought to find out if all the ponds were under ESP or if some had alternative sources of finances. Secondly, it would be important to note how many of the ponds are actively in production and out of the number, how many are not active. The information gathered on the pond performance would be instrumental in the identification of scope of improvement in areas with challenges, improve on service delivery plans to ensure value for money was achieved in the program and allow interested parties to track the progress, outcome and impact of ESP on the rural economy. A comparative analysis on the pond performance with alternative sources of funding was instrumental to be able to address the issues of ESP sustainability.

Kenya has made remarkable progress in promoting aquaculture. Kenya's Vision 2030, together with other legal policy and institutional frameworks also recognizes aquaculture as a source of food security, poverty reduction and employment creation. However, pond-based aquaculture production registered depressed pond performance for the third consecutive year with total fish output dropping from 24,096 MT in 2014 the maximum recorded production achieved, 15,320 MT in 2018 and 18, 542 MT in 2019 [5]. The study was focused to establish the performance of aquaculture within the study area about the source of funding of the specific project.

The research results detail the decline in production of ponds over the years. However, it does not clearly indicate whether the challenges in production were only faced by ponds funded under ESP or through alternative sources of funds. The study used pond performance indicators that include capacity of GoK to deliver resources inform of inputs equitably across all the farms within the study area, if the services were delivered on time or within the required time frame to ensure optimum production at the farm, to reflect on the quantity of input or output relative to the need or demand, assess the extent to which the beneficiaries were able to access the inputs and the effectiveness of the program in realizing the objective of increased food production in the rural areas and improving the rural economy.

The reduction in fish production was as a result of poor water retention capacity of ponds in some counties especially the Coastal and the Eastern region; poor extension services, inadequate capacity support, poor husbandry practices, low quality and quantity of fish farm inputs, poor marketing infrastructure, dependency syndrome on government/donor support and lack of value addition. The establishment of county governments and subsequent removal of aquaculture from the functions of the national government to county governments also led to a reduction in aquaculture activities in several counties in Kenya which lacked support programs for fish farming [14].

The study results clearly enumerate the import of resource mobilization and allocation. However, it did not indicate if the same challenges affected the study area. The factors that led to the decline of aquaculture formed part of ESP fundamental objective in terms of farmer capacity building and availability of qualified extension officers for consistent guidance on pond management. The study sought to establish if the issues were addressed within the study area.

3. Research Methodology

A research design is a set of methods and procedures that have been created to find answers to research questions. During the study, descriptive research design was used. According descriptive research is directed towards making careful observations and detailed documentation of a phenomenon of interest [15]. These observations must be based on the scientific method and therefore are more reliable than casual observations of untrained people [16]. further states that descriptive study attempts to describe systematically a situation, phenomenon, problem, service or program or provides information about say the living conditions of a community or describes the attitude towards the issue.

In order to achieve these results a method of survey research is applied for efficient data collection. According to, survey research is a quantitative research method used for collecting data from a set of respondents [17]. Survey research is implemented by researchers in cases where there is a limited cost involved and there is need to access details easily. The research design best suits the study in which a lot of insightful information was to be collected from the farmers. Use of survey in data collection was of great importance based on its flexibility to use non-probability sampling methods like snowballing.

This study was geared towards establishing the influence of resource mobilization on aquaculture production. The survey focused on farmers who were engaged in aquaculture in Kisumu West Constituency. The farmers who were not actively engaged in aquaculture formed an integral part of the study in getting the perspective of why certain farmers dropped out of the ESP, if there were resource mobilization challenges. The collected data was utilized based on the source of finance for the project (ESP, personal, and/or Sacco/group).

Questionnaire, observation and key informant interviews were used to collect data during the study from the respondents. The data collected was both qualitative and quantitative in nature. The collected data was such that they could reliably and validly address the specific objectives of the study. The collected data were coded to enable data analysis for both quantitative and qualitative data. The qualitative data was analyzed to present patterns and categories. Quantitative data on the other hand were analyzed using percentages, Pearson's correlation coefficient, Chi-square and cross-tabulation.

