Value chain analysis of wheat in Duna district, Hadiya zone, Southern Ethiopia

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ABSTRACT

Wheat is a source of food and income for Ethiopian farmers in general, and the Duna district in particular. Despite the district's high wheat production potential, a number of constraints impede the wheat sector's and value chain's development. This study, thus, analyzed the wheat value chain in Duna district, Hadiya zone, Southern Ethiopia. Descriptive statistics, marketing margin, and a multiple linear regression model were used to analyze data from 149 respondents. The result showed that the actors in the wheat value chain have a shaky relationship. According to the findings, flour wholesalers had the highest market margin (18.36%), followed by flour processors (17.70%). The estimated multiple linear regression result revealed that wheat supply is influenced by the quantity of wheat produced, household education level, farming experience, frequency of extension contact, and lagged market price. Furthermore, wheat producers identified climate variability and low wheat prices as the top two problems in wheat production and wheat marketing, respectively. Hence, the government and other concerned bodies should focus on productivity increasing technologies in the study area in order to boost productivity and thus increase wheat market supply. In addition, to solve the marketing problem, the promotion of value-added practices and the formation of wheat cooperatives are suggested.

1. Introduction

In Ethiopia, agriculture contributes over 35.8 percent to the national gross domestic product (GDP), almost 90 percent of export and 72.7 percent of employment (CIA , 2018). The most important crops in Ethiopian agriculture are cereals such as wheat, barley, maize, sorghum, and teff (GAIN, 2014). Cereal production and marketing provide a source of income for millions of smallholder households, accounting for 60 percent of rural employment, 80 percent of total cultivated land, over 40 percent of typical household food expenditures, and more than 60 percent of total caloric intake (CSA, 2017).

In Sub-Saharan Africa, Ethiopia is the largest wheat producer, representing for more than half of total production (Brasesco et al., 2019), and the only country where smallholders account for the majority of production (Spielman et al., 2010; Shiferaw et al., 2014). Based on FAO (Food and Agriculture Organization), 2014 report, the country's wheat surplus producing regions are Oromia (Bale, East Arsi, West Arsi, Western and Eastern Shoa), Southern Nations Nationalities and Peoples’ Region (SNNPR) (Hadiya and Kembata) and Central and Southern Amhara (East Gojam, North Shoa). Except for a few government-owned large-scale farms and commercial farms that produce wheat in the country, almost all wheat is grown by small-scale farmers under rain-fed conditions (Demeke and Di, 2013).

During the 2016/2017 production year, wheat was grown on 0.13 million hectares by 0.62 million private smallholders in SNNPR, with a total production of 3.39 million quintals1 and an average productivity of 26.66 quintal/ha (CSA, 2018). The Hadiya zone is the most important location in the SNNPR for wheat production. For the 2016/17 production year, the zone's total wheat production was 1.01 million quintals, with 0.12 million private smallholders cultivating wheat on 0.36 million hectares. The average productivity was 28.75 quintal per hectare (CSA, 2017). Of the total wheat coverage and harvest in the zone, 7,050.5 ha and 0.38 million quintals respectively, were obtained from Duna district (HZANRMD, 2017).

Wheat consumption has increased faster than any other major food grain in the country, particularly for pasta and bread, and is expected to

1 Quintal is a unit of weight equal to 100 kg.

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continue to do so in the future (Minot et al., 2019). It is a staple food in the diets of many Ethiopians, accounting for roughly 15 percent of the country’s caloric intake for the country’s over 90 million people (FAO (Food and Agriculture Organization), 2014). According to Mamo et al. (2018), domestic wheat consumption increased by 41 percent from 3.72 million tons in 2010 to 5.25 million tons in 2014. Even though wheat production has increased significantly over the last two decades as a result of various government programs and efforts aimed at improving agricultural growth and food security in the country, domestic wheat grain and flour self-sufficiency remains a long way off (Gebreselasie et al., 2017). For example, the Ethiopian Grain Trade Enterprise imported 1.05 million tonnes of wheat in 2016 (Brassesco et al., 2019).

