Challenges and Opportunities of Soybean Marketing in Chewaka District, Ethiopia

Kumilachew Achamyelh[1] and Mesfin Hailemariam[2*]

[1]*Ethiopian Institute of Agricultural Research, Jimma Agricultural Research Center, Department of Agricultural Economics Division, P.O. Box 192, Jimma, Ethiopia.*
[2]*Ethiopian Institute of Agricultural Research, Jimma Agricultural Research Center, Department of Field Crop Division, Pulse Breeding Division, P.O. Box, 192 Jimma, Ethiopia.*

Authors' contributions

This work was carried out in collaboration between both authors. Author KA developed the outline and carried out the major parts of the literature performed the experiments. Author MH had a literature revised and add key section of results and discussion parts. Both authors read and approved the final manuscript.

Method Article

ABSTRACT

The pricing system for soybean is complex because it involves interactions between the markets for soybean grain, soybean meal and soybean oil. The study was undertaken with the objective of identifying and describing the constraints, challenges and opportunities of soybean production and productivity and its impact on the livelihoods of smallholder producer farmers in the area. A multi-stage random sampling techniques were employed to select a total of 153 farmers from four Kebeles. Data were collected from both primary and primary secondary sources. Descriptive statistical analysis, Strengths Weaknesses, Opportunities and Threats (SWOT) analysis, econometrics analysis and value chain analysis were used to analyze the data. Soybean value chain analysis of the study area revealed that the main value chain actors are input suppliers, direct market actors and chain supporters. The major constraints identified are input supply constraints viz., rhizobium inoculants and different pesticides; lack of collateral to get credit, poor storage facilities, low price of the produce in market, and low negotiation (bargaining) power of producers.

Corresponding author: E-mail: jrmesfin@gmail.com, mhailemariam92@yahoo.com;

Moreover, the opportunities are the availability of Union and different NGOs working in soybean, strong community based seed system in the area, wide arable land for soybean production, government's policy support for soybean sub-sector and establishments of soybean based agro-industry. Therefore, improving extension services of soybean, minimizing the transaction cost of soybean, improving the transportation access, to link producers to chain actors and facilitators, to set up demand driven soybean improvement, increase land allocation for large scale production and market information dissemination are require to improve productivity and profitability of soybean farming in the region and Ethiopia at large. Practical use of trade and marketing policies (including subsidy policies) are needed in this country to compete for the export market.

1. INTRODUCTION

The trade in soybean, an important animal feed product, exemplifies the environmental and socio-economic impact of global markets and global agricultural policy [1]. According to the estimation from US department of agriculture (USDA) in the year 2018/19, soybean production is around 120,000 metric tons, up to 5,000 metric tons in the response to the growing local market. This implies that the soybean production is more than tripled from 35,000 metric tons in 2011/12. In addition to this; USDA predicts the soybean consumption is 43,000 in the year 2018/19. But the actual figures of soybean production was estimated at 200,000 metric tons, up 10,000 metric tons in response to growing local demand for cooking oil, soy-based foods, and livestock feed in Ethiopia. According to Hailu et al. [2], the growth in production is attributed mainly to the increase in area of production. The total area of land under soybean production during the last 10 years has increased by tenfold, while the total volume of production during the same period increased 21 times. Likewise, the productivity level of soybean is 2.1 tons per hectare and this level is very low as compared to its potential, which could go up to 4 tons per hectare if improved varieties are used. Unlike this fact, the land coverage of soybean around Illuababora tends to lower by 54% respondents reduce their land .From that 63% of among from the respondents' was due to make situation [3].

Ethiopia adopted the Agricultural Development Led Industrialization (ADLI) development strategy in 1994/95. The strategy argues that growth starts from agriculture and initiates the growth of other sectors especially the industry sector through backward and forward linkages (MoFED, 2006). Furthermore, Ethiopia launched and commenced implementing earnestly its Growth and Transformation Plan (GTP) in 2009/10. GTP envisages the ADLI strategy to continue with the bid to transform the Ethiopian economy from agriculture domination and using agriculture itself as a stepping board (MoFED, 2010). Therefore, it is becoming increasingly crucial for policymakers to focus immediate attention on agro-industries. Such industries, established along efficient value chains, can increase significantly the rate and scope of industrial growth (UNIDO, 2009).

