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Gender Roles in the Value Chain of Farmed Tilapia (*Oreochromis niloticus*) in Kakamega County, Kenya

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Abstract

Aquaculture value chains provide a significant level of income and employment globally directly and indirectly. However, availability of gender disaggregated data on the contribution of the sector to the livelihoods is limited. This has resulted in women's contribution in aquaculture being perceived as supportive and not equal player despite the many strides women are making in the sector. Therefore, the present study was conducted to evaluate the gender roles along the farmed tilapia value-chain in Kakamega County, Kenya. Respondents totaling 265 comprised of 200 fish farmers, 5 input suppliers, 30 traders and 30 consumers were sampled and interviewed using questionnaire. Descriptive statistics and Chi-square were used to analyze the data. Results revealed that producers/fish farmer's segment was dominated by males (74.24%) compared to female (25.76%). Input suppliers comprised of one female and four males. Majority of fish traders were female (66.7%) compared to male (33.3%). Lastly, consumers comprised of more males (56.7%) than females (43.3%). Gendered data showed that men were mainly undertaking laborious activities such as pond construction, pond preparation, pond management, fish harvesting and fish feeding while women were mainly involved in fish trade and marketing. The only female input suppliers was involved in fingerling production while the males were engaged in all activities from fingerling production, feed supply, to supply of equipment. The identified gender obstacles along the value chain included limited land access by women, labor intensiveness, lack of capital, long payback time, poor aquaculture perception by women and inadequate information on aquaculture. Chi square test revealed no significant association between gender and various socio-economic variables (participation in training activities, technical assistance and source of assistance) except for belonging to groups ($p = 0.0477$). The men's dominance in fish production probably explains cultural favoritism that allows them to easily access and own land which boosts their capital. Conversely, women probably dominated traders' segment due to intrinsic management skills as de facto home managers. Nevertheless, there is need to break gender barriers to ensure recognition of women contributions to aquaculture.

Keywords: Fish Farmer, Gender Disaggregated Data, Aquaculture

INTRODUCTION

Fish and fish products are important constituents of human diet that provide the much-needed nutrients that are not provided by cereals (Farid *et al*., 2014). As a result, the global demand for fish has increased due to the growing health concerns, population growth, urbanization and improvements in incomes (Delgado *et al.,* 2003). Unfortunately, the catches from the wild fish stocks have stagnated against a steadily growing human population and hence, demand. This has led to a widening gap between fish demand and supply (De Silva, 2000). In East Africa, there has been a decline in the per capita fish consumption from 12.5 kg in 2013 to 5.6 kg in 2019 in Uganda, from 6 kg in 2000 to 4.5 kg in 2011 for Kenya and 20.7 kg in 2009 to 5.7 kg in 2014 for Tanzania (FAO 2014; 2015). To bridge the widening gap between fish demand and supply, aquaculture is being promoted as an alternative enterprise that can complement capture fisheries production (Kumar, 2014). Aquaculture is the fastest growing food production sector in the world, whose contribution is highest in Asia (De Silva 2000; Ahmed and Lorica, 2002, Subasinghe *et al*., 2009). Estimates suggest that more than 50% of the future global fish food will come from aquaculture (FAO, 2012). This anticipated global aquaculture growth will definitely bring on table several benefits to the value chain actors. Presently however, the benefits that accrue from the sector such as employment, food and incomes are not evenly accessed by women and men of different age and social groups engaged in the sector (Kruijssen *et al*., 2017). Although consideration of gender in the allocation of jobs along the aquaculture value and supply chain is a vital intervention in facilitating fast growth (Wiliams *et al.,* 2012), it is virtually nonexistent in the sector, presently. As the aquaculture sector grows, it is advisable that gender should be part and parcel in the assessment of power structures, division of labour, welfare and empowerment, to ensure maximum performance (Akter *et al*., 2017).