However, the country has a large potential for wheat production, which has yet to be fully realized due to various production-related issues. For example, Hei et al. (2017), Abate (2018), Tesfaye et al. (2018), and Ayele et al. (2019) found that a lack of improved varieties, poor seed supply systems, producers’ reliance on local seeds, high fertilizer and seed costs, poor agronomic practices, weeds, pests, and diseases, weak farmers organizations, poor market information systems, and little research support to increase yields and climate change are major constraints to Ethiopian wheat production. On the other hand, Ethiopian wheat output markets are characterized by an insufficient transportation network, a small number of traders, insufficient capital facilities, high handling costs, an insufficient market information system, farmers’ poor bargaining power, and underdeveloped industrial sectors (Mohammed and Addisu, 2016; Mamo et al., 2018).

According to Mahamud (2016) and Shikur et al. (2020), price cheating by traders, farmers’ lack of bargaining power in the market, and unfair competition from illegal traders are the major marketing challenges faced by Ethiopian wheat farmers. To reduce the influence of local collectors, traders, and transporters on the pricing process, it is critical to establish marketing centers and cooperatives based on value chain studies (Tarekegn et al., 2020). Porter (1985) theory was one of the proposed solutions to popularize the concept of the value chain as a collection of generic activities that operate within a company and collaborate to provide value to customers. Value chains include all production factors as well as all economic activities such as input supply, production, transformation, handling, transportation, marketing, and distribution that are required to create, sell, and deliver a product to a specific location (Mango et al., 2015). Corrective measures can be identified by revealing strengths and weaknesses along the value chain, which improves overall value-chain performance and benefits all stakeholders (United Nations Industrial Development Organization, 2009).

Even though cereals, particularly wheat, are the most common crop in the Duna district where this study was conducted, the overall potential for wheat production and marketing, as well as comparative advantages and existing bottlenecks across the value chain, have not been well documented in order to assess possible value chain development strategies for upgrading wheat value chain. Moreover, there is an imbalance between supply and demand of wheat product. In order to close the supply and demand gap in the sector, a strategic approach will be required. One of these strategies is value chain analysis. Therefore, this study aimed to analyze the value chain of wheat in Duna district, Hadiya zone, southern Ethiopia. More specifically, the study examined the division of market margins throughout the wheat value chain, as well as the determinants of wheat market supply at the farm level in the district.

2. Research methodology

2.1. Description of the study area

The study was carried out in Ethiopia’s main wheat-producing district, Duna. Duna is a district in the Hadiya zone, located 275 km south of Addis Ababa and 238 km west of Hawassa, the SNNPR capital, with a total population of 148,566, including 73,183 men and 75,383 women (DWFEDO, 2017). The district’s total area is estimated to be 43,104 ha (222.5 square kilometers). It is situated at an elevation of 2001–2957 m above sea level, with annual rainfall ranging between 1001 and 1400 mm. The subsistence traditional agriculture farming system dominates the district’s economy, with mixed agriculture accounting for the majority of the people (85%) (Assefa, 2017). Wheat, teff, barley, and maize are the most widely grown crops, with wheat serving as a primary source of food and income.