4. Area of Study

Kisumu West Constituency was formed from Kisumu Town West and Kisumu Rural Constituencies. Kisumu West Constituency is strategically located and borders Kisumu Central Constituency to

the South East, Kisumu East Constituency to the East and North East, Seme Constituency to the West, Vihiga County to the North and Lake Victoria to the South. Kisumu west Constituency has five wards namely Central Kisumu, North West Kisumu, West Kisumu, South West Kisumu and North Kisumu. Though cosmopolitan, the main spoken languages are Dholuo, Kiswahili and English. The topography is undulating with seasonal streams meandering through the plain land and hills towards Lake Victoria. The terrain and weather of the area provides a suitable environment to establish fish ponds. The major economic activities in the area include small, medium and micro business enterprises, subsistence agriculture, livestock farming and commercial residential housing.

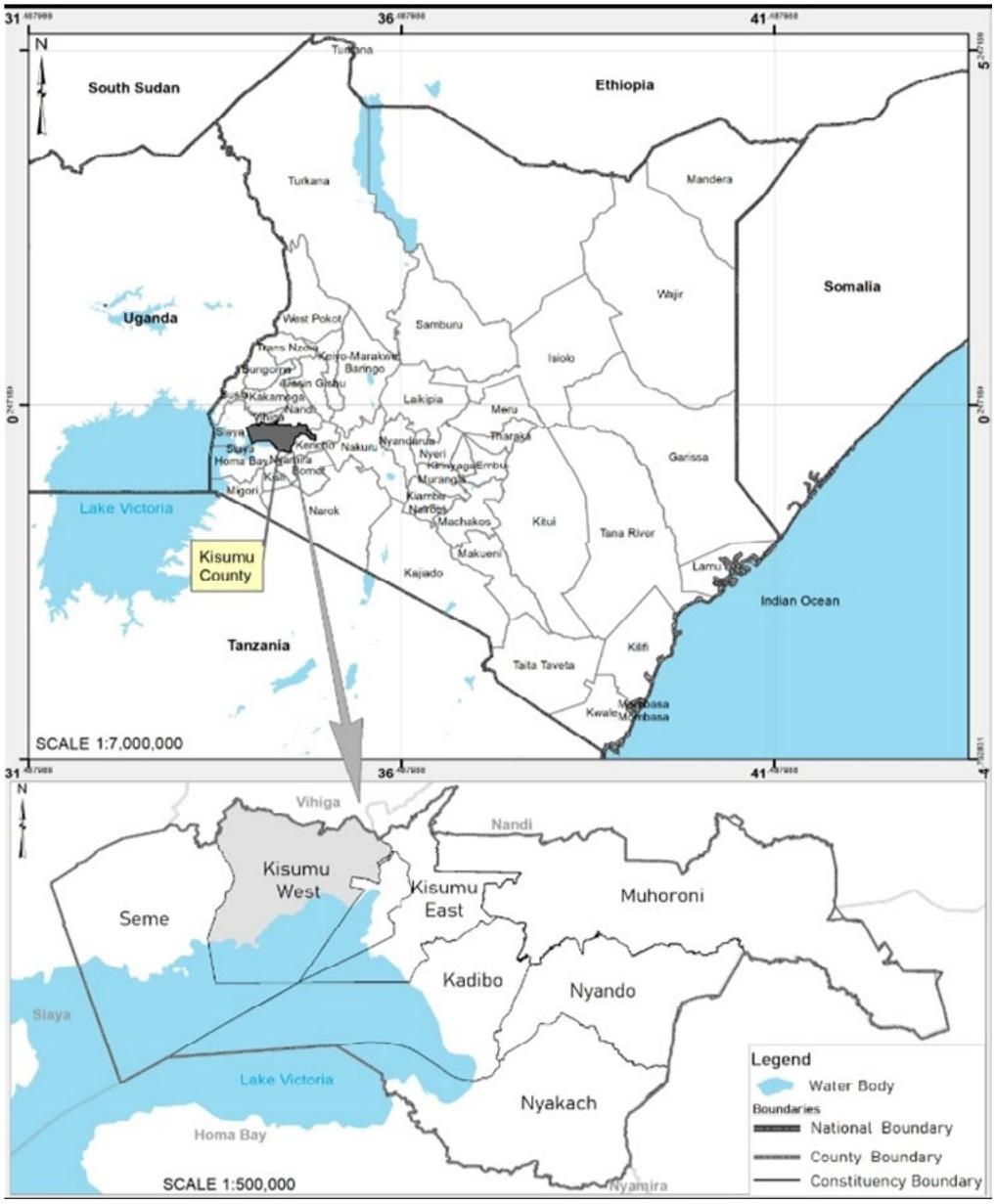

Figure 1: Map showing the location of Kisumu West Constituency.
Source: Hotosm (Kenya Open Data) Sampling and sampling procedure