Soybean is one of the biosphere's most important pulse crops with an annual worldwide world soybean production in the 2017/2018 market year will be 346.02 million metric tons. As one can see the world growth of soybeans has been impressive; growth has increased by about 350% since 1987. The commercial growth of livestock and poultry is perhaps closely correlated with this growth. Soybeans are supplying the world a needed source of protein and oil required for growth. (wwww.soymeal.org/soy-meal 2019). There is also the prospect of intercropping soybean with long stem crops such as maize and sugarcane (Jagwe and Owuor, 2004).

The main soybean-producing areas are in the western part of the country in the Oromia and Benshangul Gumuz, and Amhara regions. According *to* the land suitability analysis of the *crop,* soybean is the second among legumes in terms of land area moderately and highly suitable for its production in the country. It covers an estimated 42,067,700 (37.2%) ha of land, of which Oromia (14.6%), Amhara (6.3%), SNNP (6.2%), Benshangul Gumez (4.2%), Tigray (2.5%), Gambella (1.7%) and Somali (0.87%) regions that contributed about 16.5, 7.2, 7.0, 4.8, 2.8, 1.9 and 1.0 million hectare of land, respectively [4]. This implies low to mid altitude areas of the country are suitable for the *crop.* Buno Bedele zone of Chewaka woreda is

one of the high potential area for enhan*cing* commercial soybean production (Ethiopia, 2009; J.H.M.). Despite the importance of soybean to deal with food and nutrition insecurity problems prevailing within the country, little emphasis has been given to the assembly, supply, and export of this important commodity.

Buno Bedele Zone of Chewaka districts, is one of the the most suitable and prominent soybean production areas in Ethiopia. Soybean is a major cash crop which is mainly produced by smallholder farmers and in some extent by private farmers. However, the farmers do not have the expected benefit as of having potential because of market-related problems. Therefore, this study aims the challenges opportunity and prospects of soybean production and productivity.

1.1 Objective of the Study

The major aim of this study is to identify and describe the constraints, challengies, opportunities, and of soybean production and productivity and its impact on the livelihoods of smallholder farmers in the study area.

Specifically, the study was proposed:

- ❖ To identify the determinants of soybean production supply to the market and;
- ❖ To isolate the prospects of soybean production, productivity, and marketing in the study area.

2. METHODOLOGY

2.1 Description of the Study Area

Chewaka woreda is located in the Buno Bedele zone and is located 600 kilometers west of Addis Ababa. It has 28 administrative *kebeles.* The total land area of the woreda is about 52,227 hectares and the population estimated to be 78,783.

Chewaka lies in the moist "*Weina dega"* agro-climatic zone and experiences both high temperatures and rainfall. The average temperature is 24.0°C. The rainfall of the woreda is between 1,200-1,500 mm per annum and has an altitude ranging from 1,600-2,000 above sea levels. Red brown soils and such trees as Acacia, Cordia, and Ficustend to characterize the zone. It has two crop production seasons –*Meher* (main) and *Belg* (short rain).

2.2 Types and Sources of Data

Both primary and secondary sources were used for data collection. Primary data sources were soybean producer farmers from four purposely selected Kebeles and soybean traders (wholesalers, retailers, and local collectors). Secondary data were collected from different sources such as: District Agricultural Office, District Trade and Market Development Office, District Cooperative Promotion Office, Ethiopian Commodity exchange(ECX), reports, bulletins and websites.
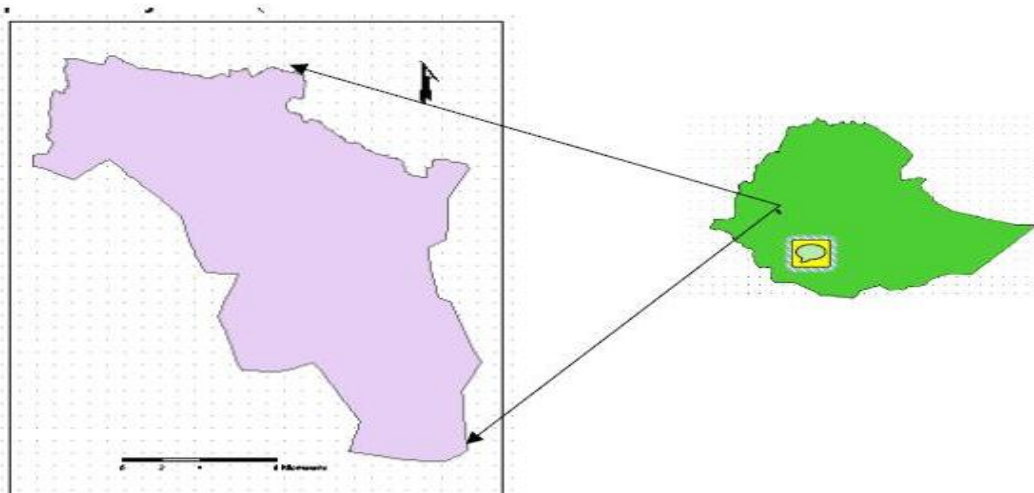