2.2. Data types, sources, and collection methods

Both quantitative and qualitative research methods (mixed methods) were employed in this study. As recommended by Creswell (2009) and Ariho et al. (2015), to increase the data’s reliability and precision, a triangulation method (semi-structured questionnaires, focus group discussions, key informant interviews, and literature review) was used. Primary data was collected from chain actors such as wheat growers, cooperatives, traders, and processing factories using semi-structured questionnaires and checklists based on individual farmer surveys, observation, focus group discussions, and key informant interviews. Prior to the formal survey, the questionnaire was pretested on 12 households using a pilot survey to determine the appropriateness of the design, clarity, relevance, and interpretation of the questions, as well as the time required for an interview. The questionnaire was modified as needed based on the feedback received during the pretest. The data was coded and entered into the Statistical Package for Social Sciences (SPSS) statistical software. The data was cleaned for potential outliers after entry before being subjected to a thorough statistical analysis. Preliminary descriptive analysis was used to identify inconsistencies and irregularities in data entry, which were then corrected by crosschecking on the questionnaires. In addition, secondary data was gathered from the Hadiya Zone Agriculture and Natural Resource Development Department (HZDANRDO), the Duna District Agriculture and Natural Resource Development Office (DDANRDO), the Licha Hadiya Farmers’ Cooperative Union (LHFCU), and flour processing factories in Hossana town.

2.3. Sample size and sampling procedure

The Duna district was purposively selected for this study because of its highest wheat production potential in Hadiya zone. The study employed two-stage sampling techniques to collect data from actors involved in the wheat chain. In the first stage, from a total of 31 rural kebeles in the Duna district, 3 kebeles were selected randomly. In the second stage, wheat producers, cooperatives, traders and processors were randomly selected. In order to gather the necessary information, 149 sample (120 producers, 5 cooperatives, 20 traders, and 4 processors) were interviewed. A total of 120 sample wheat producers for the study were determined based on the following formula given by Becker (1997).

\[ n = \frac{Z^2p(1-p)}{e^2} \]

where n is the sample size; Z is the confidence level (Z = 1.96), and p is the proportion that belongs to the target population out of total population. The population of wheat producing farmers in the 31 kebeles of the district is about 29,883 in which the size of wheat farmers in the three sample kebeles is about 9 percent.

In addition to the survey, the qualitative data on current production and marketing constraints wheat chain in study area was collected through group discussion. Two focus group discussions were conducted with a group of 8 farmers from each kebele by using the checklist. The selection of farmers for group discussion was done based on their experience in wheat production and marketing and the involvement in the community. The discussion was assisted by the researcher and

2 Kebele is the smallest administrative unit in Ethiopia.
enumerators by using discussion guide to encourage group members to speak freely on a particular topic.

### 2.4. Method of data analysis

To meet the study’s objectives, descriptive statistics and econometric analysis were used to analyze data collected from households and wheat value chain actors. Descriptive methods included chain maps and economic parameters. Analysis defining the roles of each actor in the wheat chain depicted on the map. Profit and gross margins were analyzed across the chain using economic parameters. A multiple linear regression econometric model was used to investigate the determinants of wheat quantity supplied to the market.

#### 2.4.1. Marketing margin

Marketing margins are important indices in assessing value chain performance according to (Ghorbani, 2008). The difference between the purchase and sale prices of an agricultural commodity through its marketing channel is referred to as the marketing margin. The gross margin is calculated by dividing the gross revenue earned from sales by the gross income or gross profit. To get a percentage, multiply by 100. The gross marketing margin (GMM) of wheat is calculated as follows:

\[
GMM = \frac{\text{End buyer price} - \text{Seller price}}{\text{End buyer price}} \times 100
\]

The net marketing margin (NMM) is the percentage of the final price earned by intermediaries as net income after marketing costs are deducted. It is calculated as follows:

\[
NMM = \frac{\text{Gross margin} - \text{Marketing costs}}{\text{End buyer price}} \times 100
\]

According to the Equation (3), a higher marketing margin reduces the producer’s share of the market, and vice versa. It also shows how welfare is distributed among production and marketing agents.

