Farmers' Level of Participation and its Determinants on Sesame Value Chains in Kafta Humera, Western Zone of Tigray-Ethiopia

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Abstract

In Ethiopia, sesame is the major oil seed crop in the country, in terms of exports, next to coffee, accounting for over 90 percent of the value of oil seeds exports. However, efforts focused only on production and marketing issues to improve sesame commodity. This will not produce considerable results except the level and determinants of farmer's participation on sesame value chains analysis are fully investigated. Therefore, this study analyzes the level and determinants of farmers' participation on sesame value chains analysis in Kafta Humera district of Tigray, Ethiopia. Multi-stage sampling method was applied to select a total of 135 farm households and 6 sesame chain actors for the study. Data on demographic characteristics of sample respondents and determinants of farmers' participation on sesame value chains analysis were conducted using descriptive analysis. Moreover, Tobit regression model was employed to analyze factors influencing the level of farmer's participation in sesame value chains. Tobit regression model results revealed that sex and access to market information were found to influence farmer's level of participation in sesame value chains positively, while distance of sesame farm from the nearest market center, access to credit, and house hold membership to multipurpose cooperative were found to influence their participation negatively at P<5%. The study concluded that stakeholder (farmers, investors, traders, exporters, governments and research institutions) participation is very much important in transforming subsistence agriculture to market orientation like sesame farm. The study suggests that policies aimed at strengthening sesame value chains through farmers participation to accelerate agricultural development in the area could be successful if they consider and address these negatively affecting factors.

Keywords*:* Level of participation, sesame value chains, Kafta Humera district, Tigray, Ethiopia

1 Introduction

Agriculture remains the backbone of economic development in many developing countries, with smallholder and family farms playing a pivotal role (Meemken, & Bellemare, 2020). In Ethiopia, smallholder farmers cultivate approximately 95% of the nation's agricultural land and produce over 95% of its agricultural output (Jebesa, 2019). This sector contributes about 41% of the country's gross domestic product (GDP) and is responsible for more than 90% of Ethiopia's foreign currency earnings (Addis, 2019). This underscores the critical importance of the smallholder sub-sector for overall agricultural growth and the broader economy of the nation.

Ethiopia stands out as one of the top five sesame-producing countries globally, ranking as the third-largest exporter of sesame seeds after India and Sudan (Girmay, 2018). Sesame is the most significant oilseed crop in Ethiopia, generating over 90% of the value of oil-seed exports, second only to coffee (Temesgen & Megersa, 2017). Recent studies suggest that the country still has vast arable land suitable for sesame cultivation, and the increasing demand for sesame in international markets presents substantial growth opportunities (Amsale, 2017). However, realizing this potential hinges on farmers' active participation in the sesame value chains.

While a variety of studies have delved into aspects of the sesame value chain in Kafta Humera, such as production techniques and market access (Shamble & Makonnen, 2020; Hagos et al., 2021), there is a notable lack of in-depth research focused specifically on farmers' participation levels and the socio-economic and institutional

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determinants influencing this participation. For example, research by Abebe (2020) highlighted the challenges faced by sesame producers in accessing markets but did not address the specific factors that either encourage or deter farmer engagement in the value chains. Furthermore, studies like those by Merhawi et al. (2022) have predominantly focused on the marketing dimensions of sesame production without fully exploring how varying participation levels affect overall productivity and income generation for farmers.

This gap in the literature raises critical questions about the mechanisms that facilitate or inhibit smallholder farmers' participation in the sesame value chain in Kafta Humera. Existing research has often treated participation as a given rather than exploring the nuanced factors that limit or enhance it. By overlooking the intricate dynamics at play, efforts aimed solely at improving production and marketing strategies may be insufficient to boost the economic viability and sustainability of sesame farming.

Hence, this study seeks to fill this research gap by analyzing both the levels of participation among smallholder sesame farmers and the socio-economic, environmental, and institutional determinants affecting their engagement in the sesame value chains. Understanding these dynamics is essential for developing targeted interventions that can enhance farmers' participation, ultimately contributing to the economic development of Ethiopia.