State that snowballing sampling is commonly used in social science when a sampling frame is difficult to get [18]. Existing subjects are asked to nominate further subjects known to them as such, the sample increases in size like a rolling snowball. The sample frame for the farmers in Kisumu West Constituency was difficult to get since only a few contacts o the farmers were provided at the Kisumu West sub-county fisheries office during the pre-study visit. Based on this, the interviews were carried out starting with farmers, who could be engaged through the contacts provided by the fisheries office. Once a farmer was taken through the questionnaire, they were probing was done to get contacts and locations of other farmers they knew to be active or had practiced aquaculture before.

WARD	Total number of farmers registered	Number of farmers sampled	Percentage of total number of farmers sampled
Central Kisumu	25	23 (92%)	5.9%
Kisumu North	223	217 (97%)	55.8%
North West Kisumu	63	57 (90%)	14.6%
South West Kisumu	55	49 (89%)	12.6%
West Kisumu	51	43 (84%)	11.1%
TOTAL	417	389 (93%)	100%
Source of Data: Kisumu West Sub County Fisheries Office.			

Table 1: Sampling Frame

5. Data Analysis

Qualitative data should be pre-analyzed to allow data organization, coded to create categories, themes and patterns and finally analysis and interpretation of the information. The process of data analysis of qualitative data involves: editing of field notes to ensure data organization, detection of various categories which are distinct, establish relationships between the categories, develop codes that are used to generate categories. The codes for various themes, categories once created the data can be analyzed using quantitative methods. Differences noted are equally important for the study [19]. Data processing and analysis began as soon as data was received. Qualitative data were coded to create themes and categories. Thematic analysis was done on the results from the key informant interviews for purposes of triangulation. Categories realized were used to create contingency tables, which were further analyzed in form of quantitative data to find chi-square values. The results generated addressed all the three research objectives and questions conclusively.

The quantitative data were summarized through frequency tables. From the frequency tables the data was analyzed using software tools in this case Excel and Stata to get attain frequency, percentages, mean, chi-square and Pearson's correlation coefficient between the variables. The analysis was done at 0.05 confidence level. In order to facilitate data interpretation ease of communication and understanding of results text, tables, cross –tabulation, frequency tables, pie charts, graphs were used.

6. Results and Discussions

6.1 Socio – Demographic Information

Gender equality and equity have remained a major focus for the government of Kenya with an expectation to at least reach out to a third of the minority gender. The same is a concern for planners during implementation of projects. In this study, the gender and age of the respondents were considered since it may influence the production management skills at the farms.

AGE	GENDER		FREQUENCY	PERCENTAGE
	MALE	FEMALE		
18 – 27	32	17	49	12.6
28 – 37	39	4	43	11.1
38 – 47	48	26	74	19.0
48 – 57	61	42	103	26.5
58 – 67	36	21	57	14.6
68 – 77	16	20	36	9.3
78 – 87	14	13	27	6.9
TOTAL	246	143	389	100
% OF TOTAL	63.2	36.8		

Table 2: Age and Gender of the Respondent

Table 2 shows that 63.2 % of the 389 respondents interviewed were males and 36.8% were female. The male outnumbered the female in all age clusters apart from 68 – 77 and 78 – 87 age group clusters. The age groups 58 – 67, 38 – 47 and 48 – 47 were dominant with percentage representation of 14.6%, 19.0% and 26.5% respectively, accounting for 60.2% of the population. The project was earmarked to be a source of employment for the unemployed youth bracket however, from the results of the study the participants were only 23.7% of the total population of the farmers. The average age of the farm respondent was 50 years, that of the male respondent 48 years and that of the female respondents 53 years. The average ages show that the participants in aquaculture have a majority who are adults above 35 years of age with established homes and are land owners. These results indicate that ESP did not meet the expectation of creating employment for youth and women in order to spruce up the rural economy. According to, Women's participation in aquaculture as a business is on the rise (22% ownership of all fish ponds in Kenya) [20].

