

Full Length Research Paper

Value chain analysis of fruits: The case of mango and avocado producing smallholder farmers in Gurage Zone, Ethiopia

Selamawit Mengesha^{1*}, Dubale Abate², Chigign Adamu¹, Aklok Zewde¹ and Yonnas Addis²

¹Department of Plant Science, College of Agriculture and Natural Resource, Wolkite University, P. O. Box 07, Wolkite, Ethiopia.

²Department of Agribusiness and Value Chain Management, College of Agriculture and Natural Resource, Wolkite University, P. O. Box 07, Wolkite, Ethiopia.

Received 14 December, 2018; Accepted 2 February, 2019

The study was aimed to analyze avocado and mango value chains actors and identify factors that determine avocado and mango market supply in the selected area of Gurage zone. A total of 259 avocado and mango producers were selected through three-stage sampling technique and 151 traders from different level were used to collect primary data using questionnaire and semi-structured interview. Descriptive and econometrics method of analysis were applied for analysis. Value chain approach analysis result revealed that input suppliers, avocado and mango producer, collectors, wholesalers, retailers, and consumers were the main actors in avocado and mango value chain. The profitability and gross marketing margin approach of market analysis showed that wholesalers received the highest marketing margin (34.62%) and highest profit share (36.75%), while producers received the least marketing margins (15.17%) from avocado and mango trade. Generally, all market participants were operating at profitable level, but producers were relatively disadvantaged from the market as they received lowest share from consumers' price. Moreover, sex of household, land allocated to mango, market distance, farming experience, extension service, market price, and family labor determined mango market supply. Likewise, education level of household, market distance, farm experience, extension service, and family labor affected market supply of avocado. Accordingly, market performance of avocado and mango has shown that producers were relatively disadvantaged and various determinants contributed to reduced market supply of mango and avocado. Therefore, strengthening of extension service and education of farmers, efficient use of family labor, and improvement of farmers' experience and infrastructure is recommended.

Key words: Avocado, mango, value chain.

INTRODUCTION

The fruit crops sub-sector is one of the strategic priorities as it plays a significant role in the local economy as a

means of earning livelihoods for farmers, creating jobs and generating foreign exchange revenues in Ethiopia.

*Corresponding author. E-mail: selilove21@gmail.com.

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The country puts greater emphasis on increasing production of fruit crops by nearly half at the end of Second Growth and Transformation Plan (GAIN, 2018).

Fruits are important ingredients of Ethiopian kitchen during fasting times. However, per capita consumption of fresh fruits in Ethiopia equals around 7 kg per person per year, which is 8 times lower than the average amount for the East Africa region, which stands at 55 kg per person per year and 21 times far below the World Health Organization (WHO) and Food and Agriculture Organization (FAO) recommended minimum level of dietary intake, and may be due to low income, below capacity production and weak dietary habits resulting from inadequate awareness of nutritional benefit (GAIN, 2018).

The production of fruit crops are estimated at 780,000 metric tons, nearly 760,000 metric tons of which is destined for domestic consumption. Mango (*Mangifera indica* L.) and avocado (*Persea americana* Miller.) are among the dominant fruit crops next to banana in terms of area coverage, total production and export value in Ethiopia. The South Western part of Ethiopia is the key production belt for them. The production of mango and avocados are contributing to 14 and 10% of the national fruit production years, respectively, covering about 18 and 15% of the harvested area of fruit crops in the country, respectively. South Nation and Nationalities (SNNPR), Oromia, and Amhara regional states are the major growing areas of edible fruits. These regions have the largest potential for production increases using rain-fed as well as irrigated commercial farming systems (CSA, 2017).

There has been increased progress in production and consumption of fruits. The production and cultivated land for mango and avocado were increased by half over the last five years (CSA, 2017). However, the national average yield of fruits in general, mango and avocado in particular showed fluctuation and vary across these fruit crops. Hence, yield per hectare for mangos had declined whereas yield of avocados has increased during these five-year periods (GAIN, 2018).