Empirical Review

Empirical studies on smallholder farmers' participation in agricultural value chains have highlighted a multitude of socio-economic and institutional factors influencing engagement levels. For instance, Yared et al. (2020) found that access to financial services significantly enhances farmers' participation in value chains by providing the necessary capital for input purchases and investments in production. This study suggests that when farmers have better access to credit, they tend to engage more actively in higher-value crops like sesame.

Access to market information has also been shown to play an essential role in participation. Merhawi and Hagos (2021) examined how timely market information affects smallholder farmers' decisions in the sesame value chain and found that those with robust market information networks made more informed production and marketing decisions, ultimately increasing their participation levels. Furthermore, a related study by Asfaw et al. (2019) corroborates this by demonstrating that improved market access information leads to better price negotiations, enhancing farmers' income and encouraging them to partake in value-added activities.

Infrastructure development is another critical factor impacting participation. Abebe (2020) emphasized rural infrastructure's role in enhancing smallholder farmers' connectivity to markets, revealing that investments in roads and storage facilities improve access and significantly reduce post-harvest losses. Complementing this, the research by Hailu et al. (2021) found that better transportation infrastructures have a direct correlation with increased revenue generation for farmers, which in turn incentivizes their participation in more lucrative markets like sesame.

In addition, the effects of collective organizational structures have been reviewed extensively in the literature. The study by Tadesse and Kauffman (2020) indicated that participation in cooperatives not only provides smallholder farmers with better access to inputs and technology but also enhances their collective bargaining power in local and international markets. This aligns with the finding of Kassa and Alemayehu (2021), who found that farmer groups facilitate knowledge sharing and resource pooling, thereby bolstering participation rates in value chains.

Furthermore, socio-cultural factors have been noted to significantly affect farmers' participation in value chains. Jebesa (2019) discussed how social networks play a crucial role in information dissemination and community mobilization among smallholders. This social capital is vital for collective action, which can lead to improved market access and enhanced bargaining power within value chains.

Environmental factors also impact participation, as demonstrated by a study from Tadesse et al. (2021), which highlighted the influence of climate variables on sesame production. They found that changes in climate-related agricultural practices significantly affected farmers' yields and, subsequently, their willingness to engage in market-oriented sesame cultivation.

Despite these insights, gaps persist in the literature regarding specific socio-economic variables that uniquely affect participation levels among sesame farmers in different regions of Ethiopia. Many existing studies have broadly addressed agricultural practices without pinpointing unique determinants of sesame value chains participation. This study aims to build on these empirical foundations by investigating the specific socio-economic

and institutional determinants affecting smallholder farmers' participation in the sesame value chains in Kafta Humera.

2 Methodology

2.1 Study Area

Kafta-Humera is one of the three districts located in the western zone of Tigray Regional State. It is situated 954 km north of Addis Ababa (the capital city of Ethiopia) and 570 km west of Mekelle (the capital of Tigray Regional State). Geographically, the district spans approximately between 13°40’ and 14°27’N latitude and 36°27’ and 37°32’E longitude. This district is bordered to the west by Sudan, to the north by Eritrea, to the south by Welkait and partially by Tsegede woredas, and to the southwest by the Amhara Region.

In addition to these geographical features, it is crucial to understand the socio-economic context of the Kafta-Humera district. The demographics of the area reflect a diverse population engaged primarily in agricultural livelihoods, with a significant reliance on cash crops such as sesame. Community livelihoods are shaped by traditional farming practices, with many households participating in subsistence agriculture while also seeking integration into value chains for cash crops.

Infrastructure in the study area plays a pivotal role in the accessibility and connectivity of farmers to markets and resources. While the district has some road networks facilitating trade, other infrastructural challenges persist, impacting transportation and the timely access to markets. Additionally, the availability of services such as education, health, and agricultural extension can significantly influence the overall quality of life and economic opportunities for the residents.

The environmental landscape of Kafta-Humera is characterized by a mix of highland and lowland terrains, with the Tekeze River flowing along the eastern boundary and the Ruba-Kazza (Bahreselam) River. The district's climate and topography significantly affect agricultural practices and productivity, with variations in rainfall patterns influencing crop yields.

