

Research Article

Value Chain Analysis of Hot Pepper in West Hararghe Zone, Oromia National Regional State, Ethiopia

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Abstract

This study focused on the analysis of hot pepper value chain in West Hararghe zone with specific objectives of identifying and mapping actors and their functions along hot pepper value chain, identifying the marketing channels of hot pepper in the area, estimate the distribution of benefits of actors along the hot pepper value chain, identifying the factors that affect the supply of hot pepper to the market in the study area. Primary data were collected from 172 farmers and 44 hot pepper traders using structured questionnaires. Descriptive statistics and Econometrics models were used to analyze the collected data. Descriptive statistics results showed that the main hot pepper value chain actors in the study area are input suppliers, farmers/producers, collectors, wholesalers, processors, retailers and consumers. The study result showed that the major production constraints of hot pepper were low quality of improved seed, weed, disease pest, drought/ shortage of rainfall, cold rooftop water, lack of chemicals and lack of access to extension services. On marketing side, low price of product, illegal traders, unfair weighing and lack of legal action on illegal traders were the major problems. About 61.05% of the quantity of hot pepper supplied to market goes outside of the zone. The highest gross marketing of producers was 96.13% (channel 2) which was followed by 90.48% (channel 5). The multiple linear regression model result indicated that age, sex and education were the significant variable that affected quantity of hot pepper supplied to market positively, whereas distance to market, disease and drought affected significantly and negatively. Therefore, policies aiming at increasing farmer's awareness of producing value added hot pepper produce and increasing quantity supplied to market are recommended to strengthen chain development.

Keywords

Value Chain, Hot Pepper, Actors, Multiple Linear Regression Model, Market Channel

1. Introduction

Hot peppers are the most widely produced spice that adds taste and color to food while also supplying vital vitamins and minerals, making them the second most important vegetable in the world after tomatoes. The primary producers are in tropical Africa (North Africa, Senegal, Nigeria, Ghana, and Kenya), tropical Asia (India, Malaysia, Thailand, Indonesia, and the

Philippines), and South America (Mexico) and the Caribbean. Asia produces more than 48% of the world's pepper, with China being the top producer. China's output alone surpasses that of all European nations combined [15]. The United States and Germany are the top importers of dry chilli peppers, whereas India is the top exporter, followed by China [5].

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Received: 25 November 2024; Accepted: 7 December 2024; Published: 27 December 2024



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In Ethiopia, pepper has arguably had a longer history than any other vegetable product [9]. According to [6], 72% of pepper production is typically for the market, with an estimated 2.8 million quintals produced nationwide during the 2013–2014 major cropping season (Meher). Dark red pepper is highly prized by Ethiopians primarily for its high level of pungency. While the green pod is eaten as a vegetable with other foods, the finely powdered, pungent result is an essential flavoring and coloring element in the popular traditional sauce "Wot." Apart from its significant contribution to Ethiopian cuisine, it also has a significant impact on the country's economy. It is a highly valuable crop for both export and domestic markets. It creates jobs for both urban and rural workers because it is a commercial and industrial crop. The spiced ground is supplied to the local market, but the primary processed product, oleoresin, is exported to various nations. Red pepper is used to extract oleoresin, which is utilized as food coloring, for export. In the nation, there is a significant demand for the deep red cultivars for processing [9].

Hot peppers are grown in the west Harerge zone for both sale and consumption. An estimated 196,641.68 quintals were produced from 10,161.28 hectares during the 2017/18 main cropping season [8]. The zone produces it and distrib-

utes it to various marketplaces. Hot pepper is often used in rural areas for ceremonial purposes as well as in everyday meals. In the zone, fluctuating seasonal circumstances limit pepper output. Consequently, there is a significant difference in its supply between the rural and urban markets. Pepper has not received enough attention, despite its importance in smallholder producers' ability to generate money in comparison to its potential in the zone. There is no work that tries to examine the entire perspective of the value chain of hot pepper in the research area, and a value chain analysis is necessary to completely comprehend and address the issue of hot pepper markets at all levels. The study area has not yet examined how and why the price of hot peppers is high for consumers or if producers profit from rising prices.

