

THE CONTRIBUTION OF POTATO TO FOOD SECURITY, INCOME GENERATION, EMPLOYMENT, AND THE NATIONAL ECONOMY OF ETHIOPIA

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RESEARCH REPORT

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The contribution of potato to food security, income generation, employment, and the national economy of Ethiopia

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Acknowledgement

This report is an outcome of field surveys conducted in selected potato growing areas of Ethiopia, and an extensive review of literature and policy documents. Several smallholder potato growers, relevant government staff members, scholars and development partners were consulted or engaged in data generation. We thank them all. We are grateful to the CGIAR Initiative on National Policies and Strategies (NPS) for the financial support to carry out this study. Our appreciation is also extended to the members of the Irish Potato Research and Development Association of Ethiopia (IPRaDA) for their valuable inputs that were used to enrich the research report.

Acronyms

CIP	International Potato Center
COMESA	Common Market for Eastern and Southern Africa
CSA	Central Statistical Authority
CSS	Central Statistical Service
FAO	Food and Agriculture Organization of the United Nations -
FGD	Focus Group Discussion
GDP	Gross Domestic Product
GTP	Growth and Transformation Plan
GVA	Gross Value Addition
GVO	Gross Value of Output
HGER	Home Grown Economic Reform
ISIC	International Standard Industrial Classification
Kg	Kilogram
MoA	Ministry of Agriculture
MoPD	Ministry of Planning and Development
NPDC	National Plan and Development Commission, Ethiopia
NPSPDS	National Potato and Sweetpotato Development Strategy
SNNPR	Southern Nations, Nationalities and Peoples Region
t/ha	tons per hectare

Executive Summary

Ethiopia is one of the top potato producing countries in Africa and probably displays a unique position for having the highest potential areas for cultivating the crop. It is grown in a wide range of agro-ecological zones, throughout the year under different production systems. The crop has colossal valuable social and economic contributions.

Objective of the study: The overall objective of this study was to analyze the contributions of potato to food security, income generation, employment opportunity and the national economy of Ethiopia, and thereby bring the significance of the crop to the attention of policymakers, development partners, and other relevant stakeholders.

Methodological approach: Building on extensive review of literature, policy and strategy documents relevant to the potato sub-sector in Ethiopia, available secondary data was collected from Central Statistical Service. To substantiate the existing knowledge, a quick survey was conducted with farmers in selected high potential potato growing districts, and with market actors at local and central markets. Opinions and perceptions of senior researchers, government officials, experts at federal, regional and district levels were also included.

Key findings of the study: Based on thorough analysis of the collected data, the major findings of the study are highlighted as follows:

1. About 4.33 million smallholder households (15% female headed) are directly engaged in potato cultivation on an estimated area of 431 thousand hectares, which is about 53.5% of the total area covered by root and tuber crops and 2.11% of the total cropland. Increasing number of farmers have been practicing irrigation, with an estimated 372 thousand household are currently growing potato under this production system. The annual production of potato in Ethiopia is estimated at about 5.9 million tons. The national average yield of potato is about 13.62 t/ha, which is obviously low at any standard, given the favorable soil and climatic conditions of the country. Yet, the average yield reported under improved practices is between 19 and 38 t/ha, and some progressive farmers could produce from 25 to 40 t/ha using good agronomic practices, implying a huge productivity gap offering opportunities for improvement. In high potential areas, the average potato yield under farmers' management is reported to be about double of the national average - implying huge productivity gap offering opportunities for potential yield increment over 30 t/ha through use improved varieties and management practices.

2. Nationally, potato growers allocate, on average, about 64% of their potato produce for home consumption, sell 23.7% directly in the local markets or to aggregators, retain 11.4% for seed, and 20% is assumed to be wasted. However, in the high potential production regions, potato is primarily produced for market, and farmers sell up to 65% of their produce, use 13.7% for home consumption, and 15% for seed.

3. Potato provides about 4.11 million tons of tubers for domestic consumption for the rural and urban dwellers which are equivalent to a per capita consumption of 32.52 kg per year (34.4 kg for the rural and 26.2 kg for the urban). Obviously, the rural communities, majority of which are in the low-income category, and the urban poor are most benefiting to secure their food and nutrition requirement. Consumption of potatoes can be promoted as a healthy and versatile component of a nutritious and balanced diet including other vegetables and whole grain foods. From a human nutrition perspective, potatoes are an essential source of energy, protein, and micronutrients like iron and zinc. They also provide key nutrients to the diet including vitamin C, potassium, and dietary fiber.

4. With an estimated 3.5 family members per household to actively participate in field operations, around 15.2 million people are directly involved and employed in potato production. In addition, potato indirectly contributes to employment opportunities for another 2.37 million people along its value chain as seed multipliers, input suppliers, market agents, transporters, processors, and exporters. Thus, the potato sub-sector is currently providing employment opportunities for nearly 17.5 million people at national level.

5. The average fresh annual potato produces worth about ETB 18.7 billion contributing averagely 2.7% to agricultural gross value product and 0.9% to the national Gross Domestic Product (GDP). Over the last five years (2019 to 2023), Ethiopia earned on average USD 13.63 million per year from fresh potato tuber export which accounts for about 0.45% of the total national export earnings.

Conclusion and Recommendations: The contributions of potato to social and economic benefits for the producing communities and the society are enormous. All the above-mentioned contributions of the potato sub-sector are considerably high and should attract the attention of policy makers, planners, development partners and practitioners. Given the existing favorable natural environment the county has, the untapped potential for potato development would provide immeasurable contributions to the socio-economy of the population. Thus, addressing challenges such as unavailability of quality seed and chemicals, inefficient market system, lack of proper storage and feeder roads and inadequate budget for research and development are areas that warrant intervention.

1 Introduction

Potato is the third most important food crop in the world after rice and wheat in terms of human consumption. It is grown on an estimated 20 million hectares of farmland globally producing about 376 million metric tons and consumed in over 100 countries worldwide, making a significant milestone for the industry (FAOSTAT, 2023).

Global statistics also indicate that potato production has significantly increased in developing countries such as Africa reaching 26 million metric tons (reference). In Africa, the potato production and harvested areas have more than doubled over the last two decades. It reaffirms the increasing importance of potatoes as a source of food, employment, and income in Asia, Africa, and Latin America (Devaux A, et al, 2021). Thus, potatoes significantly help to maximize agricultural productivity and to feed a growing population.

Potato is a nutritionally balanced food, which provides a high calorie intake and a substantial number of vitamins. It is rich in protein, calcium, potassium, and vitamins, and has an especially good amino acid balance (Birch et al., 2012). In addition, potatoes are used for several industrial purposes to produce processed products such as French fries, chips, dehydrated potatoes and to produce starch and alcohol. Potato starch (farina) is used in laundries and for sizing yarn in textile mills. Potatoes are also used to produce dextrin and glucose. The economic contribution of the crop in terms of employment, income generation, export earnings and ultimately to the national income is significant (Lutaladio and Castaidi, 2009).

Despite the multiple economic and social benefits of the crop, the potato subsector lacks adequate attention and development support from the Ethiopian government, donors, and the private sector. Limited investment (budget allocation) in research and extension services has profoundly hindered the development of this sub sector. As regards, the food and economic contribution of potatoes (subsector) is not well documented and available information needs to be updated to inspire policy makers, private sectors, practitioners and development partners.

This study was initiated to assess the contribution of potato to food security, income generation, employment, and the national income of Ethiopia. The evidence generated from the proposed study will be used to advocate for the importance of potato among policy makers, donors, value chain actors and the wider public. Thus, the document will be shared with policy makers, planners, concerned ministries and development partners to motivate and influence them to take affirmative actions aimed at strengthening research, development and businesses related to the potato subsector.

2 Objective of the study

The overall objective of this study was to analyze the contributions of potato to food security, income generation, employment opportunity and the national economy of Ethiopia, and thereby bring the significance of the crop to the attention of policymakers, development partners, and other relevant stakeholders. Specifically, this study aimed at:

1. Estimating the annual potato production and the proportions of its utilization for household consumption (among growers), on-farm seed, loss (wastage), and sold as a surplus to markets to generate cash income to support their livelihood
2. Assessing the contribution of potato to **food security status** of the rural and urban households in major growing regions of Ethiopia
3. Assessing the **national economic contribution** of the potato subsector along the value chain: production, marketing, processing and consumption of potato products
4. Estimating the total **employment generated** by the potato sector that includes direct employment along the value chain.
5. Exploring the gaps and challenges and suggesting the interventions needed to fill the gaps.

3 Methodological Approach

Combinations of three different methods were employed for the study: literature review and secondary data, key informants/experts' consultation, and field survey for appraisals. The literature review consisted of examination of research papers, government reports, strategies and policies related to the potato sub-sector in Ethiopia. Building on review of literature and policy/ strategy documents, secondary data was collected from Central Statistical Service (CSS) and from other pertinent different sources. This approach helped in generating data on the production and productivity status, as well as the challenges and opportunities of the sub-sector.

