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# Investigation of participatory management and sustainable aquaculture development in Kirinyaga County, Kenya

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## Abstract

The study assesses the effectiveness of stakeholders' participation in aquaculture decision making for sustainable aquaculture development in Kirinyaga County, Kenya. Stratify random sampling and purposive sampling were adopted to select 97 fish farmers and government officers with a stake in aquaculture respectively. Semi structured questionnaire was used to collect data from fish farmers through a face to face interviews, while an interview guide served for key informant interviews. Study findings reveal that there is ineffective collaboration between government institutions. Additionally, (95.9%) of fish farmers were of the view that they are not consulted when the government makes policy decision concerning aquaculture in the county. Only 10.3% of fish farmers were members of aquaculture association, while the majority (89.7%) were not. Due to ineffective participation of aquaculture stakeholders in the decision-making process, majority (86.6%) of participants to the study thought that aquaculture is not a sustainable activity in the county, while 13.4% responded otherwise. There is therefore a need for the government to establish an interdepartmental lead agency for aquaculture, develop the capacity of aquaculture association to provide services to members for effective stakeholders' participation in decision making and sustainable aquaculture development in Kirinyaga County and Kenya as a whole.

**Keywords:** Participatory Management; Aquaculture; Decision Making; Sustainability

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## 1. Introduction

Recent studies stipulates that environmental governance tools should aim at harmonizing human and ecological well-being by internalizing externalities that result from short sighted behaviors (Ovie and Raji, 2006; Lio and liu, 2008; FAO, 2016). Aquaculture sector is facing major challenges or risks including quality feed and seeds availability, benthic enrichment, eutrophication of water column, escapees, loss aesthetic value, water pollution, diseases and loss of biodiversity, and can also result in mangrove destruction and conflict with other water resource users (Leilei and Shuolin, 2015; Li et al., 2011, Adewumi, 2015). Therefore, the challenge of aquaculture governance is to make sure right measures are put in place and implemented for sustainability of the sector. Environmental governance theory specifies that these challenges can all be overcome with greater political will, strategic partnerships and full engagement with civil society and the private sector at all levels of decision-making process (Brandes and Brooks, 2005).

To this end, participatory governance or co-management should incorporate stakeholders whether producers or local communities in decision-making at policy and farm management levels. Self-regulation and co-management are the principal forms of participatory management, where aquaculture producers implement a detailed code of practice, under the overall supervision of the State agency (FAO, 2009). Several economic arguments for promoting stakeholders participation in aquaculture decision-making have been put forward. These include the fact that participation should increase acceptance and compliance with policy and regulatory frameworks, thereby reducing transaction and enforcement related costs. Secondly, by educating the public, there is enhance trust in aquaculture, increasing consumer acceptance of farmed fish. Thirdly, participation encourages the incorporation of local (indigenous) knowledge in decision-making, which could be critically important in improving productivity and sustainability of the sector (FAO, 2008; Berkes, 2009; Akinrotimi, et al., 2011).

In Kenya, aquaculture has been identified as the main viable alternative source of fish (Gitonga et al., 2004; Government of Kenya, 2013; Munguti et al., 2014), especially with the decline of the natural fish stocks. Over the past years, the Government of Kenyan has undertaken several initiatives in order to increase the contribution of the sector to food security and the country's economic growth. These efforts entailed construction of several aquaculture facilities as research center and training facilities, provision of aquaculture information and extension services, together with they improved seed supply and supports covering investment in the sector (Munguti et al., 2014; Ngugi and Manyala, 2009). Therefore, farmed fish production in the country has been steadily increasing reaching 49,093 MT valued at 18 billion shillings in 2013 (Government of Kenya, 2016).

Aquaculture has recently emerged as a major agricultural activity in Kirinyaga county with a total of 1,297 fishponds spread throughout the county in 2015 (Government of Kenya, 2016; Government of Kenya, 2013). Apart from the many households engaged into fish farming in the county, most public primary and secondary schools in Kirinyaga County have also embraced fish farming with the aim of enhancing their income and food security. This County being high potential aquaculture area in Kenya, the sector will continue to grow as the human population and demand for fish increase. However, the sustainability of the sector is threaten by inadequate management which presents a risk to the environment on which the aquaculture industry depends.

