

## Research Article

# Analysis of Wheat Seed Supply System in the Wheat-Dominated Smallholder Farming System in West Arsi and East Shewa Zones, Oromia National Regional State

**Beriso Bati Bukul\*** 

Agricultural Economics, Adami Tulu Agricultural Research Centre, Oromia Agricultural Research Institute, Batu, Ethiopia

## Abstract

In Ethiopia, lower productivity of wheat production has been one of the significant contributors to food insecurity. Considerable efforts have been made by the government, NGOs and researchers in generating, introducing and disseminating appropriate wheat technologies to boost the production and productivity of wheat. The objective of this study was to identify the status and performance of wheat seed supply and factors that determine wheat seed supply system in West Arsi and East Shewa zones. A multi-stage random sampling procedure was used to select 240 sample wheat producers from both zones using probability proportional to size. Secondary data were also used. Descriptive statistics and econometric model were used to analyze data. Descriptive statistics and econometric model were used to analyze data. In both zones formal, informal, and alternative wheat seed systems co-exist which accounts for 18.955, 31.791 and 49.25%, respectively. Access to market and market information and credit service plays an important role in accessing of improved wheat seed supply system by smallholders' farmers. Therefore, any interventions that make farmers access to above mentioned service of the households have better enhances farmer's access to wheat seed in the area. Total land cultivated and farm experiences effect farmer's access to wheat seed supply system. Therefore, total land allocated for wheat production and farm experience have a positive effect on farmers access to wheat seed supply system. Therefore, total land cultivated should be increased by using rent-in and shared-in land to enhance access of wheat seed supply systems and farm experience have to be increased by providing different training. Based on the results obtained, the study suggests that the government and stakeholders should focus on strengthening the provision of formal and informal training, arranging experience sharing program, enhancing farmer's resource endowment in order to increase access to wheat seed supply in the study area. It is, therefore, expected that the seed producers should be capacitated through accessing credit and logistics, farm machineries, seed processing plant, store and capability (motivated and competent human resource) of seed producers to supply quality seed that could meet the zonal seed demand. Incentive mechanisms need to be devised and implemented to increase participation of cooperative unions, primary seed producer cooperatives, agents/agro-dealers and private sectors in the seed industry. Moreover, there is a need to provide training on the part of government to seed producers and agents/agro dealers on seed marketing mix.

## Keywords

Wheat, Seed Supply, West Arsi Zone, East Shewa Zone, Probit Model

\*Corresponding author: [batiberis@gmail.com](mailto:batiberis@gmail.com) (Beriso Bati Bukul)

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# 1. Introduction

## 1.1. Background and Justification

Ethiopia is the largest producer of wheat in sub-Saharan Africa (SSA), over 1.8 million hectares annually [1]. Wheat ranks third in area coverage and total production after Teff and maize, and after maize and sorghum for productivity. Bread wheat is grown primarily as a cereal crop in Ethiopia and it has been cultivated for a long period of time in the country. Although traditionally grown in the highlands, Wheat can be grown under a wide variety of agro climatic conditions, including elevations from zero to 2800 meters above sea level (m.a.s.l), under a similarly wide variety of moisture, temperature, and soil conditions. Recently, areas for wheat cultivation and its consumption have been increased rapidly in all over the world in General and in Ethiopia in particular and this may be because of its importance for consumption and raw material for agro processing [2].

In Ethiopia, Wheat is the second important food crop in area coverage after teff [3]. However, yield levels obtained by small scale farmers remained stagnant despite the availability of improved varieties [4]. On the other hand, growth in food production is not in equal footings with population pressure. Land degradation due to soil erosion, removal of organic matter for different purpose and unbalanced fertilizer application are major challenges of agricultural production.

The supply of any seed material depends on the availability of seed from the formal and the informal sectors, and their ability to develop and provide seeds of the cultivars needed to the local producers [5]. The seed system in Ethiopia consists of the formal seed sector, the informal (farmers') seed system, as well as the occasional emergency seed programs, which are often operated by some NGOs and relief agencies [5].

As a result, research and development practitioners developed different models for effective seed delivery. The overall objective of different seed supply models was to ensure seed security by enhancing the availability and accessibility of seeds. To this regard, participation of farmers in seed production could be considered as an alternative strategy in securing the seed demand of the majority of the small holder farmers. Thus, farmers will be trained to produce quality seed for their own use and for local seed provision to explore opportunities for small-scale seed enterprise. So, based on this idea farmer-based seed production and marketing schemes is designed as an alternative strategy to increasing farmers' access to and the availability of seeds of improved varieties in the study area.

