Effect of Management Skills on Performance of Economic Stimulus Program Financed Aquaculture Farms Kisumu West Constituency, Kenya

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Abstract: In the endeavour to stimulate the Kenyan Economy after the post-election violence in 2008, the Economic Stimulus Program (ESP) was developed so as to jumpstart the economy. Commercialization of aquaculture farming was one of the key objectives supported through construction and stocking of 200 fish ponds per constituency in 140 constituencies. Despite this effort, there has been a declining trend in production from aquaculture farms in Kenya. This study sought to establish if there exists a relationship between decline in performance in aquaculture and farmers' acquisition of technical management skills. A population of 417 farmers was used for the study from which a sample of 389 was derived. The researchers collected data from the field by use of questionnaires, key informant interviews, and observation. The study established that capacity building and training on technical management skills were not done by extension officers during the project implementation leading to a high dropout rate of farmers and decline in performance of the farms. The study recommends establishment of regional based aquaculture producer organizations which integrates training and marketing infrastructure for the farmers.

Key Words: *Aquaculture, Economic Stimulus Program, Regional Planning, Kenya, Cross-sectional study*

Introduction

Management entails designing and maintaining an environment to ensure that a given set of objectives are accomplished in an efficient manner. Various researchers have established that managers usually carry out the functions of planning, organizing, staffing, leading, and controlling, with the management function acting as a steering influence on production (Weihrich, Cannice, & Koontz, 2008; Kaehler, Boris, & Grundei, 2019). According to Bateman & Zenithal (1993), management functions are a cornerstone of a manager's job. Managers therefore need a variety of skills to execute these functions successfully. These management skills include technical skills, conceptual and decision-making skills, interpersonal, and communication skills. Commercializing aquaculture to improve on production levels requires the farmer to operate as an enterprise and embrace the position of a manager. As a manager, the aquaculture farmer should be adequately trained on functions and skills of management. Strategies for economic viability of commercial aquaculture farms in the pacific include management of production risks, improvement of technical and operational efficiency, and management of marketing risks and better market access (Food and Organisation, 2020). In Africa, many governments and development agencies have promoted aquaculture as a panacea for household security, rural development, and poverty reduction. However, aquaculture production in the continent remains low despite significant investments (Obiero, Waidbacher, Nyawanda, et al., 2019).

According to Mwatsuma, Cherutich & Nyamu (2012), many African countries did not register success in aquaculture farming due to little or no pre-stocking preparation of ponds occasioned by poorly resourced extension agents. This thought is significant since it determines to what extent aquaculture farmers are technically resourced to undertake the enterprise to prosperity. Mwangi (2008) explains that the Tilapine species is a major share of the total aquaculture production in

Kenya. Further, the researcher points out that the production of the Tilapines and the African Catfish is characterized by low pond productivity mainly due to low quality fish feed and employment of low pond management practices. This resulted to stagnated national aquaculture production over the past decades (Mwangi, 2008).

According to the Department of Fisheries in Kisumu County, there has been a significant drop in fish farming production. The Economic Stimulus Program (ESP) was then established as a government project with the core function to spur the country's economic growth after the 2007-2008 post-election violence (Food and Agriculture Organisation, 2014).

Among other key objectives, commercializing aquaculture farming and capacity building on the aquaculture farmers formed part of the key deliverables related to the study. This was to ensure that they were adequately armed with production management skills aimed at improving on the pond production levels. Through the program, farmers were trained on coordination of pond management technical skills and planning on post-harvest management skills. In addition to this, farmers were financed in the following aquaculture categories: pond construction, purchase of feeds, fertilizer, fingerlings, and purchase of pond liners. Extension officers were also employed to ensure the objective of increased production levels are achieved by the commercialized farms.

However, the impact of capacity development in order to commercialize aquaculture farming through inculcation of management skills to the farmer does not seem to have realized the expected outcome. The study evaluated if there exists a significant relationship between the evidenced decline in performance of aquaculture farms in terms of production levels and the acquisition of production management skills by the farmer.

Study Objective

The main objective of the study was to establish the effect of management skills on performance of the Economic Stimulus Program (ESP) financed aquaculture farming projects in Kisumu West Constituency, Kisumu County.

Literature Review

Inappropriate pond construction techniques, poor soils, and low-quality feeds obtained from agro-industrial by-product have been observed as a hindrance to commercial aquaculture (Fakoya, Owodeinde, Go Jimoh, & Akintolp, 2001). The studies of Fakoya, Owodeinde, Jimoh & Akintolp. (2001), Mwangi (2008), and Mwatsuma et al. (2012) enumerate technical skills that are a necessity for prudent development of commercial aquaculture. However, the studies emphasize on the training levelled towards extension officers but does not mention if this training was adequately disseminated to the fish farmer. Neither do they enlist any training programs focusing on the fish farmer to ensure technical preparedness for the agribusiness enterprise.