To substantiate the existing evidence and provide primary data and validate secondary sources, a quick field survey was undertaken with potato producers, wholesalers, retailers and key informants. Then using checklists both quantitative and qualitative data on production and productivity as well as challenges and opportunities were gathered. Accordingly, seven well-known high potential potato producing districts were purposely selected (Figure 1). These include Sinan and Guagusa Shikudad in Amhara, Shashamane, Jaldu and Kombolcha/Hararge in Oromia, and Chencha in Gamo and Gumer in Gurage zones. In these districts, qualitative data was collected through focused group discussions (FGDs) with both female and male headed households. In addition, consultations were made with key officials and experts from the selected high potential districts, and senior experts and directors at the Ministry of

Agriculture, researchers working at research centers affiliated with potato. Finally, thorough interviews were conducted with wholesalers and retailers located in Shaggar City and Addis Ababa to obtain specific information on potato supply, demand, value addition and job creation at different levels of the value chain.

Both quantitative and qualitative analyses were carried out to estimate the economic and social contribution of potato sub-sector. Contribution of potato to food security and employment were estimated all from households' farm engagement, market actors, volume of output produced and consumed and sold to the market. In line with the working manual of the Macro Department of the Ministry of Planning and Development of Ethiopia, the contribution of potato to the national income was estimated using the National Income Accounting Procedure (section 9 includes the details). Thematic and narrative analyses of qualitative data were used to identify strategic bottlenecks and intervention needed to upgrade opportunities that will drive the competitiveness the sub-sector.

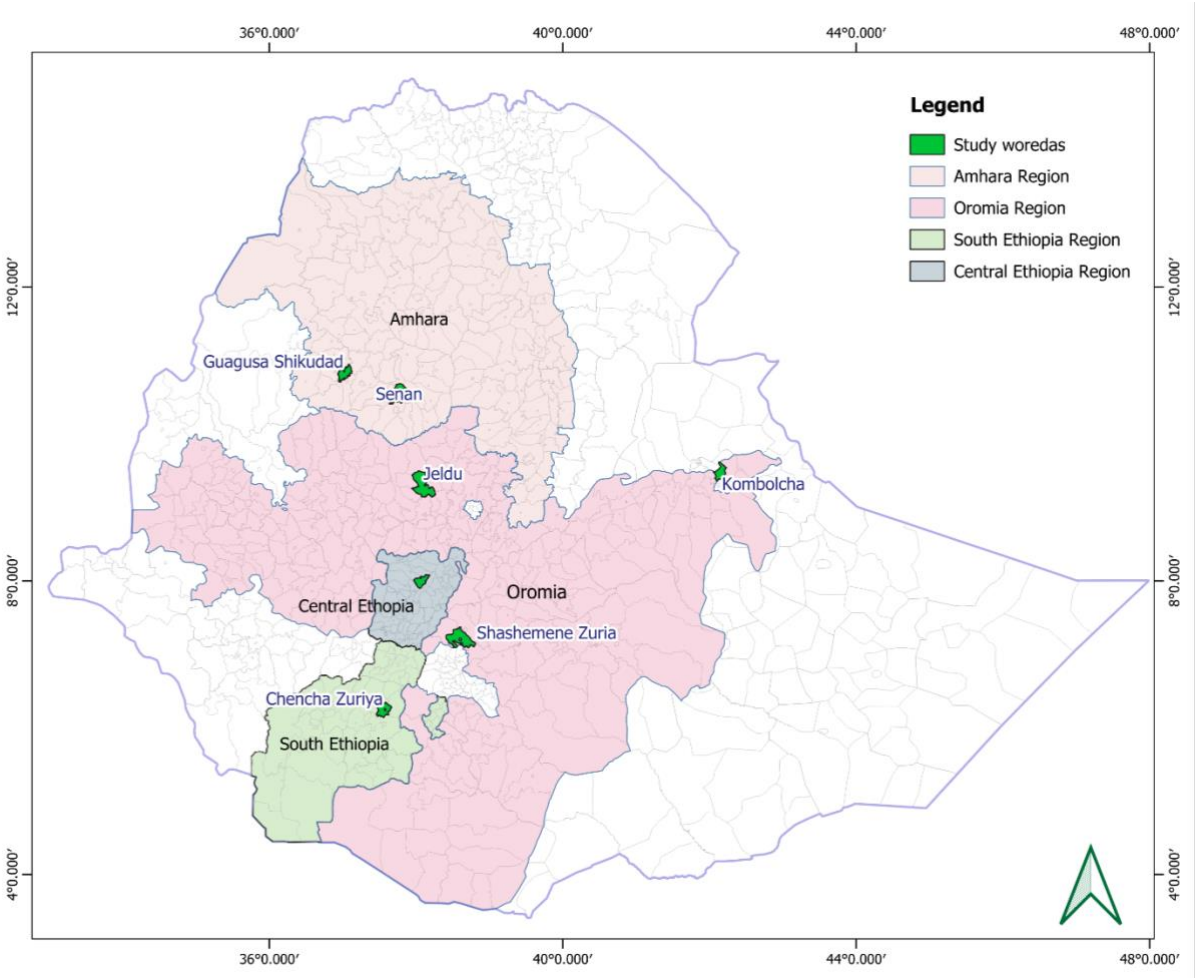


Figure 1: Location of the survey districts in the high potential potato growing areas of the country

4 Potentials of Potato for Food Security: A Brief of Global Perspectives

Potato has multiple and unique features most relevant to low income and poor societies. According to MoA (2024), potato is characterized with its high yield per unit area of land compared to many other crops. Potato on average gave yields up to 20 tons/ha globally, compared to maize, rice, and wheat, which produced an average yield of 5.7, 4.7 tons/ha and 3.5 tons/ha, respectively, in 2017 CIP (2020). Potato is one of the most productive food crops, producing more dry matter (food) per hectare than commonly cultivated cereals. As such, it can significantly contribute to food and nutrition security. A hectare of potatoes provides up to four times the calories of a grain crop and up to 85% of the plant is edible human food, compared to around 50% in cereals.

Compared to commonly cultivated cereals in Ethiopia, potato is a short duration crop that can yield up to 35 t/ha within three to four months, and the productivity has a potential to reach up to 50 t/ha (Joshi, et al., 2009). That means, a hectare of potato can yield two to four times the food quantity of grain crops. It implies that, in Ethiopia, potato has a huge prospect for food and nutrition security due to its high yield potential and nutritional quality tuber, short growing period, and wider adaptability (Tewodros, et al., 2014). Similarly, Hirpa et al. (2013) underscored that potato contributes significantly to food security because of its better ability to provide a high yield of better-quality product per unit input with a shorter crop cycle compared to major cereals such as maize. Furthermore, potato is a water efficient crop that produces more food per unit of water than any other major food crops and is up to seven times more efficient in using water than cereals and thus is more sustainable to mitigate the effects of climate change (Arya S, et al, 2015; Egata Shunka, 2019).

Potato provides significant amounts of nutritional value to the human diet for rural and the urban poor who have little food options rich in protein, vitamins, macro-and micronutrients, polyphenols, carotenoids and tocopherols (André D., et al, 2021). Thus, nutritionally it can be considered as a well-balanced food crop with a good ratio between protein and calories and can be considered as a good weaning food (FAO, et al, 2020; Bailey et al. 2015). That means, small-scale potato cultivation in a home garden can be a game-changer for local poor economies, i.e., by growing potatoes, communities can reduce reliance on long-distance food supply chains, keeping the economic benefits closer to home and can quickly curb the problem of food shortage and hunger (Brasesco et al., 2019). Thus, among several other food sources, potato is one that can help match for food security worldwide, particularly in developing countries with high levels of poverty, hunger, and malnutrition.

Lutaladio and Castaidi (2009) further explained that in developing countries and under marginal growing conditions, potato is a cheap source of nutrients, thus playing an important

role in guaranteeing food security, income generation, and employment opportunity. Potato plays an increasing role in the livelihood of people in Eastern Africa as a cash and food security crop (FAO, 2021).

According to Diego Naziri et al. (2024), industrial-level processing of potato in Kenya, Rwanda and Uganda, although still limited, is growing at a rapid pace, with rapidly increasing demand for primarily chips and crisps. While the urban poor often prefer boiled potato to consume, the potato processing industry encompasses various activities, including cleaning, peeling, cutting, blanching, frying, freezing, and packaging which benefits the urban poor offering job opportunity and wage income.

Potato is ideally suited to places where land is limited and labor is abundant, conditions that characterize much of the developing world. It has a relatively short growing cycle that allows for multiple harvests in a year, further increasing land productivity per annum. It benefits most of the low-income households, where land shortage is a constraint. That is because potato is one of the most productive food crops in terms of yields of edible energy and good quality protein per unit area and per unit of time fitting into intensive cropping systems, and a central crop for food security (Birch et al., 2012; Devaux A, 2021).