Fig. 1. Map of study Area (Chewaka Woreda)

2.3 Sampling Procedure and Sample Size

A multi-stage sampling technique was employed to select soybean producer households for the study. In the first stage, the four highest soybeans producing kebeles were purposively selected from the 27 soybean-producing kebeles in the district. These kebeles were chosen based on their relatively large contribution to total soybean output in the woreda in the 2018/2019 cropping season. In the second stage, a simple random sampling technique will be used to select the households. Probability proportional to size (PPS) was used to determine the number of farmers from e*ach kebeles*, in the third stage. Finally, simple random sampling was be used to select the sample soybean-producing farmers' households (Table 1).

The sample size determination will be resolved by means of Yamane [5] sampling formula with 95 percent confidence level.

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

(1)

n= sample size for the research use
N= total number of households in four soybeans producing Kebeles
e= margin of errors at 5%

Table 1. Shows sample distribution of soybean producers in the study area

Name of kebeles	Sample distribution	
	Population	Sample
Godare	76	47
DursituMisoma	61	38
Shimale Toke	68	42
Waltayina	43	26
Total	248	153

Source: District Agricultural Office, 2019 and own computation

2.4 Traders' Survey

The study locations for the trader surveys will be market towns in which a good sample of soybean traders exists. The soybean traders was purposively selected. As a result, 33 soybean traders (twelve cooperatives, one union, eight local collectors and twelve wholesalers) were purposively selected from the two markets for the study.

2.5 Methods of Data Collection

Enumerators who have a college diploma and work, as development agents was recruited and trained to implement data collection using a semi-structured questionnaire.

Purposive sampling method was employed to collect data from different people class such as elders, youth, and women farmers and responsible persons of different institutions on the subject covering four kebeles in the Chewaka district. Discussions with agricultural experts in the district and key informants were used to triangulate the data. Moreover,, focus group discussions was organized with three groups consisting of 5-6 people from each kebeles and key informant interviews were held with six different organizations and institutions. Suitably, the data generated at various levels was triangulated with secondary data.

2.6 Methods of Data Analysis

Descriptive, value chain, econometrics and SWOT analyses was used for analyzing the data collected from farmers and traders in the study area.

2.7 Descriptive Analysis

These methods of data analysis refer to the use of percentages, means, and standard deviations in the process of examining and describing marketing functions, facilities, services, and household characteristics. It was employed in the process of examining and describing marketing functions, farm household characteristics, role of intermediaries, marketing margin, value and profit share examining and describing marketing functions, farm household characteristics, role of intermediaries, marketing margin, value, and profit share soybean value chain actors.

2.8 Value Chain Analysis

To analyze the soybean value chain, mapping the value chain was a tool used to understand the characteristics of the chain actors, their link to each other, and the flow of production through the chain. This information was obtained by conducting surveys and interviews as well as by collecting secondary data from various sources.

2.9 SWOT Analysis

A SWOT analysis will be used to analyze the challenges and opportunities of the soybean value chain.

4. RESULTS AND DISCUSSION

4.1 Description of Soybean Producers

4.1.1 Demographic characteristics of sample households

This section presents demographic and socioeconomic characteristics of the sample respondents. Of the total sample respondents of 153 farmers included in the survey, 84.3% were male-headed households and only 15.7% were female-headed households. With regards to educational status of the study area, from 153 respondents 83% and 17% of the respondents were illiterate and literate, respectively. Farming was the main occupation and source of livelihood for all sample farmers (100%) in the study area.