However, there were no comprehensive earlier studies which investigated on the status and performances of durum and bread wheat seed supply system in the study area. Virtually, no study has been done on factors affecting wheat seed supply among wheat producing farmers in West Arsi and

East shoa zones. Thus, there is a little knowledge about the level/status of seed supply and the underlying factors affecting them in West Arsi and East shoa zones. This project study, therefore, aims at assessing the status and determinants of wheat seed supply, with a view to filling the existing knowledge gap.

## 1.2. Research Questions

What is the status and performances of wheat seed supply systems in West Arsi and East Shewa zones?

What are the factors determining wheat seed supply system in West Arsi and East Shewa zones?

## 1.3. Objectives of the Study

The overall objective of this project study is to assess the status and performance of wheat seed supply system and factors influencing durum and bread wheat seed supply in West Arsi and East Shewa zones of Oromia National Regional State, Ethiopia.

*Specific objectives of the study*

- 1) To describe the status and performance of wheat seed supply systems in the study area
- 2) To identify factors that determines wheat seed supply in West Arsi and East Shewa zones

# 2. Research Methodology

## 2.1. Description of the Study Area

The research were conducted in West Arsi and East Shoa Zones. West Arsi Zone is found in the south part whereas East Shoa Zone is found in central part of the Oromia National Regional State. West Arsi Zone lies between 6° 00' N to 7° 35' N and 38° 00' E to 40° 00' E and demarcated by Bale Zone in west direction, Arsi Zone in East direction, Southern Nation Nationality and People Regional State in South direction, and East Shoa Zone in north direction. The Zone has 12 districts. Shashemane is the capital city of West Arsi Zone and located at 250 km from Addis Ababa/Finfinnee towards South direction on Addis Ababa/Finfinnee-Hawassa main asphalt road.

West Arsi Zone encompasses different agro-ecologies namely high land, midland and lowland. In the Zone the high land agro-ecology (47.92%) took more coverage followed by midland (42.50%) and lowland (9.82%) agro-ecologies. The Zone lies within altitude of 1500-3800 meter above sea level [6].

The total population in the Zone was 2,290,280 of which 45.50% are male and 50.50% are female. The Zone receives 600mm-2700mm annual rain fall and has a bimodal pattern

of rain fall. It also receives 12°C-27°C annual temperature per year. The Zone has a total of 1,286,277.50 hectare of land. From the total land, 0.36% is arable land, 29.27% cultivated land, 19.50% forest land, 17.05% grazing land, 4.58% used for construction and 29.26% used for other purposes [6].

East Shoa Zone lies between 60 00' N to 70 35'N and 380 00'E to 400 00'E. This zone is bordered on the South by the West Arsi Zone, on the Southwest by the Southern Nations, Nationalities and Peoples Region, on the West by South west Shoa Zone, on the Northwest by North Shoa, and on the Southeast by Arsi Zone. Adama city is the capital city of East Shoa Zone and located at 100 km from Addis Ababa/Finfinnee towards South-East direction.

East Shoa Zone has different agro-ecologies which categorized as highland, midland and lowland agro-ecologies. In the Zone, 18.70% of the agro-ecology is high land, 27.50% is midland and 53.80% is lowland. The total population in the Zone was 1,275,645 of which 53.26% are male and 46.74% are female. It receives 350mm-1150 mm annual rain fall and has uni-modal nature of rain fall pattern. This Zone also receives 12°C-39°C annual temperature per year [6].

The Zone has a total of 971,159.21 hectare of land. From the total land, 12.57% is arable land, 47.31% is cultivated land, 4.18% forest land, 14.58% grazing land, 4.89% is used for construction and 12.82% is used for other purposes [6].

## 2.2. Data Types, Sources and Methods of Data Collection

Both primary and secondary data source were used for this project study. This research were primarily based on primary data generated through cross-sectional survey during 2020 production season. The primary data was collected using structured questionnaire, key informant interviews, and focus-group discussions. Semi-structured questionnaire: semi-structured questionnaire was used to collect primary data on wheat seed supply related information. Both closed and open-ended semi-structured questionnaire prepared to generate the required information. Prior to the actual data collection, semi-structured questionnaire were pre-tested to ensure clarity, validity, and sequence of the question. The questionnaire were pre-tested in each selected *Woreda* and revised according to the feedback obtained. Then, the final semi-structured questionnaire will be employed to collect data from the sample wheat producing farmers. Key informant interview: This was used to collect more information from some key informants on pertinent issues. This helps to understand better the issues that were raised and to triangulate the answers provided by the respondents. To obtain the views of key informant interviewees, checklist was prepared and information was collected through unstructured interview. Key informant interview was conducted with government officials and development agents in each sample *Woreda* of east shoa zone. Focus-Group Discussions (FGD): This was made on the issues related to Durum and bread wheat

seed supply system among Durum and bread wheat - dominated smallholder farmers operating in the Durum and bread wheat-dominated farming system. This helps to take into account different points of views and helps to strengthen or argue against some answers of farmers based on the results obtained. Accordingly, with the help of checklists/unstructured question discussions were held with selected Durum and bread wheat producing farmers to get some general information about Durum and bread wheat seed supply system in the selected *Woredas* of West Arsi and East shoa zones.