2.2 Research Design and Data Type

This study employed a mixed-methods research design, integrating both quantitative and qualitative approaches to provide a comprehensive analysis of the socio-economic and institutional determinants affecting smallholder farmers' participation in the sesame value chains in Kafta Humera, Ethiopia.

1. **Quantitative Component**: A cross-sectional survey was conducted to collect quantitative data from a statistically representative sample of smallholder farmers engaged in sesame production. This component aimed to identify and quantify the relationships between various socio-economic factors (e.g., education level, access to credit, land size, and market access) and farmers' participation levels in the sesame value chains. Structured questionnaires were utilized to gather data on demographic characteristics, farming practices, market engagement, and perceived barriers to participation.
2. **Qualitative Component**: In-depth interviews and focus group discussions were carried out to enhance the understanding of the complex realities that smallholder farmers encountered in their participation in the sesame value chains. This component provided rich contextual insights into the socio-cultural, institutional, and environmental factors influencing their decisions. Purposive sampling was employed to select participants who had varying experiences and levels of engagement in the sesame value chains, ensuring a diverse range of perspectives and insights.

Type of Data

1. Quantitative Data: The quantitative data collected through surveys were numerical in nature, enabling statistical analysis. Key variables included:

- **Demographic Information: Age, gender, education level, household size, etc.**
- **Socio-Economic Factors: Income levels, farm size, access to credit and extension services.**
- **Participation Indicators: Quantity and value of sesame produced, marketing channels used, and frequency of market participation.**

Data analysis involved descriptive statistics, correlation analysis, and regression models to determine the significance of various factors influencing participation.

2. **Qualitative Data:** Qualitative data were gathered through open-ended questions during interviews and focus group discussions. This data included:

- **Experiences and Perceptions: Farmers' views on barriers to participation, benefits of engagement in the sesame value chains, and the role of community networks.**
- **Institutional Context: Insights into the effectiveness of local cooperatives, extension services, and market information systems.**

2.3 Sampling Technique

For this study, a multistage sampling technique was employed to ensure a robust and representative sample of smallholder farmers involved in the sesame value chain in Kafta Humera district. The sampling process is detailed as follows:

Stage 1: Selection of District and Kebeles

The first stage involved purposive sampling to select the Kafta Humera district, recognized for its significant sesame production. Within this district, specific kebeles were chosen based on the density of sesame producers. The selection was guided by available agricultural data that indicated the number of sesame farmers in each kebeles, ensuring that more productive areas were represented in the sample.

Stage 2: Proportional Stratification of Households

In the second stage, household heads were proportionally stratified based on the number of sesame producers identified in each village. The following steps were taken during this stage:

1. Data Collection: The total number of sesame producers in each selected village was documented to facilitate proportional allocation.
2. Calculation of Proportions: Using the total number of producers across all selected Kebeles, the proportion of sesame farmers in each village was calculated.
3. Sample Size Distribution: The total sample size of 150 household heads was then allocated proportionally to each kebele according to the previously calculated proportions. This process ensured that the sampling reflected the actual distribution of sesame producers across the Kebeles of Maykadra and Adebay.

Sampling size was computed by Cochran's(1977)proportionate to size sampling methodology.

$$n = \frac{z^2}{\varepsilon^2}(pq)$$

Where

Z= 95% degree of confidence (1.96)

p= population proportion (0.11) of target population and the balance q (0.89)

n = the sample size

e=allowable error

Accordingly, the sample size is estimated to be 150 units.

Table 1: Distribution of Sample Respondents by kebele

Name of kebele	Household Head	Sample Size
Maykadra	3200	87
Adebay	2300	63
Total	5500	150

Source: survey result 2017

2.4 Data Analysis

Quantitative approach was employed to explore the farmers' level of participation on value chains whereas econometric analysis (Tobit Model) was used to analyze factors affecting level of farmers' participation on sesame value chain.