The main cause of the disparity with males includes low access to production inputs such as land and capital, insecure land property rights among women leads to under- investment and underutilization of productive inputs which in turn translate into lower yields. Apart from the crosscutting challenges some women face constraints that include inadequate skills, information and knowledge; negative attitude towards fisheries as a career; public sector systems that have concentrated more on production leaving out value addition, processing and marketing rendering the sector unprofitable and unattractive for entrepreneurship; lack of access to financial services or credit and it is both capital and labor intensive at the initial stages. It was further observed that men control the land units and family income in most households. However, most of the labour in the fish ponds were undertaken by female despite the ownership being male.

7. Resource Mobilization and Aquaculture Production

This section addresses how resource mobilization influenced the production of aquaculture in Kisumu West Constituency. The indicators of current status of the farm were whether the farms are active or inactive, number of employees within the active farms to address the need for direct and indirect employment, number of ponds harvested within a period of a year from the time of the study and the number of pieces of fish harvested and their sum weight. A comparative analysis of these indicators would be done with the different sources of capital to establish the source that has more sustainable farms. The limitations and challenges faced by the farmers was also analyzed.

8. Sources of Capital

The Kenyan government through ESP provided financial support to identified farmers to develop commercialized aquaculture farms. The information gathered from the respondents is represented in table 4.3.

SOURCE OF CAPITAL	NUMBER OF FARMERS	PERCENTAGE
ESP	157	40
Pesrsonal	126	32
Sacco/Group	43	11
ESP and Personal	55	14
Personal and Sacco/Group	8	2
Total	389	100

Table 3: Source of Capital for the Aquaculture Project

From Table 3 of the respondents interviewed, 40% of the farmers were financed from the ESP kitty, 32 per cent established the projects from personal finances, 14% used both personal and ESP funds, 11 per cent received their funding from Group/Sacco loans while 2% of those interviewed used had both personal and Sacco/Group loan as source of funds to establish the projects. This indicates that about 54% of the farmers received funding from the government to establish their farms. The main stream financial institutions including banks and microfinance institutions did not finance any aquaculture project within the constituency.

'ESP was earmarked to fully finance the farmers until harvesting of fish'. (Sub- County Fisheries Officer). The assertion by the sub-County Fisheries Officer was not realized on the ground. The results from the study indicates that 15% of the farmers were not fully funded since they had to mobilize for alternative resources to manage the ponds. Further results from the farmers showed that, some did not receive other categories of financing leading to drop out as shown on the figure 2 below.

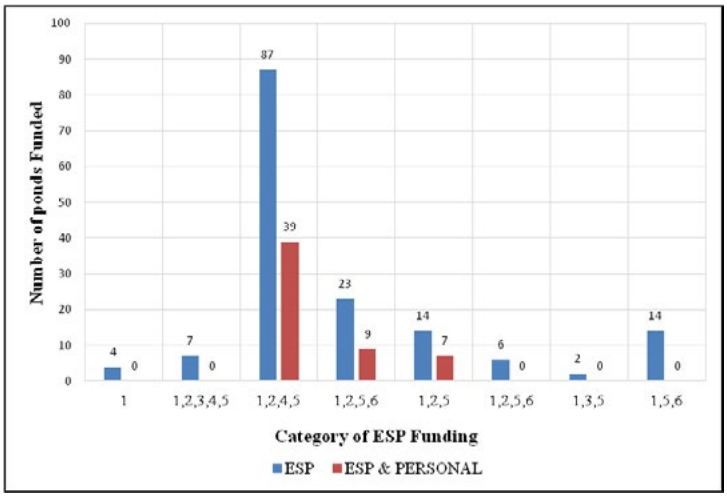

Figure 2: Categories of ESP Financing for the Aquaculture Projects

Category: Forms of ESP funding: 1 – Pond construction; 2 – Feeds purchase; 3 – Fertilizer; 4 – Training; 5 – Fingerlings; 6 – Pond Liner

Figure 2 shows the different combinations of forms of finance received from ESP. From the farm interviews carried out, of the 389 farmers, 157 farmers received full funding for some components of the aquaculture project. Four farmers received funds towards construction of ponds without any further additional funding, hence they were not operationalized. Seven ponds received capitation for full establishment however, no pond liner was issued on assumption that the soil type could comfortably retain water. 87 ponds were fully funded inclusive of the pond liner but did not receive fertilizer which was a key component in production. From the results it was clearly evident that most of the farmers capitalized through ESP, missed out on the fertilizer component. Farmers received only a measure of 2 Kg fertilizer, against an expectation of 15 kg as was indicated on the project program. It is also evident that fertilizer though being a key ingredient during growth and development of the fingerlings during production it was not distributed to most of the farmers who were beneficiaries of ESP.