To complement the primary data, secondary data were collected from both government and Non-Government Organizations (NGOs). The major sources of secondary data were from both published materials and online resources such as Central Statistics Agency (CSA), Food and Agriculture Organization (FAO) data base and West Arsi and East shoa zones agriculture office.

## 2.3. Sampling Procedure and Sample Size

The study was based on the data that were obtained through a farm household survey administered to sample farm households drawn through multi-stage sampling techniques. The three-stages that involve the selection of (1) sample *Districts*, (2) *Kebeles* and (3) smallholder farmers are as follows:

Stage 1: In the first stage, four *Districts* were purposively selected based on potential of Durum and bread wheat volume of production for both zones each with the collaboration of east shoa and west Arsi zones agricultural office expert.

Stage 2: In the second stage, three wheat growing *Kebeles* were selected from each of the four selected *Districts* using simple random sampling method for both zones.

Stage 3: In the third stage, 240 farm households were randomly selected from both zone (120 households from each zone) from lists of names of household head in the *Kebeles* using simple random sampling. Accordingly, a sample of two hundred and forty (240) farming households were collected based on sample determination formula of [7]. as follows:

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

Where, n = is the sample size of wheat producer households, N= total number of households producing wheat in the districts, e= level of precision considered 9%. The probability proportional to size were to select sample farmers from each selected *Kebeles* of the study area.

## 2.4. Methods of Data Analysis

In this study, descriptive and inferential statistics and econometric models were used to analyze data.

### *Descriptive analysis*

Descriptive statistical tools such as average, ratios, percentages, frequencies, etc. were applied to describe household and farm characteristics of the study areas while inferential statistical methods such as  $\chi^2$ , t-tests were used to see the relationship b/n variables of interest.

#### *Econometrics model*

The purpose of this section is to describe the analytical models for estimation of source of durum and bread wheat seed supply inefficiencies and its determinants. Probit model were used to analyze factors that determine durum and bread wheat seed supply inefficiency.

### 3. Result and Discussion

From a total of 240 sample respondents collected, 120 were from West Arsi zone (Negele Arsi and Dodola districts) whereas the remained 120 was from East Shewa zone (Lume and Dugda districts).

#### 3.1. Demographic Characteristics of Sampled Households for West Arsi Zone

**Table 1.** Socio-demographic characteristics for West Arsi zone.

Items	Sample size (120)	
	Mean $\pm$ Std. dev.	Range
Age	40.77 $\pm$ 13.94	20-99
Experience in wheat production	20.93 $\pm$ 11.82	1-52
Household size	7.73 $\pm$ 2.96	1-15
Own land holding (ha)	1.308 $\pm$ 1.079	0.125-5.5
Irrigated land (ha)	0.031 $\pm$ 0.143	0-1
Total land holding (ha)	1.80 $\pm$ 1.488	1-11
Land allocated under wheat/seed (ha)	1.226 $\pm$ 2.93	0.63-11
TLU	7.6658 $\pm$ 5.032	
Grade level	6.059 $\pm$ 3.4318	

Source: Survey result 2022

The most dominant crop produced in West Arsi zone was wheat. Seed wheat farmers allotted substantial area of total operated land for wheat production, i.e., 68.11% (1.226ha from 1.80 ha) [Table 1](#). The average age of the sample respondents were found to be 40.77 years. This result implied that the sample respondents were work age group and can increase production if they get technology and training. The average education level of literate sample household heads during survey period was about 6 years with the minimum of

zero years (illiterate) and maximum of 12 years. The average family size of the sample households was 8 persons per household, which is more than the national average of 4.6 persons per household [\[8\]](#). The farming experience of wheat production were about 20.93 years. This implies that the producers can increase the efficiency as their experience increase since they were adult. On average, sample household owned livestock of 7.67 TLU. This indicates that the farming system in Ethiopia is mainly based on plough by animal draught power that has created complementarity between crop and livestock production ([Table 1](#)).

