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Impact assessment of aquaculture intervention on the households` income in aquaculture potential areas of Oromia regional state, Ethiopia

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Keywords

Aquaculture intervention, determinants, impact, and participation

Abstract

The study was conducted to examine the determinants and impact of participating in aquaculture activities on households' income at aquaculture potential areas of Oromia region. Districts were selected using purposive sampling techniques.The four stage sampling technique was used to select 167 target respondents. The prima ry data were collected using an interview schedule, conducting focus group discussi ons, and key informant interviews. The logit model was employed to identify the de terminants of participation in aquaculture activities while propensity score matchin g techniques were used to quantify the impact.

The result of the Logit model shows that four variables (education level of household head, access to credit services, access to water source and annual farm income of household head) have a strong significant effect on the variable of interest at 1% and 5% significance level.

The Propensity score matching result revealed that involvement in aquaculture prod uction activities had a significant effect (15,411 ETB) on household income at 5% significance level. Major constraints of participation in aquaculture activities such as high cost of fish feed and it`s availability, skill and knowledge gap,Lack of improved fish seed and aquaculture technology, lack of access to water source and shortage of fishing equipment and training for fishers were identified in the study area. To ensure long-term sustainability of aquaculture sector, efforts should have to focus on raising awareness on aquaculture activities and advancing research in aquaculture production, environmental and water source management.

Introduction

In Ethiopia, aquaculture is considered for its immense potential to address the problems of nutritional insecurity, low income and unemployment (Akua and Kwamena, 2019; Lakew 2025; Yalew 2023; Abdulhakim and Addisu 2024). Aquaculture can easily be integrated with agricultural activities, like crop and animal husbandry with an aspect of improving output of the others. The potential use of aquaculture in food self-sufficiency, nutritional security, income generation and creation of job opportunity were credited and its development has been promoted (Gupta, 2018; Tofique and Belton, 2014). More than thousand farmers had fish ponds in Ethiopia in 2013/14 and these ponds were used for subsistence purpose (Hussein, 2015 and Abdulhakim, 2025).

In Oromia region, by realizing the contribution of aquaculture to the economy, aquaculture development has been practiced in aquaculture potential areas like Jimma, Bedele, Horo Guduru Wolega, East Wollega, Southwest Shoa, West Shoa, West Arsi, East Shoa, North Shoa and Finfinne surrounding special zone by different government and non-government organization such as Oromia livestock and fisher office, Sebeta fish research center, Batu Fish and Other Aquatic Life research center, Jimma University around Jima and Beddelle and World vision, fish for all and Livestock and fishery sector development project. Specifically, in West Shoa, over 63 subsistent fish ponds were prepared on farmers plot and stocked with fish in 2008/2009. The establishment of fish in stocked ponds and the interest of farmers to own the fish ponds are increasing, promising for the development of the sector. Recently, pond preparation and fish stockings were made by farmers in all zones of the region by the advice and aid of fishery extension workers. The fish seed source to stock these ponds has mainly been from Batu Fish and other aquatic life research center. Annual fish production from aquaculture in Ethiopia was reported 38 tonnes in 2012, consisting mainly of tilapias (33 tonnes) and common carps (5 tonnes) (FAO, 2015) and estimated at 41 tonnes in 2013/14 (Hussein, 2015, Mahendra , 2025).
Starting from 2000 E.C Batu fish and other aquatic life research center have been constructed fish farms (ponds) on the individuals farm to boost the production and productivity of aquaculture and integrated fish-poultry and horticulture in different districts of Oromia region. In those all districts different fish species like Nile tilapia, African catfish and common carp have been introduced to the constructed ponds and fish and ponds have been managed for several years by Batu fish and other aquatic life research center in collaboration with farmers. However, the contribution of aquaculture intervention to household`s livelihood has not been assessed in this area. In addition to this, baseline information and scientific evidence on the contribution of aquaculture on the household`s livelihood is not documented in the study area. Therefore, this study was assessed the households' income contribution as a result of participation in aquaculture intervention to come up with the points of the solution so that the policy actions and extension activities can be undertaken.