Extensive literature on aquaculture in Kenya focuses on increasing production; while some studies have mostly tackled participatory management or co-management in the capture fishery subsector. Hence, there is scarcity of information with regard to stakeholders' participation in aquaculture management.

### 1.1. Problem statement

Though aquaculture represents the main sustainable alternative to bridge the existing national fish supply and demand gap in Kenya, the sustainability of the sector still remains questionable. Literature predict that effective management and sustainability of aquaculture depends on effective governance of the sector, translated by appropriate policies, legal and institutional frameworks with effective participation of all stakeholders in the entire decision-making process. However, in Kirinyaga County as one of the major high potential aquaculture area in Kenya, this has not been demonstrated. With the explosive interest in fish farming in the County, new challenges from environmental pollution, biosecurity, the spread of diseases and more water resource users' conflicts are likely to emerge in the near future (Munguti et al., 2014) if the development of the sector is not well planned and appropriately guided. Consequently, the industry is likely to collapse with tremendous impact on food and nutrition security for the county and Kenya in general. Hence, the appropriate co-management arrangement that allow effective participation of all stakeholders in the entire decision-making process is critical.

This study therefore aims to assess the effectiveness of stakeholders' participation in decision making process for sustainable aquaculture development in Kirinyaga County; Kenya.

### 1.2. Theoretical framework

The study was grounded on co-management theory (Plummer and Funnell, 2006) as a basis for natural resource management. It is usually considered as joint management, shared management, participatory management, multi-stakeholder management. The idea in co-management or participatory management is that an agency with jurisdiction over a resource (usually a state agency) might develop a partnership with other relevant stakeholders (local residents and resource users) that specifies and guarantees sharing of power and responsibilities between both partners (Borrini-Feyerabend et al., 2004). According to this decentralized approach to decision making involving local resource users and state agency as equal partners, measures of power sharing may be used as criteria to assess success of participatory management. Capacity building, knowledge sharing and institution strengthening are identified as critical for effective participation.

This study, will pay attention to level of power sharing between government agencies and resources users (fish farmers) by evaluating their participation in decision making process (from policy design, implementation and enforcement, and monitoring and evaluation). This will be specifically done through assessing provisions for knowledge and information sharing, capacity building (training opportunities and extension services) and institutional strengthening of farmers associations. All these are means for community or resource user empowerment for them to effectively participate in the entire management process of

aquaculture operation and development, therefore ensuring good management practices and responsible aquaculture development.

The strength of this model is that resource users often are the repository of local or indigenous knowledge that if effectively integrated in the decision making process will allow for the best possible and sustainable outcome. Co-management include the combination of indigenous and scientific knowledge, hence the decision-making address relevant issues from an informed point of view. The effective involvement of community at all level of decision-making process promote ownership, and compliance with new policy or regulation and ensure it implementation and enforcement.

The weaknesses of the co-management theory is that it is time and resource consuming as it require bringing as many community members as possible to the table and gaining their trust so that they can feel part of the process. There is a need for effective communication strategy between the government and the community, hence developing the capacity of community member is essential for them to make informed decision. The current method of fisheries governance being more government led, there could be a need to alter existing policies and regulations to allow for the structure of co-management. In addition, skeptics are doubtful to the idea that government agencies could willingly give up their power by sharing it with resource users (Berkes, 2009).

## **2. Research methodology**

### **2.1. Study area**

Kirinyaga County is one of the 47 counties in Kenya and is located between latitudes 001" and 00 40" South and longitudes 370 and 380 East. Sitting at the foothills of Mount Kenya, some 112km from Nairobi, Kirinyaga County covers 1,479.1 square kilometers and borders Embu to the East, Machakos to the South, Murang'a to South West and Nyeri to the West. The county is named after Mount Kenya, which was originally known as "Kirinyaga", meaning the crest of whiteness, synonymous with its snow-capped peaks. Kirinyaga County comprises of four constituencies: Mwea, Gichugu, Ndia and Kirinyaga Central.