Objectives

- 1) To identify and map actors and their functions along hot pepper value chain
- 2) To identify the marketing channels of hot pepper in the area
- 3) To estimate the distribution of benefits of actors along the hot pepper value chain
- 4) To identify the factors that affect the supply of hot pepper to the market in the study area

2. Methodology

2.1. Description of the Study Areas

Table 1. Description of the study areas.

District	Location	Altitude	Rainfall	Temperature
Daro Lebu	434 to South East of Finfine and 115km to South of Chiro	1350-2450	900-1000	14-26
Boke	70 km to South West of Chiro	1100-1980	600-800	15-28
Hawi Gudina				

Source: Survey result, 2023

2.2. Sampling Technique and Sample Size

In this study a multi-stage sampling technique was used to select hot pepper producers. In the first stage three major hot pepper producing districts were selected purposively based on their potential for hot pepper production and marketing. In the second stage, among the potential hot pepper producing kebeles that exist in each district two kebeles were selected purposively. Finally, a representative sample size of hot pepper producer households was selected using random sampling technique. According to [20] formula was employed to determine the required sample size.

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

Table 2. Sample size distribution.

Districts	Kebele	Number of sample households
Daro Lebu	Merdida	25
	Milkaye	18
Hawi Gudina	Ibsa	28
	Tao	28

Districts	Kebele	Number of sample households
Boke	Chebi	35
	Tokuma	38
Total		172

Source: Survey results, 2023

Traders (collectors, retailers, wholesalers and processors) survey mainly participated in the hot pepper value chain were also conducted. On the basis of flow of hot pepper, main hot pepper marketing sites were selected in the study area. Hence, a purposive sampling method was used to select the traders from the markets that hot pepper passed through.

Table 3. Sample distribution of hot pepper value chain actors.

Actors	D/Lebu	H/Gudina	Boke	Habro	Odabultum	Chiro	Sub-total
Collectors	-	2	3	-	-	-	5
Retailers	6	1	2	4	1	4	18
Wholesalers	2	-	3	-	7	-	12
Processors	-	-	-	2	3	4	9
Total							44

Source: Survey results, 2023

2.3. Methods of Data Collection

In this study, both the primary and secondary data was used. The primary data were collected through a household survey and focused group discussions. To generate relevant secondary data on hot pepper production and marketing, data was collected from different published and unpublished sources such as: the district and zone Agriculture offices and district marketing office reports.

2.4. Method of Data Analysis

2.4.1. Descriptive Statistics Analysis

Descriptive statistics like mean, standard deviation, frequency and percentage was used in order to explain and interpret the data obtained from sampled households. The Multiple linear regression model was used to identify factors affecting quantity of hot pepper supplied to the market. The collected raw data was analyzed by using STATA ver. 13.

Value Chain Analysis

The actors and their roles along the hot pepper value chain were examined using the value chain analysis approach; claim [11]. The research question determines the approach to value chain analysis. As a result, this study has used two value-chain analysis facets. First, value chain analysis maps out the players involved in a product's manufacturing, distribution, processing, marketing, and consumption in a methodical manner. Second, by analyzing the chain's margins and profits, one can ascertain which actors stand to gain from

greater organization support and who gains from chain participation.

Estimation of benefit distribution of actors in market chain

The difference between the farm price and the retail price is known as the marketing margin [8]. The total gross marketing margin (TGMM), which is calculated as a percentage, is always connected to the final price that the customer pays [13]. According to [14] asserts that because a high marketing margin is dependent on marketing expenses as well as purchase and sale prices, it may occasionally indicate little to no profit or loss for the specific actor in the chain.

$$TGMM = \frac{\text{End buyer price} - \text{first seller price}}{\text{End buyer price}} \times 100$$

Where, TGMM is total gross marketing margin. It is useful to introduce the idea of 'producer's participation', 'farmer's portion', or 'producer's gross margin (GMMP) which is the portion of the price paid by the consumer that goes to the producer.