The aquaculture value chain (VC) includes stakeholders that execute different activities, those who intervene and interact with actors in fish production and consumption (Kaplinsky & Moris, 2001). The aquaculture VC includes the upstream actors (such as the fish hatcheries/ nurseries, equipment and feed suppliers, laborers and producers) and downstream actors (including processors, traders, and exporters). The VC also survives on the support actors such as the commissioning agents, transporters, technical service providers, and consulting experts. Accordingly, the aquaculture value chains provide considerable employment and incomes, and are estimated to employ between 28 and 57 million people globally at the different segments (Philips *et al*., 2016). While estimates suggest considerable employment from aquaculture, there is no gender disaggregated data at the various segments of the VC (FAO, 2013). Absence of gender disaggregated data in aquaculture value-chain is attributed to the traditional perception that fish production is masculine, where women mostly play a supportive role (Cliff *et al*., 2011). Unlike capture fisheries where men dominate, women play an important role in aquaculture, but, lack of gender disaggregated data masks their contribution. As a result, the specific needs for women are ignored in the sectoral developmental planning. Therefore, collection and analysis of gender disaggregated data can help in the development of strategies that specifically target women, the youth, the disabled and the elderly who actively operate in aquaculture development (Africa, 2016).

Global statistics estimated that women constitute half of the workforce in fisheries and aquaculture (Gopal *et al*., 2020), but the proportionate contribution of the youths, disabled and the elderly is unknown. In aquaculture, women are typically involved in fish feeding, data collection, net repairing, fish processing and overall management (De Silva, 2011). On the contrary, men mostly participate in energy demanding operations, such as cage mooring, pond construction,

loading and off-loading of fish products among others (Ramachandran, 2012). Studies by Agbayani (2012), Monfort (2015) and Rutaisire *et al*. (2010) showed that women actively participate in the supply of aquaculture inputs. Women also fully participate in production segments (Kiumbuka *et al*., 2013), and randomly at the different stages and/or nodes of aquaculture value/supply chain (Dalsgaard *et al*., 2012). Women are the leading processors, marketers and distributors of processed fish in most East African markets (Gopal *et al.*, 2020). The participation of women in aquaculture value chain and fisheries contributes to the generation of incomes and maintenance of households as well as community development in rural areas (Kaminski, *et al*., 2018). Kizito *et al*. (2017) reported that the lucrative of the aquaculture VC segments (such as input supply, aquaculture production, distribution, middle and large-scale trade) are dominated by men. Women take up activities at the lower end of the value chain like grading, sorting and cleaning that are less paying. Women also participate in fish marketing, majority being on small scale. The positions of influence are also occupied by men (Weeratunge and Pant, 2011), meaning that women rarely participate in decisions making.

Thus, there is an intrinsic gender division of labour due to socially constructed norms, roles and behavior of men and women. These disparities in gender participation in the fish farming value chain affect fish production since women's potential is underutilized (Githukia *et al*., 2020). Gender inequality in aquaculture value chains across the world is propagated by women empowerment restraining cultures, religious beliefs and masculine thinking perspective (Bosma *et al.*, 2019; Morgan *et al.*, 2017). Retrogressive cultures particularly in Sub Saharan Africa (SSA) have mainstreamed women-specific roles that confine them into their households (Okello, 2010). Moreover, the limitation of women from accessing the basic resources for business establishment and development is also high (Ogutu, 1992; Nayak, 2000 and Halwart, 2003).

Gender biases in the aquaculture impede its development by limiting women's creativity and dedication (Riisgaard *et al*., 2010). These disparities in gender roles can negatively affect the rapid production trails in the absence of deliberate policy intervention (Williams *et al*., 2012). Among the impacts resulting from gender biases is a low synergy between men and women in the sector which prevents creativity, efficiency and is the cause of misallocation of resources (Desai, 1994). Gender imbalances relating to unequal access to land, resources, dissemination of information and credit access communities pose a threat to food production whereas the gender disparities in value for labour, access and control over resources in many communities creates an impediment to socio-economic development, food security and livelihood improvement because it denies women essential means of production (FAO, 1999).