Average age was 43.32 years. The average total household size of the respondents was seven persons in households. The average years of farming experience related to soybean production was 4.53.

4.2 Household Characteristics of Soya bean Producers

The average age of sample households was about 43.32 years with a standard deviation of 11.34 and the average family size of sample households was 6.66 persons per household with a standard deviation of 2.15. The average educational level expressed in years of schooling of the sample households was about 3.03. With regards to sex and marital status out of the total sample households about 95% and 97.5% were male-headed and married, respectively (Table 3).

4.3 Land Holding for Major Grown Crops with their Productivity

In the study area like maize, soya bean, sorghum, and rice are the major grown crops by sample households. On average 0.51 and 0.56 hectares of cultivated land were allocated for soya bean during 2018/19 and 2018/19 cropping season, respectively. The productivity of this crop was 1.86 and 1.95 tons during 2018/19 and 2016/17 cropping season, respectively (Table 2). This implies that soya bean is the more important crop grown by farmers. Land allocated for maize, sorghum, and rice were summarized with their productivity during 2018/19 and 2016/17 cropping season Table 2.

4.4 Soybean Processors

In the study area, farmers produce soybean for home consumption and income source purposes. According to the study findings both supply and demand sides were increased for the past five years. The majority of the respondents confirm that both supply and demand are increasing from time to time. The demand for soybean bulk products at the national level is very high. Different lead-firms like Guts Agro-industry, Alema Koudjis Feed Factory, FAFa Food Share Company, different poultry farms and others were widely used soybean grain products for the production of blended soya-maize flour, and poultry feeds. Therefore, different NGOs and private companies were popularized soybean technologies for producers. This indicates that the demand for soybean grain bulk at the national level is very high while the linkage among local producers and the final grain buyers is very weak. Similarly, Getahun and Tefera [6] found that AFA, Helena, Guts Agro, Healthcare, Akaki AF, Alem AF and others in Addis Ababa city are the main actors in particularly in Metekel and the whole Ethiopia.

Table 2. Demographic and socioeconomic characteristics of samples of categorical variables

Variables	Category	Frequency	Percentages
Sex of the respondents	Male	129	84.3
	Females	24	15.7
Education level of the respondents	Illiterate	127	83
	Literate	26	17

Source: Survey result, 2019

Table 3. Demographic and socioeconomic characteristics of samples of continuous variables

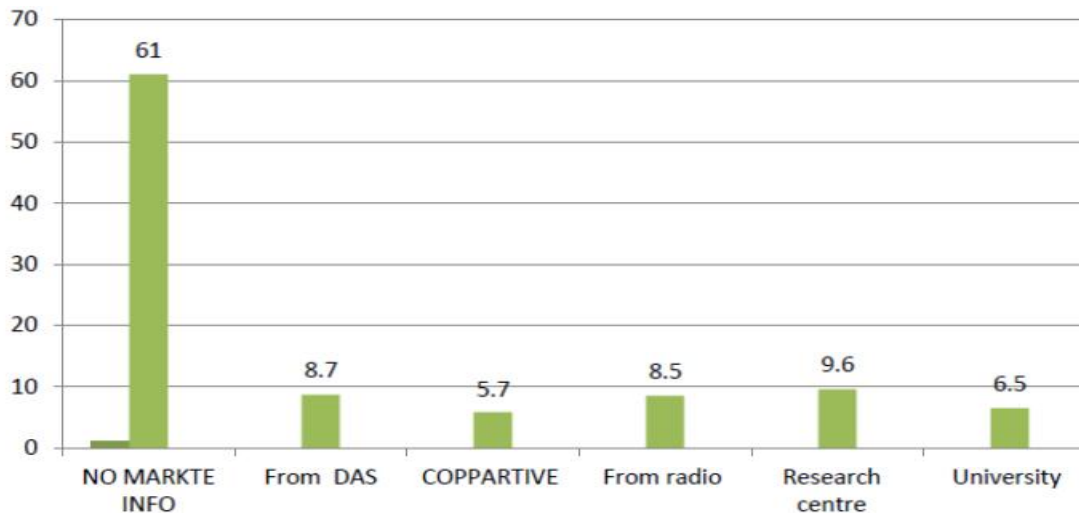| Variables	N	Mean	Std. Deviation
Age of the respondents	248	43.32	5.87
Total family size	248	6.66	1.23
Experience of production	248	4.53	0.89