Moreover, fruits are important source of income for millions of households in Ethiopia. This is also true for producers, traders and processors found in the study area. However, sustainability in fruit production like mango and avocado becomes questionable as a result of disorganized marketing and value chain actors' coordination system (Nega et al., 2016). Unsustainable supply of these fruits was a result of dynamic changing of the consumers taste in urban areas, rain fed dependent production, and subsistence-oriented level of production is great problem for development of agriculture in developing countries (ACET, 2012).

Gurage zone, where this study was conducted, is one of the potential areas where large varieties and amount of fruit crops were cultivated. However, downstream value chain actors of fruit value chain namely consumers and

processors were always constrained by ineffective fruit value chain development, which leads to great price fluctuation, high consumer with low producer price and absence or few market provisions. There is no effectively developed fruit value chain working mechanisms in the study area and most value chain actors were targeted to enhance his/her own benefit, and also compete with other actors with in fruit value chain. This shows that there are certain factors that hinder the producers not to get the direct market chain so as to benefit from better price and also obtain better profit for their resources.

In spite of all the aforementioned constraints, this study was aimed to identify the value chain actors and their role, assess the value share among participants, and identify determinant factors of avocado and mango market supply in the study area.

RESEARCH METHODS

Description of the study area

The study was conducted in Gurage zone (Figure 1). It is located 155 km south of Addis Ababa, capital city of Ethiopia. Abeshge, Cheha and Kebena are among 13 districts under the Zone with a relatively great potential in avocado and mango production. A total population of 73,123, 62,353, and 14,644 were living in Abeshge, Kebena and Cheha, respectively (CSA, 2016).

Data sources and collection methods

The data was collected from primary and secondary data sources using formal and informal sample survey method. Primary data were collected through pre-tested structured and semi-structured interview schedules.

The primary data that were gathered from farmers include educational level, credit and extension service availability, farming experience, cost of production, quantities produced and sold, potential buyer of their product, and price related information, quantity of avocado and mango sold in 2016/17 production year.

Secondary data were collected from the Central Statistical Agency, published and unpublished sources, District Agricultural and Natural Resource Office, and Trade and Industry Office of the districts.

Sampling method and sample size

Three stage sampling technique were employed to obtain representative respondents. In the first stage, out of 13 districts in Gurage Zone, 3 districts, namely Abeshige, Cheha and Kebena districts were selected based on their avocado and mango based on their relative production potential. Then, in the second stage, 3 *kebeles* (county) from each district were selected randomly. Finally, out of 3765 avocado and mango producers, 259 were selected randomly using probability proportion to population size sampling technique.

The total sample size (n=259) was determined following a simplified formula provided by Yamane (1967). Accordingly, the required sample size at 90% confidence level with degree of variability of 5% and level of precision equal to 6% were used to obtain a sample size required to represent the true population.