One of the major factors aiding the perpetuation of gender inequality in aquaculture is the skewed studies that overlook the roles played by different groups of people. Therefore, there is need to integrate gender issues in value chain analysis for social justice because men and women, hold equal rights to benefit from development. There's direct link between gender equity and poverty reduction, which suggest that countries with recognized gender equity, have reached higher levels of economic growth and social wellbeing (Weeratunge *et al*., 2010) while inequity results in inefficiency in the allocation of human resources and missed opportunities for innovations (Kantor, 2013). Hence, inequalities relating to gender need to be well understood, in order to target the right people for fish production technologies without bias towards a certain group of people. Therefore, the present study was conducted to evaluate the gender roles along the farmed tilapia value-chain in Kakamega County, Kenya.

MATERIALS AND METHODS

Study Area

This study was conducted in Kakamega, one of the prominent fish farming counties in Western Kenya (Figure 1), that is endowed with high rainfall (range: 1250-1750 mm per annum) and suitable temperatures (i.e. 18-29 ^{o}C) for fish farming (CIDP, 2018; Climate-Data, 2020). Fish farming is also widely practiced in Kakamega County as a sideline activity integrated with agriculture or as an intensive commercial enterprise. Tilapia (*Oreochromis niloticus)* and African catfish (*Clarias gariepinus*) are the mostly cultured fish species like elsewhere in East Africa.

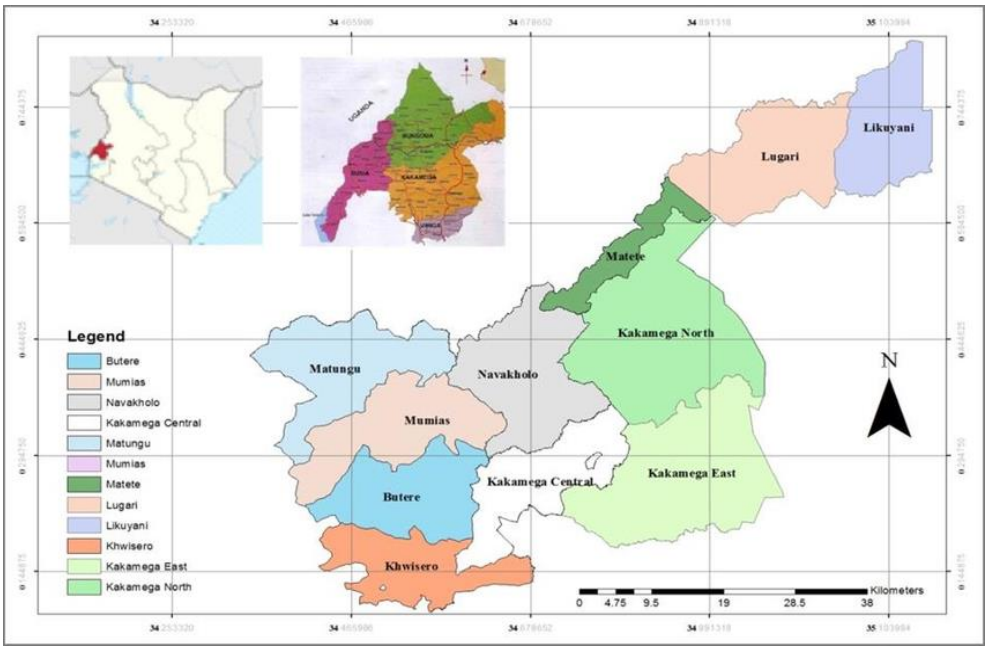

Figure 2: Location of Kakamega County and her Various Sub-Counties.