#### 3.2. Demographic Characteristics of Sampled Households for East Shewa Zone

Average age of the overall sampled respondent was found to be 41.82 years. The average age of the sample households during the survey period, was about 41.82 years having farming experience 23.15 years which was less than 65.97 year of average life expectancy for both sex in Ethiopia [\[8\]](#). Based on [\[8\]](#) this average value of age included in the most economically active age group of 17-50 year.

The average education level of literate sample household heads during survey period was about 6.4 years with the minimum of zero years (illiterate) and maximum of 12 years. Family size plays an important role in crop production and most farmers depend mainly on family labor. The average family size of the sample households was 6 persons per household ([Table 2](#)) which is greater than 4.6 persons per household as Ethiopia, based on household size and composition around the world in 2017.

Cultivated farmland was calculated as a sum of owned land, rented-in and shared-in farm land less shared-out farm. It is an effective farm land amount used by sample households to undertake agricultural production. Sample households were found to hold a mean of 1.44 ha of cultivated land in the survey year from total land holding of 1.92ha.

On average, sample household owned livestock of 6.345 TLU. This indicates that the farming system in Ethiopia is mainly based on plough by animal draught power that has created complementarity between crop and livestock production ([Table 2](#)).

**Table 2.** Socio-demographic characteristics for East Shewa zone.

Demographic characteristics	Total Sample (n=120)	
	Mean	Std. Dev
Age of HH head	41.823	12.3215
Farm Experience	23.1535	12.268
Family size	6	2.9988
TLU	6.3488	3.369



Demographic characteristics	Total Sample (n=120)	
	Mean	Std. Dev
Grade level	6.4323	2.7398
Land cultivated	1.442	.9559
Total land holding	1.924	1.2590

Source: Survey result of 2022

### 3.3. Wheat Seed Systems in West Arsi and East Shewa Zones

The seed system involves organizations, individuals and institutions performing different functions in the seed value chain, i.e., the development, multiplication, processing, storage, distribution and marketing of seeds. In the mean time, seed systems can be defined as the ways in which farmers produce, select, save and acquire seeds [9]. As the study result indicate that, in both zones i.e. West Arsi and East Shewa, there are three seed wheat systems exist, namely formal, informal, and alternative. All of the systems are briefly explained below.

#### *Formal seed system*

The formal seed system on the other hand is a system that involves the production of seed using known sources of planting materials and under goes certification process for its seed production. Thus it encompasses at least breeding system that supply initial planting material, licensed seed producers and regulatory system that certify the produced seed. It is governed by strict regulations in order to maintain variety identity and purity as well as to guarantee physical, physiological and sanitary quality. In Oromia, the major actors in formal seed system are public organizations (IQQO, OSE, ESE), unions and private seed companies (Pioneer Hi Bred Seed, Ano Agro-industry, etc). As the study result show that it supplies 18.96% of the seed required in study area.

**Weaknesses:** Insufficient supply of seed: The proportion of seed supplied by formal seed system is estimated to cover 18.96% of cultivated land per year (Table 3), suggesting that few farmers have access to seeds of pure improved varieties seeds. Nevertheless, after more than many years of operation, the formal seed sector could not adequately satisfy the seed demand of the vast majority of the zones' farmers who are smallholders and subsistence.

#### *Informal seed supply system*

The informal seed system in Ethiopian context is defined as seed production and distribution along with the different actors where there is no legal certification in the process. This includes retained seed by farmers, farmer-to-farmer seed exchange, community-based seed multiplication and distribution, NGO based seed multiplication and distribution, relief seed, on-farm seed multiplication by research centers

and universities with college of agriculture in the process of technology demonstration and pre-scaling out schemes. Much of the seeds supply dominated mainly by informal seed system. This seed system exists in all wheat growing districts of West Arsi and East Shewa zones. As the study result show that it supplies 31.79% of the seed required in study area meaning 31.79% the cultivated land in 2022 cropping season is covered with this seed supplied from the informal seed system.

**Weakness:** Poor seed quality: farmers' seeds are poor in quality due to poor pre and post-harvest management. Further, it is due to low knowledge and skill on seed production and quality maintenance as well as poor storage.

#### *Intermediary/integrated seed system*

The integrated seed system is specifically defined as business-oriented formally organized farmers groups (seed producer cooperatives) that are engaged in the multiplication and distribution of certified seeds. These groups fall into a middle category outside of formal and informal seed system. In this case, seed producer cooperatives are the major actors of the system. Intermediary seed system focusing on organizing and supporting groups of farmers and then legally registered and licensed as seed producer cooperatives to produce and market quality seed at the local level [10, 11]. The seed producer cooperatives target on diverse crops and varieties that are less focused by public and private seed producers. The seed producers sell their seed through diversified market channel: directly sell to the farmers, through contractual agreement either with public, unions or private seed producers and even direct sell to different institutions.