Today, the production and consumption of potato is expanding across Africa (including Ethiopia) mainly because of the increasing availability of improved technologies such as improved varieties, management practices, use of irrigation farming, and the growing interests of farmers to grow the crop for home consumption and market. The increase in potato production in East African countries over the last years has been impressive, suggesting a higher contribution of the crop to local food systems. In Tanzania, for instance, potato supply has almost tripled between 2000 and 2014, while in Rwanda potato is included in the national priority list of crops due to its role in national food security with approximately 125 kg per capita consumed per year (FAOSTAT, 2017). The mounting urbanization and increasing demand for processing plants have boosted the demand for the crop. The policy environment and the support of development partners significantly contributed to the increasing production and consumption of potato (Abebe, 2020; Desta, 2024; MoA, 2024)

Like many other countries in the world, potato is a very important food and cash crop especially in the highland and mid altitude areas of Ethiopia (Loyya Consults, 2022). Recent reports show that 68% of the potato produced in Ethiopia is locally consumed, 20% is sold for family income generation and 12% used as planting material (Brasesco et al., 2019). This shows that potato is becoming a significant source of staple food and cash income and thus entails special attention in the national food sector development agenda.

5 A synopsis of Review of Recent Ethiopian Development Plans

Potato could be considered as one of the spearheads of agricultural policy by the Ethiopian policymakers because of its potential for food security, export, and income generation. In its quest to improve food security for a rising population, the Government of Ethiopia has been considering the crop in its national development strategies and plans to increase the production and consumption of potato and promoting the crop for domestic and export markets.

Among the most popular National Development Plans include the ***Growth and Transformation Plan (GTP***) implemented in two phases: Phase GTP I (2010-2015) and Phase GTP II (2016-2020). GTP I was a national five-year plan developed by the Ethiopian government to improve the country's economy by achieving a projected gross domestic product (GDP) growth of 11to 15% per year from 2010 to 2015 (MoFED, 2010). Among the major development pillars was maintaining agriculture as a major source of economic growth. The plan also clearly articulated that ensuring food security and supporting the food industry by increasing crop production through increasing productivity and cultivable agricultural land. It duly considered in its plan to increasing productivity of root crops by 77% and its production by 86% by the end of 2015 from the levels in 2010. Potato was considered as one of the spearheads of agricultural policy by the Ethiopian policymakers because of its potential for food security, export, and income generation (Abebe, 2013). It is also appreciated for its high yield per unit area of land and as a good source of nutritious food and cash income by a large number of food-insecure smallholder farmers and agro-pastoralists in Ethiopia (Haverkort et. al., 2012).

According the NPDC (2016), GTP II envisioned bringing the country to become a lower middle-income country by 2025. In the same fashion, Agricultural Development and Rural Transformation were among the pillars of the plan, and ensuring food security by increasing crop productivity was among the key objectives to be achieved. This initiative opened opportunity for modernizing the farming sector, moving towards high value crops, advanced irrigation, better quality seeds, increased fertilizer use and strategies to yield multiple harvests a year. As regards, increasing the production of vegetables, fruits and root crops was emphasized.

However, the Government of Ethiopia lately declared that while significant strides have been made, both GTP I and GTP II were not entirely successful in achieving economic structural transformation and stimulating exports. The registered yield and agricultural growth remained insufficient to meet domestic food and nutrition security, export, and industrial needs. Though efforts were made to enhance the productivity and production of certain cereals crops (mainly wheat, maize and tef), little attention was given to the other agricultural sub-sectors. As such,

the country has been reliant on imports to fulfill domestic demand for strategic commodities such as wheat, rice and edible oils. Particularly, horticultural crops including root crops seem totally overlooked in the GTP implementation process. To this end, the Government of Ethiopia launched a national economic reform program in 2020: ***"A Home-grown Economic Reform Agenda (HGER): A Pathway to Prosperity***" *(*MoPD, 2020). HGER consists of three pillars. These are macro-financial reforms, structural reforms and sectoral reforms with the aim of achieving macroeconomic stabilization and returning to a path of high growth.

The economic reform agenda has initiated the revision of an overarching policy and strategy framework which had guided agriculture and rural development in the last decades. The reform entails sectoral reforms to unlock new and existing growth potential of agriculture, among others. The HGER explains that this sector accounts for more than 75% of employment, 36% of GDP, and more than 30% of total exports- implying that because agriculture dominates the economy it will remain an important driver of the economic growth and poverty reduction. The agenda underscores that efforts will be made to achieve a varying degree of import substitution of wheat, cotton, rice, and oilseeds and lowland pulses as well as sesame for the export market. It also proposed to take measures to improve export competitiveness on coffee, horticulture, livestock and livestock products, oilseed, and pulses.

The MoA has prepared a ***10 Year Agriculture Sector Perspective Plan*** (2020 - 2030) with the objective of structural transformation of agriculture. The plan aspires to enhanced productivity, value addition and competitiveness of smallholder agriculture, resulting in increased income and poverty reduction of farmers and pastoralists, as well as achieving **food and nutrition security**. The Ten-Year Perspective Plan has identified eight strategic interventions: (i) transforming rainfed agriculture to irrigated agriculture; (ii) promoting agricultural mechanization; (iii) supporting smallholder commercialization and emerging commercial farmers; (iv) enhancing livestock resource, feed resource and livestock health; (v) developing horticulture; (vi) promoting rural job creation and involvement of the private sector; (vii) strengthening implementation capacity; and (viii) building resilience of the agricultural sector. In this Perspective Plan, the Government of Ethiopia considers potato as one of the strategic commodities for ensuring food security in the country due to its importance as source of food and employment.

Following the perspective plan, the MoA has formulated ***"10 in 10 National Programs (2021 – 2030)"-*** meaning 10 development programs to be completed in 10 years. The programs have been prioritized given their strategic importance of addressing food inflation through increased supply in the local market, substituting import that will save at least one billion USD every year and improving earnings for agricultural exports. The program consists of five components that cover (i) grain crops (wheat, rice and oil seed), (ii) vegetables (tomato and onion), (iii) perennials (coffee, avocado, banana and bamboo), (v) livestock (poultry, dairy and

red meat) and (v) enabling environment (policy and input supply systems). Across these areas, the program has set more ambitious targets than the Agriculture Sector Prospective Plan to raise production and productivity levels beyond the targets set for the prospective plan above mentioned. Presently, the 10 in 10 programs are the focus of the ministry and its development partners. Currently the prioritized programs are under implementation and seems to override all the above-mentioned agricultural development plan and strategies.

However, while the horticulture development strategy and the Ten-year agricultural sector perspective plan do consider the need to enhance the development of root and tuber crops, the 10 in 10 national programs (lately developed) totally excludes these crops from the priority focus in the actual efforts of the implementation process. De facto, potato has been side-lined despite its massive contribution to food and nutrition security and employment in the entire part of the country. It is noteworthy noting that roots and tuber crops are food economy for the entire parts of the country and major staple diet for millions of people in southern and southwestern parts of the country (Kutoya Kusse, 2021). The implication is that there is inconsistency and gaps in strategizing, planning and programming denying giving attention to root crops development in general. Consultation with the stakeholders also confirms that research, extension and development activities in this-subsector are weak because of lack of budgetary support. It is also noted that development partners (donors and non-governments organizations) do often follow the interest and development program of the government, and thus only few of them are supporting the development of root and tuber crops in general and potato in particular.

Recently, in line with the HGER, Ethiopia has launched a ***10-year National Horticulture Development and Marketing strategy (2024-2033)***. The strategy is expected to address the gap in making the country's major horticulture exporter (MoA, 2024). The horticultural sector accounts for 4.5% of the agricultural gross product (MoA, 2024) that consists of flowers, vegetables, fruits, and root crops (*potato, sweetpotato, cassava, enset, taro, yam, etc.*). ESS (2022) reported small farmers engaged in this sector reached 24.4 million in 2022 - dramatically increasing from 16.5 million in 2013 of which 9.6 million are in the vegetables subsector and the remaining 15.44 million in the root crops and fruits sub-sectors.

Appreciating that horticulture has the potential to generate revenue for the country and can significantly contribute to the national food and nutrition security; the strategy has ambitiously planned to increase national horticultural production from the current level of 163,230 tons to 62.8 million tons. In particular, the strategy targeted to double the yield of root crops (*which should also imply for potato*) in the main rain season (meher) from the present 21.5 t/ha to 43.8t/ha and with irrigation from 22.2 t/ha to 44.85 t/ha through supporting research and extension services. Thus, it can be learned that the horticultural development strategy has been ambitiously formulated to boost the production and productivity of the sector (which is

inclusive of root crops and hence potato) to enhance their contribution to producers' income and competitiveness for export earnings.