Objectives of the study

- To identify the determinants of households participation decision in aquaculture activities in the study area
- To assess the contribution of aquaculture intervention on the fisher`s income in the area

Research Methodology

Description of the study

The study was conducted in four zones of Oromia region by selecting potential district like Qarsa, Omo nada, Woliso, Wonci, Adama, ada`a, Shashemene and Nagele Arsi

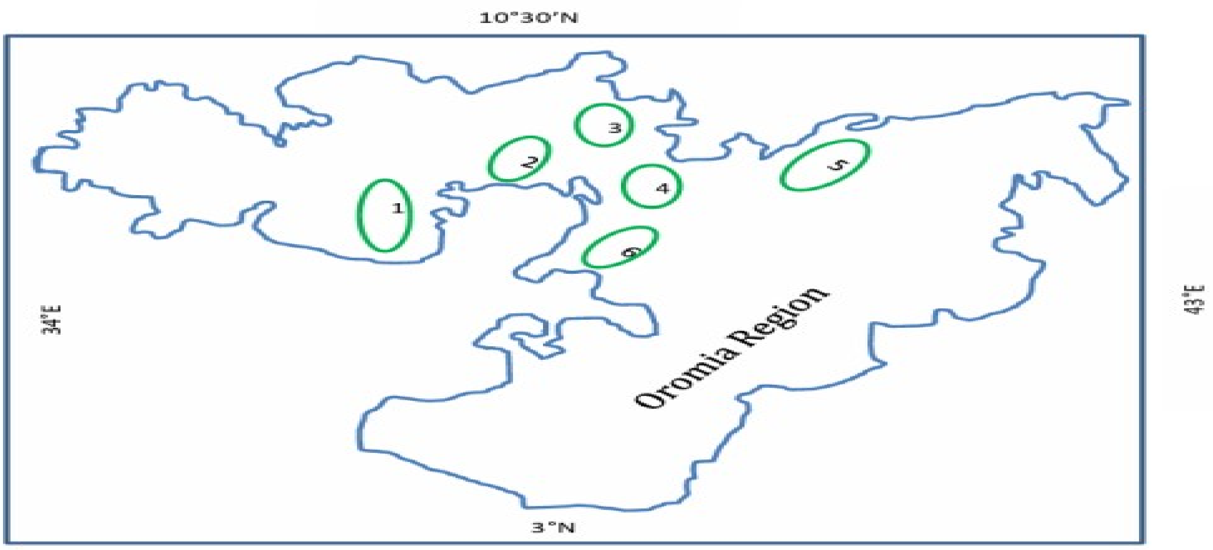

Figure 1: Map of the study sites by Zones

Note: 1 indicate Jimma, 2 indicate Southwest Shoa, 4 indicate East Shoa and 6 indicate West Arsi

Sampling technique

Four-stage sampling procedures were used for the selection of sample household heads. In the first stage aquaculture potential zones (Jima, West Arsi, East Shoa, and South West Shoa) have been selected from Oromia region purposively. At the 2nd stage based on wider exposure to aquaculture activities, 8 districts (Qarsa, Omonada, Wonci, Woliso, Adama, Ada`a, Shashemene and Nagele Arsi) have been selected purposively from the zones based on the aquaculture potentiality & presence of aquaculture technologies. At the 3rd stage 16 kebeles have been selected purposively based on their aquaculture potentiality and presence of aquaculture technologies. On the 4th stage, both users and non-users of aquaculture technologies have been selected randomly & used for this study. By stratifying the households into users and non-users of the aquaculture technologies in the area, 167 sample household heads` were selected.