Local based seed productions by the seed producer cooperatives have multiple advantages. Among multiple uses, (i) provides to farmers with a broad range of seed products that are less profitable for large-scale seed enterprises (ii) potentially reduce the costs of seed production and transportation (iii) improve adoption of new crop varieties by potentially serving as demonstration sites (iv) increase timeliness of seed delivery through alternative channels and models and (v) provide more direct support for farmers to generate more income [10]. As the study result revealed that the alternative seed wheat system supplies about 49.25% of the total supply (Table 3), suggesting that majority of wheat seed demand covered by integrated seed supply system in the study area.

**Weakness:** Limited Capacity of committee members: the skill and knowledge, willingness (to serve the members) of management committee members of the seed producer cooperative are the main determinant for their success or failure. For instance, some of the cooperatives whose management committee members are capable and very committed are in a position of advancing forward in producing and marketing of quality seeds while other seed producers are failed. Moreover, election of totally new committee members (particularly, executive committee members) with less skill in management and leadership has happened, taking back the overall management capacity of a particular seed producer cooperative.

tives [12].

**Inadequate quality seed:** Some of the seed producer cooperatives fail to meet minimum quality standard because of the technical capacity gaps of the farmers, committee members, particularly the internal quality control committee. In addition, the external quality control bodies are not well furnished to address those groups farms for inspection and certification.

**Low seed recovery rate:** Due to unfair seed price compared to grain price of the same crops, particularly self-pollinated crops like bread wheat, the farmers are reluctant to collect their seed product to the cooperatives' store as collective seed marketing. In addition, lack of financial capacity for seed collection during peak time resulted in low seed recovery rate.

**Limited financial and infrastructure capacity:-**This is the fundamental challenges for most of seed producer cooperatives that resulted in poor quality seed supply and low seed recovery. In other words, the cooperatives are not strong enough in investing on value addition activities such as

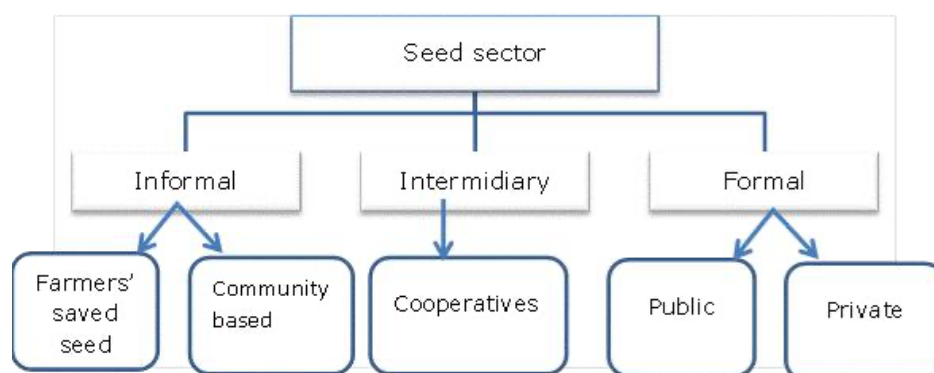
packaging, grading, treating and etc.

**Limited access to Early Generation Seeds (EGS):** Most of the seed producer cooperatives are unable to access EGS from the sources as they unable to get information, high competition for limited EGS, and overlooked by government organization during EGS allocation.

**Table 3.** Wheat seed supply system exist in West Arsi and East She-wa zones.

No	Seed system existed	Percent	Remark
1	Formal	18.96	
2	Informal	31.79	
3	Integrated	49.25	

Source: Survey result of 2022.



**Figure 1.** Structural description of seed supply sytem in Both zones.

### 3.4. Current Status of Seed Wheat Systems in the Study Area

The main characteristics describing the current status and performance of seed wheat systems in the study area are summarized in Table 4.

About 87% smallholder farmer produce wheat seed individual however the remained 13% produced by cluster. 85% of the farmer store the seed produced in different place from grains. As indicated on above Table 3, 31.79% of seed supplied in the study area was covered by informal seed supply system, from which own saving accounts for about 39% by wheat producer. In the mean time 58.62% of smallholder farmer use improved seed for production, whereas the remained use local varieties. 73.75% of smallholder farmers using improved seed for production get the seed through purchasing. The farmer purchases the certified wheat seed

mostly from Seed enterprise and cooperative union which accounts for 49.17 and 22.5%, respectively.