The producer's margin is calculated as a difference:

$$GMMP = \frac{\text{End buyer price} - \text{marketing gross margin}}{\text{End buyer price}} \times 100$$

Where, GMMP is the producer's share of consumer price.

Thus, the marketing margin in this study was understood as gross marketing margin [16].

2.4.2. Econometric Analysis

This method of data analysis refers to the use of different

economic and statistical tools or models for testing hypothesis related to the objective of the study.

Model Specification

For studying factors affecting hot pepper market supply in the study area, multiple linear regression model was used since all sample farmers interviewed participated in supplying hot pepper to the market in 2022 production year. This model was also selected for its simplicity and practical applicability [10]. Econometric model specification used in this study was given as below.

$$Y = X'\beta + U$$

Where: Y was quantity of hot pepper supplied to market, X was a vector of explanatory variables, β was a vector of parameters to be estimated and U was disturbance term

Specification tests

Multicollinearity test was undertaken to test the existence of multicollinearity problem among explanatory variables. The test result showed that the mean value of VIF was 1.61 which indicates no problem of severe multicollinearity among explanatory variables in the model. Breusch-Pagan test for heteroskedasticity was also undertaken and the result indicated that there was a problem of heteroskedasticity in the model (Prob > chi2= 0.000). Therefore, robust regression option was used to analyze and correct the heteroscedasticity problem.

3. Result and Discussions

3.1. Descriptive Analysis Results

The result of the study shows that out of the total sample households 154 (89.5%) were male while 18 (10.5%) were female. From the sampled households, 40 (23.3%) of the respondents were illiterate, 12 (7%) can read and write whereas 120 (69.8%) respondents attended formal education in the study area.

Table 4. Characteristics of respondents (categorical variables).

Variables	Frequency	Percentage
Sex Male	154	89.5
Female	18	10.5
Education status	Illiterate	40
	Read and write	12
	Formal education	120

Source: Survey results, 2023

Table 5. Characteristics of respondents (continuous variables).

Variables	Mean	SD	Min	Max
Age of household head (years)	35.61	11.14	17	69
Household size (number)	6.45	3.50	1	15
Experience in hot pepper production (years)	3.56	2.68	1	20
Price (birr/kg)	151.55	29.96	50	250
Distance to market (km)	28.16	14.38	3	70
Land holding size (ha)	2.48	2.32	0.25	20

Source: Survey results, 2023

On average, the age of sample respondents was 35.61 years with standard deviation of 11.14, while the mean household size was 6.45. The maximum age for the sample hot pepper producer farmers was 69 years while the minimum was 17 years. On average, the sampled respondents have 3.56 years of experience in hot pepper cultivation with a range of 1 to 20 years. The result of the study also shows that average land holding size of households in the study area was 2.48 hectares with standard deviation of 2.32. The average distance of producer’s to travel to district market place was 28.16 km with a range of 3 km to 70 km. In the study area, the mean selling price of hot pepper by the producers was 151.55 birr per kg. The minimum and maximum selling prices of hot pepper were 50 and 250 birr per kg in the study area (Table 5).

Major production constraints of hot pepper

In the study area, there were different factors that impede the production of hot pepper. Accordingly, the major constraints related to the production of hot pepper were identified and prioritized. Accordingly, disease and pest, drought, lack of quality improved hot pepper seed, lack of awareness on its management, lack of chemicals and lack of access to extension services were among the major production constraint in the study area.

Major marketing constraints of hot pepper

The major hot pepper marketing constraints raised by producers and traders (collectors, wholesalers, processors and retailers) were recognized and ranked in the study area. Accordingly, low price of the product, unfair weighing of buyers, interference of brokers/illegal traders, reluctance of buyers to repay money for sellers and lack of legal action on illegal bodies were the major hot pepper marketing constraints identified and prioritized in order of their importance.

Actors in Hot Pepper Value Chain in the Study Area

The main actors of hot pepper value chain in the area were input suppliers, producers, collectors, wholesalers, retailers and processors; while supporters/ enablers were trade offices of the respective district, research centers, informal credit sources and NGOs were the main supporting actors who play

a central role in the provision of supporting services like training on hot pepper production and financial services.