This has been an on-going process since 2000 to meet international quality standards of most commercial crops for both formal and alternative seed systems. For instance, the seed regulation and guidelines available both at federal and regional levels include seed proclamation No. 1288/2023, Regulation No. 375/2016, Regulation No. 361/2015, QDS Directive No. 839/2007, Certificate of Competency Directive No. 463, Management of rejected seed No. 465 and QDS Guideline (Anon., 2012). Most seed policies, strategies, and regulations, however, are not adequately implemented partly due to limited human resources, logistics and seed testing infrastructure. For example, in Oromia, one field inspector is expected to inspect 1743 ha (Nigussie et al., 2020).

The MoA has formulated the ***National Potato and Sweetpotato Development Strategy (2024-2030)*** (MOA-FDRE, 2024). The strategy aims at improving the sub-sector's overall performance through guiding the research, development and business-related issues to maximize the potential of the two crops for improved food and nutrition security, income generation, and job creation. The strategy explains that potato contributes USD 562.5 million to the total national income, nevertheless, these commodities have long been regarded as non-strategic and subsistence crops, with very little public investment in enhancing and promoting the sub-sectors, preventing the country from realizing their full potential. However, the document highlighted that although there are favorable policies and regulation, legislation, and directives to regulate seed production, certification and general seed business, their implementation and practices both at the producer and regulatory body levels are weak. For instance, while many improved varieties with superior yield and processing qualities have already been released from research institutions, the small farmers continue to use only few old-aged varieties with much lower productivity. Adoption of new varieties is hindered by the unavailability and unaffordability of quality seeds – mainly because neither the seed systems is coordinated and regulated nor the public extension system strongly supporting in demonstration and promotion to create awareness about the benefits of using quality potato seed. Thus, study remarked that unavailability of quality seed potato (certified and quality declared) remains the most critical challenges for smallholder ware potato farmers.

Thus, the strategy is expected to give the overall guidance for the establishment of a resilient, thriving, commercially oriented, and inclusive potato and sweetpotato industry that contributes considerably to national development. Furthermore, it will enhance the realization of the overall national development goals through the seven years period (2024 – 2030). Through proper coordination and effective collaboration of public, development partners, the private sector, and the general public, assures that this well-crafted strategy will take the

Ethiopian potato and sweetpotato sub-sector to the next level and significantly contributes to the overall national development.

6 National Potato Production and Productivity Analysis

The potato crop is grown mainly in cool, high-altitude areas with well-distributed rainfall. According to FAO (2019), Ethiopia has considerable potential for potato cultivation, as 70 percent of its arable land is suitable - mainly the highland areas above 1500 meters above sea level. Also, the country is one of the major producers in Africa because of its suitable agro-ecology and its domestic consumption levels. This section presents the area of land allocated, number of smallholders engaged in, and volume of production and post-harvest management of the potato sub-sector in Ethiopia.

Potato is a short-cycle crop (3 to 4 months) and predominately grown under rain-fed conditions in all regions of Ethiopia. It is grown in two distinct rainy seasons: June to December (long rain season) and January to June (short rain season). Moreover, irrigation-based potato farming has been increasing in some parts of the country enabling the farmers to produce, consume and supply the crop to the market year-round. Irrigation farming has double advantages – higher in productivity and its harvesting coincides with lower market supplies and hence commands higher prices than in any other season. Based on the recent five years CSS data (2023), results of the analysis show that, compared to the last one and a half decade, the areas for potato has increased by about three times and the volume of production by four times.

6.1 Area of Potato Production

Considering the most recent five years period, 2019 to 2023, the average total area of cropland in Ethiopia was 20.34 million hectares, of which root crops occupy 806.32 thousand ha (3.96%). Area for potato accounts for 431.61 thousand hectares, which shares about 53.5% of the total area for root crops and 2.12% of the average total cropland. The MoA (2024) also made a similar estimation for potato cropped areas at about 478.67 thousand ha. The data shows a slight decline in total potato cropland area, on average, by about 6% since the last three years perhaps due to shift to wheat production in the belg season and irrigation-based production system (see Table A1 in Annex)). It is noteworthy mentioning that there is a high potential to expand the cultivated area of potato as 70% of the total arable land is suitable for the crop and experts from the sector underscored that so far not more than 3% the total potential land has been used for. Expanding potato production in traditionally potato growing highland areas and introducing the crop to new areas such as irrigated and mid altitude areas are among the strategies suggested to increase potato production in Ethiopia.

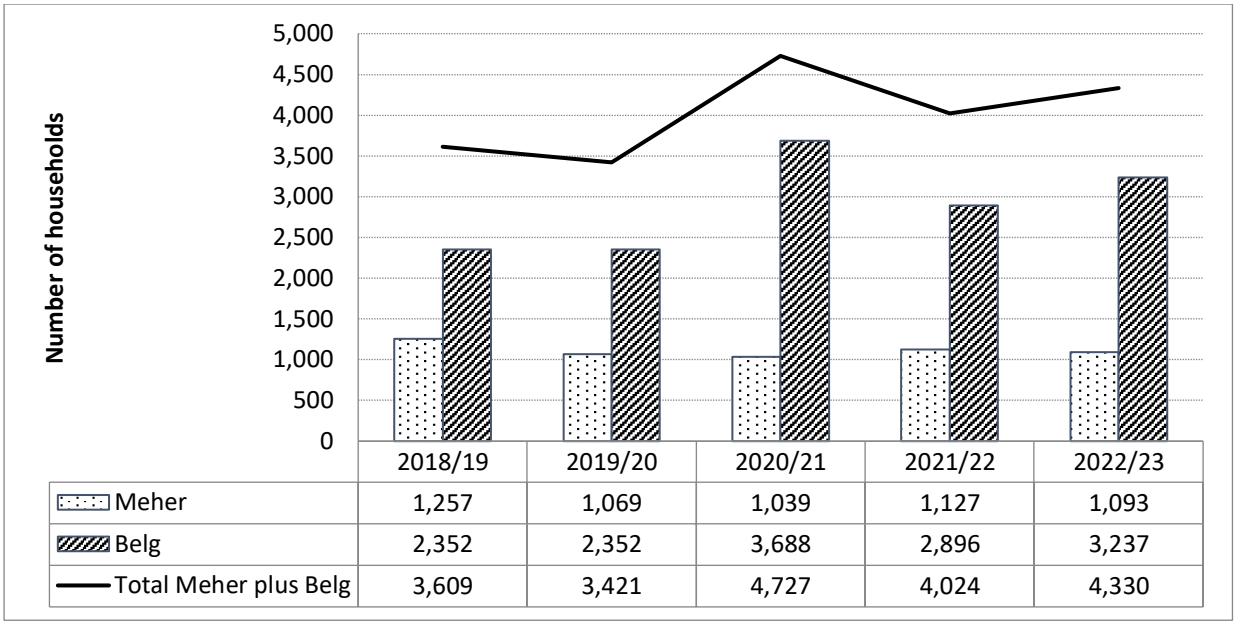
6.2 Number of Small Farmers Engaged in Potato Production

The number of small households involved in potato production over the period of 2018/19 to 2022/23 is presented in Figure 2. Considering main rainy season (meher) and short rainy season (belg), 2022/23 cropping year in Ethiopia, there were about 4.33 million smallholders growing potato raging between 3.42 and 4.73 million households over the last five years. As estimated by the MoA (2023), significant number of small households has been practicing irrigation estimated at 372,320 (about 15% of them being female headed household). Interestingly, an average of three and a half (3.5) family members participates in the production and marketing operations in each of potato growing households. It means, potato production has created jobs for nearly 15.16 million people in the rural areas.[1.]

While the number of households growing potato during the meher season remains slightly constant, the number of growers during the belg season/irrigation has been increasing and hit maximum in 2020/21. However, like the area allocated to the cultivation of the crop, the number of households also declined from 4.73 million in 2020/21 to 4.33 million households in 2022/23. As reported by key informants, subject to the government policy focus on irrigation-based wheat production, quite large number of them shifted their land to wheat and thus the number small farmers growing potato during belg (supplemented with irrigation) sharply fall dawn in the subsequent year, with slight improvement in 2023.

According to Gebeyehu et al. (2024), the roles of men, women, and youth members of the family in various operations and decision-making in potato production and marketing are similar across the sample study areas in Oromia, the main potato producing region in the country. The decisions to grow potato, and to use for home and to sell for cash income are jointly made by husband and wife. However, men were primarily responsible for land preparation, seed selection, irrigation, chemical applications and post-harvest management. All able household members, including women participate in weeding, harvesting and marketing of the crop. In high potential areas hired laborers are involved in labor-intensive field operations like during planting and harvesting when the family labor is often inadequate.

[1] *As the irrigation practice often overlaps with the belg cropping season, this figure is not separately addressed as an additional number of potato producers to avoid double counting.*



	2018/19	2019/20	2020/21	2021/22	2022/23
Meher	1,257	1,069	1,039	1,127	1,093
Belg	2,352	2,352	3,688	2,896	3,237
Total Meher plus Belg	3,609	3,421	4,727	4,024	4,330

Figure 2: Number of Households Growing Potato ('000) between 2018/19 and 2022/23
Source: CSS, 2024

6.3 Potato Productivity and Production

6.3.1 Potato Productivity

During the same period (2018/19 to 2022/23), the national average yield of potato in Ethiopia was estimated to be 13.62 t/ha which confirms the estimation of the MoA-FDRE (2024) at 13.3 t/ha. Unarguably, regardless of the good environmental conditions and research and development efforts, potato yield is far low compared to African (15.0 t/ha) and global (20.7 t/ha) averages (FAO, 2021).