Sample Size Determination and Data Collection

The study involved different actors along the Nile tilapia supply/value chain. The VC segments examined included, input supply (i.e., hatchery operators, feed manufacturers, and equipment), production, marketing and consumption. From an estimate of about 2000 farmers, 300 fish traders and 5 input suppliers (data provided by fisheries department, Kakamega County), 200 fish farmers, 30 traders, 30 consumers and 5 input suppliers were interviewed. Input suppliers being very few in the County, were all sampled. Sample sizes for fish farmers and fish traders were determined based on Mugenda & Mugenda (2003) which considers 10%-50% of target population as an acceptable sample size hence 10% sample was used. Participating fish farmers were purposively sampled from eight randomly selected sub-counties namely; Likuyani, Lugari, Malava, Lurambi, Navakholo, Shinyalu, Mumias East and Khwisero (Figure 1). Fish traders participating in the study were sampled from Lurambi and Malava sub counties that host large sizes of fish markets. With the assumption that fish consumers were homogeneous in behavior, consumers were proportionately randomly selected from the targeted group of people that visited the market to buy fish during the study in Lurambi and Malava. 30 consumers were sampled from targeted 40 identified during the study period due to the 10 being unwilling to participate in the study.

Data were collected by qualitative and quantitative methods, including semi-structured questionnaires, key informant interviews and focus group discussions. It was collected on diverse aspects likely to affect gender disaggregated participation along the farmed Nile tilapia value-chain. Some of the data collected involved disaggregated gender participation numbers at the different segments, women aquaculture training, women's presence and participation in fish farming associations, access to different services ranging from finance, financial training, women role in fish farming, labor provision focusing on type of labour and marketing. The study also explored the cultural beliefs held by men and women towards women participation in different segments of the farmed tilapia value-chain.

Data Analysis

Data were analyzed and disaggregated based on gender along the value chain. Specifically, data were analyzed using descriptive statistics and cross-tabulations. Furthermore, the Chi-Square test was used to determine the extent of association between gender and the various socio-economic variables (participation in training activities, technical assistance, source of assistance and belonging to groups). All the analyses were conducted using SPSS version 23.0.

RESULTS AND DISCUSSION

Input suppliers comprised of 1 female and 4 males. The production segment had the highest number of participants, 74.2% of them being men and only 25.8% females while majority of fish traders were female (66.7%) (Table 1). The consumers encountered comprised 56.7% males and 43.3% females. Most actors were in the age bracket of 36-60 years, 55.84% of them being farmers and 66.7% traders however 60% of the consumers respondents belonged to 18 – 35 age bracket. Regarding education, majority players in production and trading had at least attained secondary education (43%) in producer respondents, traders (60%) while for consumers majority had attained up to tertiary level (63.3%). All players/ actors along the aquaculture VC were mainly from male headed households, (92.67%) reflected in producers, (80%) traders, (80%) consumers. The married status dominated players across the chain, reflecting (84.26%) for producers, (70%) traders and (50%) consumers (Table1).

The farmed tilapia value chain in Kakamega County, Kenya revealed that gender distribution of producers (fish farmers) was dominated by males. These results are similar to Brummett *et al*. (2010) findings which stated that aquaculture production is dominated by the male gender due to access to important resources like land and capital. Probably, women participation was being affected by traditions, culture and most importantly ownership and access to production utilities. Women have inadequate access to land, capital and labor which represent some basic tools of successive fish farming. Study by Africa (2016) noted that land for fish farming in Kenya was mainly owned by men. Moreover, patriarchal arrangements favor men at the expense of women by allocating them more productive land as also reported elsewhere (Ajani, 2008). Usually, women possess smaller pieces of land compared to men due to lack of statutory land rights and patriarchal land systems (Chete, 2019; Sixsmith & Speller, 2017). The bias in ownership of land that favors men has been culturally preserved over many decades in most communities.