The Department of Fisheries though could not quantify the number of farmers financed through ESP, they provided an explanation that the deviation from the expected 200 fully financed ponds was due to the fact that, Kisumu West constituency was formed during the electoral boundary review and was hived off from Kisumu Rural and Kisumu Town constituencies that received capitation for the projects.

The Fisheries Officer from the Department of Fisheries in Kisumu West Sub County stated that:
'Funding for projects by ESP was done based on different categories that included pond construction, purchase of pond liners for areas with low water retention soils, purchase of 1,000 fingerlings to stock each pond, provision of feeds for the entire production cycle and training of the farmers on the production management skill'.

The result was however not in line with the findings from the individual farmers as captured in figure 4.1. The fish farmers received funding for some components only. For example, four farmers received only funding for pond construction leading to their drop out at the initial stage. This was a clear indication that there was under distribution of resources that had been mobilized by GoK towards implementation of ESP. According to not all fish ponds constructed were stocked with the 1000 tilapia fingerlings and some beneficiaries of the project did not receive and install the polythene pond liners [21]. Some of the farmers were not able to meet these requirements by the time the ESP program funding came to close. There were many cases where farmers eventually abandoned their ponds even before the first harvest.

According to through ESP the country experienced a rapid expansion of fish farming providing high protein food income and employment opportunities [22]. The ESP focused on pond construction, fish feed and fingerlings supply, post-harvest management and human resource capacity building of fish farmers and associated institutions. The research results were not in line with those of the study done in Kisumu West constituency noting that all the farmers did not receive the full package of financing as stipulated in the ESP performance activities.

Figure 3, below shows a pond within Kisumu West constituency funded by ESP but could not retain water since the pond liner provided to the farmer was not sufficient for the pond leading to farmer drop out.

Figure 3: Pond within Kogony, Central Kisumu Ward not fully Covered by a Pond liner

According to one of the major constraints affecting aquaculture in African countries is lack of capital. The lack of capital by the rural based farmers was to be addressed through inception of ESP [23]. However, from the study some framers did not receive full capitation as envisaged leading to farmer drop out resulting to in active farms. In the first phase of ESP in the 2009/2010 financial year 200 fish ponds were constructed in each of the 140 constituencies, totaling more than 27,000 fish ponds nationally, in addition to this, 15 Kg of fertilizer and 1000 fingerlings of monosex tilapia per fish pond were issued, it was expected that on successful harvest each of the ponds were to produce an average of 240 Kg of fish per year [22]. This observation contradicts the study findings in Kisumu West Constituency as most of the farmers did not receive the capitation as planned. Most of the ponds financed through ESP are in a dilapidated state a clear indication that resource mobilization was a challenge.

9. Current Status of Farm Activity

Table 4 below provides a summary of the findings of the current status of the farms if active or inactive and level of production. The inactive farms are drop out farmers.

Source of capital	Pond status, production and number of employees			
	Number of active farmers	Total number pieces of fish harvested	Total weight of fish harvested (kgs)	Total number of employees
ESP	31(16.6%)	10,040	1,318	143
PERSONAL	89 (47.6%)	20,840	1,530	156
SACCO/GRP	35 (18.7%)	2,100	290	35
ESP & PERSONAL	28 (15.0%)	4,830	955	27
PERSONAL & SACCO/ GRP	4 (2.1%)	160	200	4
TOTAL	187 (100%)	37,970	4,293	365

Table 4: The Source of Capital and Current Status of the Farm

From Table 4, 48.1 per cent of the farms in Kisumu West Constituency are actively in production against 51.9 percent that are not active. Of the active farms, 16.6% were financed through ESP, about half financed through proprietor personal finance, 18.7 % financed through loans from a group or Sacco, 15.0% financed through both ESP and personal funds and 2.1% funded through personal and Sacco/Group finance. This shows that a third of the firms received funding either partially or fully from the ESP kitty. For the farms that are not active 62.4% were financed by ESP, and 18.3 % financed through entrepreneurs' personal finances, 4.5% financed through loans from a group or Sacco, 13.9% financed through both ESP and personal funds and 1.0 % were funded through personal and Sacco/Group finance. Taking a comparison of the performance of the farms funded by ESP and personal finance it was noted that a great number of drop out farmers had finance from ESP (126 farms) out of the total 202 inactive farmers, which is 92.3%.