In a study conducted on aquaculture extension service in Kenya by Ngugi and Manyala (2004), one of the biggest constraints facing aquaculture development is the lack of extension staff and infrastructure to deliver technical knowledge about aquaculture to rural small holders. The study further reveals that the technical aspects of constructing small ponds of the appropriate size and depth and ensuring that they will have suitable sources of water, filtration, and aeration is complex requiring significant education and extension support. Another study investigating the relationship between staff capacity on performance of aquaculture was conducted by Mwatsuma et al. (2012). The study found that there was no significant relationship between staff capacity and performance of aquaculture. These researchers however stated that the target group for the study were the technical staff only. In Kenya, the ESP objective was to provide sufficient technical staff and build their capacity in aquaculture management (Food and Agriculture Organisation, 2017). This study conducted in Kisumu West Constituency focused on the farmer while relating their technical capacities to the performance of their aquaculture farms. The unit of analysis in this case was the farmers, rather than the technical staff.

According to the Food and Agriculture Organisation (FAO) (2017), commercializing aquaculture entails aspects of project sustainability. First, the aquaculture project should be technically adequate and feasible. Fish

farmers should have the necessary knowledge and technical skills to grow given aquaculture organisms and ensure the production inputs and growing conditions of cultured species are adapted to the local conditions. Second, the project should be economically viable. The farms should be profitable and competitive over time, thus minimizing dependency on government subsidies. Third, the project should be socially acceptable. This ensures the farm operations should benefit a broader proportion of the community including women and the youth.

Research Questions

1. Which technical skills are covered by ESP financed aquaculture farms training in Kisumu West Constituency?
2. What is the relationship between the farmer technical skills capacity development and performance of aquaculture farming?

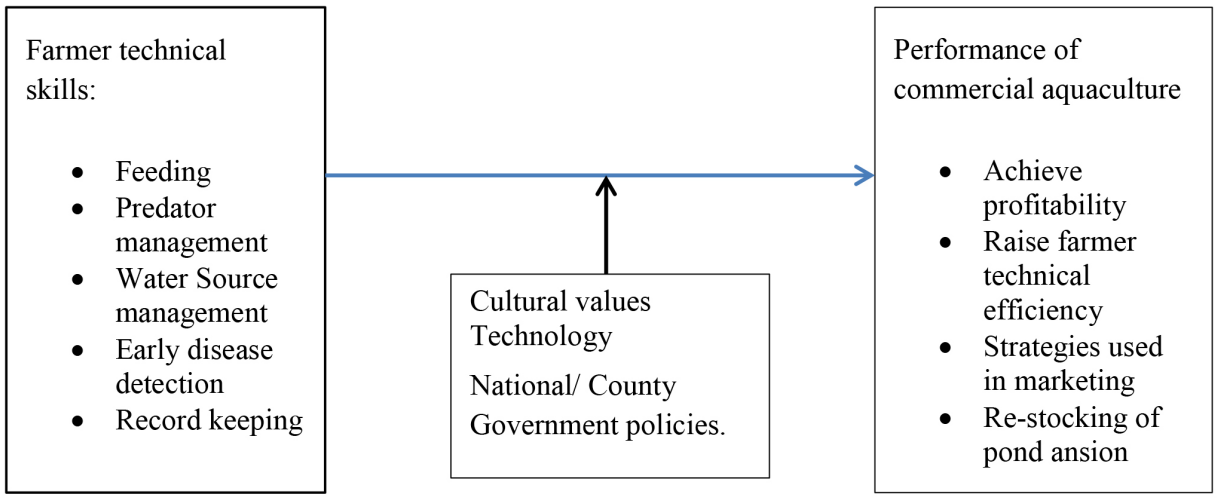

Figure 1. Conceptual Framework.

The study of Shitote, Wakhungu, and China (2013) revealed that 88.3% of fish farms were affected by predators indicating that predation was a serious threat to fish farming. The major predators include Kingfisher and other birds (44.3%), human beings (23.6%), crabs (10.7%), snakes (9.9%), and frogs (5.2%). However, the point of departure from the aforementioned study is that it did not capture if proper training or awareness was done to the farmers on fish predators, and if the farmers were trained on skills to manage the predators in order to get optimum pond production relative to fingerlings stocked. Thus, this paper presents findings based on the analysis of skills which farmers possessed in relation to the management skills employed in aquaculture farms in Kisumu West Constituency.

Methodology

This section is a description of the research design employed by the study, research setting, sampling, data collection and data analysis procedures employed in the course of the study.

Research Design

The descriptive research design was used in this study. 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 on why certain farmers pulled out of the ESP and also to identify management challenges.

Research Setting

The research locale was the Kisumu West Constituency which is strategically located and borders Kisumu Central Constituency to the Southeast, Kisumu East Constituency to the East and Northeast, Seme Constituency to the West, Vihiga County to the North, and Lake Victoria to the South. The constituency has an estimated population of 131,246 residents with an estimated area of 358.7 square kilometers. Kisumu West Constituency has five wards namely Central Kisumu, Northwest Kisumu, West Kisumu, South West Kisumu, and North Kisumu. Though cosmopolitan, the main spoken languages are Dholuo, Kiswahili, and English (Kisumu West Constituency, 2021).