According to Kirinyaga County Integrated Development Plan (Government of Kenya, 2013), the county depends highly on agriculture with 87 percent of the total population deriving their livelihood from the sector and accounting for 72 percent of household income. This county is endowed with a rich water resources constituted by six main rivers namely: Sagana, Nyamindi, Rupingazi, Thiba, Rwamuthambi and Ragati, which ultimately drain into the Tana River. Aquaculture has recently emerged as a major agricultural activity in the county with over of 1,172 fishponds spread throughout the county. Most of the public primary and secondary schools in the county have also embraced fish farming with the aim of enhancing their income.

### **2.2. Research design**

A cross sectional survey design was adopted for the study. This design describes events as reported by individuals participating in the study at a particular point in time. It facilitates rapid data collection and ability

to understand population from a sample. It helps to answer questions concerning current and past event or status of the subject being studied once data is collected (Oso and Onen, 2009). A survey design allows the researcher to generate both quantitative and qualitative data that can be used in calculating statistical parameters and measuring relationships between variables (Zar, 2010).

### 2.2.1. Study population and target population

The population of interest for this study consisted of fish farmers, government officials in charge of fisheries and aquaculture, the environment and water in the county. The focus of the study being on sustainable management of fish farming activities, the respondents were fish farm owners or their representatives. The targeted population was 532 households involved in fish farming in Ndia and Mwea sub-counties, and available officers from the Fisheries Department and from Water Resource Authority (WRA) at the county and sub-county offices. The officer from the National Environment Management Authority (NEMA) were unavailability during the entire period of data collection, hence did not participate to the study.

### 2.2.2. Sampling techniques

To undertake this study, both probability and non-probability sampling techniques were utilized to create a sampling frame. In Probabilistic technique, stratified random sampling was adopted giving all stakeholders represented in the fish farming activity an equal chance to be part of the sample to be investigated. Kirinyaga County is made of four (4) sub-counties or constituencies that served as initial blocks. Two of these blocks (Mwea and Ndia) were selected as strata to be sampled based on their importance (Number households (HH) in aquaculture, number of ponds and production levels. Participants to the study were randomly selected from a list of fish farmers obtained from the fisheries department in Kirinyaga. Sample size of 20% of the population was selected following Mugenda and Mugenda (2003), who states that a sample of 10.0% to 20% of the total population for a large or small population is adequate and large enough to provide sufficient information concerning the population under study (Table 1). In each of the selected strata, all households head or their representative were interviewed. For the purpose of triangulation, non-probability technique, using purposive sampling was applied to collect data from available government officers in charge of fisheries and aquaculture, and of water resources in the counties

**Table 1.** Sample frame

<b>Strata</b>	<b>Population (HH)</b>	<b>Proportion (%)</b>	<b>Sample size</b>
<i>Mwea</i>	298	20	60
<i>Ndia</i>	234	20	47
<b>Total</b>	532	20	107

*Source: researcher (2018)*

### 2.2.3. Instruments and methods of data collection

To collect data on stakeholders' participation in decision making and the policy implication for sustainable aquaculture development, a mixed approach was adopted with both quantitative and qualitative methods. A semi structured questionnaire and an interview guide were developed for the purpose of data collection. The semi structured questionnaire was administered to fish farmers, while the interview guide with open and close ended questions helped to collect data from government officials for triangulation.

Both the questionnaire and interview guide focused on key information to provide required data for responding to the research questions, including data on farm ownership, gender representation, education, aquaculture training, extension services, inputs, farm management, production capacity, management practices.

The research team visited the farm and interviewed the owner or farm manager. In the case where farmers did not understand English the research assistant communicated with them in Kikuyu the local language of Kirinyaga County.

### 2.2.4. Data analysis

After collecting and obtaining raw data from the field as well as policy review, it was cleaned and scrutinized to ensure completeness, accuracy and consistency of information with observation and other facts at the point of collection.