Research has been conducted over the years and a number of technologies have been developed and released since the establishment of research system in the country (Desta Bekele, 2024; Abebe, 2019). Among which variety development for different agro-ecologies, crop pest management technologies, crop husbandry, post-harvest management and food quality appraisals are the major ones, and as regards, the support of the International Potato Center (CIP) has been considerably high. The yield of improved varieties under research management ranges from 30 to 35 t/ha depending on varieties used, location and other growth factors. Under farmers' condition, the average yield reported for improved seed is between 19 and 38 t/ha varying depending on the different environmental conditions (Bezabih and Mengistu, 2011). Some progressive farmers can produce from 25 to 35 tons per hectare using best production practices in high potential areas (Loyya Consult, 2022; Tiruneh et al., 2017).

In the high potential potato growing districts that were surveyed through this study, every household involves in potato production and potato ranks third (after wheat and barley) in terms of land allocated to major food crops grown. Potato is an integral component of the

farming system of the study areas and is used as a key component in double cropping and crop rotation practices used by farmers. The average yield under farmers' management was about double of the national average, estimated at about 27 t/ha (ranging from 14.3 t/ha to 39.5 t/ha) using mixes of improved and local varieties and combining rainfed and irrigation practices, and a household produces on average 19.8 tons per year.

In high potential districts surveyed, annual production per household on average ranges between 6 to 37 tons (depending on the cropping frequency and whether irrigation is used). More specifically, three categories of potato farmers were identified with different cropping systems and different volume of production per year (Table 1):

(i) Those farmers, who plant potato only during the main rainy season (meher), cultivate on average of 0.41 ha and produce about 5.9 tons per year.
(ii) Those small farmers who use two or more production systems (meher or belg rains) supplemented with irrigation, cultivate potato on average of 0.70 ha and produce about 18.2 tons per year per household; and
(iii) Those farmers who grow potato using three production systems (i.e., meher, belg and irrigation), cultivate on an average area of 0.94 ha and produce ca. 37.1 tons per household per year.

Table 1: Potato Production and Productivity under Different Production Systems in High Potential Areas of Ethiopia

Production system	Total area cultivated/year (ha)	Total production /year (tone)	Average Productivity (tone/ha)
In high potential locations†			
a. Meher + belg + irrigation	0.94	32.1	34.15
b. Meher + belg (irrigation)	0.70	18.17	26.00
c. Meher only	0.41	5.90	14.40
d. High potential average	0.68	19.83	27.00
National average ‡	**431,610**	**5,880,620**	**13.62**

Source: † estimated from Survey; ‡CSS data

However, according to the database of FAO in 2022 (FAO 2023), current national potato productivity (13.62 ton/ha) for Ethiopia is low compared to the world average (21 ton/ha) as well as other African countries like South Africa (37.3 ton/ha), Algeria (31.2 ton/ha) and Egypt (29.2 t/ha). Obviously, the national potato production is well below its potential largely due to scarce innovation or weak technology adoption and absence of an effective seed system even though potato is one of the strategic crops for ensuring food security. The yield gap can be attributed to the use of low-quality potato seeds, poor disease management, inadequate soil fertility management and inadequate seed and ware potato storage conditions (Gebeyehu et al, 2024; Bezabih and Nigussie, 2011; Hirpha, et al., 2010).

6.3.2 Potato Production

Similar to the assessment of the MoA-FDRE (2024), the average total production of potato is estimated at closer to 6.0 million tons for the period of 2018/19-2022/23, which is about 8.5% of the average annual volume of crop production in the country (CSS, data base of 2023). Potato is primarily cultivated during the belg (short) season with 57% of total land allocated to the crop annually followed by irrigated system (25%) and meher (main rain) season (18%). Accordingly, the largest share of production comes from the Belg season (53%), followed by irrigated farming (27%) and the meher season (20%). The shift from main (meher) season to belg and irrigated system is to avoid the disease pressure that leads to significant yield loss and increased cost of production due to the need for repeated spray of fungicide (Gebeyehu et al., 2024). It is noteworthy mentioning that, in line with the trend of the area cultivated and number of households engaged in potato production, the total volume of production has showed slight decline by an average of 10 % for the last three consecutive years (Table 2). Among others, substitution of the crop by irrigated and short season wheat production was boldly reported by the survey respondents, agricultural experts, potato farmers, and marketers.

Table 2: Potato Production ('000 Tons) in Ethiopia under different production systems from 2019 to 2023

	2019	2020	2021	2022	2023	Average
Meher	1,044.44	924.53	1,141.87	1,309.57	1,426.18	1,169.32
Belg	3,529.91	3,529.91	2,909.85	2,876.07	2,696.54	3,108.46
Irrigation	1,886.46	1,731.92	1,590.04	1,459.78	1,340.20	1,601.68
Large Farm	1.68	1.45	1.21	0.81	0.64	1.16
Total	**6,462.49**	**6,187.82**	**5,642.97**	**5,646.24**	**5,463.56**	**5,880.62**

Source: Central Statistics Service Annual Agricultural Sample Survey

Three regional states account for over 95% of the national annual potato production. According to the CSS data from 2019 to 2023, Oromia, SNNPR and Amhara regional states together contribute about 95% the total annual volume of potato production in Ethiopia. Tigray produces only about 5% and all the others together account for only 1% of the total annual potato produce.

6.4 Postharvest Losses in Potato

Reducing food losses and waste is another way to address the food insecurity challenge; that is, to produce just as much as possible but waste less through better post-harvest management. Post-harvest management in potato, including storage, processing, and value chain efficiency, is a much larger problem than in cereals and deserves special attention (Olsen, 2014). In developing countries, recent studies have analyzed food loss across the potato value chain by collecting qualitative and quantitative data to provide a comprehensive identification and characterization of the losses. The results show that on average the total losses range

between 8 and 9% of production along the value chain, and the most important losses occur in the production node, ranging from 90 to 95% of the total losses in the chain. On average farmers suffer the highest loss across the value chain, ranging between 8 and 20% of their production at or before harvest, before moving on to the next node of the chain. The main causes of losses are poor crop and harvest management practices leading to pest infested tubers, high percentage of small tubers, and weather conditions such as frost and heavy rains (Delgado et al. 2017; Abebe C., 2021). However, Mohammad et al (2021) conducted post-harvest loss assessment specific to retail market of some selected districts in Bangladesh and the result was incomparably high. According to the study, the total losses due to post-harvest diseases in these markets were found to be 8.83%, and the loss due to physical abnormalities was recorded 13.78%. Thus, the sum of total potato post-harvest losses in the retail market alone was about 22.6%. Such a loss in the market seems huge.

Taking into consideration the entire value chain, Benyam et al. (2018) assessed postharvest loss in Sheka Zone, Southwest Ethiopia. The descriptive result indicated that the quantity of postharvest losses at producers was 21.7%, at local trader 1.8%, at wholesaler 3.4% and retailer 4.1%. Thus, the sum of the total quantity loss along the value chain actors equals about 31%. In similar location, Chala et al (2019) conducted detailed quantitative assessment of post-harvest losses of potato tubers but come with much lower percentage of loss, on average 12.08% all along the supply chain stages. In quantifying potato postharvest losses, survey findings by Loyya consult (2022) revealed that, on average, farmers lose about 6.0% of their total produce due to bacterial/fungal rots and pests and lack of proper store. Similar result was recorded from the field survey conducted in the high production area and along the market chain. The quantitative loss at the farm level was estimated at 6.3%, at local traders was 4.2% wholesale traders 3.5%, and at retailers 2.5%. Thus, summing the weighted average loses at farm level and along the market chain is approximately at 16.6% of the total volume of production.

Based on CSS database (2023), the estimated potato losses at the farm-level averaged about 8.2% of total volume of national produce (ranging from 5% to 20%), noting that the proportion of wastage is highest in high producing areas (5-15%), and lowest in low producing areas (1.5-3%). While computing the value addition of potato in the in the national income accounting, the Ministry of Planning and Development of the Government of Ethiopia estimates the cumulative post-harvest loss of potato at 10% of its total volume of national production.

In conclusion, the amount of post-harvest loss of potato is not very clear- estimations widely vary from one study to the other. So long as the subject is profoundly important for potato development strategies, this calls for a detailed quantitative study to be carried out at national level.