#### 2.4.2. Econometric analysis

The causal relationship between the dependent variable and the explanatory variables was estimated using econometric analysis. Understanding the effects of various factors on wheat supply to the market has paramount importance. The Ordinary Least Squares regression (OLS) model can be used to estimate market supply in understanding the effects of various factors on wheat supply to the market during the 2016/17 production year, a multiple linear regression model was used for this study. Gujarati (2004), therefore, defines the multiple linear regression model as follows:

\[
Y_i = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \ldots + \beta_n X_n + \mu_i
\]

where, \(Y_i\) refers the quantity of wheat supplied to the market, \(X_1\) represents the total amount of wheat produced by the sampled households during the 2016/17 production year; \(X_2\) represents the education level of the household farmer measured in continuous years of formal schooling; \(X_3\) refers to the number of years that farmers have been involved in wheat production; \(X_4\) is access to market information that takes a value of 1 if the wheat farmer has access to market information and zero, otherwise; \(X_5\) represents frequency of extension contact that measured by the number of extension visits by extension agents in production season; \(X_6\) is the total number of livestock in terms of Tropical Livestock Unit (TLU); \(X_7\) is the total amount of credit received by farmers in the Ethiopian currency (BIRR) for wheat production; \(X_8\) is a continuous variable that measures the annual average price of wheat in the reference market; \(X_9\) is the total number of family members living under one roof, measured in man days; \(X_{10}\) is the sex of households which takes a value of 1 if the household head is male and zero, otherwise; \(X_{11}\) is the distance between a farmer’s home and the nearest market, measured in minutes; \(X_{12}\) is the total number of family members living under one roof, measured in man days; \(X_{13}\) is the number of years that farmers have been involved in wheat production; \(X_{14}\) is the number of years that farmers have been involved in wheat production; \(X_{15}\) is the distance between a farmer’s home and the nearest market, measured in minutes; \(\beta_0\) is the intercept; \(\beta_i\) are parameters of the ith explanatory variables, and \(\mu_i\) is error term.

The main aim of identifying factors influencing wheat supply to the market was to figure out which variables could influence the dependent variable and how they are related. Therefore, Table 1 shows the hypotheses for the dependent and explanatory variables.

### 3. Results and discussion

#### 3.1. Wheat production and consumption in the study area

Wheat production in the study area is not only for home consumption but also for cash and seed requirements. The average quantity of wheat produced per households was 6.94 quintal with the standard deviation of 5.85. On average 3.26 quintals of wheat grain was transacted through different marketing outlets indicating that large volume of wheat produced is allocated for market by sampled households in the study area (Table 2).

#### 3.2. Wheat value chain map of the Duna district

A value chain map can be used to include producers, consumers, traders and other stakeholders in the value chain (Lundy et al., 2014), providing a clear understanding of the chain’s structure of activities and key actors. Therefore, to present findings, the wheat value chain is first
mapped, which includes functions, actors, and other service providers (Figure 1).

3.3. Wheat value chain actors and their functions

3.3.1. Input suppliers

Value chain analysis in agriculture starts at the input supply level. Seed, fertilizers, pesticides, and herbicides are among the production inputs supplied by the agricultural development office and private input suppliers in the study area. As it is seen in Figure 1, the major input suppliers in the wheat value chain in Duna district are Bureau of Agriculture and Natural Resource Development (BoANRD), Omo Microfinance (OMF), Areka Agricultural Research Center (AARC), cooperatives and unions and world vision Ethiopia. The survey report indicated that 65 percent of seed demand supplied through office of agricultural development. The remaining 35 percent is covered through farmer to farmer and other informal seed source. The primary cooperatives and unions play an important role in fertilizer supply through agricultural development office.

3.3.2. Producers

In this particular study producer refers to smallholder farmers producing and marketing wheat. They play major role starting from seed bed preparation to final harvesting of the produce. Activities performed by these actors are land preparation, sowing, chemical application, cultivation and weeding, harvesting, postharvest management and transport the produce to nearest market either by using pack animals or back loading. Depending on market conditions, smallholder wheat farmers have a variety of market outlets for their product. They may sell directly to rural consumers, village collectors, primary cooperatives, and/or grain wholesalers during harvest. They can also sell to other markets directly or indirectly.