The Tobit model is a statistical model proposed by Jemes Tobin (1958) to describe the relationship between a non-negative dependent variable yi and an independent variable xi. The Tobit model can be described in terms of a

latent variable y*. The latent variable yi* is observed if and only if yi* >0 and is not observed if yi* ≤ 0. Then the observed yi will be defined as:

$$y_i = \begin{cases} 1 \; if \; y_i^* \; > 0 \\ 0 \; if \; y_i^* \; \leq 0 \end{cases}$$

The Tobit model also called a censored regression model, because some observation on yi*

(those for which yi* ≤ 0) are censored. The objective is to estimate the parameters β and σ.

Therefore, the censored Tobit linear model was specified as:

yi*=β0+β1x1+ β2x2 + β3x3 + β4x4 + β5x5 + β6x6 +β7x7+β8x8+ β9x9 + β10x10 + β11x11 +ui and u~N (0, σ2)

Where

Yi = farmer's level of participation in sesame value chains (ratio of sesame land covered

to total operating land in hectare)

Xi is the vector of exogenous explanatory variables expected to influence the level of participation probability.

βi=coefficients to be estimated

ui=error term

2.5 Operational Definitions of Variables and Working Hypothesis

The important variables investigated in the research are, dependent and independent variables. Dependent variable is a variable that is affected or explained by another variable. An independent variable is a variable that causes change in another (Sarantakos, 1988)

Dependent Variable

The dependent variable(Y)for the level of participation is defined as the ratio of land allocated to sesame in 2015/16 production to the total land managed by the individual farm in that specific production season of (2015/16).

Independent Variables:

Age of Household Head (AGEHH): This is a continuous variable and defined as the number of years of household head age. In this study, it is assumed that as farmers age, they acquire knowledge and experience through continuous learning, which helps them to actively participate in the production of market-oriented cash crops (Liu & Sun, 2020). Thus, in this study, this variable is used as a proxy for farmers experience in farming.

Sex of Household Head (SEX): This is a discrete variable that takes a value of "1" if the household head is male and "0", otherwise. In this study, it is assumed that male household heads have more exposure and access to information and new interventions than female household heads, which might enable them to participate in production of sesame (Alene & Coulibaly, 2009). Thus, male household head is taken as a reference variable and is expected to participate more than female household head.

Livestock Number (TLU): This is a continuous variable measured in tropical livestock unit.

Farmers who have a number of livestock are expected to allocate a large share of their cultivated land for cereals compared to sesame in order to obtain animal feeds like straw or stover (Muhoza & Karanja, 2018).

Educational Level of Household Head (EDCN): It is generally recognized that education equips individuals with the necessary knowledge of how to make a living, and it is a discrete variable. Thus, for the purpose of this study, it is believed that those who are literate and have at least some education are better able to make the transition to cash crops (Ouma & Ng'ang, 2014). This is so because it is believed that producers with higher levels of education tend to have greater access to production and market information, and are therefore expected to produce market-oriented cash crops.

Number of Active Family Labor (FAMLAB): This is a continuous variable referring to farmers access to family labor. In this study, we consider active family labor as those who can participate in agricultural activity in the household.

Thus, this variable is expected to positively affect the probability decision to produce sesame and the amount to be produced (Agyeman & Tuffour, 2017). This is because sesame is a labor- intensive crop, requiring high labor, and in these rural areas, there is no market for labor, or if any, imperfect. Thus, family labor is the main source of labor force in such cases.

Access to Extension Service (Exten advice): Access to agricultural extension advice have a positive influenced to the level of farmers participation on sesame value chains (Davis & Heemskerk, 2012).

Access to Credit (CREDIT): It is a dummy variable, which takes value 1 if farmers have access to credit service and 0 otherwise. Since production of any cash crop requires capital, which is lacking for poor smallholder farmers, we expect that this variable to significantly explain smallholder farmers' decision to produce sesame (Edeh & Okwu, 2018). Sesame, in particular, , requires high capital throughout its production processes; farmers who have more access to credit services are expected to produce market-oriented cash crops like sesame.