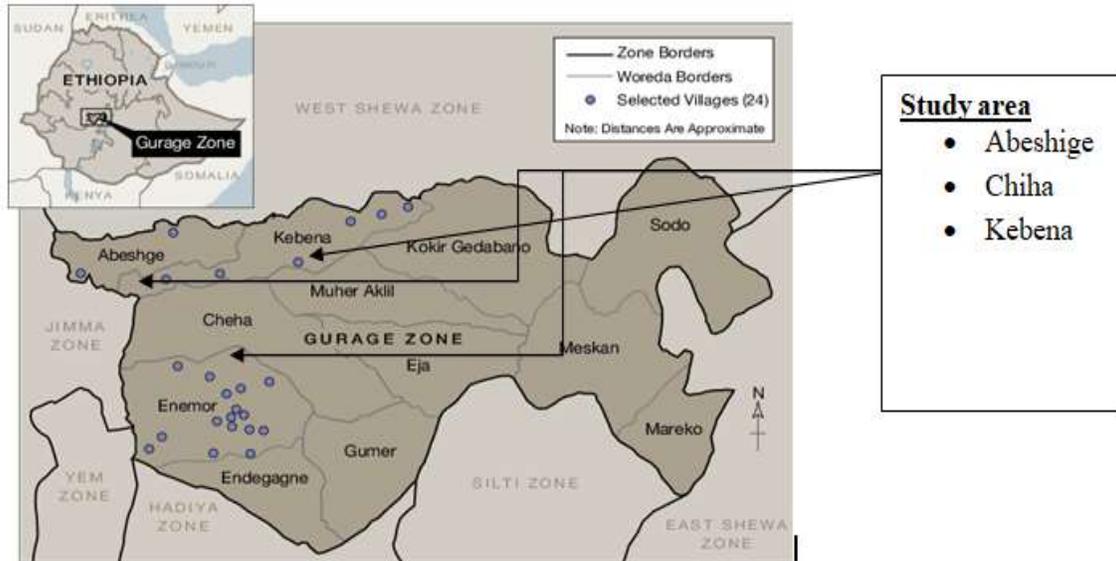


Figure 1. Location Map of study site.

$$n = \frac{N}{1 + N(e)^2}$$

Where: n = sample size, N = population size (sampling frame) and e = level of precision.

Using the above formula 85, 83 and 91 farmers producing both fruits were selected from Abeshige, Cheha and Kebena district, respectively. Besides about 46, 11, 20, 50, and 24 collectors, processors, wholesalers, retailers, and consumers were randomly taken, respectively.

Methods of data analysis

Descriptive method of analysis specifically value chain approach and gross margin approach were applied to map the value chain of these fruits and to estimate value share of market participants, respectively. Furthermore, econometrics model was employed to examine factors that had effects on supply of mango and avocado.

Value chain approaches were used to identify actors, their interaction and roles in avocado and mango value chain. The following stages were followed in value chain analysis. In the first stage, the main value chain actors and their roles were identified and mapped. Then, based on the direction of product flow, the existing market channels were designed. Likewise, gross market margin approach was used to analyze value share among avocado and mango participants. Hence, gross market margin in each market participants was calculated as follows (Mendoza, 1995):

$$\text{Market margin} = \frac{\text{Consumer price} - \text{Producers price}}{\text{Consumers price}} \times 100$$

Producers share from consumer price was calculated as:

$$\text{Producer share} = \frac{\text{Consumer price} - \text{Market margin}}{\text{Consumers price}} \times 100$$

Traders share was calculated as:

$$\text{Traders share} = 1 - \frac{\text{Market margin}}{\text{Consumers price}} \times 100$$

Multiple linear regression model was employed to identify factors affecting market supply of avocado and mango in the study area. The model was selected from other models with the reason that, all sampled mango and avocado producers have been supplied their produce to market. The dependent variables as continuous variables were measured as the amount of avocado and mango marketed by sampled households in 2016/17 production year in quintal. A combination of both quantitative and qualitative explanatory variables was hypothesized and used to determine the significant effect of each set of explanatory variables on the dependant variables. Accordingly, the econometric models were developed based on Green (2003) and specified as below

$$Y_i = \alpha_i + \beta_1 \text{Sex} + \beta_2 \text{Age} + \beta_3 \text{Family size} + \beta_4 \text{Education} + \beta_5 \text{familylabour} + \beta_6 \text{Distance} + \beta_7 \text{Experience} + \beta_8 \text{labour source} + \beta_9 \text{Extension} + \beta_{10} \text{Price} + \beta_{11} \text{Difficulty buyer} + U_i$$

Where: Y_i= quantity of mango and avocado supplied to market, α_i= intercept, β_i =coefficient of ith explanatory variable, U_i= disturbance term.

Three most important diagnostic tests were done, namely; heteroscedasticity, specification of error and multicollinearity. Heteroscedasticity problem was observed in data set and then robust command was used to overcome the problem.