3.3.3. Village collectors

These are sometimes called farm gate collectors. They are village-based middlemen who meet wheat farmers at their farm gates or along the roadside to buy freshly harvested wheat and transport it to wholesalers and/or retailers in the district market.

3.3.4. Grain wholesalers

These actors in wheat value chain purchase the wheat grain in bulk with the objective of reselling the produce to retailers and/or flour processing factories. They purchase wheat directly from producers and/or village collectors at a larger volume than any other actors. Compared to other traders, they have better storage and communication access.

3.3.5. Grain retailers

These are actors in wheat value chain who plays an important role by linking the consumers and with the product. The source of produce for these actors is either from farmers, village collectors or wholesalers and resells to consumers.

3.3.6. Flour processing factories

These actors obtain wheat grain from grain wholesalers and cooperatives and process the grain into flour. Wheat processing factories process the grain into flour with wheat bran as a byproduct. They sell the flour either to flour wholesalers and/or retailers based on the prevailing market condition. However, the flour processing factories in Hossana town get most of their wheat grain from import through Ethiopian Grain Trade Enterprise.

3.3.7. Primary cooperatives

These are actors playing a stabilizing role in wheat market by purchasing the product from farmer at better price.

| Table 2. Wheat production and consumption in Duna district. |
|---------------------------------|----------------|----------------|
| Item                            | Mean    | Std. Dev.   |
| Total production (quintal)      | 6.94    | 5.85        |
| Amount consumed (quintal)       | 2.80    | 2.12        |
| Amount maintained for seed       | 1.76    | 1.15        |
| (quintal)                       | 3.26    | 4.25        |

Source: Authors computation from the own survey data (2017).

Figure 1. The wheat value chain map in Duna district. Source: Authors computation from the own survey data (2017).
3.4. Wheat market channel

Individuals, institutions, and activities involved in the movement of goods through marketing channels from point of production to point of consumption. It is also known as a distribution channel, since it shows how products reach the end-user, or the consumer. Wheat marketing has a numbers of marketing channels than any other cereal crops. It passes through different channels before reaching final consumers. However, the volume of grain sold in each channel varies significantly. The most important wheat marketing channels identified in the study area is as described below. These are:

- **Channel I**: Producers → Consumers
- **Channel II**: Producers → Village collectors → Wholesalers → Retailers → Consumers
- **Channel III**: Producers → Wholesalers → Retailers → Consumers
- **Channel IV**: Producers → Cooperatives/Unions → Flour processors → Flour wholesalers → Bakeries → Consumers
- **Channel V**: Producers → Cooperatives/Unions → Flour processors → Flour retailers → Bakeries → Consumers
- **Channel VI**: Producers → Village collectors → Wholesalers → Flour processors → Flour wholesalers → Backeries → Consumers
- **Channel VII**: Producers → Village collectors → Wholesalers → Flour processors → Flour wholesalers → Flour retailers → Consumers

3.5. Marketing margin and associated costs

The performance of the wheat market was assessed by taking into account associated costs, profit margins, and marketing margins for the value chain’s major players. Producers, village collectors, cooperatives/unions, wholesalers, retailers, processors, flour wholesalers, bakeries, flour retailers, and consumers were the major actors in the wheat value chain in the study area. The survey result in Table 3 indicated that the cost items for wheat production in the study area include rental value of land, seed cost, fertilizer cost, chemical cost and opportunity cost of labor and oxen. For wheat production, the maximum cost incurred was observed on land rental value (3550.5 ETB/ha) followed by opportunity cost of labor. In this study, opportunity cost of labor consider both human and oxen labor supposed to use in wheat production. In general, the average production cost of wheat producer was 499.09 ETB per hectare in the study area.