Data Collection

Three data collection methods were used in collecting the primary data which allowed for triangulation, and these were observation, farm interviews, and key informant interviews focusing on the study objectives. Data collection was done on the total population of the study to enable data collection done on farmers financed by ESP, farmers with personal financed farms acting as a control group, and the drop out farmers.

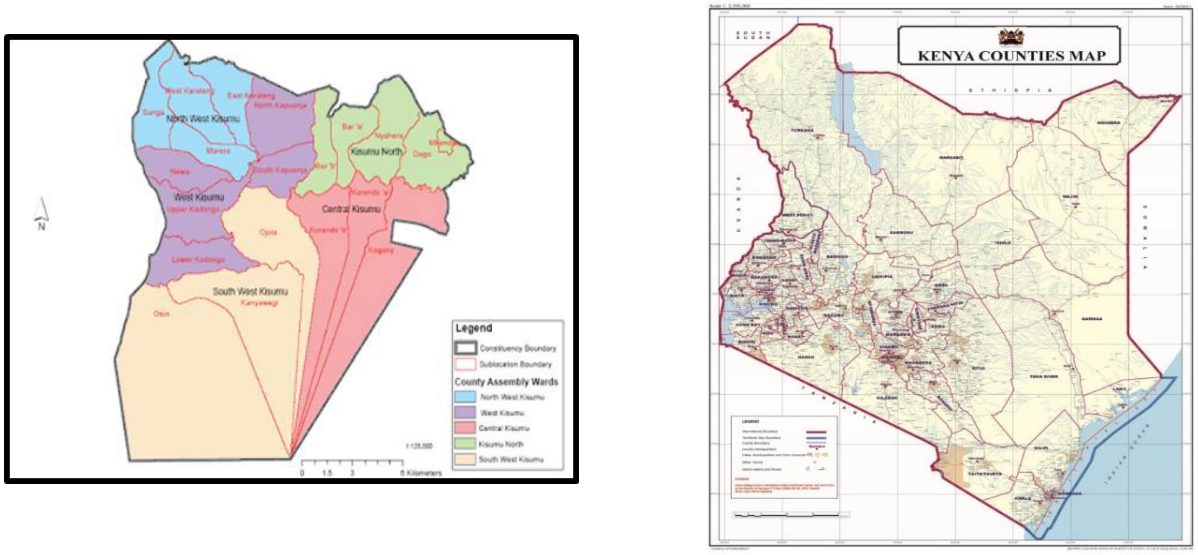

Figure 2. Research Setting.
The photograph above shows the research locale and the Kenya Counties Map.

Sampling

From Kisumu West Sub-County Fisheries Department Office, the total number of listed aquaculture farmers is 417 even though they are not categorized based on the source of finance. Majority of the fish farms are individually owned, although some are managed by groups, schools, universities, and government agricultural institutions. The study population was made up of 417 aquaculture farmers in Kisumu West Constituency. The study opted to make use of the total population sampling technique. Out of which, a total of 389 participants were interviewed. This resulted to 93.28% of the population being interviewed. A questionnaire was developed and the participants were also taken through a personal interview while the interviewer keyed in the responses.

To ascertain reliability of the farmer interview questionnaire, it was pilot tested and administered to a random sample of farmers in Kisumu East constituency that also benefited from ESP. The same questionnaire was administered within a span of two weeks and the correlation coefficient of +0.872 was attained. This was slightly more than + 0.8 showing that there was a strong relationship between the two tests and hence the tool used was reliable.

Data Analysis

Thematic analysis was done on qualitative data by categorizing relevant themes to address

both the research objectives and research questions conclusively. Quantitative data were summarized through pivot tables. From the pivot tables, the data was analysed to generate frequency distribution, mean, and percentiles.

Ethical Considerations

Respondents were informed that participation was voluntary after explicit consent was sought. The objectives of the study were explained as well as the expectation of their level of contribution to the study. The names of respondents were omitted from the interview forms to uphold confidentiality.

Results and Discussions

The results of the study based on the variables used are presented in the sections herein.

Areas Farmers Received Training on Technical Skills

Table 1 shows results based on the areas of training which the farmers had received. The specific areas of training included: predator identification and management, water source management, early fish disease detection, fish feeding program, record keeping, fish pricing, fish storage and fish value addition.

Table 1

Tabulation of Percentage of Farmers Trained on Technical Skills

Training on technical skills	Percentage trained
Predator identification and management	60.4%
Water source management	85.3%
Early fish disease detection	53.7%
Fish feeding program	77.6%
Record keeping	44.2%
Fish pricing	41.6%
Fish storage	41.6%
Fish value addition	39.1%

From all the farms interviewed both with active and non-active farms, each farmer received at least one form of training from the areas captured in Table 1 above. More than two thirds of the farmers were trained on predator identification and management (60.4%), water resource management (85.3%), and fish feeding program (76.6%). More than half were trained on early fish disease detection (53.7%) while over forty percent of the farmers were trained on record keeping (44.2%), fish pricing (41.6%), fish storage (41.6%), and value addition (39.1%).