Cochran (1977) formulas have been used to determine sample size.

$$n = \frac{Z^2 * (p)(q)}{d^2} \qquad (1)$$

n -is the sample size, Z is the standard normal deviation (1.81 for 93% confidence level)

p is 0.5 (The proportion of the population participating in aquaculture activities that is 50% due to unknown variability), q is 1-p = 0.5 (50%), d is desired degree of precision level, which is 0.07 in this case. Proportional sampling method has been used to select the sample from each kebeles, *N* – Total sample size

$$n_i = \frac{N_i\ (n)}{\sum N_i} \qquad (2)$$

Where n_i – the sample to be selected from i`s kebele, *Ni* – the total population living in the selected i`s kebele, ∑ - the summation sign, ∑ *Ni* – the sum of the total population in the selected kebeles

Types and methods of data collection

For this study, both primary and secondary data were used. The secondary data were collected from different sources. Checklists and questionnaires were prepared and employed to collect primary data from key informants, focus group discussants and fishermen.

Method of data analysis

Descriptive statistics and econometric model were used to analyze the data.

Econometric Models for determinants and impacts of aquaculture intervention on the household's income in the study area
The logit model can be expressed in probability thus:-

The equation for probability of non-event is then:-

$$\Pr ob(D=0)=1-\varphi\left[\sum_{K=1}^{K}\beta_K b_K\right]$$

The farmer's decision to use aquaculture technologies depends on the criterion function:-

$D^* = \gamma Z_i + U_i$, Where D_i^* is a latent variable that takes the value of 1 if the farmer uses aquaculture technology or post-harvest technologies and zero otherwise, Z is a vector of household characteristics and γ is a vector of parameters and U is Standard Normally Distributed Error Term.

In practice, D_i^* is unobservable. Its counterpart is D_i, which is defined by;- $D_i = 1 if\ D_i^* > 0$,(Farmer I used aquaculture technologies, and $D_i = 0$, If otherwise

In the case of normal distribution function, the model to estimate the probability of observing a farmer using an input can be stated as:-

$$P(D_i = \frac{1}{X}) = \varphi(X\beta) = \int_{-\alpha}^{X\beta} \frac{1}{\sqrt{2\pi}} \exp(\frac{-z^2}{z})dz,$$

Where, P=Probability that the ith farmer uses technologies and 0 otherwise X=K by 1 Vector of the explanatory Variables.

Z indicate Standard Normal Variable (i.e $Z \sim N(0,\delta^2)$ and $\beta = K$ by 1 Vector of the Coefficients estimated.

For a non-dichotomous variable, the marginal probability is defined by the partial derivative of the probability that Di is 1 with respect to that variable. For the jth explanatory variable, the marginal probability is defined by:-

$$\frac{\partial P}{\partial X_{ij}} = \varphi(x_{ij}\beta)\beta_j ,$$

Where, $\varphi(.)$=Distribution function for the standard normal random variable

β_j is Coefficient of jth explanatory Variable. The Logit model specification in this analysis can be written as:

$$D_I^* = X_i\beta + \varepsilon_i, \qquad D_i = \begin{cases} 1 if\ D_i^* \geq 0 \\ 0 if\ D_i^* \leq 0 \end{cases}$$

Where, D_i=Observed Dichotomous Dependent Variable takes the value of 1 if the farmer uses aquaculture technology and 0, otherwise. D_i^*= Underlying Latent Variable that indexes the adoption of aquaculture technologies. X_i=Row Vector of Values of K Regressors for the ith fishers.

β=Vector of Parameters to be estimated, ε_i=Error term

Impact of a treatment for an individual, *i* noted, T_i is defined as the difference between the potential outcome in case of treatment and the potential outcome in absence of it is given by equation below;

$$T_i = Y_i(1) - Y_i(0)$$

ATT, which measures the impact of the participation in aquaculture technology intervention on those individuals who participated:

$$T^{ATT} = E[(T)D = 1] = E[Y(1)D = 1] - E[Y(0)D = 1]$$

Results and Discussion

The results discussed in this study mainly focused on determinants that influence participation of households` in aquaculture technology intervention and impacts of aquaculture technology intervention in the selected aquaculture potential areas of Oromia region.