Table 1: Demographics of Farmed Tilapia Value-Chain Segments

	Producers (n-200)	Traders (n-30)	Consumers (n-30)
Gender (%)			
Male	74.2	33.3	56.7
Female	25.8	66.7	43.3
Marital status (%)			
Single	10.15	20	46.7
Married	84.26	70	50
Divorced	1.52		
Widowed	4.06	10	3.3
Age structure (Years)%			
18-35	18.27	30	60
35-60	55.84	66.7	40
61+	25.89	3.3	0
Education (%)			
No formal education	4.57	6.7	6.6
Primary	28.93	23.3	30
Secondary	43.15	60	63.3
Tertiary	23.35	10	
House hold head (%)			
Male headed	92.67	80	83.3
Female headed	7.33	20	16.7

The trader's segment was mainly comprised of the female gender, majority of whom were within the active age bracket of 35-60 years (Table 1). Similar findings were reported by Odulate *et al.* (2011) in their study that observed that unlike the fish production, women are economically involved in fish trade and marketing. These results were unsurprising because most respondents including fish farmers and input supplier indicated that women were better suited in the fish trade and marketing segment. Seemingly, women have good business acumen with persuasive language. Furthermore, marketing takes less time hence women can easily multi-task between doing business and managing the home. Majority of the traders were also married which boosted business stability since it is taken as an income generating activity for the family. Nwabeze *et al*. (2013) noted that women are proactive in ensuring food security in homes as well as generating incomes. Moreover, women tend to be better economic stewards at home.

Comparatively, consumers who were mostly married were mainly comprised of males than females (Table1) possibly due to culture that men are providers of the family. In addition, men have higher earning power in rural areas, unlike the women whose domestic responsibility restrict them to taking care of the home. Furthermore, most consumers were the working class with tertiary education meaning they had a high buying power due to better earning. The study findings indicate that men dominate the farmed Tilapia value chain segments that have high economic returns and requires a large amount of resources such as; production, input supply and consumers. On the other hand, women have been pushed to take up segments that are less profitable and require less capital like marketing or fish trading and operations such as salting, frying and smoking. The observations made in this study in regard to gender participation collaborates with the findings reported by FAO (1996) and Pandey (2014), who highlighted those women in developing nations are less empowered to engage themselves in beneficial aquaculture and

fishery economic activities comparable to men. This male dominance reveals traditional pattern and unbalanced power relations between men and women which is highly skewed in favour of men.

Male headed households across segments in the chain agrees with studies by (Obiero *et al*., 2019) which recognized majority of fish farming household heads to be male headed though Brugere & Wiliam (2017) note that women play control role in production segment. The results reveal that majority of the players (irrespective of the gender) though higher percentages for males had some basic education up to secondary level. Thus, as stated by Obiero *et al*. (2019) this gives an edge to the value chain players because education gives players basic knowledge on issues since, they are trainable on aspects of fish production, marketing.

Gender Disaggregated Roles in Aquaculture

The only female respondent in the input suppliers segment was inlvoved in fry/ fingerling production while the males (4) were engaged in labour activities such as fingerling production, fish feed suply and equipment supply (e.g. harvesting nets, dam liners etc).

The different stages of production attract gender roles and gender division of labour. For instance, all labour activities (pond construction, pond preparation, pond management, fish harvesting and fish feeding) are mainly undertaken by men with minimal female participation especially in feeding, pond management and harvesting (Figure 2). Conversely, fish trading and marketing is mainly done by females with limited involvement of males (Figure 2).