RESULTS AND DISCUSSION

Demographic and socio-economic characteristics of farm households

Primary data were collected from a total of 259 sampled

Table 1. Demographic and Socio-economic characteristics of farm households.

Continuous/ discrete variable	Mean	Minimum	Maximum	Standard deviation
Age (year)	49.46	19	67	10.34
Family size (number)	2.35	2	6	2.74
Educational level (year of schooling)	1.75	0	10	3.09
Experience to mango production (year)	11.57	7	31	8.21
Experience to avocado production(year)	12.37	7	25	9.3
Distance from nearest market (walking hour)	0.325	0.1	1.25	0.658
Frequency of extension contact (number)	1.85	0	7	4.25
Dummy/ categorical variables			Proportion	
Sex of a household head (male)			0.847	
Marital status				
Single			0.188	
Married			0.707	
Divorced			0.032	
Widowed			0.073	

Source: Computed from Survey Data (2016/2017).

households found in Abeshge, Cheha and Kebena districts of Gurage zone. The list of variables used in the analysis of the study is given in Table 1. About 84.7% of the respondent was males whereas about 70.7, 18.8, 3.2, and 7.3% of the sample respondents were married, single, divorced and widowed, respectively.

The overall mean age of the sampled respondents were 49.46 years with standard deviation, maximum and minimum age of 10.34, 67 and 19, respectively. The mean year of schooling of respondents was 1.75 years. On average, the respondents were contacted by development agent 1.85 times per year. The average family size of a household was 2.35 and the respondents travelled 0.325 h to reach nearest market to supply mango and avocado. Moreover, the mean mango and avocado production experience of respondents was 11.57 and 12.37 years, respectively.

Map of mango and avocado value chain

As depicted in Figure 2, value chain map involves various linkages among the growers, input suppliers, transporters, and traders of mango and avocado. The value chain map for the three districts followed similar trend and mapped together including main actor, activities and supporters. The map illustrated function of the main actors in the left, main actors on the middle, and supporters on the right side with all of them lying vertically.

Value chain actors and their roles

Mango and avocado value chain actors were those individuals or stakeholders who engaged in any field of

activities or service provision either directly or indirectly at any stage of the value chain.

Input suppliers: these could provide inputs for avocado and mango producers. Based on the result obtained from the study, most of avocado and mango farmers used their own seed and organic fertilizers like compost and manure for their production. District agricultural office, primary cooperatives union, other farmers, and local markets were also alternative input providers for farmers in the study area. Takele (2014) also stated that the major sources of inputs for mango production in Ethiopia are farmers by own endeavors, agricultural offices and markets.

Avocado and/or mango producers: these were smallholder farmers who grew mango and avocado, and supplied such to wholesalers, retailers, processors and local collectors. They could perform value addition activities like sorting and transporting to get additional benefit. They would stay in long period in both production and marketing of fruits like avocado and mango and tried to benefit from available opportunities. However, most of the farmers in the study area were challenged by post harvest handling problem, lack of linkage among participants (91.97%), and inability of using technology to produce. According to Bezabih (2010), the producers are mainly smallholder farmers who supply the product to the local traders, cooperatives, retailers and consumers.

Local collectors: these were actors collecting mango and avocado fruits either from farmers' farm or other farmers in relatively lower price and supplying it to wholesalers, retailers and consumers. Collecting, buying, assembling, repacking, sorting, transporting and selling