Households Access to off-farm Activities (NONFRM): This is a dummy variable indicating farmers access to off-farm activities. If farmers have access to alternative works to farm income sources, they are less likely to participate in sesame production. On other hand, since sesame production requires high working capital, it is argued that farmers who have access to non-farm activities and generate additional income, will likely produce high value cash crops such as sesame (Zhao & Zhang, 2016). There, the impact of this variable on farmers decision in sesame production participation is indeterminate (either positive or negative).

Households Membership Status in Local Cooperatives (MEMCOP): It is conceivable that, cooperatives have a number of contributions for smallholder rural farmers in developing countries. For example, cooperative institution provide necessary inputs, market information and buy their produce at a better prices (Karanja & Nihuka, 2018). In this study, we expect farmers who are members of local cooperatives to be more likely to produce sesame and earn better income in the study area.

Distance of Sesame Farm to the Nearest Market (DSTMRKT): This is a continuous variable represented by walking time (in minute) from home to the nearest market place. Proximity to market centers motivates farmers to produce market-oriented crops by providing easy access to inputs and market related accesses such as transportation and price information (Jabba & Ahmed, 2016). It is, therefore, expected that households living nearer to market center have better chance of participating in sesame production and receiving better prices for their produce than others.

Access to Market Information (MRKTEINFO): This is a dummy variable taking value 1 if farmers have access to price information by any means, and 0 otherwise. This is an important variable in any marketing because price information highly influences the commodity prices, and hence has a significant impact on income earned. Therefore, it is hypothesized that access to price information positively affects the income earned from sesame sale in the study area.

Table 2: Hypothesis Summary

S/no	Variables code	Unit of measurement	Definition of variables	Expected sign
1	SEX	Dummy	Gender of the household head	+
2	AGEHH	Continuous	Age of household head	+
3	EDCN	Dummy	Education Level of the household head	+
4	TLU	Continuous	Total livestock unit	+
5	FAMLAB	Continuous	Number of active family labor	+
6	CREDIT	Dummy	Access to credit services	+
7	NONFRM	Dummy	House hold access to off farm activities	-
8	EXTN	Dummy	Access extension services	+
9	MEMCOP	Dummy	Households membership status in local cooperatives	+
10	DSTMKT	Continuous	Distance of sesame farm to the nearest market center	+
11	MKTINFO	Dummy	Access to market information	+

Source: own compilation

3 Results and Discussion

3.1 Demographic and Socioeconomic Factors

Questionnaires were distributed to 150 farm households. Out of these, 15(10%) questionnaires were incomplete during data entry and it was not utilized in the analysis. Hence, this data analysis mainly focuses on 135 respondents ; this has high response rate (90%).

A household is the primary unit of analysis. Accordingly, household characteristics like; sex, age, family size and educational level were believed to influence the level of sesame production. Of the total sample respondents, 96.3% were male-headed households, while the remaining 3.7%were female-headed households (Table 1). With regard to educational status, 65.2% and 34.8% were literate and illiterate respectively. Of the total sample respondents, 99.3% were Orthodox Christians, while the remaining 0.7% were Muslims. Furthermore, among the total sample households 94.1% were married. However, household religion and marital status were not expected to influence the level of sesame production.

Table 3: Demographic Features of the Households

Variable	Items	Frequency	Percent
Sex	F	5	3.7
	M	130	96.3
	Total	135	100.0
Marital status	Married	127	94.1
	Unmarried	1	.7
	Divorce	6	4.4
	Widowed	1	0.7
	Total	135	100
Household	Orthodox	134	99.3
Religion	Muslim	1	0.7
	Total	135	100.0
Literacy	Illiterate	47	34.8
	Literate	88	65.2
	Total	135	100.0

Demographic and Socioeconomic Factors (continuous variable)

Most of the sampled sesame producers (96.6%) in the study area were categorized among the active labor groups. Thus, the average age of the sampled farm household heads was 47.57 years.

Furthermore, the average family size of the total sample respondents was found to be 5.73 persons per household (Table 4). Additionally, the average farming experience related to sesame production was 18.69 years.