To calculate the share of profit captured by key actors in product marketing, marketing costs are estimated. The standardized unit of measurement used in the analysis is ETB per quintal. Market actors incur costs for packing material, loading/unloading, labor for packing, transportation, storage, telephone, wastage/loss, watching, brokerage, taxes

### Table 3. Average cost of production of wheat in 2016/17 production year.

| Cost items                  | Cost  |
|-----------------------------|-------|
| Land rental value (ETB/ha)   | 3550.5|
| Seed cost (ETB/ha)          | 2120  |
| Fertilizer cost (ETB/ha)    | 1975  |
| Chemical cost (ETB/ha)      | 175   |
| Opportunity cost of labor (ETB/ha) | 2835  |
| Total production cost (birr/ha) | 10655.5|
| Average yield of wheat (quintal/ha) | 21.35  |
| Total production cost (ETB/quintal) | 499.09 |

Source: Authors computation from the own survey data (2017). Currency listed in Table 3 is in ETB (Ethiopian Birr), at a rate of one USD = 22.6 ETB during data collection period (2017).

### Table 4. Marketing costs and benefits of actors for different market agents for wheat (ETB/quintal).

| Marketing cost | Producers | Village collector | Wholesalers | Retailers | Cooperatives | Flour processor | Flour wholesalers | Flour retailers | Bakeries | Total |
|----------------|-----------|-------------------|-------------|-----------|--------------|-----------------|-------------------|-----------------|----------|--------|
| Production cost | 499.1     | 660.5             | 717.5       | 776.5     | 720          | 841.67          | 1650              | 1550            | 1400     | 8815   |
| Purchase price  | -         | 660.5             | 717.5       | 776.5     | 720          | 841.67          | 1650              | 1550            | 1400     | 8815   |
| Packing cost    | 12        | 12                | 10          | 12        | 10           | 15.5            | -                 | 15              | 18       | 104.5  |
| Loading/unloading | 5        | 5                 | 6           | 10        | 5            | 10              | 10                | 15              | 5        | 71.00  |
| Labor for packing | 4        | 5                 | 5           | 6         | -            | 3               | -                 | 3               | -        | 23.00  |
| Transport cost  | 5         | 5                 | 10          | 10        | 10           | 10              | 10                | 10              | 10       | 70.00  |
| Storage cost    | 2         | -                 | 3           | 3         | 2            | 2               | 2                 | 5               | 3        | 22.50  |
| Telephone charge | -        | 1.5               | 2.5         | 1.5       | 3.5          | 2.5             | 2.5               | 1.5             | 2        | 17.50  |
| Spoilage/damage | 15.5     | 10                | 3           | 5.5       | 7.5          | 2.5             | -                 | -               | 44.00    |        |
| Brokerage       | -         | -                 | 5.5         | -         | 5            | 5               | -                 | -               | 15.50    |        |
| Tax             | -         | 10                | 10          | 10        | -            | 15              | 15                | 10              | 10       | 80.00  |
| Other cost      | 5         | 5                 | 10.5        | 5         | 5            | 10              | 5                 | 5               | 5        | 55.50  |
| Total marketing cost | 48.50    | 53.50             | 65.50       | 47.00     | 49.00        | 72.50           | 55.50             | 59.50           | 52.50    | 503.5  |
| Total cost      | 382.50    | 53.50             | 65.50       | 47.00     | 49.00        | 187.50          | 55.50             | 59.50           | 155.50   | 1055   |
| % share of total cost | 36.24    | 5.07              | 6.21        | 4.45      | 4.64         | 17.76           | 5.26              | 5.64            | 14.73    | 100    |
| Sale price      | 735.00    | 731.30            | 838.80      | 870.00    | 825.00       | 1155.00         | 1975.00           | 1830.00         | 1625.00  | 10585  |
| Market margin   | 235.91    | 70.80             | 121.30      | 93.50     | 105.00       | 313.33           | 325.00            | 280.00          | 225.00   | 1770   |
| % share of margin | 13.33    | 4.00              | 6.85        | 5.28      | 5.93         | 17.70           | 18.36             | 15.82           | 12.71    | 100    |
| Profit margin   | 187.41    | 17.30             | 10.50       | 4.41      | 3.67         | 4.42            | 19.02             | 21.28           | 17.41    | 13.62  |