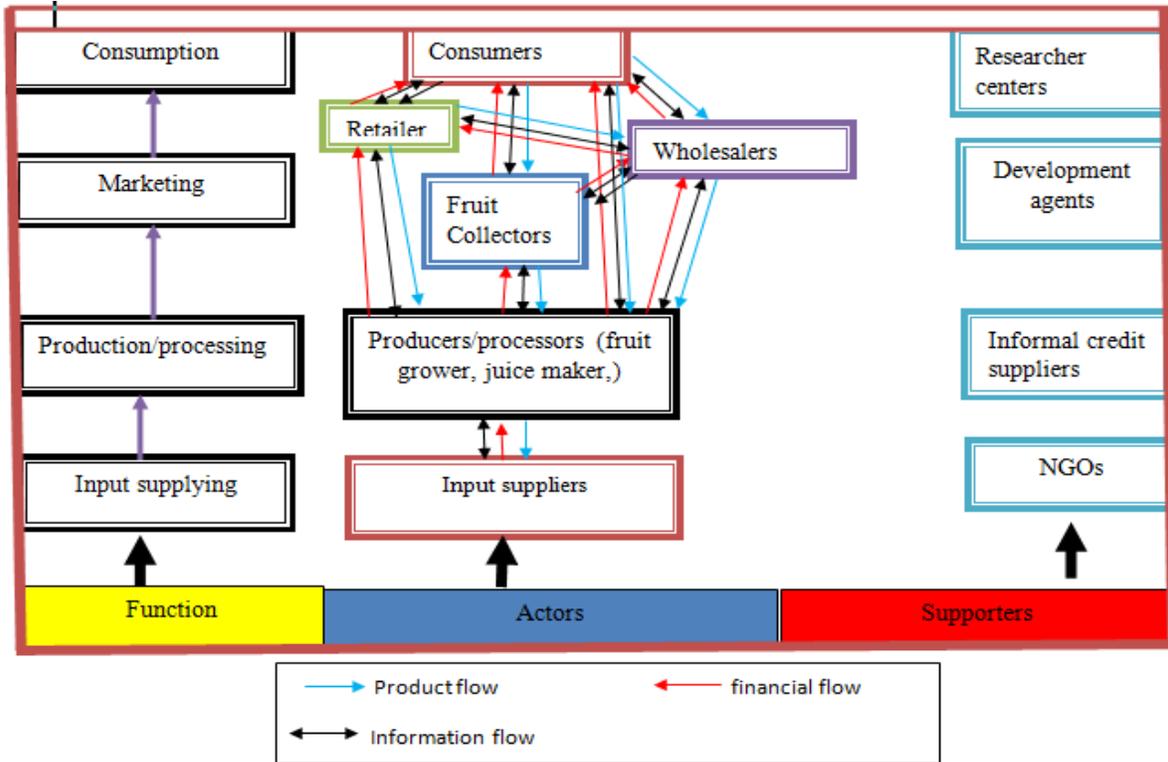


Figure 2. Value chain map of Mango and Avocado in the districts.

were some of the activities done by them. They often received cash from wholesalers either after or before selling. The flow of finance was coming only from the buyer’s side. The collected product was mostly supplied to Gubrie, Emdibir and Wolkite Markets which were found in the zone. The traders organize teams of ‘brokers’ to pick mangoes at the farms and then pack them onto trucks which leave directly for marketing; also, it is an effective operation for the traders; though it does mean that farmers are unable to derive further value from their crop through effective picking, grading, packaging, bulking and marketing (James et al., 2008).

Wholesalers: were those who bought large quantity of avocado and mango and then sell to the other traders. They purchased the fruits from other actors like producers and resold it to retailers (57.1% mango and 55.2% avocado) and consumers (42.9% mango and 44.8% avocado). They also had better information and financial capacity to get bulky commodities rather than other actors.

Retailers: were the main participants, who purchased the fruits from either producers or wholesalers in small volume and delivered them to consumers. They had limited working capital and handling relatively small volume of avocado and mango compared to other traders.

Consumers: were those who bought avocado and mango fruits for consumption. Restaurants, fruit juice householder, travelers, producers and residents were among the consumers in the study area.

Market performance of avocado and mango

Marketing margin and marketing profits were used to analyze the performance of avocado and mango market; and the average purchasing price, marketing cost and selling price were used to estimate the profit margin share of each market actors. Producers, collectors, wholesaler and retailers were important market actors in avocado and mango value chain.