Table 4: Demographic Features of the Households

Variable	Minimum	Maximum	Mean	St. Deviation
Age of the household	27.00	80.00	47.57	10.6
Household members between age of fifteen to sixty four	1	9.00	3.38	1.61
Total family size of the house hold	1.0	12.00	5.73	2.10
Years of farming experience of the house hold	1.00	47.00	18.69	7.74

3.2 Production Overview

According to Cotula et al. (2004), land is characterized as the most important economic asset for the majority of rural dwellers in developing countries. Hence, households possess land in different forms to sustain their livelihoods. Moreover, own landholdings of the sample respondents ranged from 1 hectare to 400 hectares with an average of 15.45 hectare per household. They also acquired additional land, up to a maximum of 200 hectares and 15 hectares, through rented-in and shared-in respectively (Table 5).

Table 5: Sample Respondents of Land Tenure Characteristics

Land Tenure Characteristics	Minimum	Maximum	Mean	Std. Deviation
Cropland own	1.00	400.00	15.4529	44.30168
Cropland rented in	1.00	200.00	13.5083	29.64929
Crop land rented out	---	--	--	---
Cropland shared in	2.00	15.00	6.80	4.91709
Cropland shared out	--	---	---	----
Total land managed	1.00	400.00	20.5719	47.04611

Source: survey result 2017

3.3 Land Allocation for Sesame Production

Based on the survey analysis, the average land allocated for sesame production ranges between 1 and 150 hectares. The average seed amount used per hectare was 4.86 kg and the average yields of sesame was found 3.7 quintal per hectare (Table 6).

Table 6: Land Allocation for Sesame Production

Land Allocation	Minimum	Maximum	Mean	Std. Deviation
Area covered by sesame(in ha)	1.00	150.00	12.6	24.5
sesame seed amount needed (kg/ha)	2.50	10.00	4.86	1.39
Estimated quantity gained (qt/ha)	0.36	8	3.7	2.13

Source: survey result 2017

3.4 Access to Extension Services

Technical advice provided by the extension agent was much lower and households in all of the study areas were not satisfied with the technical advice provided (Table 7). Based on this, farmers in the study area are lacking basic agricultural extension services such as training, demonstration, field days, and agriculture extension programs via radio.

Table 7: Access to Extension Services

Variable	Items	Frequency	Percent
Participation on training	No	105	77.8
	Yes	30	22.2
	Total	135	100
Participation of visiting demonstration on other farmers farm	No	125	92.6
	Yes	10	7.4
	Total	135	100.0
Participation by hosting demonstration	No	133	98.5
	Yes	2	1.5
	Total	135	100.0
Participation on field day visit with in kebele	No	130	96.3
	Yes	5	3.7
	Total	135	100.0
Participation visit outside PA	No	129	95.6
	Yes	6	4.4
	Total	135	100.0
Participation in agricultural extension radio programs	No	111	82.2
	Yes	24	17.8
	Total	135	100.0
Participation with development agent contact	No	95	70.4
	Yes	40	29.6
	Total	135	100.0

3.5 Factors Affecting Level of Participation

To identify the factors which affect the level of participation and intensity a tobit is estimated and results are depicted in Table 8 below.

Table 8: Determinant factors that affect the level of farmer's participation on sesame value chains

Number of obs = 135

Log likelihood = -81.268394 R2 = 0.1727

Tobit Regression Prob > chi2 = 0.0004

	Coefficients (dy/dx)	P-value
Farmer's level of participation in sesame value chains (area of sesame in 2015/2016 divided total land managed in 2015/2016) which is censored between [0,1]		
Age (in years)	-0.0001744	0.964
Sex of the household head (0=female 1=male)	0.3568207	0.057*
Education level of the household (0=illiterate 1=literate))	0.105374	0.166
Total livestock unit (TLU)	-0.0019604	0.449
Access of household non-farm income(0=no 1=yes)	-0.0688804	0.384
Distance of sesame farm to nearest market center(Km)	-0.0057972	0.034**
Access to market information (0=no 1=yes)	0.254395	0.010***
Access to credit (0=no 1=yes)	-0.2129256	0.004***
Access to extension service(0=no 1=yes)	0.0186517	0.797
Household membership in local multipurpose cooperative(0=no 1=yes)	-0.3203964	0.005***

dy/dx is for discrete change of dummy variable from 0 to 1 y = Linear prediction (predict) , = .68376261 :Significant level: * = 10%; ** = 5%; *** = 1%