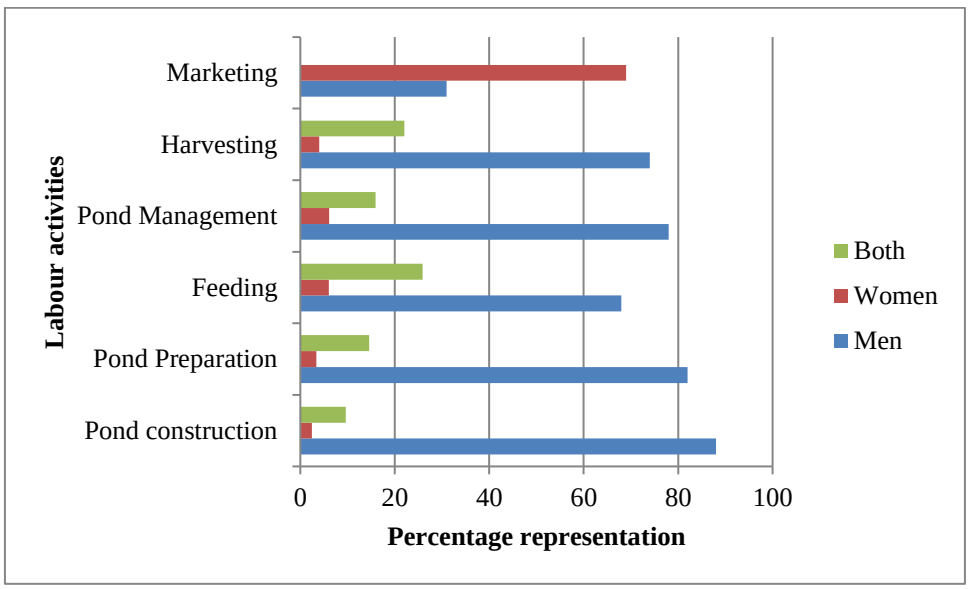

Figure 3: Gender Disaggregated Roles in Aquaculture.

The present study established distinct division of labor between women and men along the value chain of farmed tilapia. Women were mainly involved in activities that are considered less strenuous such as fish feeding and marketing with a few also producing fingerlings while men were involved in activities that are labor intensive such as pond excavation, fish stocking, pond management and fish harvesting. Furthermore, the production segment is also associated with activities that are laborious

which are perceived to be for men. On the other hand, women's role in fish production segment was mainly supportive such as feeding and marketing as also reported elsewhere (Cliffe *et al.,* 2011). Overall, results revealed that women could be more productive in fish trade and marketing because it is not laborious. Besides, women are traditionally perceived as good financial managers at household level. Similarly, studies by Agbayani (2012) and Okello *et al.* (2014) also noted that women role in fish farming chain was mainly in marketing and post-harvest handling. This probably suggest lack of motivation among women to venture into aquaculture which has for long been considered as a male domain due to limited access to productive assets such as land.

Furthermore, results showed that, gender didn't have an influence on level of production in terms of the number of ponds. Both males and females had an average number of ponds being 2 ponds (Table 2).

Table 2: Average Number of Ponds by Gender

Gender	Average Number of ponds
Female	2.12
Male	2.35

As regards distribution of social capital aspects, in terms of fish farming training received, belonging to any fish farming cooperative/ association or technical assistance received whenever needed among gender in producers/farmers segment, the study reveals almost three quarters (70%) of the interviewed farmers had received formal training in fish farming, majority (50%) being male. While 85.05% of the interviewed farmers belong to groups, majority (62.89%) of these being males and 26.16% females (Table 3). However, Chi square test revealed no significant association between gender and various variables ($p > 0.05$) (participation in training activities, technical assistance and source of assistance) except for belonging to groups ($p = 0.0477$).

Table 3: Socio-Capital Aspects of Interviewed Farmers (by sex)

Variable	Combined (n=200)	Female (26%)	Male (74%)	Significance tests; *chi2(1)*
Received training *(%Yes)*	70.20	20.20 (32.65)	50*(67.35)*	2.2239
Belong to group *(%yes)*	85.05	*26.16(15.28)*	62.89*(84.72)*	0.0477
Technical assistance *(%yes)*	73.74	18.18*(25.17)*	55.55*(74.83)*	0.3518
Sources of assistance				
Government	63.64	15.59 *(35.09)*	48.05*(64.91)*	0.103
NGO/ donor	14.94	3.24 *(12.50)*	11.69 *(15.79)*	0.298
Input dealers	12.34	1.95 *(7.50)*	10.39 *(14.04)*	0.302
Extension workers	78.57	19.48 *(75.00)*	59.09 *(79.82)*	0.109

The result of this study indicate that women are less trained in aquaculture value chain activities despite them playing important roles in all segments an observation also reported by other studies (FAO, 1996; Githukia *et al*., 2020; Weeratunge-starkloff & Pant, 2011). The lack of aquaculture training is a cyclic problem that stems from related aspects. In many rural traditions in Kenya, women are viewed as homestead caretakers with default roles that limit them to their homes (Githukia *et al*., 2020).