From the interviewed participants, the greatest percentage loss of fingerlings was through predation by birds, tortoise, snakes, frogs, and geckos. However, for matured fish the main challenge rests on security on the farms since theft by neighbours' children and youth from the village has been a major avenue for loss of fish leading to lower production levels.

According to Weihrich et al. (2008), the various functions of a good manager that include planning, organizing, staffing, leading, and controlling should be implemented for successful commercialization of aquaculture. Agbayani (1990) through his notes in Aquaculture management and training says that the manager should plan his aquaculture venture in such a way as to deal with any constraints which may hinder the success of the venture. The findings from the study carried out in Kisumu West highlight further the fact that farmers should be well enlightened and trained on their applications on the various technical skills to lead to sustainability of the farms.

The findings are also in agreement with Mwatsuma et al. (2012) and Cochrane (n.d.) who established that aquaculture management required utilisation of a variety of skills spanning farm management, identification of niche markets, and value addition. Further, Shitote et al. (2013) on their study on challenges facing fish farming development in Western Kenya found that most farmers did not manage their farms well leading to poor yields from the farms. A possible point of intervention would be the provision of training on technical pond management skills.

Opiyo, Marijani, Muendo et al. (2018) despite the gains in growth of the number of ponds aquaculture production in Kenya reduced

from 24,096 MT in 2014 to 18,656 MT in 2015 and further down to 14, 952 MT in 2016. The number of operational fishponds reduced from 69,194 (2013) to 60, 277 in 2015. The reduction was cited as a result of poor water retention capacity of ponds in some counties especially in the coastal and eastern region of Kenya. Aside from that, other factors are cited such as poor extension services, inadequate capacity support, low quality and quantity of fish farm inputs, poor marketing infrastructure, dependency syndrome on government/donor support, and lack of value addition. The findings are agreeable to the challenges that lead to the drop out of farmers since performance of the farms depends on the level of training and capacity building attained by the farmers.

The findings are also in tandem with statement by Muir and Allison (2007) that climate change, especially drought, affects inland aquaculture production through the loss of cultured stock, increased production costs due to low water quality, and the availability for aquaculture since most of the farmers in Kisumu West Constituency raised it as a challenge with some of the ponds drying up due to lack of pond liners and seasonality of some of the rivers.

Training by Extension Officers at the Farm

The study also sought to investigate the specific areas of training not adequately covered by the extension officers. Table 2 presents the results.

Table 2

Areas not Adequately Covered by Extension Officers

Area Not Adequately addressed	Percentage
Pricing and value addition	3%
Fingerlings	3%
Fish diseases identification	3%
Marketing	5%
Most do not have enough information.	6%
Maintenance of the pond	8%
Issues with feeds	8%
Predator management	14%
They do not come.	50%

Table 2 shows participants' feedback on areas where extension officers who visited the farms had difficulty in handling. This was due to lack of hands-on experience by the extension officers in the areas highlighted. The figures were low with percentages ranging between 3% and 5% for the various categories apart from maintenance of the pond and issues with feeds which had a higher level of challenge at 8%. Predator management was at 14%, while it was significant to note that half of the participants raised the concern of extension officers not visiting the farms at all. This response resonates with the challenges affecting the farmers and in effect leading to a high number of dropouts from the enterprise.

A cross check with the performance of the ponds also indicate that the number of pieces harvested compared to fingerlings stocked was at 49% which was equally low. On training, about half of the participants stated that their issues were adequately addressed by the extension officers during their visits at the farm. However, 50% of the farmers stated that the extension officers do not visit the farms. A follow up interview with the extension officers cited that the lack of sufficient funding to enable traversing the allocated areas within the constituency as reason for not being able to visit the farms. One of the extension officers interviewed oversaw Kisumu North and Northwest Kisumu Wards, while the second one handled Central Kisumu, Southwest Kisumu, and West Kisumu wards.

Kenya Marine and Fisheries Institute (KMFRI) official cited the area of coverage as the challenge to not visiting the farms adequately since the only available resource handles research and extension services in the whole of western part of Kenya. The extension officers on the other hand took responsibility for not being able to attend to the farms as expected due to lack of mode of transport to visit the farms, and their offices are located within Kisumu City. The Sub-County Department of Fisheries officials stated that after inception of devolution and fisheries functions devolved to counties, the department has not been well funded to offer capacity building and do regular extension services for the farmers. Pond farming had not received positive consideration in form of budgetary allocation. On the other hand, aquaculture farming is

used by the citizenry for provision of food and disposable income. The Kisumu CIDP 2013 and 2019 emphasizes on aquaculture as a source of food and an income earner for the residents. Lake Basin Development Authority being a regional development authority did not receive sufficient funding from the national government reducing its operations. There seems to be a disconnect in terms of what the national government is saying and the actual happening at the grass roots.