According to Adopters who were fish farmers, had reared fish for over five years continuously [24]. Of the 146 fish farmers surveyed 43.2% were adopters. Non- ESP members adopted fish farming at 76.9% as compared to 39.8% of ESP members. The implication is that non-ESP members might have been prepared to undertake fish farming in resources and expertise. A majority of ESP members were non-adopters as illustrated by 96.4% of the total non-adopters. The number of adopters and non-adopters, almost equals the active or inactive ESP farmers from the current study done within Kisumu West Constituency. Of the 34 ponds harvested that were funded by ESP, 10, 040 pieces of fish were harvested. Personal financed farms with same size harvested 20,840 pieces which is double the number of fish harvested. ESP funded active farms are 31 and the ponds harvested in the last one year stands at 34, this showed that the farmers are continually dropping out from the enterprise upon harvesting. From the findings there was a clear indication that farms financed through the entrepreneur's personal finances of evidenced more sustainability, followed by Sacco/Group loan financed, those capitalized through ESP only were the least sustainable.

The active farms have a mean of 37.4 farms standard deviation of 31.28 depending on the sources of funds and positively skewed by 0.9045 from the normal curve. The inactive farms on the other hand have a mean of 40.4, a standard deviation of 49.88 and positively skewed by 1.21081 from the normal curve. This showed that more farms were inactive. Inactive farms showed a wide deviation from the mean value across the different modes of funding that is a minimum of 2 drop out farmers to a maximum of 126 farmers cutting across the different sources of capital.

The number of pieces harvested varied highly from the mean at 8,284, the weight also bears a high variation from the mean at 597, this was an indicator that the farm production varied across all the farms within the constituency. The variation was evidenced even though all the ponds are of the same size and received an input of 1,000 seed fingerlings issued to the ESP-financed farmers. The variations were attributed to the different pond management skills put in place by the farmers with those financed through personal finances showing better harvest quantities in terms of both number of pieces and weight. The study results were in line with that of that found out that, pond-based farming was a highly profitable venture in Egypt, was widely managed and funded through private sector investment [25].

The results corroborate with that on development of aquaculture farms in Zambia, Ghana and Malawi as reported by, from the survey of fish farmers (n=129, 98%), practical semi-intensive system of aquaculture [23]. In pond systems, 97% (n=127) of farmers cultured fish in earthen ponds. Earthen pond system is more dominant because of the low cost of establishment and management. However, there was no farmer practicing extensive culture system due to the low productivity and less returns associated with the same. The survey also revealed only 2%, (n=2) engaging in intensive aquaculture practice.

This is perhaps attributed to high startup cost, operational costs and the risk associated with such systems. Production reduced drastically in the past 3 years with 14,952 metric tonnes. In order to mitigate on the high level of drop out farmers participatory approach in planning should have been utilized. This would support in actualizing the needs of the farmers and addressing the anticipated challenges like the serious demand for pond liners due to poor soil in some areas, some farmers lack of capacity to sustain the project without consistent funding from the GoK.

Figure 4: Pond Funded through ESP at Ojolla, South West Kisumu Ward

The photo taken by the author shows a farm that received funding for pond construction through ESP and has since grown the enterprise to own three ponds.

The farmer received funding for Pond construction, feeds purchase, fertilizer, training and purchase of 1,000 fingerlings. From the income earned in addition to personal finances the farmer has been able to increase the number of ponds at the farm to three.

	Fish Type					
Source of capital	**Cat fish**	**Other fish**	**Tilapia**	**Tilapia Cat fish**	**Tilapia other**	**Total**
ESP			29	5		34
PERSONAL	1	1	19	3	1	25
SACCO/GROUP		1	4			5
ESP PERSONAL			5	5	1	11
PERSONAL, SACCO/ GROUP				1		1
Grand Total	1	2	57	14	2	76

Table 5: Type of Fish Farmed and the Count of Ponds Harvested

Weight of fish harvested per fish type						
Source of funds	**Cat fish**	**Other**	**Tilapia**	**Tilapia Cat fish**	**Tilapia & other**	**Total**
ESP			1194	124		1318
PERSONAL	0	14	1401	96	20	1531
SACCO/GROUP		75	215			290
ESP PERSONAL			650	55	250	955
PERSONAL, SACCO/GROUP				200		200
Total	0	89	3460	475	270	4294
Percentage	0	2.07	80.58	11.06	6.29	100
Average weight per pond	0	44.5	60.7	33.9	135	56.5

Table 6: Type of Fish and the Sum of Weight of Fish Harvested

From the 76 ponds harvested, a total of 4,294 Kg of fish was harvested indicating an average weight of 56.5 Kg per pond. It was noted that one pond stocked with cat fish realized no fish harvested, a clear indication of effects of fish predation and theft. Farms financed by ESP and personal funds exemplified the highest estimated weight harvested at 1,318 Kg and 1,531Kg respectively even though ESP farms had the highest number of ponds harvested over a period of one year.