Source: Survey result, 2016

Fig. 2. From the study area producers access to market information from the sample 61% are no market information, the remaining 8.7 from agricultural extension service 5.7 from cooperative,8.5, from radio 9.6 from Agricultural research Centre and 6.5 access from Jimma university

4.5 Access of Market Information

In Chewaka district, getting market information is not the problem. At local level friends, client traders, personal visit of the market and nearby farmers, and rarely radio served as the sources of market information. For the better off traders (wholesalers, exporters) the main information source has been the internet. Despite the availability of these formal sources, none of the studied individuals neither producers nor traders responded using this channel of information (newspapers) as a source.

The main reason according to Demelash (2004) is that the information is not timely and reliable. Some producers tried to get scanty and outdated price information from their respective cooperatives. Even there are times to change the price within a day. Soybean exporters had better access to all information through electronic media, the internet and played significant role in price decision. In the existing marketing system, cooperatives and small traders followed the price trends of big institutional buyers and exporters in their price setting.

4.6 Soyabean Value Chain Analysis

4.6.1 Core functions and major actors

The core functions in the soya bean value chain of the study area include input supply, production, marketing, processing, and consumption. Under these core functions, actors are broadly classified into three, namely inputs suppliers, direct market actors and chain supporters (Fig. 2). Major actors who involved in input supply functions were farmers, private dealers, NGOs, agricultural research centers, cooperative union, primary cooperatives, woreda office of agriculture. They are mainly delivered inputs like fertilizers, inoculants, seed, and others (such as credit, insecticide, etc). The direct market actors were those involved in soya bean trade who order the flow of soya bean in time and space. These include producers, local collectors, primary cooperatives, cooperative unions, wholesalers, lead-firms and consumers. The chain supporters are involved in technical advice, service provision and policy formulation and implementation of the chain. Technical advice like extension services and

marketing information along soybean value chain provided by DAs, BoA, Agricultural Research Center and NGOs.

According to the survey report about 69%, 19%, and 4% obtained information from government experts, research center and NGOs, respectively. The market information share and buyers were only traders and cooperatives in the study area. Accordingly, about 92% and 8% of buyers were traders and cooperative, respectively. Financial is another most important chain support especially, in soya bean production and marketing functions.

4.7 Marketing Channels

A marketing channel is an organized network of different agencies and institutions which in combination perform all the activities required to link producers with consumers to accomplish the marketing tasks. Only a small portion of goods and services is consumed at the point of production and only a small fraction of any output is purchased by the ultimate consumers directly from the final producers [7]. Marketing of soya bean in the study area starts from production areas moving on to the end-users. Based on the direction of flow and volume of soya bean transacted, five marketing channels were identified (Fig. 2).

4.8 Major Constraints and Opportunities in Soya bean Value Chain

Different constraints influence the development of the soya bean value chain in the study area. Some of the major constraints that influence the value chain actors are described as follows.

4.8.1 Input supply constraints

According to the respondents, the availability of soya bean rust resistance variety and inoculants are the major important constraints. There are no local market supply inoculants to the farmers in the study area.

4.9 Major Means of Income for Farming Households

4.9.1 SWOT analysis for soybean value chain

The matrix described in the table below (Table 4) gives a summary of the strengths, weaknesses,

opportunities, and threats in the soybean value chain. Strengths and weaknesses are from the chain (endogenous) while opportunities and threats are exogenous. The SWOT analysis is critical in identifying the challenges/constraints in the value chain and therefore finds the possible interventions to improve it.

4.10 Production Constraints

The major production constraints reported by respondents were disease (yellow rust), weed control problem, low price of grain, low productivity, shortage of information and shortage of information and credit. In the study area recently, soya bean yellow rust and weed control problem is the bottleneck to boost soya bean production and productivity.