Despite the challenges evidenced, training was done by officers from the following institutions; County Fisheries department, Lake Basin development Authority, Maisha Bora, Archbishop Okoth, Ahero Multipurpose, Pioneer Farm, Maseno Veterinary, Maseno University, Fingerling Outlet and Agricultural shows. The spread of the training per institution is as shown in Figure 3.

The Ministry of Fisheries was initially under the national government and then devolved to the County government after the 2012 election and promulgation of the new constitution in the year 2010. Trainings by this Ministry led in percentage on farms trained at 65%. Fingerling outlet expert and fish farming expert managed to train 1.43% each. Although KMFRI has sufficient expertise on aquaculture farming and also hosts a regional research centre within the constituency, it did not offer any form of training on management skills to the farmers.

Ngugi & Manyala (2004) posit that inappropriate infrastructure amongst the rural folk has led to failure of aquaculture. Inadequate infrastructure also encompasses lack of extension officers who can offer the much-needed technical skills. The study carried out in Kisumu West Constituency revealed that through ESP, two extension officers were employed by the government to oversee production and extension services of the farms within the constituency.

According to Hishamunda (2001) lack of compliance to the project management cycle of aquaculture farms led to failed farms. Mwangi (2008) explains further on the effect of inadequate technical skills by extension staff occasioned by low staff levels with limited practical aquaculture skills as the main constraint to commercialized

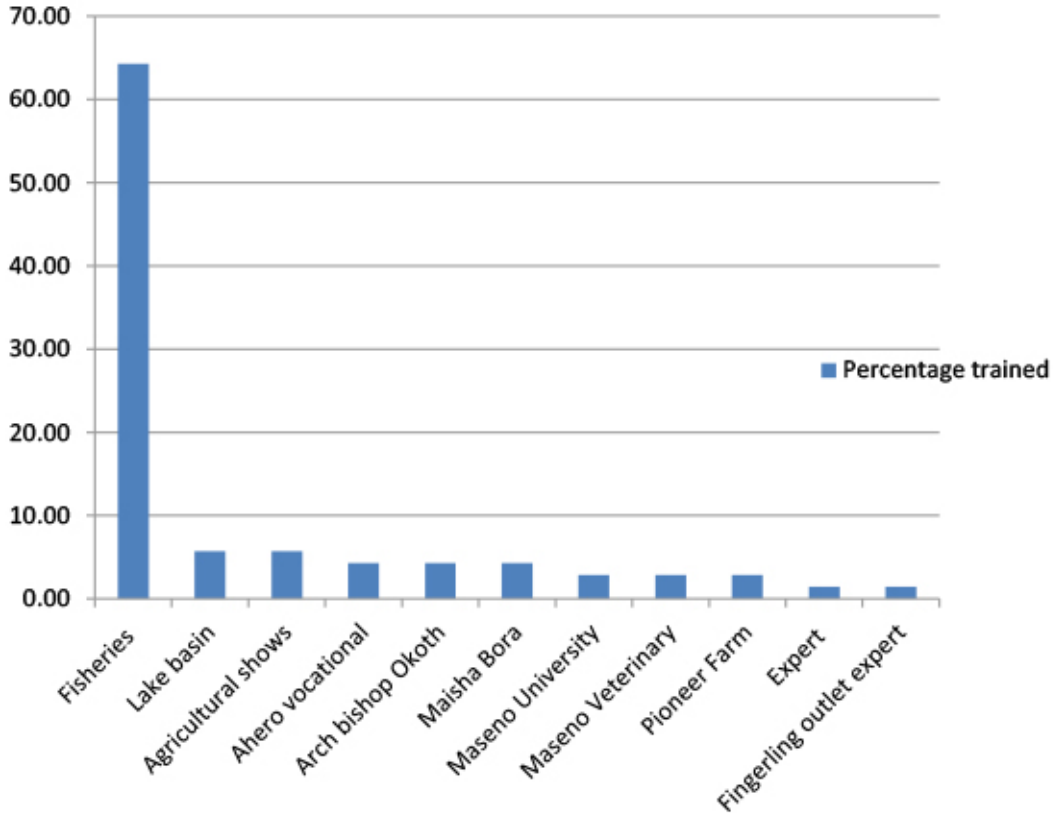

Figure 3. Percentage of farmers trained per Trainer or institution offering training.

aquaculture in Kenya. The study findings agree with this as it was widely noted that most farmers did not have sufficient technical skills to successfully manage aquaculture farms in Kisumu West Constituency and only employed unskilled workers at the farms. Through ESP, two extension officers were recruited. Though they qualified in aquaculture farming, they lacked sufficient practical exposure to aquaculture farming. Further interrogation showed that the Department of Fisheries had not facilitated for them to attend capacity building workshops on aquaculture farming. The Department of Fisheries conversely decried lack of sufficient resources to mobilize the extension officers to consistently perform their duties.

This finding corroborates with that of Opiyo, Marijani, Muendo et al. (2018) that one of the challenges in aquaculture farming was due to transfer of aquaculture management from the national government of Kenya to the County governments. This led to failure of most aquaculture farms within the country.