7 Utilization of Potato Products

In the coming decades, feeding the expanded global population nutritiously and sustainably will require substantial improvements to the global food system worldwide. Among several other food sources, the potato crop is one that can easily help match the food security requirements (food availability, food access, food use and quality, and food stability) due to its highly diverse distribution pattern particularly in developing countries with high levels of poverty, hunger, and malnutrition (CIP, 2020). It is evident from the field survey that potato growers are both home consumers for own families and suppliers to the urban consumers. In high potential and surplus potato producing areas, potato is grown mainly for market as source of cash income, but in those areas with low to moderate potential areas, potato is primarily cultivated for own consumption. Although not very substantial compared to the other commodities, quite a large volume of potato is exported to the neighboring countries. Potato growers also reserve a significant amount of their harvest for seed for the next production season. Potato is a staple foods crop and provides a reliable and affordable source of nutrition for millions of people in Ethiopia. As explained in the preceding chapter, this crop is rich in carbohydrates making it an excellent source of calorie for energy. It also contains vital micronutrients such as minerals and vitamins that boost the immune system, support normal growth and development and thereby reduce micronutrient malnutrition (CIP, 2021).

7.1 Domestic Potato Consumption and Its Contribution to Food Security

Potato is among the most important root and tuber crops grown and consumed in Ethiopia. Major domestic potato consumers consist of households in rural and urban areas, as well as institutions (hotels, restaurants, canteens, schools, hospitals, and others) that purchase potatoes for daily consumption. However, it is impossible to precisely estimate consumption levels for each market segments as studies and literature on consumption in Ethiopia is scanty. For ease of analysis, only two broad consumption segments, urban and rural households, are identified.

In Ethiopia, potatoes are an integral part of the diet of majority of the population for both urban dwellers and the rural population, and it is probably a leading staple food in most high highland areas of Ethiopia where population density is also high. Potato is a strategic crop to address food insecurity problems. Particularly in rural areas, it is most consumed during *mid of July to September*, when households often run out of their stocks of cereals at home. According to the survey result in the high potential areas average, the per capital potato consumption of the farm households in those localities was about 56 kilograms, and ranges between 33 kg during short period and 80 kg during harvesting period. In the highlands of Ethiopia, this period is characterized by cold weather condition that with its rich starch or carbohydrate content, consumption of potato is most preferred to meet the households' need

for extra energy to stay warm and work on their farms (Loyya Consult, 2022; Hirpa et al, 2016, Haverkort et al, 2012).

Many potato dishes are part of the traditional Ethiopian cuisine as well as new trends, especially in urban areas. In rural homes, especially within the producing areas, potatoes are consumed daily for both lunch and dinner. Potato stew, potato bread, mashed and boiled potatoes, potato chips and fries are widely known and consumed. It can be mixed with meats and vegetables, such as carrots and cabbage, and made into stews that are eaten with Enjera, local bread, or rice. Boiled potato mixed with processed linseed is traditional well consumed particularly in the northern Ethiopia. These modes of consuming potatoes are duplicated in urban homes of families whose origins are from potato growing areas (Bezabih and Mengistu, 2011).

The demand for potato in Ethiopia is increasing because of the rapid urbanization and change in consumption patterns of the urban population towards processed products like chips (Agajie et al., 2013). Recent study by Cherinet Work (2019) also added the consumption of processed potato products, including chips and French fries, has been steadily increasing due to urbanization and higher disposable incomes. Urban populations are increasingly seeking convenient snack options, which have led to a growing market for processed potatoes.

Changes in the consumption habit are manifested mainly in the urban centers for two main reasons, increasing urbanization (increasing movement of the rural to urban centers), and emerging and growing new forms of potato-based food products. One can observe that supermarkets started to sell potato products like chips and crisps; hotels, restaurants and cafes prepare French Fries and chips from potatoes which are major form of value addition for potatoes. Street vendors also prepare French Fries and chips and supply to consumers at dusk. These food products from potato have been becoming popular part of the diet in cities and small towns.

The inclusion of potato in diets helps diversify food sources and enhance food security. By incorporating these versatile crops into local food systems, communities in Ethiopia can mitigate the risks associated with relying heavily on a few staple grain crops. This diversification contributes to a more balanced and nutritious diet, reducing the vulnerability to nutrient deficiencies. In a nutshell, potato is vital for national food and nutrition security due to their nutritional composition, adaptability, productivity, and potential to enhance dietary diversity.

In the high potential areas, farmers produce potato mainly for market purposes with the aim to generate income which can be used to access other food items, meet social obligation or investment. According to the survey results in the high producing localities, out of an average 19.83 tons of annual production, about 65% of the potato produce is sold to the market (ranging from 50% to 90%), and they use 13.7% for home consumption, and 15% saved for

seed assuming 6.3% of the produce is estimated to be wastage. Similar results were reported by Bezabih and Mengistu (2011) from a household survey conducted in central and southern Ethiopia. The results further showed that in central and southern parts of the country, on average farmers produce 4.9 tons per year of which 67% was reportedly sold, 19% consumed at home and 14% retained for seed. Results of the same study conducted in Tigray have shown that farmers produced an average of about 3.7 tons per year and sold the largest proportion of the produce (on average of 75%) retaining 14% for seed and consumed only 9% of the total harvest. Contrary to what has been reported above, farmers in low to moderate potato production areas (such as many potato growers located in the altitude ranging from 1,500 to 2000 masl), supply to the market only 15% of their total produce, use 74.5% for home consumption, and retain about 8.5% as seed. Note that in such areas, wastage is minimal and estimated at about 2% only. In the surveyed high potential areas, the per capita potato consumption ranges from 22 to 33 kilograms per month.

The contribution of potato to food and nutrition security is substantial in Ethiopia particularly for the producing small households and the urban low-income groups by virtue of its ability to mature earlier than most other crops at time of critical food need. Haverkort et al. (2012) and Abebe et al. (2017) also concur that Ethiopian potato growers are relatively more food secured during the hunger months of August to October when other cereal crops were mostly not ready for harvest, and also generated additional income from sales of surplus produce. With the rain-fed production system, August to September is the peak season of potato harvesting which coincides with peak potato consumption by all rural and urban consumers. It is considered a "hunger breaking crop" because potato can be harvested and available for consumption when cereals in the stock are already depleted and those in the field have not attained maturity stage for harvest either, the get critically in short supply and expensive in the market.

Potato is the only food crop grown to any large extent in the dry season where rainfall is erratic and unpredictable in the months of March through May mitigating the food insecurity problem (Kolech et al., 2015). Today, with the expansion of belg season and irrigation-based farming, potato is increasingly available for consumption throughout the year creating a good opportunity for food security for the poor. The stakeholders' survey result also confirms appreciation for its good source of nutritious food and cash income by many food-insecure smallholder farmers and urban consumers. The respondents of potato retailers and roadside vendors emphasized that, in rural villages and urban areas, the low-income households and the daily laborers constitute the largest buyers of all their customers. Potato is probably the cheapest affordable food crop that provides the highest nutritive values for the poor to secure their food and nutrition security.

It would be a breakthrough to improve food security in Ethiopia if supported with availing improved potato production and processing technologies and efficient market systems, due to its high yield potential and nutritional quality tuber, short growing period, and wider adaptability (Tewodros et al., 2014).). By promoting the cultivation and consumption of potato, it is feasible to improve the availability of nutritious food, particularly in regions facing food insecurity and malnutrition challenges.

7.2 National Potato Demand Estimation

To precisely estimate consumption levels for each market segments is impossible. However, this section reviews secondary data and computes rough estimates of consumption levels. For ease of analysis, only two broad consumption segments, urban and rural households, are identified. At the commercial level, potatoes are mainly consumed as chips served in restaurants and takeaway facilities in Ethiopia and other major towns. With increasing urbanization, we expect a continued rise in potato demand in line with growth of per capita income and urban population. Based on the strategic plan of the government (MoA-FDRE, 2024), both urban and rural demand for potato as well as for export is expected to grow.

Since nearly all potato produced in Ethiopia is used locally (exports are negligible and import is almost none except for experimental seeds), estimates of national consumption are derived from total production and population. There is a general trend of increasing demand for potatoes which seems to be linked to changes in consumption habits and increasing population size.

Assuming a five-year average of total production (2019-2023), about 5,880,600 tons of potato is produced at national level annually. Generally, farmers use a larger proportion of what they produce for their food needs while the limited amount is sold for income. Recent reports show that 68% of the potato produced in Ethiopia is locally consumed, 20% is sold for family income generation and 12% used as planting material (Brasesco et al., 2019). Similar estimation by CSS (2023) indicates that potato growers allocate, on average, about 64.8% of their produce for home consumption; sell 23.7% to the market; and retain 11.5% for seed.

As indicated above in section 6.4, wastages along the value chain actors (producers and traders) pessimistically estimated to constitute close to 20% of the national potato produce, and the net available after the post-harvest loss for different uses is equivalent to 4,704,480 tones, which is 80% of the total produce. By these calculations, further keeping out the amount retained for seed (11.5% of the net available after the post-harvest loss), about 71% of the total national potato produce is used for domestic consumption and export. During the same five years period considered (2019 - 2023), the average annual volume of potato exported was about 51,639 tons per annum (0.88% of the total national potato production). Thus, a net of 70% of the total volume of national potato produce is consumed domestically by rural and

urban dwellers that are equivalent to 4.11 million tons. Considering the present population of Ethiopia estimated at 126.5 million, the country's' potato consumption per capita is equivalent 32.5 kg per year. This figure is incomparably much higher than the estimated amount by FAO, 7.74 kg/person per year (FAOSTAT 2023).