Moreover, lack of access to training and other resources also exacerbates the non-involvement of women in aquaculture. Therefore, addressing gender inequalities by improving educational levels, access to information, technology and participating in decision making could enhance capabilities in households. Study by Nathan & Apu (1998) revealed that organizing women in groups improved women's access to resources, technologies and services resulting in improved livelihoods of the poor households in Bangladesh. Nonetheless, government and non-governmental organizations (NGOs) interventions are trying to address gender inequality through grants and loans that target fish farmers regardless of gender. For instance, Kenyan government in 2009 introduced Economic Stimulus Program (ESP) that provided aquaculture inputs (fingerlings, fish feed etc.) and helped with excavation of ponds hence the relatively high numbers of women fish farmers. These interventions need to be strengthened along the value chain to ensure that all segments benefit thereby capacitating women. Development programs and policies often tend to ignore trading and post harvesting segments where women are more dominant and focus on production activities than improving processing and access to markets, which would provide more opportunities for employment and profit margins.

The present study also identified several obstacles that contribute to low women participation in producers' segment of farmed tilapia in Kakamega County. Both women and men respondents, identified limited women land accessibility, fish production intensive labour requirements, lack of capital, long benefit time compared to other enterprises, poor attitude towards aquaculture by women and inadequate information regarding fish farming sector as obstacles affecting the women gender as indicated in Figure 3.

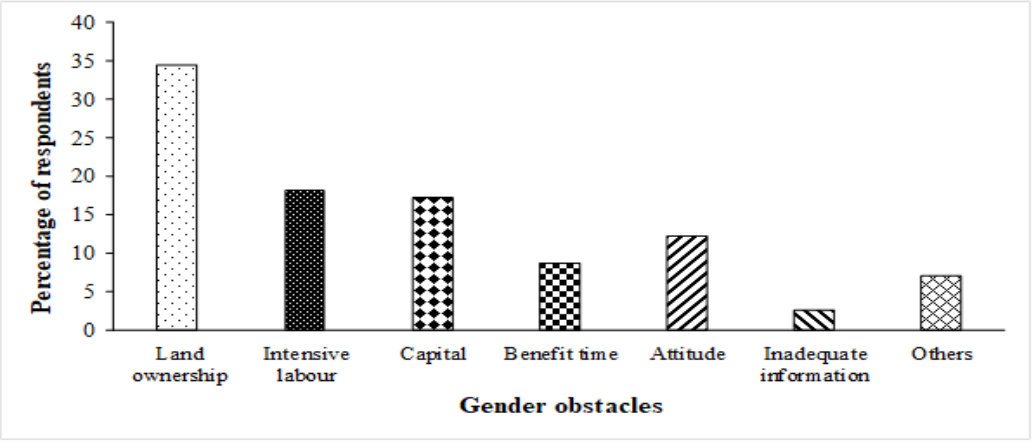

Figure 4: Gender Obstacles to Fish Production Segment in Kakamega County.

This study identified that lack of production assets (e.g., land) ownership among women was one of the major constraints limiting their participation in aquaculture. Similarly, Barman (2001) also found that women's low inheritance rights to ponds or other fish culture resources in Bangladesh acted as constraints to their active involvement in different activities of fish culture. Furthermore, aquaculture is capital intensive venture hence most women are unable to join the sector due to lack of capital and access to loans from lending institution (Figure 3). Most women are unable to access loans because they often lack collateral required to borrow money. This concurs with findings of Ndaga *et al.* (2013) which stated that the major barrier to entry into the fish farming sector was high initial capital outlay.

Traders cited gender obstacles that mainly included long distances travelled in search of fish, lack of trust (affects male traders) and inadequate capital. The respondents felt these challenges could be addressed by organizing traders into associations where they could buy fish in bulk as a group or centralizing fish distribution points to curb on the long distances, providing accessible loans to solve issue inadequate capital.