4.11 Marketing Constraints

Regarding marketing (traders and lead-firms) were low supply, poor infrastructure (poor market linkage and road), and low capital are reported as major constraints by respondents. Poor infrastructure, shortage of credit and low supply were the series of problems in soya bean marketing in the study area.

4.12 Processing Constraints

It was reported that poor quality and low supply were the major constraints in processing soybean. Due to the weak of vertical linkage, there is an information gap between lead-firms and producers on grain quality amount supply in a year. Even though there is a supply increase in the past five years; it's not full fill demand interest (with both quality and quantity of lead-firms).

4.13 Major Opportunities

4.13.1 Hunde Chewaka union and different NGOs work on soya bean

Due to increasing trend of demand Hunde chewaka union and other NGOs like 2SCALE, FC, AGRA, N2-Africa work on inputs supply and collect the grain through primary cooperatives. In the study area, there are few local collectors and no input suppliers. Currently under chewaka union installed their capacity supporting by different NGOs to competitiveness input supply to farmers and grain supply to lead-firms.

19

Table 4. Key challenges and opportunities of soybean production, utilization and marketing

Strength	Weakness
Production • High production (Large Volume) • Availability of Extension services • Adequate labor force • Soybean demand industry • Availability of research centers • Availability of NGO **Marketing** • Available of cooperatives and Unions • Available local processors • Adequate market information's	**Production** • Low access of fertilizer • Collateral problem • Poor value addition activities • Poor storage facilities • Low home consumptions **Marketing** • Poor linkage with other value chain actors • Use of manpower for the transportation of soybean • Use of poor storage materials • Difficulty to find buyers • Limited to access to finance • Low levels of value addition • Poor infrastructure • Feeder roads are impassable and do not link farms to markets
Production opportunity • Availability of suitable environments • Infrastructural development could facilitate soybean production • Currently, the government is promoting self-contained plan to create modern marketing system (cooperatives) • Producers compactly building • The existence of some NGOs and researcher centers used as development projects by provides input supply **Marketing opportunities** • Infrastructure development could facilitate soybean marketing by create a link between buyers and farmers • The existence of advantageous government policies which supports small scale businesses was another opportunity for farmers of the districts	**Production threats** • Disease and pests • Low female participation on marketing • Pesticides and herbicides application • Low access to credit for soybean production • Low access to soybean processing materials • Distance from home to nearest market • Transportation cost • Most farmers used traditional value adding for soybean consumption purpose **Marketing Threats** • Lack of packing materials • low seed Quality problem • High market center distance • Low access to credit for soybean marketing

Sources: Own Results (2017/18)

4.13.2 There are strong community seed producers in the study area

In the study area, there are formal community seed producers to produce and supply seeds to other farmers. Therefore, smallholder producers can access improved and certified seed easily with minimum resources to other producers.

4.13.3 Government commitment to support legume production

Chewaka district is one of the Maize and sorghum mono-cropping dominants areas. In this area, to break this mono-cropping system soya bean and common bean production is the only solution to break these mono-cropping systems.

Therefore, different research centers, universities, NGOs and others interested to provide the necessary support for soybean production.

4.13.4 Many local soya factories established in the country

There is a huge demand for soya bean bulk products in the country. For instance, Gut-Agro Industry needs more than 5000 metric tons per annum of legume including soybean grain product for the production of blended soya-maize flour [8] and the government of Ethiopia has agreed to produce corn-soybean blend (CDB) to produce up to 39000 metric tons with eight different local manufacturers (Francom and Counselor, 2016). This indicates that the demand of soybean grain bulk at the national level is very high while the linkage among local producers and the final grain buyers is very weak.

5. CONCLUSION AND FUTURE LINE OF WORK

5.1 Conclusion

The existing soybean production in smallholder farmers or large scale is highly dependent on marketable value and suitability of the environmental conditions. The suitability of potential environmental opportunities for crop production and the presence of the yield potential in Ethiopia would give a better image and possibility for yield gap improvement.