To assess stakeholder's participation, quantitative data from the questionnaire as well as qualitative data from key informants' interview was used. Quantitative data was then coded in order to reduce the responses to small number of classes. Qualitative data was organized (classified) into different categories based on research question and attributes. The quantitative data were then analyze using descriptive statistics (mean, mode and median), and presented in form of frequencies table, pie chart, bar graphs. All statistics were performed using the Statistical Package for Social Sciences (SPSS) software version 23.0 and MS Office Excel 2013.

## 3. Results and discussion

### 3.1. Government institutions with a stake in aquaculture in the county

When asked which government institution was in charge on aquaculture development in the county, 98% of respondents said it was the Fisheries Department, 1% cited in addition NEMA and WRMA; and 1% did not know.

**Table 2.** Government institutions with stake in aquaculture

Responses	Frequency	Percentage
Fisheries department	95	98
Fisheries, NEMA, WRMA	1	1
Do not know	1	1

Source: Field Data (May 2018)

These results demonstrate that most fish farmers dealt only with the Fisheries Department in their Aquaculture practice, hence do not know the role of NEMA and WRMA. These results, underline the lack of effective institutional collaboration in aquaculture management and development.

These situation was equally confirmed by key informants who stated as follows:

*The Fisheries department is in charge of aquaculture development in the county. When need be we incorporate other institutions (NEMA, WRA and KFS) as there are our stakeholders (Source: An officer from Fisheries department).*

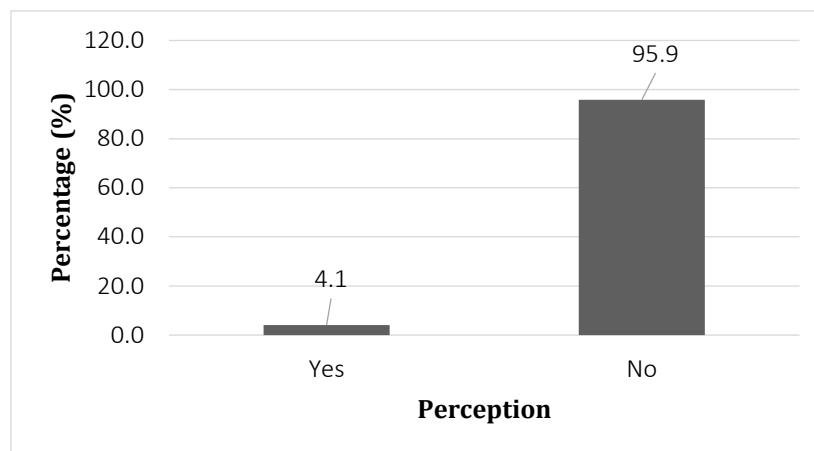
*There is no official framework for institutional collaboration. The collaboration is challenging because any institution has its own sectorial laws and mandate, thus implementation is done independently; but when needed we can call other institutions for consultation or be called by them. (Source: An officer from WRA).*

This finding shows that there is no effective collaboration between government institutions having a stake in aquaculture, because there is no official framework for institutional collaboration. This corroborate with Hishamunda et al., (2014) who believe that institutional collaboration should be enhanced through having an official framework for collaboration and establishment of a lead agency that is interdepartmental. The lead agency will coordinate the planning bringing together all institutions for integrated aquaculture policies and regulatory frameworks. Consequently, reducing the risk of administrative overlap, departmental competition and associated transaction costs.

### 3.2. Fish farmers' involvement in policy making process

Figure 1 shows that the majority of respondents (95.9%) stated that fish farmers are not consulted when the government make policy decision concerning aquaculture, and only a few (4.1%) agreed they are consulted. Of those who revealed that farmers are consulted, 50% explained that the consultation is done through Fish farmers' Association in the County, while the remaining 50% said it was through extension officers. These results therefore reveal very little involvement of fish farmers in decision making process.