As the study result indicate that, 73.33% of farmers facing problems in getting high quality seed when they need for planting. Farmers can obtain information on name, source, yielding ability, marketability and food quality of varieties and production practices from various sources, such as family members, neighboring farmers, extension agents, NGO employees, researchers, and potato traders. Study result indicate that about 60.83% of the farmers in the study area of both zones obtain information on the aforementioned characteristics of varieties from farmers in their own community.

There was variability in technical inputs and output among wheat producing farmers (Table 4). Land, fertilizer, labor, seed, and chemical were included in production function to produce wheat output. This is economic process of producing output from these inputs or uses resources to create output that are suitable for users. On average sample households

produced 47.175 and 39.042 quintals of grain wheat and seed wheat respectively.

**Table 4.** Summary of Seed Wheat production and supply systems.

Item	Current status	Remark
Seed system		
Formal	18.955%	
Alternative/integrated	49.25 (Few specialized cooperative and private seed growers)	
Informal	31.791	
Seed source and% of farmers using this source		
Own saving	39.19	
Purchased from other farmers	15.00	
Purchased from traders	7.5	
Own saved, purchased from other farmer and trader	15.00	
Own saved and purchased from other farmer	8.33	
Other	14.98	
Did you purchased certified seed of improved wheat?		
Yes (%)	73.75	
No (%)	26.25	
Have you been growing improved wheat seed?		
Yes	58.62	
No	41.38	
By whom the seed was produced?		
Ethiopia seed enterprise	49.17	
Oromia seed enterprise	15.00	
Private seed company	1.67	
Seed producing cooperative union	22.50	
Other source (NGO)	11.66	
Source of Certified seed of wheat		
Cooperative	50.00	
Woreda agriooffice	8.33	
Woreda agriooffice and NGo	18.33	
NGO	5.10	
Public seed campony	8.33	
Private seed campany	10	
Availability/access of high quality seed of wheat when you need for planting		
Yes	26.67	
% of farmers facing problems in getting high quality seed	73.33	
Ways of wheat Seed producing		
By cluster	13.10	

Item	Current status	Remark
Individual	86.90	
Seed storage methods (% of farmers)-store the seed in different place from grains?		
Yes	85.22	
No	14.78	
Production and productivity		
Land cultivated under wheat (ha)	1.22	
Average wheat yield (qu/ha)	47.175	
Land allocated under wheat seed (ha)		
Actual seed wheat yield (qu/ha)	39.042	

Source: Survey result of 2022

### 3.5. Factors That Determines' Wheat Seed Supply/Access/Availability in the Study Area

**Table 5.** Factors that determines wheat seed supply/Access/Availability in the study area.

<b>Number of observations =240</b> <b>LR chi<sup>2</sup>(12) = 48.31</b> <b>Prob &gt; chi2 = 0.00000</b> <b>Pseudo R2 = 0.3539</b> <b>Log likelihood = -44.1024</b>				
	Coefficients	Std. Err.	z	P>z
Age of HH	0.047*	0.0605	1.84	0.0605
Sex of HH	1.034**	0.500	2.07	0.039
Education level of HH	0.199	0.251	0.79	0.430
Farm experience	0.049*	0.0266	1.84	0.065
Family Size	-0.023	0.0588	- 0.39	0.694
Total land	0.314 ***	1.22	2.57	0.010
Access to extension	0.465	0.322	1.45	0.148
Access to credit	0.833*	0.477	1.74	0.081
Market access	0.951**	0.4612	2.06	0.039
Access to market information	1.893***	0.429	4.41	0.000
Cooperative	-0.6056	0.387	1.56	0.118
Constant	-1.799	1.4056	-1.28	0.200

\*\*\*, \*\*, \*: implies statistical significance at 1%, 5%, and 10% levels, a = Natural logarithm, Log pseudo likelihood = -44.1024, Pseudo R<sup>2</sup> = 0.3539, Wald chi2 (12) = 48.31, Prob> chi2 = 0.0000, N = 240, Source; model result, 2022.

Age of HH: As the probit model result indicate that, as households age increases the likelihood of accessing wheat seed increase by 4.7%. This result is in conformity with the finding of [13].

Sex of HH Head: As the probit model result indicates, be-

ing male household head had positive and highly significant influence on the likelihood of accessing wheat seed at 5% significance level, suggesting male family heads get access to seed wheat than female family head by 10.3%.