Therefore, Ethiopia consumes more potato than Kenya which is an average of 25 kg per capita a year (https://www.potatopro.com/potato-markets/kenya). This indicates that Ethiopia consumes significant amount of potato per capita, particularly in the highland rural areas where potato is a major food crop. However, it is still much lower than the per capita consumption in Europe with 87.8 kg/capita global, and the global monthly consumption of potato per capita is 31.3 kilograms.

This national average however masks the significant difference between average consumption by urban and rural per capita as well as that of the major producing areas. Based on Household Final Consumption Expenditure Survey 2015/16 (CSA, 2016), households in the urban areas consume 18.6% of available potato supply and the rural people about 81.4%. Of the total 126.5 million Ethiopian populations in 2023[2], the rural population of the country approximated to constitute for 76.84% and urban population 23.16%. Accordingly, the total and the per capita potato consumption in rural and urban dwellers are estimated (Table 3). The per capita consumption of potato in the rural area is estimated at 34.4 kilograms which is higher than the per capital consumption for the urban consumers, estimated at 26.2 kilogram per person per annum.

Table 3: Estimated potato consumption among rural and urban households in Ethiopia

Location	Potato Consumption ('000 tons)	% of potato Consumption †	Consumption per capita (kg)
Urban	766,444.3	18.6	26.2
Rural	3,345,381.5	81.4	34.4
Total	4,111,825.8	100.0	32.5

Source: †Computed based on the Household Final Consumption Expenditure Survey 2015/16 of CSA

The per capita consumption of potatoes has a strong correlation with income levels and production status. In Ethiopia, as reported by the retailers during the survey, potato is generally the main dish for the poor or most frequently consumed by the low-income urban consumers, implying that the urban households in the middle- and high-income category seem to consume lower than those households in the low income category (this needs further investigation). Evidence from the market survey in the urban areas indicated that the low-income categories are the dominant clients of the potato retailers. It means that, for households with low-income consuming potato seems economical because they can afford with low budget and get high calorie for the family who often go for combination of cereals,

[2] (https://www.worldbank.org/en/country/ethiopia/overview

and vegetables with relishes made from meat. However, regular consumption of potato is a culture of communities in the high potato producing areas irrespective of their income differences. In the long run, it is expected that the national per capita consumption of the urban areas will surpass that of the rural because of increasing inflow of the low-income population that will drive the demand for cheap high calorie food such as potato.

7.2.1 Potato Industrial Processing

The growing demand of potato products represents an opportunity for resource-poor producers to generate additional income by selling their fresh produce. In addition, there is great potential for developing a processing industry as consumption of potato-processed product is constantly increasing, indicating that there are good opportunities for import substitution. In particular, emerging Integrated Agro-Industrial Parks all over the country will create market opportunities for producers located within the Agro-Commodities Procurement Zones and will represent a means to develop the potato value chain by increasing production and productivity and strengthening commercialization (Brasesco et al, 2019).

7.2.2 Small Scale Potato Processing

Potatoes are an integral part of the diet of many Ethiopians, from urban dwellers to rural population. In rural households of many eastern African countries, including Ethiopia, consumption of boiled potato is dominant. Potatoes are also prepared in the form of sauce mixed with other spices called *dinich wot*, one of the most popular cultural dishes in Ethiopia. The consumption of boiled potatoes and *wot* is higher among low-income category in urban and traditionally potato growing and consuming rural areas. Indeed, key informants expressed that Orthodox Christians followers largely consume boiled potatoes during fasting period with no difference in income category.

At the commercial level, potatoes are mainly processed and consumed as chips served in cafes, restaurants and roadside takeaway in Addis Ababa and other urban centers of the country. In Central-Eastern Oromia, potatoes are commonly processed (boiled or fried) by small-scale street vendors and cottage processors. In the streets of cites like Addis Ababa, Shashemane, Adama and Bishoftu, it is possible to buy freshly processed French fries from street vendors with a small fryer as their sole equipment. In the urban, hotels and restaurant also include French fries in their menus (Abebe, et al, 2017; Bezabih and Mensgistu, 2011). For instance, a fast-food restaurant in Woliso uses 750 -1000 kilograms of ware potato weekly supplied by wholesalers from the fresh vegetable market in Addis Ababa. Together with the roadside French fry makers and women selling whole- boiled potato in many towns, the fast-food restaurants and cafes contribute to a large market demand pull in the potato value chain (Gebeyehu et al., 2024).

Consumption reflects the seasonality of the crop, especially in rural areas: it is higher during harvesting season because of greater availability and lower prices of potatoes. According to Gebeyehu et al. (2024), at the fast-food restaurant, consumption of French fries is highest between June and September during which many youths have school holidays and visit the restaurants. Fortunately, this happens when ware potato is most abundant to satisfy the demand. At Sunselet PLC (PEPSICO Food owned processing industry), the demand for crisps is constant and the amount that is processed every month is completely sold leaving a deficit, meaning the potato crisp market in Ethiopia is active and still growing. This is an opportunity for farmers in Oromia region to increase production of processor-desired potato varieties and increase their income unless there are other underlying bottlenecks.

While cafes and restaurants have been increasingly involving, the roadside food vendors are the major potato processors. Small scale processors who make French fries in urban areas buy potato from wholesalers or retailers and sometimes directly from the producers.

In Ethiopia, production and consumption of other potato products like chips and French fries is still limited compared to other countries, yet young consumers are gradually replacing boiled potatoes with fried products. Likewise, the emerging middle-income households consume more chips and French fries, compared to the lower income groups. As incomes and urbanization are on the rise, the prospects for diet diversification and increased demand will be decidedly positive (Devaux et al, 2021).

7.2.3 Large Scale Potato Processing Industries

Large-scale commercial potato processors are limited in Ethiopia. At present, there are only two potato processing large scale industries; Senselet (PepsiCO Food) located in north Shewa zone and Loli Chips of ELFORA located in Hawassa. Both are sourcing tubers from wherever available. The Senselet Food Processing is the first and one of the two large scale potato processing plant in the country. The company processes, sells and market potato products (i.e. potato chips). The factory is currently using 10,000 tons of ware potato for processing and is planning to expand processing capacity to 35,000 to 40,000 tons in the near future. The quality criteria include size, firmness of the skin, form, degree of dust, and stains. Since the factory needs a year-round supply, the presence of irrigation system is critical during the identification of producing areas.

As indicated in the National Potato and Sweet potato Development Strategy 2024-2030 (MoA-FDRE, 2024), the processing industries are potential sinks to locally produced raw materials to strengthen subsector development. The experience of Senselet (PepsiCo) Food and Loli Chips agro-processing industries provides an impetus to both the import substitution and export promotion agenda of the country. Chips are already being exported to Somaliland and Djibouti with future expansion to the Middle East. With the expansion of industrialization and the establishment of agro-industrial parks, there is an anticipated steady growth in the demand for these crops as a raw material.

According to Ergetew (2020) and MoA-FDRE (2024), these agro-processing companies use more than 18,000 tons of fresh potato tubers per year to make chips, with a 40% growth per year, adding momentum to the country's import substitution and export promotion program. This indicates a robust market potential for further investment in processing facilities. As industrialization expands and agro-industrial parks are established, the demand for these crops as raw materials is expected to rise steadily. Aside from these, potato could be used to make snacks, glucose, beverages, adhesives, and other products, creating additional jobs and contributing to the national economic growth. They play a key role in the value chain as they engage in multiple activities like aggregation, transportation and marketing. Both processors, irrespective of the scale of operation, require a steady supply of ware potato throughout the year. Thus, with the expansion of industrialization and the establishment of agro-industrial parks, there is an anticipated steady growth in the demand for this crop as a raw material. Because the managers of the processing companies are hesitant to give detailed information, important data on their employment, wage payment, annual income and their overall contribution to the economy is missing.

7.3 Potato Domestic Marketing and Distribution of the Marginal Benefits

Like for many agricultural products in Ethiopia, the potato marketing is carried out mainly through informal channel whereby the non-licensed traders are dominating and usually fix prices with limited or no transparency and with no regulatory oversight due to the lack of market alternatives (FAO, 2017). In the informal channel, potatoes are distributed directly from producers to consumers, or pass through one or more intermediaries up to small-scale retail shops in village markets and towns (when transport is available and affordable).

On the other hand, the formal channel usually involves primary cooperatives and unions as aggregation points, as well as rural wholesalers and licensed traders that supply to institutional buyers and large retailers (e.g. supermarkets) in urban areas. In the formal channel, potatoes are distributed from primary cooperatives to licensed wholesalers, which then sell to a wide range of retailers in urban areas. The influence of these actors on the value chain is, at times, over-emphasized, although wholesalers' role must not be underestimated as they are key players.