Institutional characteristics of sampled respondents in the study area

Household heads` access to credit facilities (Credit): About 93.3% and 77.1% of credit accessed households were users and non-users respectively. Household heads that were obtained access to credit were 6.6% users and 22.8% nonusers (Table 1). The Chi^2 result indicted that there was a highly significant difference between users and nonusers of technologies in terms of access to credit facilities at 1% significance level. The result of this variable indicated those household heads that were obtained access to credit participate more in aquaculture activities than who do not obtain credit access.

Access to extension services (Ext): frequency of extension contact affected positively and significantly the probability of participation in pond fish production at 1% significance level. The result of marginal effect indicated that *ceteris paribus*, when the frequency of extension per year increases by one day, the probability of participation of smallholder farmers in pond fish production also increases by 63.45%. The result indicated that individuals who have access to contact have a greater likelihood of participation in new agricultural technology than those who cannot access to extension contact.

Access to water source (Yes/No): For the total observation about 44.31% of households did not have access to water source. About 76.09% of the non-users and 5.33% of the users had access to water source (Table 1). There was significant difference between the users and nonusers of aquaculture technologies in terms of access to water source at 1% significance level. The result of this variable indicates that aquaculture technology adopter's households have access to water source more than the nonuser households.

Table 1: Distribution of the categorical variables across users and non users of aquaculture technologies in the study area

Explanatory variables		For total observation 167 Frequency (Proportion/%)	Users (75) Frequency (Proportion/%)	Non-users (92) Frequency (Proportion/%)	Chi^2 value
Credit access	Accessed	141 (84)	70 (93.3)	71(77.1)	5.2***
	No access	26 (15.5)	5 (6.6)	21 (22.8)	
Extension access	Accessed	106 (63.47)	58 (77.33)	48 (52.17)	9.2***
	No access	61(36.53)	17 (22.67)	44 (47.83)	
Water access	Yes	93 (55.69)	71 (94.67)	22 (23.91)	4.1***
	No	74 (44.31)	4 (5.33)	70 (76.09)	
Training	Trained	81 (48)	36 (48.00)	45 (48.91)	0.03
	Not trained	86 (51)	39 (52.00)	47 (51.09)	

*****,** shows significant at 1% level of significance

Source: own computation result from survey data, 2024

Demographic and Socio-economic characteristics of sampled respondents in the study area

Education level of Household head: The results in the table (2) below indicate that, there was a significant difference in the education level between users and non-users household heads at 1% level of significance. The result indicates that the education level of the non-users was lower as compared to the users of aquaculture technologies` education level.

Number of ponds owned by households: the number of fish ponds owned, by total households in the study area was 1.3 on average, and the minimum and maximum number of fish ponds were 0 and 5, respectively. Mean difference test indicated that there was no significant difference between users and non-users of technologies in number of fish ponds owned.

Fish farming Experience of the fishers (Experience): The mean fish farming experience of the non-user was 2.3 with the minimum and maximum experience of 0 and 5 years respectively, whereas that of the users was 4.82, 1 and 9 respectively (Table 2). The descriptive analysis revealed that there was a statistical significant difference in the year of experience of households between users and non-user of aquaculture technology practices at 1%. The mean difference of aquaculture technology practices experience between the non-users and users was positive and it was highly significant at 1%.

No of poultry owned by Fish-Poultry integrated farmers (Poultry): the number of poultry owned, by total households in the study area was 17 on average, and the minimum and maximum number of poultry were 0 and 40, respectively. The mean number of poultry owned for the non-user was 15.3 whereas that of the users was 27.2 poultry. Mean difference test indicated that there was no significant difference between users and non-users of technologies (table 2).

Cost of aquaculture input (Cost of Input): The mean input cost of the sampled households in the study area was Birr 7591 with minimum and maximum input cost of Birr 1550 and 13500, respectively. But the mean input cost of the non-users was 1685 with minimum and maximum input cost of Birr 1550 and 2500 respectively, whereas that of the users is Birr 7595, with minimum and maximum input cost of Birr 5895 and 13500 respectively. The descriptive analysis revealed that there was a significant difference in the input cost of households between users and non-users in the adoption of aquaculture technologies. The mean difference between the non-users and users was significant at 5% significance level.