Farm Experience of HH: As the probit model result indi-



cate that, as households farm experience increases by 1 year the likelihood of accessing wheat seed increase by 4.9%. The consistent with *prior* expectation, Farm experience significantly and positively affected access of wheat seed supply system at 10% level of statistical significance. The result implies that for each additional 1 year, the households would 4.9% more likely to access wheat seed supply system, keeping other factors constant. Farmers with higher farm experience are found to be better access of wheat seed supply system as compared to those with lower farm experience levels.

**Total Land cultivated:** Land is one of the most important and scarce resources in agricultural production. The size of total land cultivated hypothesized to have positive impact on the access of improved wheat seed supply system. The consistent with *prior* expectation, total land cultivated significantly and positively affected access of wheat seed supply system at 1% level of statistical significance. The result implies that for each additional hectare of total land cultivated for wheat production by 1 ha, the households would 31.4% more likely to access wheat seed supply system, keeping other factors constant. Farmers with higher total land cultivated are found to be better access of wheat seed supply system as compared to those with lower total land cultivated. Some studies suggested that small farm size is expected to be more access to efficient wheat seed supply system than large frames because of its less expensive and less transaction costs. But some others oppose to this, they argue that larger farmer is more likely to employ improved agricultural technologies, used as a capital base and enhances the risk bearing ability of farmers and hence could be more access to wheat seed supply system than small farms due to its advantage of the economic scale and scope associated with larger sizes [14].

**Access to Credit:** Consistent with *prior* expectation, access to credit of the household head, which is one of the important indicators of capital, has a positive and significant effect on access of wheat seed varieties at 10% level of significance, implying that the likelihood of access to wheat seed supply system increases with farmers' access to credit. Being access to credit service of the household head increases the probability that a farmer access to wheat seed supply system by 83.3%. Use of cash credit in wheat production is one of the important factors that affect the wheat seed supply system. It affects the ability of a farmer to obtain the necessary inputs at the right time and in suitable quantities. This, in turn, substantially affects efficiencies of wheat seed supply system. Thus, a positive relationship was expected between the use of credit (cash) and wheat seed supply system.

**Market access:** Market access statistical significant at 5% level. Being access to market access increase the probability of wheat seed supply access of households by 95.1%.

**Access to market information:** Access to market information statistical significant at 1% level. Being access to market information increase the probability of wheat seed supply access of households by 18.93%. Therefore, in order to increase seed access Establishing Seed Information Sys-

tem is important- to increase information on what seed is available and accessible and to modernize the delivery of the seed sector service and address some of these seed issues establishing a database and an ICT-based service delivery and information exchange should get due attention from all stakeholders. This type of data management system, which is ICT assisted system, can be accessed easily by seed actors to make seed available to areas in need [15].

## 4. Conclusions and Recommendation

### 4.1. Conclusions

In this study we describe the state of affairs of seed wheat systems in West Arsi and East Shewa zones and we attempt to elicit the main areas of improvement and the main steps to be taken in the roadmap towards these improvements. With regard to the current status of seed wheat systems we conclude that there are three seed wheat systems operating in the study area, i.e. the formal, informal, and alternative.

More specifically we conclude:

- 1) Wheat seed supplied by the informal seed wheat system (supplies 31.79% of seed used in the study area of the zones) are deemed to be poor in health, unsuitable in physiological age, poor in genetic quality, impure (varietal mix-up), physically damaged and inappropriate in size. Besides, in the informal seed potato system, seed are produced usually as part of grain and stored under poor conditions. In this seed system farmers usually use varieties of unknown origin and improved varieties are not available to the majority of the farmers. Lack of awareness about the availability and use of improved technology and practices has also impeded adoption of wheat technologies.
- 2) The alternative potato system, which co-exists with the informal seed system in the study areas, supplies better quality seed tubers than the informal seed potato system. Amount of seed supplied by the alternative seed wheat system is very high (49.25%) and thus the system still has covers large amount of wheat seed demanded by small holder farmers in the study area.
- 3) The formal seed system on the other hand is a system that involves the production of seed using known sources of planting materials and under goes certification process for its seed production. Thus it encompasses at least breeding system that supply initial planting material, licensed seed producers and regulatory system that certify the produced seed. It is governed by strict regulations in order to maintain variety identity and purity as well as to guarantee physical, physiological and sanitary quality. In Oromia, the major actors in formal seed system are public organizations (IQQO, OSE, ESE), unions and private seed companies (Pioneer Hi Bred Seed, Ano Agro-industry, etc). As the study result show that it supplies 18.96% of the seed

required in study area.

The main objective of this study was intended to identify the status and performance of wheat seed supply system in West Arsi and East Shewa zones and determine the factors affecting wheat seed supply system in the study area, Oromia National Regional State, Ethiopia. The model output result shows that age of HH, sex of HH, Farm experience, land cultivated, access to credit, access to market and access to market information, have positive influences on farmer access to wheat seed supply system.