The proximity of the country to the international market and the high market demand for Ethiopian Soybean seed/especially organic soybean seed/ can be considered as another opportunity. The oil qualities of varieties currently under production are relatively good and encouraging but need to improve further that targeted to the customer traits of interest. Though there is an effort by some research centers in Ethiopia in variety development and agronomic research practices, but yet it is not enough to bring an impact in increasing production and productivity in line with increasing soybean seed system. Therefore, one of the most important means of increasing soybean production and productivity in line with increasing soybean seed system is expanding, addressing and pushing soybean crop towards the competitive crops belts like maize and sesame

5.2 Future Line of Work for Soybean Sub-sector (Implications for Policy and Research)

To solve different challenges that soybean production and productivity faces in Ethiopia the future direction of research should focus on improving soybean production, productivity as well as the quality of soybean crop through the use of improved technologies is highly recommended. Thus, it is important to focus on, client preferences that understanding the needs of smallholder farmers, processors, traders, retailers, consumers and other actors along a value chain, development of high yielding potential variety with improved quality traits through the application of modern breeding techniques.

1. Development of improved agronomic and management practices to meet the yield potential of the crop. The need for the collaborative efforts of all concerned stakeholders should include government organizations, researchers, NGOs, private investors and farmers in the improvement program of the crop.
2. Future research should target on introduction and identification of better adaptable cultivars with better resistance to various environmental changes that brought about by the climate change that limit crop yields specially heat and water stresses.
3. Market research to define the performance, standard and priority of each varietal characteristic and to test for validation key assumptions should be throughout variety development process and capacity building on soybean crop improvement and post-harvest handling to maintain the quality of soybean produced.
4. The need for the collaborative efforts of all concerned stakeholders *viz.,* government organizations, estate farms, commercial farms, researchers, NGOs, private investors and farmers in the improvement program of the crop.
5. Attention should be given to start refining processes for oilseeds in Ethiopia than importing refined edible oil with a comparable value that is being obtained from expert earnings from oilseed and environmental clustering for high oil quality, as oil quality is influenced by environmental factors.

6. To improve the soybean value chain market interventions are required to improve market. Supporting the producers to minimize transaction costs in the study area is crucial. Thus, those governments, non-government should thoroughly link producers to other chain actors and facilitators. Escalating producers participate in cooperative membership and developments of farmers marketing organization are also a good option to reduce marketing problems.

7. Reducing unnecessary chain actors in the market, bonding producers directly to the processing company, revisiting strategies of promotion of cooperatives membership should also be given due emphasis. Improving transportation access to the farmers is essential to make the soybean market efficient in addition to developing road infrastructures that could also promote soybean production.9.Agricultural extension service increases soybean production which was seen as a significant factor to promote soybean production and productivity. Hence, the government should emphasize accessing development agents and linking producers and extension services together.

ACKNOWLEDGEMENT

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Boerema A, Peeters A, Swolfs S, Vandevenne F, Jacobs S, Staes J, et al. Soybean Trade: Balancing Environmental and Socio-Economic Impacts of an Intercontinental Market. PLoS ONE. 2016;11(5):e0155222. DOI:10.1371/journal. pone.0155222

2. Hailu M, Kelemu K. Trends in soy bean trade in Ethiopia. Research Journal of Agriculture and Environmental Management. 2014;3(9):477-484.

3. Samuel Diro, Efrem Asfaw, Beza Erko, Misganaw Anteneh. Factors affecting adoption and degree of adoption of soya bean in Ilu-Ababora Zone; Southwestern Ethiopia. Agricultural Science Research Journal. 2017;7(1):15 -26

4. Demeke Nigussie. GIS-Based Land Suitability Mapping for Legume Crops Technology Targeting and Scaling-Up. Ethiopian Journal of Crop Science; 2018.

5. Yamane T. Statistics, An Introductory Analysis, 2nd Ed. New York: Harper and Row; 1967.

6. Getahun A, Tefera E. Soybean value chain assessment study in northwestern Ethiopia, Metekel Zone. Asian Journal of Agricultural Extension, Economics & Sociology. 2016;1-14.

7. Jaleta F. Determinants of smallholder farmers' cattle market participation and outlet choices in Western Oromia, Ethiopia. MSc Thesis, Huazhong Agricultural University, Wuhan, China; 2011.

8. Wolde-meskel E. Moving forward the legume technology and value chain for sustainable development.ILRI-N2Africa-Ethiopia: Highlights on Project Progress. Addis Ababa Ethiopia; 2017.