As illustrated in Table 1, the market margin share of avocado producers, collectors, wholesalers, and retailers were 15.17, 16.24, 34.62 and 33.97%, respectively. The profit share of avocado producers, collectors, wholesalers, and retailers were 18.09, 13.41, 36.75, and 31.75% respectively. Likewise, the percentage market share of mango producers, collectors, wholesalers, and retailers were 17.51, 16.27, 36.01 and 30.21, respectively. The percentage profit share of the producers, collectors, wholesalers, and retailers were 21.72, 14.57, 38.31 and 25.40%, respectively. Generally, the performance result implied that all market actors for both fruits were operated at profitable level. The share of producers was less than

traders and consequently producers were relatively disadvantaged from avocado and mango market.

Determinant of marketed supply

Based on multiple linear regression models, the F-value of the model from the analysis was 87.7 and 28.59 for mango and avocado, respectively. This implies that the fitness of the model to explain effect of hypothesized variable was satisfactory and it was significant at 1% significant level. Coefficient of multiple determinations (R^2) showed 65.25 and 56.25% of the variation in the farm level market supply of mango and avocado, respectively were explained by the hypothesized explanatory variables.

The model output (OLS estimation) revealed that, among the hypothesized 11 variables only seven of them, namely sex of household, land allocated for mango, distance to nearest market, farm experience, extension service, price information, and family labor were found to be significantly determined marketed supply of mango.

Sex of household head: This variable had a negative and significant effect on the volume of mango market supply and it was significant at 10% significant level. Male household heads could supply 9.34% less mango to the market than the counterpart, keeping other factors constant. Traditionally, fruit is assumed to be grown around home and more likely to be grown by females. As a result, decision to supply and meeting households' requirement belongs to females.

Land allocated to mango: This variable was significantly and positively related with the amount of mango supplied to the market and it was significant at 1% level. As size of land allocated to mango increased by one hectare, the amount of mango supplied to the market increased by 17.12 qt. This result was similar to the finding by Addisu (2016) and Aman et al. (2014) who found that the size of land allocated for horticultural crops and potato, respectively increased quantity of produce available for sale.

Distance to nearest market: This negatively and significantly affected the market supply of mango at 1% level. As distance between households and nearest market increased by one waking hour, market supply of mango decreased by 1.29 qt keeping other factors constant. Therefore, remoteness to market determined market supply trends of both fruits due to the fact that far market leads to higher market cost and thereby reduces household's interest to produce more fruits for market. This result was consistent with the work of Holloway et al. (1999); Wolday (1994) and Ayelech (2011) who indicated that distance to market caused market surplus to decline.

Experience in mango production: This variable significantly and positively determined mango market supply at 1% significant level. The result revealed that as experience of mango farmer increased by one year, the mango supplied to market increased by 2.46 qt. This result was in line with Abriham (2013) who found that as the farmer's farming experience of vegetable production increased by a year, the market supply of vegetable also increased.

Extension service: This variable was significantly determining marketed supply of mango at 5% significant level. As number of extension contact increased by one additional contact, the marketed supply of mango increased by 2.06 qt, keeping other factors constant. The reason behind this may be as the farmer gets more extension service, they could have full information about the market and supply mango in the market. Study by Ayelech (2011) who revealed extension service avails information regarding technology which improves education that affects the marketable surplus.

Price of mango: This variable was significant at 5% level and positively related with marketed supply of mango. As the price of mango increases by one birr, the quantity of mango supplied to the market will decrease by 24.72 qt, keeping other factors constant. This may be due to the reason that price serves as an incentive for producers to increase production and marketed supply. The result was in agreement with the study by Ayelech (2011) who confirmed that a unit price increase in the avocado market directs to the household to increase yearly avocado sales to market. The result also coincides with the findings of Wolelaw (2005) who stated that as the price for products in the market increased, there will be higher supply of products.