**Figure 1.** Fish farmers' participation in policy making process  
(Source: Field Data, May 2018)

Key informants' interviews seem to express conflicting views as indicated in the below verbatim quotes:

*Fish farmers are effectively involved in policy making process through consultation with their representatives (fish farmers' associations) who are informed and they give their views on issues at hand. (Source: An officer from Fisheries department).*

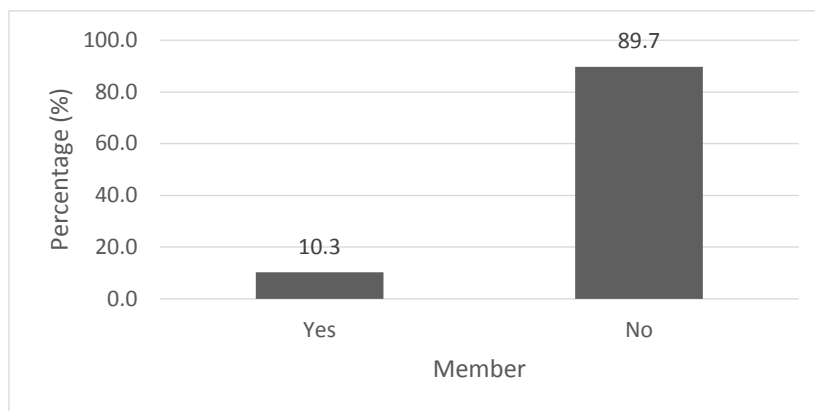
*No, fish farmers are not effectively involved in the policy making process. Policies are made through a top down approach, they are consulted to rubber stamp decisions already made by the government (Source: An officer WRA).*

Though key informants have different views, this could be seen as confirming to a certain extent fish farmers' position that there are not effectively involved in policy decision making process, as they play no active role in its design. The consultation as expressed by the interviewees seems to be informative as decision are made by the government with little or no inputs from farmers. These findings concur with Ovie and Raji (2006) and Obiero et al. (2015) who indicated that the concept of participatory planning, design and implementation in the fisheries development and management is yet to be adopted by the government institutions who consider the management and development of the sector as their safeguard. Fisheries policy making process was characterized by a top down approach. This situation removes the legitimacy and ownership of the policies and make implementation, monitoring and compliance of management actions difficult, hence compromising expected results.

### 3.3. Membership and role of aquaculture association

When asked if they were member of any aquaculture association, 89.7% of respondents replied by the negative, while the 10.3% responded by affirmative (Figure 2).





**Figure 2.** Membership in aquaculture association (Source: Field Data, May 2018)

The results demonstrate that the Aquaculture association present in the County (Kirinyaga Aquaculture Association) was not effective in assuming his responsibility of bringing together all fish farmers in the county. If the government is to rely on fish farmers’ association to insure their effective involvement as key stakeholders at all level of aquaculture management, it will be important to have a system that require every one interested in fish farming to start from registering as a member in the relevant aquaculture association, hence empowering the association.

A study by Ammani et al. (2011) in Nigeria confirms to the above finding; revealing that most of the respondents did not belong to any farmer association or cooperative society. According to the authors, this result indicated the inadequacy of extension services in delivering their expected role of organizing, strengthening and supporting farmer organizations.

In addition, it was found that fish farmers’ association role was mainly facilitating collaboration with government (table 3).

**Table 3.** Role of Aquaculture Association

Roles	Frequency
Facilitate collaboration with government	10
Provide extension services	0
Provide trainings	2
Marketing	0
Monitoring and compliance	0

Source: Field Data (May 2018)

These findings were confirmed by the views of key informants who alleged that;

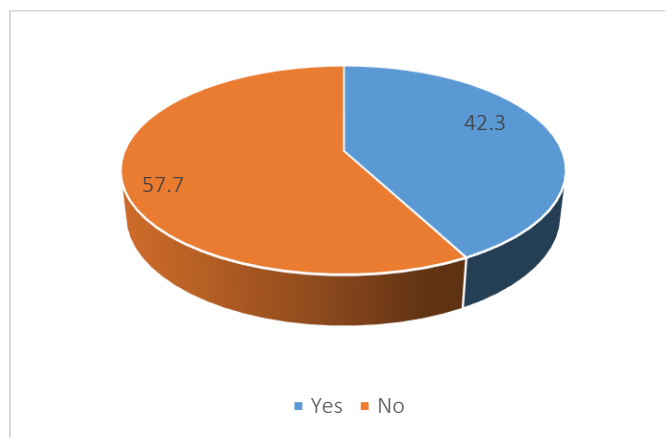
*For now, fish farmers' association do no play any role apart from facilitating collaboration with government institutions. They do not have the capacity to offer other services such as extension services, marketing, monitoring, evaluation and compliance to aquaculture regulation in the county. We are working toward insuring that. Associations should be in a position to organize their members, to plan production to cover the entire year and also help to provide those other services (Source: an officer from fisheries department).*