As hypothesized, Sex of the household head had positively and statically significance at 10 percent (P=0.057). This means that male farmers who participated in sesame value chains allocated larger share of land to sesame production compared to female counterparts. Specifically, being male-headed households, the level of participation in sesame value chains increased by 36% (Table 4). This suggests that male-headed households are more market oriented than female; male-headed households are believed to have strong bargaining power which in turn increases the proportion of sesame sales. Hence, they participate more in the production of cash crops like sesame. This finding is in line with the arguments made by Mutayoba, & Ngaruko (2015) that sex of the household head significantly and positively influences the extent of market participation in which unit of increase by one male increases the proportion of tomato sale by 12.8 percentage in Tanzania.

As expected, the distance of sesame farm to the nearest market center (Km) significantly influences the level of participation in sesame value chains in the study area, which is statistically significant (P=0.034) at less than 5 percent probability level. The estimated coefficient for this variable shows a negative correlation between households' sesame farms from the nearest market center and level of sesame participation in sesame value chains. It was noted that for every one-kilometer increase from the market center, the likelihood that the level of farmers' participation of sesame value chains decreased by 0.57%.

This result suggests that farmers who have farmland near to market centers have lower marketing cost, transportation costs and easier access to different buyers, as well as easier expected crop husbandry management and regular visits to the sesame farm. This finding is also similar to Bezu, & Villanger (2019), who indicated that distance to district center is negative and significant at 10% in the participation equation and negative and significant at 5% in the quantity equation in Tanzania. This also implies farmers living further from the district center are less likely to participate in cash crop market; and if they participate, they supply less than those who live close to the center.

Credit access had negatively significant influence on the level of participation in sesame value chains in the study area, which is statistically significant (P=0.004) at less than 1 percent probability level. The estimated coefficient for this variable shows that there is a negative correlation between households' access to credit and level of sesame participation in sesame value chains.

The study found that access to credit had a negatively significant influence on the level of participation in sesame value chains, with a statistically significant P-value of 0.004 at less than 1 percent probability level. The estimated coefficient indicates a negative correlation, suggesting that as credit access increases, the likelihood of farmers' participation in sesame value chains decreases by 21.29%. This inverse relationship can be attributed to several key factors. Firstly, households may choose to invest their credit in non-farm activities that offer quicker or more stable returns compared to sesame production due to concerns about the risks associated with low selling prices and the potential for market failures. This shift in investment priorities reflects a broader strategy to diversify income sources, which can detract from the resources allocated to sesame farming.

Additionally, the timing of credit plays a crucial role; farmers often require credit during the harvest season to cover labor costs and manage post-harvest storage, but if they have already allocated their credit elsewhere or cannot access it in a timely manner, this leads to decreased participation in sesame production. The bureaucratic hurdles and lengthy processes associated with obtaining credit can exacerbate these issues, causing delays that disrupt farming schedules and reduce productivity (Gela et al., 2019; Abate, 2019). Furthermore, while credit availability can facilitate investments, it can also lead to less intensive management of agricultural practices, as noted by Pender and Kerr (1998), causing farmers to place less emphasis on sesame cultivation in favor of alternative income-generating activities. Ultimately, the combination of risk aversion, opportunity costs, and behavioral factors—such as a psychological inclination to prioritize less risky investments—collectively justify the observed inverse relationship between credit access and participation in sesame value chains.

To access market information and production knowledge, farmers have to interface with a number of market and institutional actors who include traders, Radio/TV, ECX and cooperatives. In this study, results indicated that household access to market information had a positively and statistically significant (P =0.010) effect at less than 1 percent probability. This indicates that as market information increases by one, the likelihood level of farmers' participation in sesame value chains increases by 25.4%. This finding is in line with Goshme, Tegegne, & Zemedu (2018), who studied that access to market information positively and significantly affected market supply of sesame at 5% significance level. The positive sign indicated that as farmers have access to market information, the quantity of sesame supplied to market increases.