This study in Kisumu West Constituency also established that farmers who engaged skilled workers were able to get advice on technical management skills. As a result, their farms did much better that their counterparts who shunned the advice of professionals. The farmers should engage skilled workers who will be able to prudently advise on technical management skills. The findings are in line with Corbin and Young (1997) who underscore the importance of bringing technical advice on board to ensure success of aquaculture ventures. However, the findings from the study are contrary to the findings published by WHO (2013) on fish farming in South Imenti constituency in Meru County, Kenya where participants were trained on the skills required to properly manage an aquaculture farm as a business. In South Imenti, farmers were also able to access extension field workers whenever the need arose.

These findings are also at a disparity with the findings of the research done in Kisumu West Constituency based on the training lead. In South Imenti, there was an intersectoral collaboration between different line ministries in the implementation of the program. Training was handled by the Ministry of Education and the Fisheries Department did farm visits, within which continuous training was done. In Kisumu West Constituency, all the roles were handled by the Department of Fisheries. The number of farmers who required training on the ground outnumbered the personnel who were availed for the training exercises in technical skill acquisition.

Musyoka and Mutia (2016) in their study in Makueni County found out that majority of the sampled farmers (64%) cited lack of information or training as a major problem. It was widely accepted that during the ESP, projects were hurriedly initiated without proper sensitization of both the farmers and the supervisors. Extension officers were the main source of information to farmers. Majority of the farmers stated that they only received training and information during the early stages of project implementation in 2009. Since then, they claim that they are rarely visited by extension officers. However, a great number of farmers with functional ponds appreciated the current county government's effort as they were not only provided with handy information and training but also exposed to other successful farmers around the country. Despite the internet having all the necessary information which is easily accessible, only 0.4% of the farmers utilize it. These findings are partially in agreement with the current study on the challenges faced by the farmers, however the Kisumu County Government has not been supportive as their Makueni counterparts on the development of aquaculture farming.

Education Level of the Farmer verses Farm Production Level

This area seeks to make a comparison of the level of skills gained by the farm manager before engaging in aquaculture farming and assess if it has an impact on general management of the farm, and in effect improve the performance level of the farm. Capacity building and training to most of the farmers was done at the initial stages of the project. Table 3 presents the results of education level, training and the average number of pieces of fish harvested per pond.

Table 3 revealed that the status of farms, whether active or not, was not dependent on education level since farmers with active ponds were spread across those who had no education all the way up to those who had university education. Those who attended primary school, secondary school, and college had more training at the initial stages of pond set up than those who had university education. This also translates to the number of active ponds since these three categories also had the highest number of active ponds. Farmers who had gone to college or university attended more yearly and half yearly trainings than those who did not have formal education and those who attended primary or secondary schools. A close inspection of these findings reveals that training during the initial phases of pond set up had a direct influence on whether the pond would be active or not. Continuing education on pond management was also done yearly and half yearly. Farmers who attended trainings acquired more skills, and these trainings determined whether in the long run the ponds would be active or inactive.

Table 3
Education Level, Training, Farm Status vs. Average Number of Fish Pieces Harvested

Education level	**Training**					**Farm Status**		**Average no of pieces harvested per pond**
	Quarterly	**Half yearly**	**Yearly**	**Initial stages**	**No Training**	**% Active**	**% Non-Active**	
None	2	0	1	1	1	2	3	242
Primary	11	5	5	64	17	49	53	376
Secondary	23	6	5	51	11	43	53	232
College	11	13	16	67	18	56	69	423
University	27	7	13	9	5	37	24	736
Total	74	31	40	192	52	187	202	389

The study employed Pearson's correlation to ascertain whether there was a significant relationship between farm status and the education level and farm performance in terms of pieces harvested. A correlation coefficient of the responses given in Table 3 was obtained, and it revealed that the correlation coefficient between the education level of the active farm and the number of pieces harvested is + 0.271. The correlation coefficient between the education level of the non-active farms and the average number of pieces harvested is – 0.06. The results show that for the active farms, there is existence of a slightly moderate relationship between the farms and the number of pieces harvested per pond. However, for the non-active farms, no relationship exists with the number of pieces harvested. This comes on the backdrop of the fact that all the farmers were trained on at least one component of the training areas expected to successfully commercialize the farms.

The correlation coefficient between the training done quarterly and active farms is + 0.4466 which is a moderate positive relationship. The correlation coefficient between the training done half yearly and active farms is + 0.84459 which is a strong positive relationship. The correlation coefficient between the training done once at the initiation point of the project and non-active ponds is + 0.9624 which is a strong positive relationship. From the findings, it was noted that training of the technical skills was only done at the initial point. Thereafter, continuous engagement of the extension officers became a challenge. This has evidenced a high dropout rate of the farmers financed through ESP due to the lack of expertise and unprecedented high production cost. Despite the challenges faced on training frequency, farmers who have attained some formal training showed a higher production level compared to those who did not attend to any formal training. This could be due to use of ICT to gain information on aquaculture or engagement of skilled labour at the farm due to alternative source of income.