*To my knowledge fish farmers' association do not play any role in monitoring and enforcement of aquaculture regulations (Source: An officer from WRA).*

This study results do not agree with Kassam et al. (2011) who argues that fish farmers' associations can be very useful in stimulating the development of the sector through promotion of codes of practice; promoting the proper and efficient use of resources including water, sites, seed, feed and other inputs; developing human capacity by facilitating exchange of information, diffusion of technical knowledge and technology transfer through training and provision of extension services; facilitating mechanism for self-regulation, monitoring and enforcement.

#### 3.4. Access to extension services

Among fish farmers in the study, 57.7% said they did not have access to government extension services while 42.3% recognized to have access to them (Figure 3).



**Figure 3.** Fish farmers' access to extension services  
(Source: Field Data, May 2018)

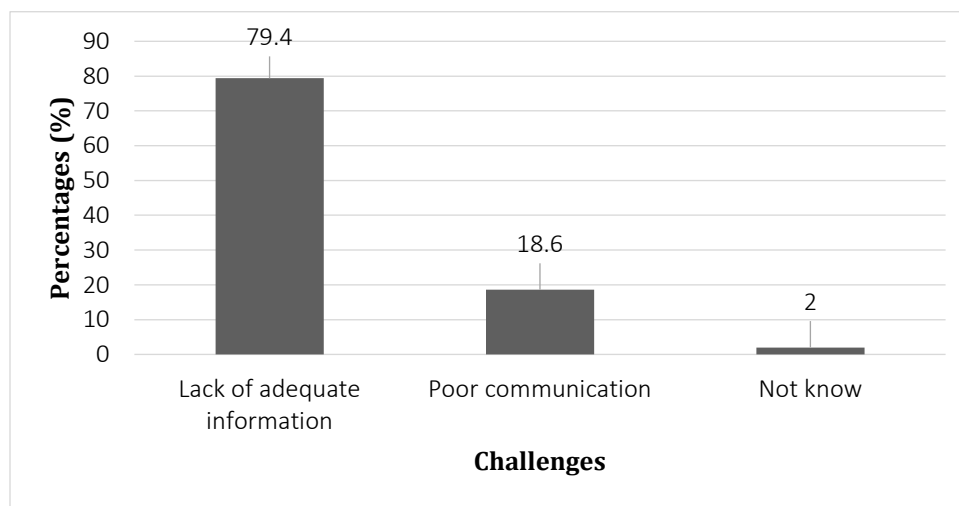
These results could be due to the inappropriate logistical support provided by the local County Government to the fisheries department. As fisheries officers revealed that:

*Since agriculture was devolved to the county government, we have not received a dedicated budget for fisheries/ aquaculture extension, hence could not be effective in our role of facilitating effective fish farming development in the county and farmers participating in aquaculture decision making process (Source: an officer from fisheries department).*

Similar result was obtained by Ayisi et al. (2016) in a study extension services in Ghana indicated that a large number of fish farmers (48%) found extension services unavailable. In the same vein, Ammani et al. (2011) reported a higher percentage (69%) respondents finding extension services unavailable in the study in Nigeria.

### 3.5. Challenges to participate in aquaculture decision making

When asked to identify the major challenge for fish farmers to participate in decision making, 79.4% said it was lack of appropriate information, 18.6%-pointed poor communication and 2% did not have an answer (Figure 4).