Value chain governance

According to [11] asserts that the key players in the value chain facilitate the process. They control the level of prices and the movement of commodities. They essentially control the value chain, and the majority of chain participants follow the guidelines established during the marketing process. The study result indicates that the producers and wholesalers were the key value chain governors. The consumer market was heavily dependent on producers supply and therefore the hot pepper value chains were highly influenced by the pro-

ducers. Wholesaler traders in the study area usually refer to outside district markets for high price and they fix price of hot pepper from collectors and farmers. Overall, the governance of the hot pepper value chain was producers push with minimum consideration of customers need.

Value chain map of hot pepper in the study area

Value chain mapping enables to visualize the flow of the product from conception to end consumer through various actors. It also helps to identify the different actors involved in the value chain, and to understand their roles and linkages. Accordingly, the value chain map of hot pepper in West Hararge zone was depicted as follows:

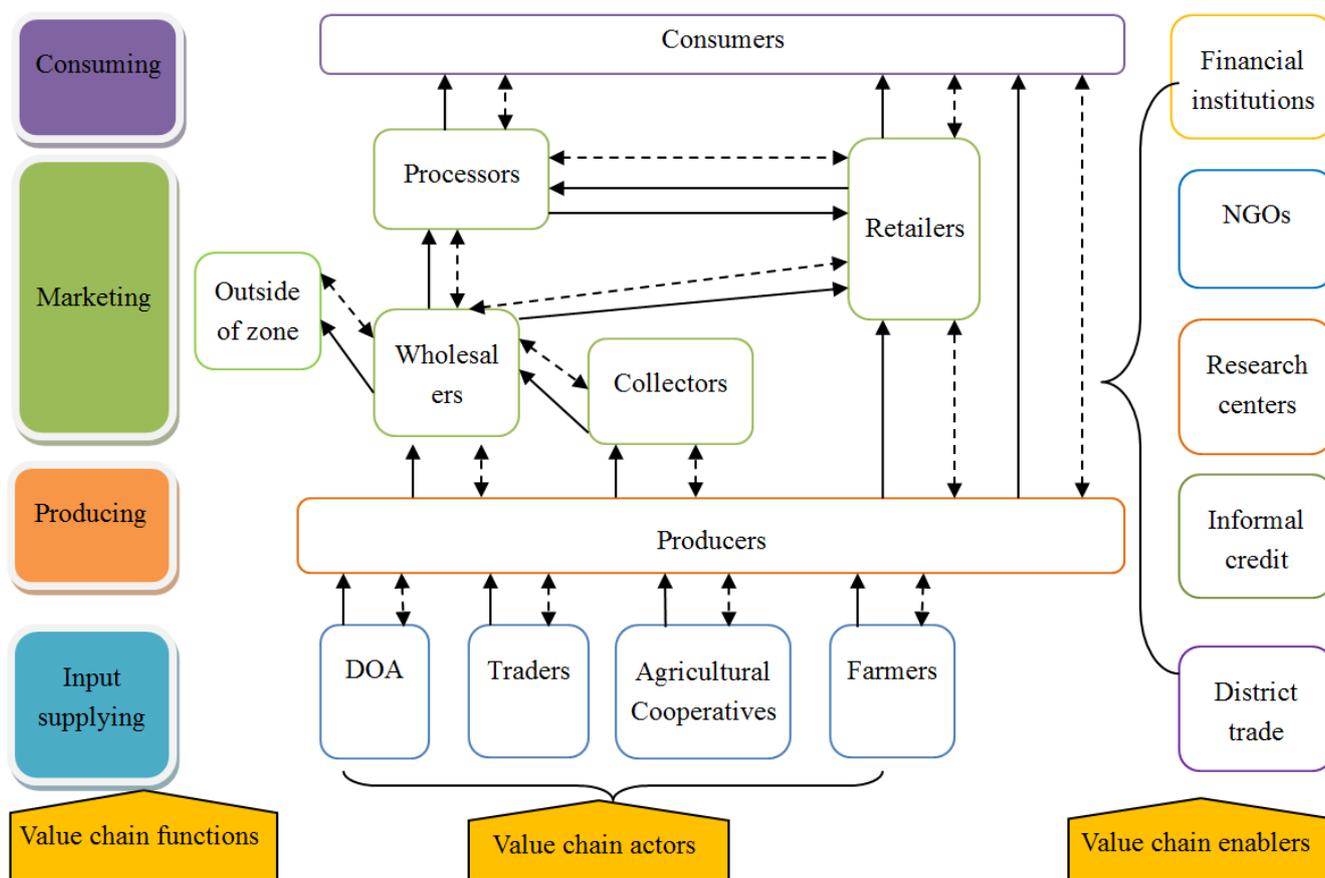


Figure 1. Map of hot pepper value chain in the study area.

- Shows flow of inputs and products
- ↔ Shows two way flow of information and payments

Marketing channels of hot pepper in the study area

For the value chain of hot pepper eight marketing channels were identified in the study area. The survey result indicated that out of the total amount of hot pepper supplied by farmers to the market, 61.05% go out of the zone. The major receivers of hot pepper product from producers were collectors

and wholesalers. Farmers sold about 52.24% of hot pepper product to collectors and 38.84% to wholesalers. Following collectors and wholesalers, retailers are the third actors that shares 9.24% of hot pepper sold by farmers in the study area. According to the quantity of hot pepper passed through, the channel 8 was found as the dominant channel.

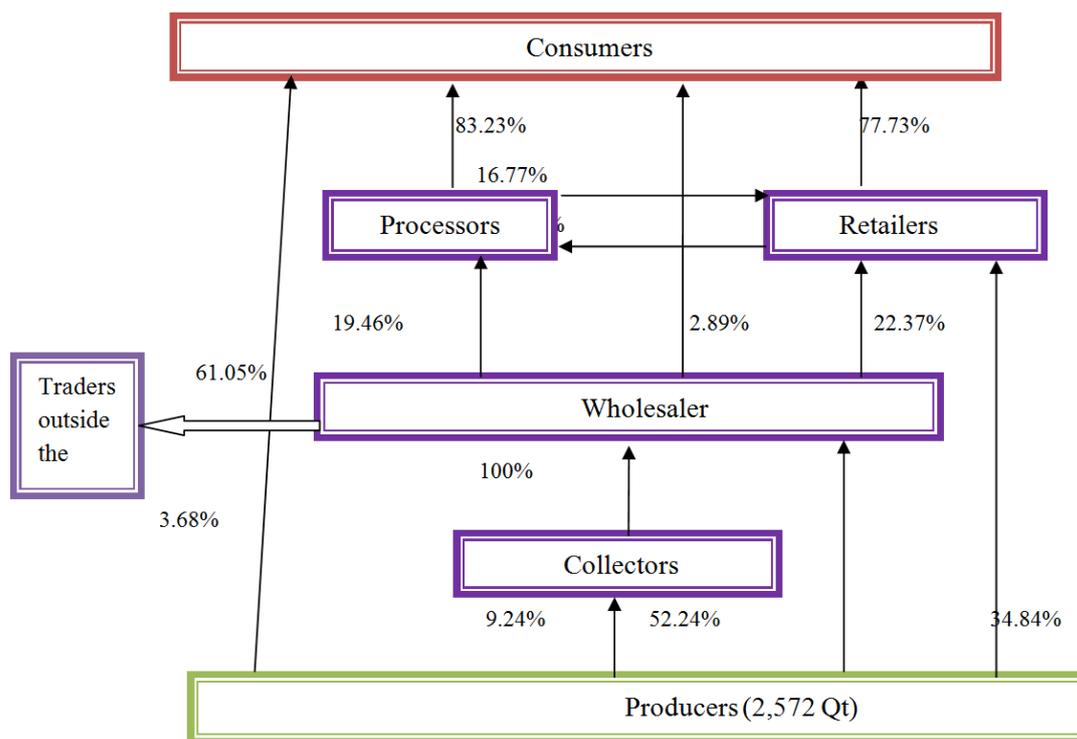


Figure 2. Hot pepper market channel existing in west Harerghe zone.