Source: Authors computation from the own survey data (2017).
Table 5. OLS results of factors affecting farm-level marketable supply of wheat.

| Variables                     | Coefficient | Standard error | t-value |
|-------------------------------|-------------|----------------|---------|
| Constant                      | 5.97***     | 2.12           | 2.82    |
| Quantity of wheat produced    | 0.13***     | 0.03           | 4.21    |
| Education level of households | 0.04**      | 0.02           | 2.23    |
| Farming experience            | 0.15*       | 0.08           | 1.86    |
| Access to market information  | -0.06       | 0.23           | -0.29   |
| Frequency of extension contact| 0.04***     | 0.01           | 4.04    |
| Number of livestock           | 0.05        | 0.04           | 1.34    |
| Amount of credit used         | 0.15        | 0.12           | 1.24    |
| Lagged market price           | 0.30***     | 0.08           | 3.76    |
| Family size                   | 0.04        | 0.05           | 0.88    |
| Sex of the households head    | 0.01        | 0.01           | 0.44    |
| Distance to nearest market    | -0.13       | 0.12           | -1.14   |
| R-Squared                     |             | 0.88           |         |

Source: Authors computation from the own survey data (2017); Note: ***, ** and * are significant at 1%, 5% and 10% level of probability, respectively.

3.6. Factors affecting wheat supply to the market

The results of multiple linear regressions (Table 5) indicate that five of the eleven hypothesized explanatory variables were found to have significantly influenced market supply of wheat in the district. The significant variables were quantity of wheat produced, education level of households, farming experience, frequency of extension contact and lagged market price. The signs of the significant variable's parameter estimates were as expected.

3.6.1. Quantity of wheat produced

The model result in Table 5 showed that quantity produced of wheat has significant effect at 1% significance level for wheat supplied to market with expected positive sign. Positive signs of coefficients indicate that farmers producing more wheat are increasing supply on the market. Thus, the result implied that, as quantity produced of wheat increase by one quintal, the amount of wheat supplied to market is increased by 0.13 quintal, keeping others factors constant. According to Usman (2016) and Mohammed et al. (2018), farmers' wheat production has a positive and significant effect on market supply.

3.6.2. Education level

Education has a positive relationship with the amount of wheat delivered to market at a 5% significance level. Table 5 shows that as the level of educational grade attended by the households increases, the market supply of wheat produce increases. Higher education levels can enhance the ability of an individual to upgrade and synchronize high-input grain supplies with the appropriate market place and time, thus increasing total market supply. Dibaba and Goshu (2018) found similar finding, confirming that highly educated farmers have a larger supply of marketable produce.

3.6.3. Farming experience

This variable influenced wheat market supply in a significant and positive way. The result showed that as farmers' experience increased by a year, the amount of wheat supplied to the market increased by 0.15 quintals, while all other factors remained constant. This means that farmers with more wheat production and marketing experience are better able to sell more wheat products in the market than farmers with less experience because they have a larger marketing network and more information. This is in line with the findings of Ele et al. (2013), who found that as farmers' experience grows, so does the volume of crops they supply to the market.

3.6.4. Frequency of extension contacts

The result showed that wheat frequency of extension contacts has significance effect at 1% significant level for wheat quantity supplied to market. Positive sign of the coefficient indicates that farmers who are visited frequently increase quantity of marketed supply. Visits by extension agent improve participation and increase the quantity of wheat supply to market. This is in line with previous study conducted by Mohammed et al. (2018) who found that found that frequency of extension contact on volume of wheat supply had significant and positive effect.