Data provided by the Department of Fisheries, Kisumu West Sub-county during the interview, showed that in the financial year 2016 – 2017, 2,319 Kg of fish was harvested from 47 ponds with an average of 49.34 Kg per pond. In the 2017 – 2018 financial year, 6, 130 Kg were harvested from 48 ponds, giving an average of 127.71 Kg per pond, and in the financial year 2018- 2019, 3,867 Kg of fish was harvested from 53 ponds which is an average of 72.96 Kg per pond. This was generally a declining trend that was against the projected target of ESP.

Number of employees per farm					**Total number of ponds harvested per source of capital**
Source of capital	0	1	2	3	
ESP	2	30	1	1	34
PERSONAL		16	7	2	25
SACCO/GROUP		5			5
ESP PERSONAL	1	9	1		11
PERSONAL, SACCO/GROUP		1			1
Grand Total	3	61	9	3	76

Table 7: Number of Ponds Harvested against Number of Employees Per Farm Depending on Source of Capital

Table 7 indicates that of the 76 farms harvested in the last one year three ponds did not have any employees at the farm, 61 ponds were manned by one employee each, 9 ponds manned by 2 employees each and 3 ponds manned by 3 employees. The total number of employees was 88 for the 76 ponds harvested. Close to half of the employees handling the ponds harvested in the last one year were funded through ESP. A further interrogation of the respondents showed that the average number of employees per farm is 1.2 earning an average monthly salary of Kshs 3,712.00. Most of the employees in the farms are male youths. ESP had the objective of commercializing the farms to be a source of employment for the youth and women in the rural areas for economic empowerment.

Sum of weight harvested in relation to number of employees per farm (Kgs)					
Source of capital/ No. of Employees	**0**	**1**	**2**	**3**	**Total weight harvested (Kgs)**
ESP	0	1,238	35	45	1,318
PERSONAL		405	822	304	1,531
SACCO/GROUP		290			290
ESP PERSONAL	100	855	0		954
PERSONAL, SACCO/GROUP		200			200
Grand Total	100	2,988	857	349	4,294
Average weight per pond	33.33	48.98	95.22	116.33	56.5

Table 8: Weight of Fish Harvested and Number of Employees Per Farm

Table 8 shows the impact of the employees on the farms they work in. The three ponds harvested with no employee assigned recorded an average 33.33 Kg of fish per pond. One of the ESP ponds with no employee did not register any harvest. Ponds having a single employee working had an average of 48.98 Kg which was 69.5% of the total production, two employees 95.22 Kg and 3 employees 116.33 Kg. This implies that the optimum number of employees per pond should be two for maximum return. From the study it is also evident that the male youth recorded the highest production level at 49.1%, followed by the male adult at 31.2%, female adult at 17.8% and female youth at 1.8% denoting the lowest pond production.

	Active	No. of Ponds	No. of Pieces	Weight harvested	No. of employees
Active	1.0000				
No. of Ponds	0.5311	1.0000			
No. of Pieces	0.9217	0.7577	1.0000		
Weight harvested	0.7245	0.9019	0.8975	1.0000	
No. of employees	0.7511	0.9360	0.9021	0.8881	1.0000

Table 9: Correlation Between Farm Status, Number of Ponds, Number of Pieces, Weight Harvested and the Number of Employees

From Table 9 the following Pearson's correlation coefficients realized show the following relationships:
Active and inactive farms showed a weak positive relationship due to the high increase in drop out farmers financed through ESP compared to other sources of finance. However, the active farmers did not show such wide disparity. Active farms showed a moderate relationship, while inactive farms showed a strong positive relationship with the number of ponds harvested. This leads to a conclusion that consistent drop in the number of ponds harvested in the last one year signifies a high dropout rate of farmers from fish farming.