The eight marketing channels identified in the study area are listed as follows:

- Channel 1: Producers → Consumers (3.68%)
- Channel 2: Producers → Retailers → Consumers (4%)
- Channel 3: Producers → Collectors → Wholesalers → Retailers → Consumers (6.64%)
- Channel 4: Producers → Collectors → Wholesalers → Processors → Consumers (6.79%)
- Channel 5: Producers → Wholesalers → Retailers → Consumers (5.71%)
- Channel 6: Producers → Wholesalers → Processors → Retailers → Consumers (5.98%)
- Channel 7: Producers → Retailers → Processors →

Consumers (4.38%)

- Channel 8: Producers → Collectors → Wholesalers → Outside zone (61.05%)

Marketing margins

Total gross marketing margin was the highest in channel 4 which is 43.14%. Without considering channel 1, in which farmers sell directly to consumers, producers have got the highest gross margin in channel 2 which was 96.13% and channel 5 which was 90.48%. Therefore, without considering channel 1 (producers directly sell to consumer), channel 2 was the important channel which results in the highest producers share/benefit (Table 6 below).

Table 6. Actors marketing margins per each channels of hot pepper.

Marketing margin (birr/kg)	Ch-1	Ch-2	Ch-3	Ch-4	Ch-5	Ch-6	Ch-7	Ch-8
TGMM	0	3.87	16.3	43.14	9.52	35.34	42.69	12.41
GMMp	100	96.13	83.7	56.86	90.48	64.66	57.31	87.59
GMMc	-	-	4.7	2.02	-	-	-	6.01
GMMw	-	-	6.04	5.28	5.27	6.8	-	6.4
GMMr	-	3.87	5.56	-	4.22	4.26	6.2	-
GMMpr	-	-	-	35.87	-	24.28	36.49	-

Note: GMMp, GMMc, GMMw, GMMr and GMMpr means gross marketing margins for producers, collectors, wholesalers, retailers and processors, respectively.

3.2. Econometric Analysis Result

Factors Affecting Quantity of Hot pepper Supplied to the Market

From the 11 explanatory variables hypothesized to influence quantity of hot pepper supplied to the market (dependent variable), six (6) variables were found to significantly influence the dependent variable.

Table 7. Factors affecting quantity of hot pepper supplied to the market.

Variables	Coefficients	Robust SE	t
Age of household head	1.41	0.76	1.86*
Sex of household head	37.84	18.88	2.00**
Education of household head	7.34	2.77	2.64***
Distance from nearest market	-0.98	0.35	-2.82***
Household size	1.12	3.35	0.33
Livestock owned (TLU)	-2.93	3.08	-0.95
Access to market information	-13.62	10.94	-1.25
Extension contact	4.44	11.32	0.39
Credit	0.32	11.66	0.03
Disease and pests	-22.98	9.92	-2.32**
Drought	-19.13	10.47	-1.83*
Constant	92.30	50.77	1.82*

Note: *, ** and *** imply 10%, 5% and 1% significance levels, respectively.

Source: Model output, 2023

Age: Age affected quantity of hot pepper supplied positively and significantly at 10% significance level. It is believed that age can serve as a proxy for experience. This may be due to aged household heads are believed to be wise in resource use, and it is expected to have a positive effect on market participation and marketable surplus. Additionally, the result indicated that as farmers have high hot pepper production experience the amount of hot pepper supplied to the market increased through its effect on hot pepper production. The study is in line with [2, 19].

Sex: This variable affected the quantity of hot pepper supplied to the market significantly at 5% significance level. Male headed households have more probability of supplying hot pepper to the market. This may be due to a lot of obstacles such as lack of capital, less bargaining power and less access to extension services, may affect women's participation in hot pepper production and marketing. The study agrees with the findings of [19, 18].