3.6.5. Lagged market prices

This result showed that a lagged market price has a significant effect on wheat supplied to market at a 1% significance level. As a result, as the farmer's lagged market price increased by one ETB, the amount of wheat supplied to market increased by 0.30 quintal, while all other variables remained constant. Farmers would be interested in producing and
supplying more wheat if the price of wheat was high in the market the previous year. The study of Asfaw and Ketema (2014) argued that the lagged durum wheat market price has direct relations with marketed supply.

### 3.7. Constraints in wheat production and marketing

Identifying the most important constraints in the value chain helps in the upgrade of the chain from input supply to final product marketing. During the focus group discussion, experts, farmers, and traders were asked to rank the most important constraints in wheat production and marketing in the study area. Accordingly, wheat production and marketing were limited by political, economic, social, technical and environmental factors (Figures 2 and 3).

#### 3.7.1. Production constraints

Wheat is produced predominantly by smallholder farmers in Duna district. According to the Hadiya Zone Agricultural and Natural Resource Management Department (HZANRMD), wheat farmers reported an average yield of 25.8 quintal per hectare, which was lower than the average yield (27.36 quintal per hectare) reported by Ethiopia’s Central Statistical Agency (CSA) for the 2017 production year. Most important constraints identified in wheat production in the study area include lack of viable seed, fertilizer shortage and cost, weed, drought/climate variability, erosion, frost, lack of oxen labor, wheat disease, shortage of pesticide and small land size. Of those production constraints, drought/climate variability ranked first as 98.3 percent of the sampled respondents reported as a most important constraint in wheat production in the study area (Figure 2).

#### 3.7.2. Marketing constraints

Lack of market, low wheat price, lack of storage facility, lack of transportation facility, poor shortage, lack of market information, poor market linkage with product value chain actors, low product quality, low demand, long market distance, and storage pest were the main constraints confronting the wheat marketing system in the study area. Low wheat prices were ranked first as the most important constraint in wheat marketing in the study area by respondents (Figure 3).

### 3.8. Conclusion and policy implications

In the study area, there are many actors involved in wheat value chain playing different roles. The major once are input suppliers, producers, village level collectors, wholesalers, retailers, flour processors, primary cooperatives, unions, bakeries and consumers. Regarding marketing margins and profit share across the wheat chain, flour wholesalers had the highest share of market margin (18.36%) followed by flour processors (17.70%). The highest profit share (21.28%) was obtained by flour wholesalers while village collectors obtained lower (1.37%) profit share than the other actors. This suggests that the distribution of wheat value shares was inefficient throughout the chain.

Furthermore, the results of the linear regression model revealed that the amount of wheat produced, household education level, farming experience, frequency of extension contact, and lagged market price all have a significant effect on the amount of wheat supplied to the market. Hence, the government and other relevant stakeholders should place a greater emphasis on the availability and use of improved seeds and other yield-enhancing technologies, as well as improved post-harvest practices and creating stable demand for surplus production. Agriculture extension services are critical for increasing production and productivity. It also facilitates the exchange of information and the dissemination of knowledge and scientific findings that will help farmers in the production of value-added products. As a result, bringing farmers into contact with extension agents and providing them with the necessary advice can assist farmers in increasing their output and productivity.

To share the knowledge of model households with less experienced farmers, the local government should organize field days, cross-visits, create a forum for sharing model household experience, and provide short-term training programs. The government must also devote sufficient resources to strengthening and establishing both formal and informal types of farmer education, utilizing existing human and physical resources such as extension agents and Farmers Training Centers (FTC).

### Declarations

**Author contribution statement**

Assefa Ayele; Tessema Erchafo: Conceived and designed the experiments; Performed the experiments; Analyzed and interpreted the data; Wrote the paper.

Alemayehu Bashe; Seyfu Tesfeyohannes: Performed the experiments.

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**Data availability statement**

Data will be made available on request.
Declaration of interests statement

The authors declare no conflict of interest.

Additional information

No additional information is available for this paper.

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