Household membership in local multipurpose cooperatives has a statistically significant negative influence on the level of participation in sesame value chains in the study area (p = 0.005), indicating that being a member of the outlet for cooperatives decreases by 32%. This finding contrasts sharply with insights from focus group discussions (FGDs) and key informant interviews, which highlighted the potential benefits of cooperative membership.

Despite recognizing the crucial role that cooperatives can play in value chain development, participants pointed out various challenges that undermine their effectiveness. The FGDs revealed that issues of trust among cooperative members are particularly detrimental. Farmers expressed concerns about "free riding" behaviors, where some members benefit from the collective effort without contributing adequately. This lack of trust often stems from insufficient internal and external communication, leading to a breakdown in collaboration.

Additionally, participants noted that a lack of transparency between cooperative administrators and members contributes to distrust. In many instances, administrators possess better information and knowledge (asymmetric information), which exacerbates feelings of disconnection and disenfranchisement among farmers. When farmers do not feel that their contributions are valued or that they are privy to important information, their motivation to engage with the cooperative diminishes.

Interestingly, this stands in stark contrast to the findings of Gebre and Haile (2019) and Workye (2019), which indicated that cooperative membership significantly and positively influences the choice of cooperative market outlets. In those studies, being a member of a sesame cooperative was associated with better access to market information and future returns commensurate with members' contributions. This divergence may reflect variations in the operational effectiveness and trust dynamics of cooperatives in different regions, as well as the specific challenges faced in the study area.

Overall, while cooperatives are positioned to facilitate farmers' participation in value chains, overcoming issues related to trust, transparency, and equitable management is essential for their success and sustainability. Addressing these challenges will be key to helping farmers realize the full benefits of cooperative membership in enhancing their role in the sesame value chain.

Concluding remarks

The study concludes that for a country with a total economic dependence on rain-fed agriculture like Ethiopian, there is a huge demand to strengthen the value chain aspects of high-value crops of which sesame takes a leading portion in the country and the study area in particular. The study further stated that access to market and credit, access to extension service and market information are primary ways to increase the levels of farmer's participation on sesame value chains. Authors also believe that high sesame production through increased farmers' participation would satisfy export market, resulting in considerable financial stability of the country. Hence, this calls stakeholders, such as farmers, investors, traders, exporters, concerned government bodies and research institutions to look forward to alternative ways of transforming from the subsistence agriculture to market orientation.

Based on the findings, authors suggest the following recommendations:

In general, the level of participation in sesame value chains in the study community is relatively low. Hence, researchers, extension agents, policy makers and farmers should collaborate in promoting the commodity, to bridge the current knowledge gap and to develop multiple technologies (packages) appropriate to the farmers' situations.

Being a male-headed household increases the probability of farmers' participation in sesame value chains. Therefore, sesame value chain should be gender- inclusive to address the crosscutting issue of gender mainstreaming for comprehensive development by providing training and credit facilities for female farmers.

Regression result revealed that the longer the distance from the market center, the lower the level of participation in sesame value chain. Therefore, in order to speed up expansion of this commodity in such areas, there is a need to make special emphasis to target these segments of the community by development agents. This should be accompanied by the development of infrastructural facilities. Household membership in local multipurpose cooperatives negatively affects farmers' participation in sesame value chain because farmers lack trust, free riding and control and management cost of members. Therefore, cooperative agencies should support cooperative leaders to be committed, accountable, to own sophisticated technologies and competent with sesame traders to benefit their members.

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Authors' Contributions

Kidane Tesfay: Managed the overall activities of the research (starting from data collection, data analysis, and wrote the paper)
Bihon Kasa: Advising and editing the paper
Weldmicheal Hailu: Advising and editing the paper

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Availability of Data and Materials

The datasets used and analyzed during the current study are available from the corresponding author upon request.

Ethics Approval and Consent to Participate

Not applicable

Consent for Publication

Not applicable

Competing Interests

We declare that we do not have competing interests.

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