Figure 4 is a photograph taken by the researcher which shows an example of a farm within Kisumu West Constituency with skills on water source management not well articulated by the farmer.

Figure 4. Photograph of a pond which dried up due to lack of water.

The pond lacked a pond liner since the soil type could not retain water especially during the dry season. Upon further inquiry, it was established that the farmer did not have resources to purchase the pond liner, and in effect, the project did not progress. The source of water was earmarked to be from the rains and water from a nearby spring. The challenge for the farmer was how to direct the water from a nearby stream to the pond and at the same time avoid conflict of water use with the neighbours. Figure 5 shows a picture of a successful aquaculture venture.

Figure 5. Photograph of a farmer feeding fish within the schedules as trained.

The farmer in Figure 4 received training on technical skills and applied the knowledge learned at the farm. This proved resourceful as the farmer was able to harvest and earn income from the farm. The farm is managed by a youth and has acted as an income earner and source of employment. The researchers also noted that the farmer has well-kept farm records.

Relationship between Farm Status and Training Areas

In order to ascertain if a significant relationship existed between the farm status and the areas of training, the researchers conducted a chi square test. The chi square test revealed that the status of aquaculture farms whether active or not active was dependent on the component trained on. Areas of training included predator identification, disease control, records, pricing, storage, and value addition. Water source management is the only parameter which showed some independence. The critical value was 3.841 at 0.05 confidence level, and only the value for water source management at 1.8 fell within the accepted area. Therefore, training and capacity building on the identified components afforded to the farmers are essential to achieve the objective of commercializing aquaculture farming through improved performance.

According to Weihrich et al. (2008), the various functions of a good manager that include planning, organizing, staffing, leading, and controlling should be implemented for successful commercialization of aquaculture. This study highlighted that farmers should be well enlightened and trained on their applications on the various technical skills which lead to sustainability of the farms. The findings are also in agreement with Mwatsuma et al. (2012) that production of fish or fishery products require a different set of technical and management skills compared to other agriculture activities. Before a would-be aquaculturalist could successfully grow aquatic organisms, he/she needs specialized training in water quality management, aquatic weed control, parasite and disease control, nutrition and feeds, cultural techniques, marketing, and value addition skills.

The findings of this study bring to light the challenges that lead to the drop out of farmers since performance of the farms depends on the level of training and capacity building attained by the farmers. The findings are also in tandem

with the statement by Muir and Allison (2007) that climate change especially drought affects inland aquaculture production through loss of cultured stock, increased production costs due to low water quality and availability for aquaculture since most of the farmers in Kisumu West Constituency raised it as a challenge with some of the ponds drying up due to lack of pond liners and seasonality of some of the rivers. Shitote et al. (2013) in their study on aquaculture challenges also talked of drought as a serious problem threatening farmers.

Conclusion

Capacity building by the Department of Fisheries and other stakeholders was done to aquaculture farmers covering the following areas: predator identification and management, water source management, early fish disease detection, fish feeding program, record keeping, fish pricing, fish storage, and value addition. However, predation and theft still remain to be a major challenge to aquaculture farming in the rural areas. This led to a majority of farmer drop out from the enterprise.

The study established that although the farmers were trained on predator identification and management, the farmers faced a big challenge towards loss of fish within the ponds due to the presence of predators in the ponds. A possible point of intervention would be the need for extension officers to adequately address the component of management of the predators. Possible areas of intervention include: zoning of farms, location of ponds within neighbourhoods so as to enable farmers work together in sharing of security and management of common predators.

Another finding highlighted by this study is that farmers who made use of skilled labour got better yields from their farms as opposed to those who did not make use of skilled labour. The study also revealed further that through the ESP, a god number of extension officers had been deployed to the study area. Farmers who had followed the instructions of the extension officers had successful aquaculture farms.

Various stakeholders took part in training and capacity building of aquaculture farmers on technical management skills required for enhanced production of the farms. The Department of Fisheries took a lead role followed by the Lake Basin Development Authority and agricultural shows. Pioneer farm though a private enterprise was instrumental in addressing challenges faced by farmers in the neighbourhood. KMFRI with a regional office established within the constituency with highly skilled resource in aquaculture did not participate in capacity building of aquaculture farmers.

The study in Kisumu West also identified siltation and inadequate maintenance as problems. It is therefore needed that trainings covering technicalities surrounding pond management be offered to the farmers in this locale.

Recommendation

This study recommends the following: training and capacity building should be enhanced in these areas to turn around the sector and achieve the objective of commercialized farms. To satisfactorily reach many farmers and deliver modest training, an inter-sector approach should be adopted to increase synergy. The following facilities can be used for the training: Maseno University, Maseno Veterinary Farm, Maseno Farmers Training Centre and Ramogi Institute of Advanced Technology.

In addition to this, training of the farmers and refresher courses to the extension officers should be enhanced on the technical skills required that is predator identification and management, early disease identification, feeding program, records keeping and management, pricing of fish products, storage, and value addition on fish after harvesting. To achieve these, sufficient resources should be allocated to the department of fisheries from the county government and synergy between different stake holders encouraged.