Annual income (Ainc): The mean annual farm income of the non-users was Birr 5300 with minimum and maximum annual income of Birr 4700 and 9000 respectively, whereas that of the users is Birr 17400, with minimum and maximum annual farm income of Birr 13500 and 28000 respectively. The descriptive analysis revealed that there was a statistical significant difference in the annual farm income of households between users and non-users in the adoption of aquaculture technologies at 5% significance level. The mean difference between the non-users and users was significant at 5% significance level. This implies that the income of the users was higher as compared to non-users. This implies that, the higher the income level of a fish farmer from fish farming, the more he will be willing to adopt improved aquaculture technologies. The finding of this study is similar with the result of (Tibebu, 2021; Abdulhakim and Addisu, 2024).

Table 2: Summary statistics of continuous variables included in the study

	For total observation 167				Users=75				Non-users =92				Mean diff.
Variable	Mean	SD	Min	Max	Mean	SD	Min	Max	Mean	SD	Min	max	
Ponds	1.3	1.39	0	5	2.10	1.51	1	5	0.65	1.3	0	1	1.25
Poultry	17.0	6.3	0	40	27.2	8.5	21	40	15.3	7.8	0	25	1.31
Input cost	7591	3510	1550	13500	7595	2500	5895	13500	1685	1200	1550	2500	2.9**
AInc	11.25	3.9	4.7	28	17.4	5.75	135	28	5.3	1.25	4.7	9.0	7.75**
Experience	4.10	6.4	0	9	4.82	7.60	1	9	2.3	2.4	0	5	5.1***

** and ***, shows significant at 5% and 1% level of significance
Source: own computation result from survey data, 2024

Livelihood activities of the respondents in the study area

According to survey results, among the interviewed households 35.9% produced maize, 41,9% produced wheat, 33.53% produced teff and 32.9% were produced sorghum for consumption and source of cash in line with fishing activities (table 3).

Table 3: Major crop produced by selected fishers in the selected study area

Crop type		Frequency	Percent (%)
Maize	Yes	60	35.92
	No	107	64.08
Teff	Yes	60	35.92
	No	107	64.08
Wheat	Yes	70	41.9
	No	97	58.1
Sorghum	Yes	55	32.9
	No	112	67.1

Source: Own survey results, 2024

Types of Aquaculture production and aquaculture practices in the study area

From the total user sample households, the majority (52%) uses the aquaculture type of fish with ponds only (table 4). There were about 40% users that use integrated fish –poultry- vegetables farm. Concrete pond (8%) was the other aquaculture type practiced by fish farmers in the study area (table 4 below).

Table 4: Distribution of sample households by the type of aquaculture used by aquaculture technology users in the study area

Aquaculture practices	Frequency	Percent (%)
Fish with earthen pond only	39	52
Integrated fish- poultry farm	30	40
Concrete pond with fish	6	8
Gift	40	53.33
Inheritance	35	46.67
Number of ponds owned by farmers		
1	17	22.67
2	14	18.67
3	18	24
4	11	14.67
5	9	12
More than 5 pond	6	8
Distribution of respondents by fish-farm size (m^2)		
≤100	35	46.67
150-200	23	39.67
201-300	13	17.33
>300	4	5.33
Fish seed stocked in the ponds		
Tilapia	35	46.67
Tilapia with African catfish	30	40
Tilapia with African catfish and Common carp	19	13.33
No of poultry owned by Fish-poultry integrated farmers		
≤ 20	9	30
21-45	15	50
≥ 46	6	20
Total	30	

Source: Own survey results, 2024

Factors affecting the respondent's participation in aquaculture activities in the study area

The Logit model result, given in Table 5 reveals that out of 11 explanatory variables, four variables were found to significantly determine the adoption decision of the fish farmers, at different significance level. These variables influence the participation decision of the farm household in different directions and indicated in Table 5 below.