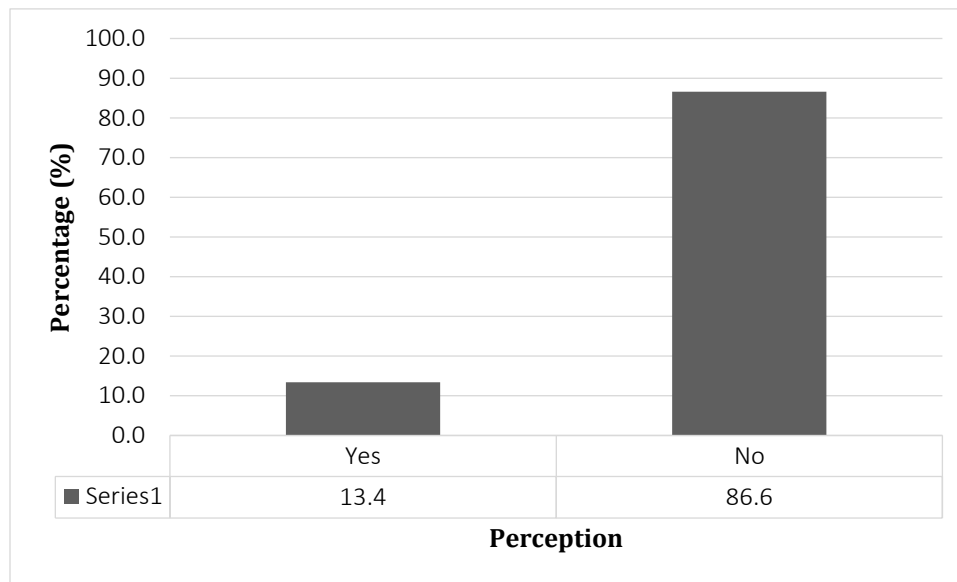


**Figure 4.** Challenges to participate in decision making (Source: Field Data, May 2018)

This result shows that poor or lack of participation of fish farmers in aquaculture decision making is mainly due to communication challenges. This is a consequence of the limited membership of fish farmers in aquaculture association and the inadequate access to extension officers as they do not have an appropriate communication channel to access aquaculture related information as indicated above.

### 3.6. Fish Farmers participation in decision making and sustainable aquaculture development

The study sought to examine fish farmers' participation in decision making and the implication for sustainable aquaculture development in the county. From the below results (Figure 5), 86.6% of respondents think aquaculture is not a sustainable activity, while 13.4% think it is sustainable.



**Figure 5.** Fish farmers' participation and sustainability of aquaculture (Source: Field Data, May 2018)

These findings show that the majority of fish farmers consider that given the current situation of low participation of fish farmers in decision making process, aquaculture development in the county cannot be sustainable. This is because of the consequences of their low involvement in policy making process, the weakness of aquaculture association as demonstrated by the low representativeness of Kirinyaga fish farmers' association, and inadequate extension service provision. These findings are in line with Akinrotimi et al. (2011) who also support that sustainability of aquaculture can only be guaranteed if all stakeholders are part of the decision making as well of implementation process.

#### 4. Conclusion and recommendations

The study sought to assess extent of participation of aquaculture stakeholders in the decision-making process for sustainable aquaculture development in Kirinyaga County; Kenya. The above results prove that there is not effective participation of aquaculture stakeholders in the decision-making process as revealed by the weak institutional collaboration, the low fish farmers engagement. This was further exacerbated by the weak representativeness of Kirinyaga fish farmers association and the farmers' inadequate access to extension service. Consequently, the sustainability of aquaculture sector in the county is not guaranteed.

There is therefore a need to strengthen institutional collaboration between government institutions with a stake in aquaculture development by establishing an interdepartmental lead agency. The role of the agency will be to coordinate, facilitate planning and establish regulatory requirements for aquaculture industry; integrating related administrative and regulatory initiatives vertically and horizontally.

As government rely on aquaculture associations to ensure effective fish farmers' engagement in sector's decision making. There is therefore a need to strengthen the association by building their capacity to provide services (extension services, inputs, market access, business planning, performance monitoring and evaluation) to members and develop a mechanism of resource mobilization for self-reliance. This association could be further empowered through given it the responsibility for licensing under supervision of the lead agency. This could be done through the already existing model of water Users Association (WRUA) used by WRA; it would promote integrated aquaculture as all those involved in fish farming in the county are also crops and/or livestock farmers.

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