In regard to what the value chain player's perception of the best role that women can engage in effectively, 67.9% respondents suggested, marketing, followed by value addition in form of cleaning, smoking, drying and frying of fish, while in fish production, respondents felt women could play a supportive role in feeding (Figure 4).

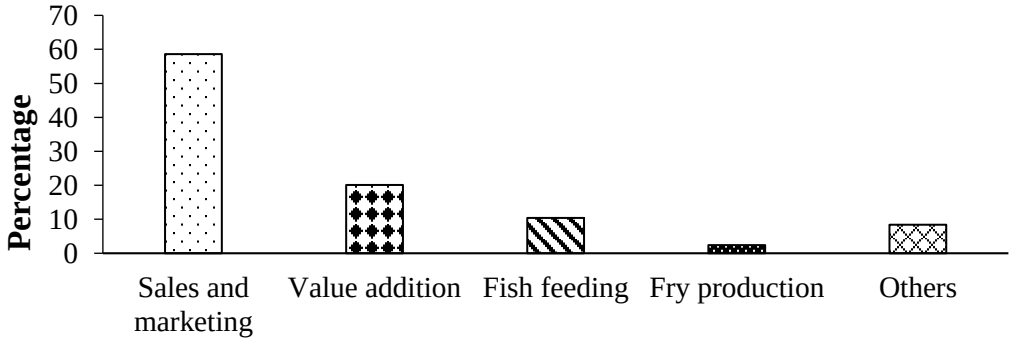

Figure 4: Suggested Ideal Segments for Women in the Tilapia Farming Value Chain from Respondents.

Women's perception of aquaculture is a significant and unique challenge that hinders women's participation in different value chain nodes as reported by results. However, the majority of the negative perceptions identified are engineered by men and embedded in culture, Nandeesha (2009) reports that women are made to view some of the tasks such as pond construction as labor-intensive and can only be done by men. The observation made by Kruijssen *et al*. (2018), builds on the perceptions issues and agrees with the findings made by this study. Aquaculture is an investment that takes variable periods to materials into financial benefits depending on the segment of engagement. Due to a lack of information on the segments which has quick economic returns such as fingerling hatchery, women have been made to believe that aquaculture benefits take a longer time to materialize. This kind of induced perception combined with lack of information limits women's participation as also reported by (Kusakabe, 2003) because of their limited access to resources. Nevertheless, *f*ish trader's component that is dominated by women should be encouraged to indulge in fish processing in order to expand their market thereby increase economic returns. Fish is highly perishable hence processing such as drying increases their shelf-life allowing fish traders to sale them to distant market as opposed to concentration on localized market. Comparably, Jagger & Pender (2001) also noted that venturing into post-harvest practices allow for fish to reach a larger market which has the potential to break barriers of subsistence farming with localized sales because of lack of access to formal chains and transport constraints.

Implications of Mapping Gender Disparities in the Farmed Tilapia Value Chain

Identification of challenges and factors hindering women participation in farmed

tilapia within Kakamega County will inform the policy makers and other actors to develop approaches that enhance gender inclusivity. Women play a vital role in the growth and development of any value chain. Their increased presence particularly in all nodes of operation will spur fish farming especially of Tilapia which is the most preferred species.

CONCLUSION

Women remain important players in fish culture despite the social construct, which has resulted in men generally owning and managing family land and income. Therefore, gender disparities in aquaculture can result in lower labor productivity within the sector as well as inefficient allocation of labor at household and national level. Thus, to ensure women's utilization of their full potential in aquaculture and consequently contribution to food security there's need for empowering rural women through proper training and support, come up with innovative technology targeting the right people without bias, social inclusion such that the aquaculture interventions have lasting impact on livelihoods and policies that promote gender equitability. There is also need for development programs and policies to focus on improving fish processing and access to markets, which would provide more opportunities for employment and profit margins for women.

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