The number of pieces of fish harvested depends on the activity of the farmers. Therefore, the strong positive relationship between active farms and number of pieces harvested confirms the trend. The weak positive relationship with inactive farms shows the lack of consistency in production of the farms before the farmer finally dropped out of farming. Government of Kenya in 2009 initiated ESP, with the aim of commercializing aquaculture. The program aimed to increase production of farmed fish from 4,000 MT, to over 20,000 MT in the medium term and to more than 100,000 MT in the long term [26]. The figures would provide an average production of 95.23 MT per constituency in the medium term and in the long term 476.19 MT. The study showed harvest of 4,294 Kgs of fish from the constituency was far short of the expected ESP projected figure in the long term.

On interrogation of some of the farm owners they decried delayed delivery of feeds and fertilizer and in some instances against an expectation of 15 Kg of fertilizer only 2 Kg was delivered to the farm by the fisheries department officers. Department of Fisheries reaction to this was: *"There was no budgetary allocation on facilitation of aquaculture extension officers to visit the farms from the County Government of Kisumu".* Results from the survey done showed that 50% of the farmers indicated that it's rare to get visits from the fisheries department. The established farms with high production levels per pond decried lack of support from the fisheries department. The lack of farmer visits exposes farmers to challenges in pond management. The result provides justification for the low pond production in the area of study. The pond production level was far below the expectations as captured by that fish ponds in Kenya range from dug holes to designed ponds with inlet and outlet channels and harvest basins yielding approximately 1 – 2 tons/Ha/year under competent management [6].

10. According to Kmfri Officer:

Production of farms is affected by lack of effective group organization which reduces ability to negotiate on cost of input and share experiences. Best management practices not formally adopted or applied in culture systems, over reliance on funding from government and development partners creating a 'donor syndrome.

This observation is replicated on the ESP program since farmers recruited to manage ponds failed to progress to the first harvest due to lack of support from the government. Though the funds were availed by the government to ensure full funding of the projects it is evident to note that some of the funds did not reach the intended farmers. The decline in production levels of the farms evidenced is contrary to who stated that aquaculture is rising rapidly and by 2030 is estimated that aquaculture production will be close to that of capture production and in Egypt aquaculture represented 77% of total fish production in 2014 compared to 54% in 2000 [9,25].

According to aquaculture provides opportunities for employment and income generation to youth and women especially in the rural areas [20]. To this end, ESP had an objective to increase employment opportunities in the fisheries and aquaculture sectors from 80,000 to approximately 2.0 million by 2030. From the findings, if the optimum number of employees that maximizes production per farm is 2 per pond then 200 ponds per farm should at least have 400 employees. The total count of ponds constructed in Kisumu west constituency total 441 both active and inactive and therefore the projected employee number per farm should be 882 employees.

In their study of success of aquaculture in Pakistan found out that farm innovation and skilled farm labor reduce costs and raise efficiency [27]. This therefore informs that farmers in Kisumu

West constituency should focus on employing skilled labor to improve on pond performance. The increase in drop out farmers in form farm inactivity directly affects pond production. The trend therefore affects the realization of the medium-term and long-term objectives of ESP. Therefore, measures should be taken to adequately provide the farmers with the requisite production management skills. Production directly relates to the number of ponds that are active and strongly related to the active ponds and if the numbers would increase then the projected medium term and long-term values would be attained.

Generally, the weight of fish harvested showed a strong positive relationship to the active ponds, a number of ponds harvested and a number of pieces harvested. This was attributed to low weight per piece harvested that showed a similar trend. This could be alleviated by engaging the farmers in proper management of the feeding program for the farms to allow the fish to attain the requisite weight. The evidenced decline in farm production especially for the ESP-financed farms was a clear indicator that most of the activities were not diligently implemented to ensure achievement of the projected goals. To establish sufficient and prudent control and monitoring of the progress of the farms. Gannt charts should be introduced within the farms to illustrate achievement of various activities and timelines within which they were attained.

11. Conclusion

Aquaculture is a capital-intensive venture that requires prudent resource mobilization. Drop out farmers were evident on the ESP financed farms due to lack of sufficient resources to run the farms. Funding through ESP was not done to all the components envisaged propping up challenges to the farmers. This was established when farmers put in additional resources from their personal savings to ensure the projects were a success. The study has clearly shown the importance of farmer needs analysis done before project inception to ensure sufficient resources are provided to sustain the venture [28-69].

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