## 4.2. Recommendation

In order to solve the above core constraints and other related weaknesses discussed in this document, the following interventions are forwarded in order of priority so as to improve the both zones seed industry.

Access to market information and credit service plays an important role in accessing of improved wheat seed supplied by smallholders' farmers. Therefore, any interventions that make farmers access to above mentioned service of the households have better enhances farmer's access to wheat seed supply systems in the study area.

Land allocated for wheat production have a positive effect on farmers access to wheat seed supply system. Therefore, land allocated for wheat production should be increased by using rent-in and shared-in land to enhance access of wheat seed supply systems.

- 1) To improve the informal seed wheat system increasing awareness and skills of farmers, improving seed quality, and improving market access is the best solution.
- 2) To improve alternative seed systems availing new varieties, designing quality control methods and reducing cost of seed production as solution to solve the problem.
- 3) To improve the overall seed wheat supply in the study area, there should be co-existence and a good linkage of the three seed systems, and development of self-regulatory and self-certification in the informal, alternative and formal cooperative seed wheat systems. As a continuation of this study several studies are underway. These include analysis of options to improve the seed quality and designing of an improved seed wheat supply chain.

**Improving the Seed Supply System:** Despite the availability of superior improved seeds varieties, their supply and distribution have often been limited. In this line, the seed multiplication and distribution activities should be strengthened. This can be realized through, among others, improving the capacity of the available seed multiplication and dissemination systems and encouraging the involvement of private sector in seed multiplication, the public being limited to the overall supervision of the seed quality being produced and other regulatory measures.

- 1) It is, therefore, expected that the seed producers should be capacitated through accessing credit and logistics, farm machineries, seed processing plant, store and ca-

pability (motivated and competent human resource) of seed producers to supply quality seed that could meet the zonal seed demand. Incentive mechanisms need to be devised and implemented to increase participation of cooperative unions, primary seed producer cooperatives, agents/agro-dealers and private sectors in the seed industry. Moreover, there is a need to provide training on the part of government to seed producers and agents/agro dealers on seed marketing mix.

- 2) There is a continuous limitation in availability of EGS for crops and varieties in production. The failure to put in place a coordination system that governs quality EGS production and accountability, as laid down by the mandate given by different legal frameworks, is a major challenge. There is an experience where a given EGS producer or recipient company will not be accountable for what they entered to the agreement. In this regard the proposed approach designed to bring accountability of producers in contract-based EGS production and supply has to be institutionalized, well-coordinated, strengthened and enforced.
- 3) The marketing and distribution should be done by both public and private seed producers and/or their legal agents (that could be cooperative unions, agents, agro-dealers, etc) to ensure traceability, accountability and transparency as well as competitiveness in terms of price, quality, brand and convinces. Farmers' awareness about the use of improved seed, availability and characteristics of varieties would also be encouraged through seed extension and other promotional activities such as demonstration, field days, mass media and other methods. Besides the extension work carried out by Oromia BOANR, seed producers should also be encouraged to undertake seed extension and promotion.
- 4) Agro-dealers/agents development should be encouraged as a strategy to ensure efficient seed distribution including other agricultural input. Development of guide lines to ensure transparency, accountability and enforcement mechanisms should be in place to enhance stakeholders' confidence in the DSM. The regulatory body of the region should award license and COC for the agents and/or agro- dealers so as to ensure transparency and accountability.
- 5) Enhancing the performance of conventional seed distribution system: this is possible through making stakeholders engaged in seed distribution is accountable in seed demand assessment and allocation which means demand is assessed by multipurpose cooperative unions and FCUs themselves.
- 6) Establish Seed Information System:- to increase information on what seed is available and accessible and to modernize the delivery of the seed sector service and address some of these seed issues establishing a database and an ICT-based service delivery and information exchange should get due attention from all stakeholders.

This type of data management system, which is ICT assisted system, can be accessed easily by seed actors to make seed available to areas in need (SST, 2019).

## Abbreviations

CSA	Central Statistics Agency
EGS	Early Generation Seeds
FGD	Focus-Group Discussions
Ha	Hectares
HH	Households
m.a.s.l	Meters Above Sea Level
NGO	Non-Governmental Organizations
SSA	Sub-Saharan Africa
TLU	Tropical Livestock Unit

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## Author Contributions

Beriso Bati Bukul is the sole author. The author read and approved the final manuscript.

## Conflicts of Interest

The author declares no conflicts of interest.

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