Access to credit use: From Table 5 below, the result of the marginal effect of this variable, 0.53 reveals that the predicted probability of participating in aquaculture technologies increases by 53% for the farmers having access to credit services as compared to the farmers who do not have access to credit services. This may, as farmers use credit they expected to purchase different farm inputs than non- users and thus can allocate more land for aquaculture activities. Tibebu, 2021, Abdulhakim, 2024; Neupane and Gharti (2018) support the finding of the current study by arguing for agricultural credit as it plays a vital role in the process of smallholder.

Education level of household head: As expected, educational status had a positive and statistically significant effect on households' participation in aquaculture production activities. The probability of participating in fish production increases by 35% if the household head is literate. This implies that the participation of literate households in aquaculture production is more than illiterate households' heads. This is because literate heads have better knowledge about the role of aquaculture activities to diversify household income and job creation, so as to achieve food security of his/her family than illiterate household heads. In addition to this, education is an important weapon to change the lives of smallholder farmers because educated household heads adopt important technologies and manipulate these technologies easily to improve their production and productivity which gives them more chance to engage in other alternative farm and non-farm activities (Birara *et al*., 2020; Salau *et al*., 2014).

Annual farm income (Income): The result from the model indicate that as the annual farm income level of household head increases by 1000 Birr, the probability of participating in aquaculture technologies and its practices increases by 57%, holding another factors constant. This implies that the higher the farm income level of a fish farmer from fish farming, the more he/she will be willing to adopt improved aquaculture technologies as he will be able to afford the technologies unlike those who earn less from fish farming and perceive the fish farming as a non-profitable venture. The finding of this study is similar to the result of (Olaoy *et al*., 2016; Tibebu, 2021; Abdulhakim and Addisu, 2024).

Access to water source: The result from the logit model revealed that, there was significant difference between the users and nonusers of aquaculture technologies in terms of access to water source at 1% significance level. This implies that aquaculture technology adopter's households have access to water source more than the nonuser households heads in the study area. This implies that without enough water sources and access to sustainable water sources the fishers could not adopt/uses aquaculture technonogies to participate in aquaculture activities in the study area

Table 5: Factors influencing farmers` adoption decision of aquaculture technologies in the study area

Variables	Coefficient	Robust Std. Err.	Z	Marginal effect
Education level	0.6564**	0.0442	3.35	0.3546
Pond	0.2207	0.3168	0.70	0.0580
Poultry	0.0231	0.0355	0.65	0.0060
AInc	0.4138***	0.1163	2.70	0.5714
CostCHPcF	0.0631	0.0542	1.16	0.0163
FishExp	0.0004	0.0224	0.02	0.0001
Credit	0.7893***	0.3168	2.81	0.53
Extension	0.7695**	0.3497	2.20	0.1805
Acc to water source	1.404***	0.42	4.42	0.347
Training	0.0523	0.2338	0.49	0.0139
Observation number = 167				
		Wald chi2 (11) = 91.96		
		Prob > chi^2 = 0.0000		
Log pseudo likelihood = -48.6000		Pseudo R^2 = 0.7540		

Source: Own survey result of 2024

Impact of aquaculture intervention on the household income in the study area

Propensity score matching (PSM) method of impact evaluation was mainly used for this study, because of the absence of baseline data. The overlapping area for the estimated propensity score is constructed based on the summary statistics of the user and non-user. Therefore, it was determined by taking the maximum of the minimums and minimum of the maximums for the two groups' propensity scores. It was found to be between the value of propensity score of 0.26 and 0.62 (Table 6).

Table 6: Estimation of propensity score and overlapping area for estimated propensity score

Variable		Observation	Mean	Std. Dev	Min	Max
Propensity score	Common support	144	0.44	0.088	0.25	0.626
	Non-participants	92	0.42	0.3077	0.26	**0.62**
	Participants	75	0.47	0.2223	**0.25**	0.91

Source: Own survey results of 2024

Matching Algorithm Selection

After estimation of propensity score, units in the user group are then matched with non-user with similar probability. There are some matching algorithms that can be employed in undertaking the impact evaluation to get the effect of the treatment. The most common matching algorithms used in propensity score matching include kernel matching, nearest-neighbor matching and radius matching.