In light of the findings highlighted herein, it can be noted that the government made a step in employing extension officers through ESP. However, after the functions were devolved to the counties the fisheries department has not been well resourced to adequately perform their functions. Therefore, the Kisumu County Government should adequately allocate sufficient resource to the Department of Fisheries through review of the training and management master

plan of aquaculture to ensure the objective of commercialized farms is accomplished.

References

Agbayani, F. R. (1990). Lecture notes in aquaculture management training course. *Tigbauan, Iloilo, Philippines: SEAFDEC/AQD.*

Bateman, T. S. & Zenithal, C. P. (1993). *Management function and strategy*. Chapel Hill, Burr Ridge, Illinois, Boston, Sydney, Australia, Irwin: The University of North Carolina.

Cochrane, K. (n.d.). Fisheries management. Rome: Food and Agriculture Organisation. Retrieved from www.fao.org

Corbin, J.S., & Young, L.G.L. (1997). *Planning, regulation, and administration of sustainable aquaculture*. New York: Wiley and Sons.

Fakoya K.A., Owodeinde, F., Go Jimoh A., & Akintolp, S.L. (2001). *An overview of the challenges and prospects in developing an aquaculture industry in Lagos state, Nigeria.* Lagos State, Nigeria: Lagos State University, P.M.B.

Food and Agriculture Organisation. (2014). *Communication strategy: For a better visibility and use of country STAT.* Rome: United Nations. Retrieved from http://www.fao.org/3/i3750e/i3750e.pdf

Food and Agriculture Organisation. (2017). *Doing aquaculture as a business for small and medium scale farmers: Pratical training manual.* Rome: United Nations Retrieved from http://www.fao.org/3/i7461e/i7461e.pdf

Food and Agriculture Organisation (2020). *The state of world fisheries and aquaculture 2020 sustainability in action.* Rome. https.//doi.org/10.4060/ca9229en

Hishamunda, N. (2001). Commercial shrimp farming in Mozambique: A summary in promotion of sustainable commercial aquaculture in Sub-Saharan Africa. *Research and Development Series No. 34.*, Alabama: Auburn University.

Kaehler, B., and Grundei, J. (2019). The concept of management: In search of a new definition. human resource governance. Retrieved from https://www.researchgate.net/publication/326209797_The_Concept_of_Management_In_Search_of_a_New_Definition

Kenya, Republic of, (2012). *Strategy of revitalizing agriculture.* Ministry of Agriculture and Ministry of Livestock and Fisheries Development. Nairobi: Government printers.

Kisumu West Constituency. (2021). *About Kisumu West*. Retrieved from http://www.kisumuwest.cdf.go.ke/about-us/background

Musyoka, S. N. & Mutia, G.M. (2016). The status of fish farming development in arid and semi-arid counties of Kenya: Case of Makueni County. *European Journal of Physical and Agricultural Sciences,* 4 (3), 28 - 40.

Mwangi, M. (2008) Aquaculture in Kenya: Status, challenges, and opportunities. Retrieved from https.//aquadocs.org/handle/1834/7367

Mwatsuma, M. K., Cherutich, B. K., & Nyamu, H. M. (2012). Performance of commercial aquaculture under the economic stimulus program in Kenya. *International Journal for Business and Commerce,* 2 (3), 01-20.

Ngugi, C. C., & Manyala, J. O. (2004). *Aquaculture extension services in Kenya; Aquaculture Extension Services Sub-Saharan Africa.* Fisheries Department Circular No. 1002. Rome: FAO Fisheries Department, Pp 35 – 42.

Opiyo, M. A., Marijani, P.E., Muendo, P., Odede, R., Leschen, W. & Charo-Karisa, H. (2018). A review of aquaculture production and health management practices of farmed fish in Kenya. *International Journal of Veterinary Science and Medicine*, 6 (2), 141-148, doi: 10.1016/j.ijvsm.2018.07.001.

Obiero, K., Waidbacher, H., Nyawanda, B., Munguti J., Manyala J. and Kaunda-Arara B.

Predicting uptake of aquaculture technologies among smallholder fish farmers in Kenya. *Aquacult Int* 27**,** 1689–1707 (2019). https://doi.org/10.1007/

s10499-019-00423-0. Accessed on 19th April, 2021 from https://link.springer.com/article/10.1007/s10499-019-00423-0

Shitote, Z., Wakhungu, J. & China, S. (2013). Challenges facing fish farming development in Western Kenya. *Greener Journal of Agricultural Sciences*, 3(5), 305-311, http://doi.org/10.15580/GJAS.2013.5.012213403.

Weihrich. H., Cannice M. V., & Koontz H. (2008). *Management: A global and enterpreneurial perspective*. New Delhi: Tata McGraw Hill Education.

WHO. (2013). *Intersectoral case study addressing determinants of health through intersectoral collaboration: Fish farming project in South Imenti constituency in Meru County, Kenya*. WHO Regional Office for Africa.