Active labor force: This variable was negatively associated with mango marketed supply and it was significant at 1% level. As family labor increased by one-person, marketed supply of mango decreased by 5.74 qt. Most producers used family labor source for mango production which is characterized by inefficient use of resource including time, thus reducing mango production and productivity. In other word, as production declined, fewer amounts of the products are available for sale and thereby affecting marketed supply. According to Wolday (1994), marketable supply of agricultural product could be affected by family size, access to labor and age.

Similarly, five variables namely educational level, extension service, farm experience, labor sources, and distance from nearest market significantly affected marketed supply of avocado in the study area.

Education level of household: As hypothesized, this variable positively and significantly determines the volume of avocado marketed at 1% significance level. As

years of schooling of household heads in formal education increased by one year, the amount of avocado supplied to market increased by 8.11 qt, keeping other factors constant. This implied that spending more years in formal education would improve household ability to gain new knowledge and encourage producers to be market oriented. This is also in line with previous studies conducted by Ayelech (2011) and Amare (2013), who found that if avocado and pepper producers gets educated, the amount of avocado and pepper supplied to the market increases, respectively.

Distance to the nearest market: Distance from market had a negative and significant effect on the supply of avocado to the market and it was significant at 1% level. This means that as distance from nearest market increased by one hour on foot, the volume of avocado supplied to market decreased by 1.13 qt, keeping other factors constant. The result is consistent with the finding by Abriham (2013) who illustrated the inverse relation distance to market on the cabbage market supply.

Experience in avocado production: It was significant at 10% level and affected the volume of avocado marketed as expected. Thus, the result implied that, as farmer's experience increase by one year, the avocado supplied to market increased by 0.72 qt. This result coincided with works of Ayelech (2011), El et al. (2013) and Addisu (2016) who illustrated that as farmer's experience increased, the volume of avocado, crops supplied and onion to the market has increased, respectively.

Frequency of extension contact: As hypothesized, this positively determines marketed supply of avocado and was significant at 1% level. One more additional contact of extension agent with avocado producers increases marketed supply of avocado by 2.85 qt. The result implied that number of frequent extension service contact helps producers in availing an up-to date production and market information, which in-turn enhances marketed supply of the fruit.

Active labor force: This negatively and significantly determined the marketed supply of avocado at 1% significant level. As active labor source increased by one person, the quantity of avocado supply to market decreased by 5.9 qt, keeping other factors constant. This might be due to family members acting as source of labor with family members not readily giving due attention to the production decline as a result of carelessness. This may in turn reduce the marketed supply of avocado. This result is in contrast with the finding by Derib (2014) that the positive relation implies that the more the farming household is likely to get access to labor force from any source, the higher is the probability that the family's interest to farm more size of land and produce surplus thereby quantity of supply to the market would increase.

CONCLUSION AND IMPLICATIONS

Input suppliers, avocado and mango producers, local collectors, wholesalers, retailers were identified as a main value chain actor for both fruits. However, value chain of both mango and avocado was ineffective due to poor horizontal/vertical coordination and integration; competition with actors in the chain; inadequate support from enablers and financial institution in the study area. The market performance of avocado and mango has shown that producers were relatively disadvantaged from avocado and mango market and thus it was not performing well. Various determinants contributed towards reduced market supply of mango and avocado. Therefore, an adjustment on significant socio-economic and institutional factors may enhance and increase the market supply of mango and avocado in the study area.

Based on the findings of the study, the following relevant implications were drawn:

- i) Strengthening of value chain actors' linkage.
- ii) Promoting collective marketing to ensure farmers benefit from produce by collective marketing.
- iii) Extension service and farmers' education needs to be greatly strengthened.
- iv) Infrastructure like road accesses, continuous price and labor force used information should be improved.
- v) Farmers should be trained in their farms to enhance their experience.

CONFLICT OF INTERESTS

The authors have not declared any conflict of interests.

ACKNOWLEDGEMENTS

The authors appreciate Wolkite University for financial support to accomplish this work.

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