Education level: Education has showed positive effect on hot pepper quantity supplied to the market with positive sign and at 1% significance level. Education has supported hot pepper farmers in the production and marketing of hot pepper in the study area. This might be due to education enable them to have better skills in hot pepper production and access to market information to increase the quantity of market

supplied. This was also in line with previous studies conducted by [3].

Distance to Market: It affects quantity of hot pepper supplied to the market negatively and significantly at 1% significance level. This is may be due to the reason that as the distance to the market center increases transportation cost increases, its weight decreases highly and other marketing costs increased. This is in line with [4].

Disease and pests: As it was expected, disease and pests occurrence affected the quantity of hot pepper to the market negatively and significantly at 5% significance level. According to [12] also found that disease affected marketable supply of red pepper negatively and significantly.

Drought: The model output result indicated that drought affected the quantity of hot pepper supplied to market negatively and it was significant at 10% significance level. The might be due to agriculture is one of the most heavily impacted sectors during a drought. Drought is making it difficult for farmers to grow their hot pepper crop in the study area. The increasing drought effects on this crop were also causing the decreasing quantity of hot pepper produced and supplied to the market. This result is in line with the finding of [17].

4. Conclusion and Recommendations

This study was conducted with the main objective of mapping hot pepper value chain, determining the benefit share of the value chain actors and identifying the factors affecting the quantity of hot pepper supplied to the market in the study area.

A total of 172 sample respondents were interviewed using structured questionnaire to collect primary data. Additionally, wholesalers, retailers, processors, consumers and input suppliers were interviewed. Focused group discussions were also conducted. Secondary data were also collected from district agriculture office, district trade office and from published and unpublished documents. The data were analyzed using econometrics and descriptive statistical tools.

Out of the total respondents, 89.5% and 10.5% were male and female household heads respectively. The minimum and maximum age of the respondents was 17 and 69 years, respectively with mean age of 35.61 years. The average household size in the study area was 6.45. The minimum and maximum sizes of landholding size of the respondent farmers were 0.25 and 20 hectares, respectively with mean of 2.48 hectares. On average, respondents allocated 1.09 hectares of land for hot pepper production.

The main hot pepper value chain actors in the area are input suppliers, producers, collectors, wholesalers, processors, retailers and consumers. The main sources of inputs were traders, district agriculture offices, primary agricultural cooperatives and fellow farmers in the area. The survey result showed that the major sources of seed were traders covering 88.9% followed by neighbor farmers (8.2%). Fertilizer was among one of the inputs used for hot pepper production. Hot pepper farmers get fertilizer through DOA, traders and cooperatives covering 47.4%, 36.4% and 16.2%, respectively. Chemicals were supplied by private vendors found mainly in district markets.

The result of multiple regression showed that age, education and sex were found to influence the amount of hot pepper supplied to market positively and significantly. On the other hand, distance to market, disease pest and drought affected the quantity of hot pepper supplied to the market negatively and significantly in the study area.

Based on the findings of the study the following recommendations were given:

- 1) Establishing an early warning system and developing and disseminating disease resistant, drought tolerant and high yielding varieties is crucial in the area.
- 2) Increasing farmers' skill, knowledge and awareness on the hot pepper crop management and on production of quality seed by themselves is important.
- 3) It is better to improve transportation road facilities and inputs distribution networks need to be organized.
- 4) For the future it is better to incorporate all major areas in which hot pepper is produced and marketed for primary data.

Abbreviations

CSA	Central Statistical Agency
DOA	District Office of Agriculture
ha	Hectare
km	Kilometer
TLU	Tropical Livestock Unit
VIF	Variance Inflation Factor

Acknowledgments

The authors acknowledged Zonal and District Office of Agriculture and respective Development Agents at each kebeles. We are also thankful to all researchers and driver for their kindly support during data collection. Our thanks also extended to OARI and McARC for allocating budget and executing resources for the study.

Author Contributions

Gosa Alemu: Conceptualization, Data curation, Formal Analysis, Investigation, Writing—original draft

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Nimona Sime: Conceptualization, Data curation, Investigation, Writing—review & editing

Conflicts of Interest

The authors declare no conflicts of interest.

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