Table 7: Test on the propensity score matching algorithms

Matching algorithm	Mean bias	Pseudo R square	No. of matched observation	No. of balanced covariates
Nearest neighbour/s	5.6	0.028	144	11
Radius matching	11.7	0.071	144	11
Kernel matching	3.6	0.003	144	11

Source: Own survey results of 2024

Estimation of the Effect of Treatment and Interpretation of Results

The impact measurement of a certain technology intervention is based on the above-mentioned steps of propensity score matching when we do not have the baseline data. Following the estimation of propensity scores, the implementation of a matching algorithm, and the achievement of balance, the technology intervention's impact may be estimated by averaging the differences in outcome between each participated unit and its neighbor/s from the constructed comparison group. The average treatment effect on the treated is about Ethiopian Birr 15,411.8 and it is significant at a 5% significance level. This finding is consistent with the study conducted on the impact of participation in fishery activities on the household`s income using propensity score matching (Abdulhakim 2025). Therefore, participation in aquaculture production activities should be encouraged by the government and any other stakeholders in the study and other aquaculture potential areas.

Major constraints of aquaculture production in the study area

Table 8: Major constraints of aquaculture production in the study area

Major constraints	Frequency	%	Rank
High cost of fish feed and lack of it`s availability in the area	35	20.93	1st
Skill and knowledge gap	31	18.56	2nd
Lack of improved fish seed and aquaculture technology	26	15.57	3rd
Lack of access to water source	24	14.37	4th
Lack of access to credit and in adequate storage facilities	17	10.18	5th
Poor extension contact and follow-up	14	8.4	6th
Lack of fishing equipment and training for fishers	11	6.6	7th
Poor coordination between stakeholders	9	5.39	8th

Source: Own survey result of 2024

Conclusion and Recommendations

Conclusion

The study concluded that aquaculture production activities and its` technology are adopted by fishers and primarily operated for home consumption and marketing purpose in the study area. Adoption of aquaculture activities and its` technology are dynamic and highly influenced by demographic, socioeconomic, environmental and institutional factors which can be changed with time. Regarding to the determinants of participation in aquaculture production activities and its technology usage, and it`s impacts on the household's income. Eleven (11) variables were hypothesized to identify determinants of participation decision in aquaculture production activities. The result of Logit model shows that, four variables (education level of household head, access to credit services, Access to water source and annual farm income level of household head) have strong significant effect on the variable of interest. Impact of aquaculture technology intervention was quantified by using propensity score matching and it brings positive impact on the household’s income in the area. Major constraints of participation in aquaculture activities were identified in the study area.

Recommendations

Based on the findings of this study the following recommendations have been given:

- Use locally available feed staffs such as poultry excreta, animal manure, wastes after human consumption and others should be used to cutoff feed costs. Before starting the pond excavation, adequate pre-intervention observation by experts and aquaculture training from site selection to the consumption of aquaculture products must be provided.
- Establishment of at least one improved fingerling multiplication site and hatcheries in each aquaculture potential zone of Oromia region to boost aquaculture development.
- Enforcement and implementation of fisheries and aquaculture development and utilization proclamation and policies to sustain aquaculture development in the area,
- Hiring appropriate and knowledgeable fishery and aquaculture professionals in each district and Zone from the start of fishing activities to the consumption of aquaculture products in the study area to support fishing communities and to overcome the problem of poor coordination between stakeholders, Extension and credit services that would improve the participation of fishers in aquaculture should

have to give more emphasis by livestock experts and other stakeholders in the area.

- Any stakeholders in the aquaculture sector should have to work on the issue of enough and sustainable water source to encourage fishers participation in the adoption of aquaculture technologies in the study area
- Government institutions, donors and non-government organization should have to facilitate credit access to strengthen the participation of farmers in aquaculture activities in the study area

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Conflict of interest

The author has not declared any conflict of interest

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