Domestic market including central market in Addis Ababa and capital of the Regional States and zonal towns are the main end market for over 90% potatoes originating from surplus producing areas. While Addis Ababa is the central market receiving the lion's share of potato sales, other cities and towns such as Bahir Dar, Debre Markos, Mekele, Adama, Shashamane, Hawassa, Arba Minch, Moyale, Dire Dawa, and Jigjiga are also the major destinations of potato domestic markets. Quite large quantiles of potato are also transported from different major producing corners of the country to be exported to Djibouti via Dire Dawa, and to Somaliland via Kombolcha/Hararge markets. For instance, the largest proportion of potato produced in

Arsi, West Arsi, highlands of Gurage, Hadiya and Hararghe zones are transported to Addis Ababa, as well as to Kombolcha/Hararge for export and part of this quantity is transferred to northern Ethiopia reaching Mekele and beyond (Loyya Consult, 2022; Bezabih and Mengistu, 2011).

7.3.1 Major Potato Market Actors and Supply Channel

Local collectors, wholesalers and retailers are the key potato market actors in Ethiopia. Brokers play crucial role in potato marketing system of Ethiopia by facilitating potato transaction and linking producers with traders, a wholesaler with another wholesaler, and wholesalers with retailers. The role of brokers in potato selling is high, particularly in high potential areas. The brokers sometimes go beyond facilitation of transaction and tend to control and fix prices, create price symmetry and make extra benefits from the process. The brokers in many parts of the country work in an unregulated and informal way. They do not follow proper business conduct and as a result they constrain the marketing system more than they facilitate it (Loyya Consult, 2022). Similar findings were also reported by Gebeyehu et al. (2024) underlining that farmers generally do not have equitable markets for ware potato. Potato prices are seemingly determined through a 'tripartite negotiation' between the farmer, trader (aggregator) and the local broker or middlemen. However, in many cases, farmers are price takers. The real potato traders (aggregators) are often unknown to farmers who may be based in major urban centres (Addis Ababa, Shashamane, Adama, Hawasa, etc.).

The local collectors operate in the small villages often in high potato producing areas. These are small-scale traders who gather potatoes from smallholder producers at village markets or directly at the farm gate. They assemble, sort, re-pack and transport potatoes to markets located in larger towns. Often, most local traders act as agents for rural wholesalers. They use their knowledge about the prices, quality and quantity in surplus producing areas.

Wholesalers operate mainly in the regional towns and central-eastern Oromia (Shashamane) and Addis Ababa. They handle bulk transportation and distribution at regional level. While the wholesalers distribute the product to the consumers mainly through the retailers, they also directly distribute potatoes at a wholesale price to urban retailers such as to supermarkets, restaurants, hotels, urban shops and cafes. Large-scale wholesalers also supply to institutional buyers such as hospitals, schools and to the army. A wholesaler also sells bulks of potato to another wholesaler, who transports the product across regions. For instance, the wholesalers in Addis Ababa could sell to those in Mekele, Kombolcha, Moyale, Jijiga, etc. Wholesalers' trading activities reach peak level during harvesting season when those with sufficient storage capacity and capital buy large amounts of potato to distribute to the market in net consuming areas.

Retailers are key actors in potato value chain and the last link between producers and consumers. They mostly buy potato from wholesalers and sell it to final customers, along with other types of vegetables, through their stores and open stalls in urban and rural markets. At times, they also buy directly from producers, and they often handle small quantities of potato. Consumers usually buy the product from retailers as they offer the quality and quantity of the product as per the requirement and purchasing power of the buyers. Roadside retailing (under temporary sheds in crowded areas) is another common practice in parts of the country such as central-eastern Oromia. Mostly, roadside retailers receive potatoes and other vegetables directly from the nearby smallholder producers. In some instances, producers themselves engage in roadside retailing.

The value chain of potato is complex with dense unregulated flow which explains that the marketing system is undeveloped. For evidence, the potato value chain map developed by Loyya Consult (2022) can be a good example (Figure 3).

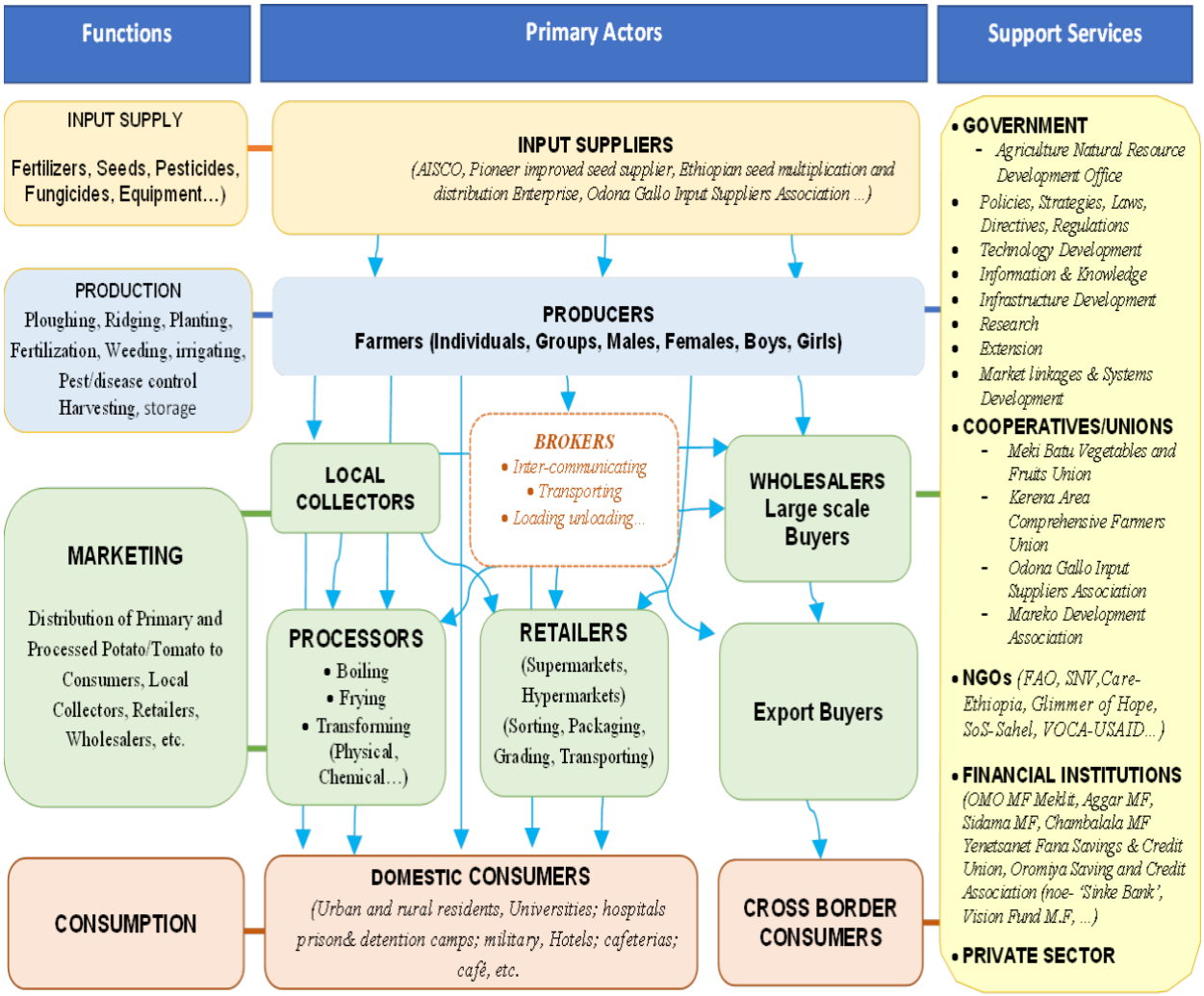


Figure 3: Potato Value Chain Map in Ethiopia

From the detailed value chain analysis conducted by Loyya consult (2022) in Oromia, Amhara and SNNPR, the local small traders (collectors) directly buy the lion's share of potato (53.8%) supplied by the producers and deliver to it wholesalers. The local consumers buy 28.2% of the producers supply; hotels and restaurants in the market towns purchase 13.6%; and the balancing share is believed to be bought by processors, and other governmental institutions and NGOs (4.5%) (Figure 4). The result of the study further explains that, in surplus potato producing areas, about 42.8% of small producers sell their products at local market centers while 38.4% of the producers sell on/at farms (farm gates); 18.5% of them in their villages, and very few (0.3%) along roads side. While those in high potential producing areas sell their product at farm gate, majority of the producers need to carry potatoes to marketplaces using horse or donkey carts, traveling 60 to 90 minutes on average, and the quality losses are immense.

Farmers and market actors reported that like for many agricultural products, potato market transactions are mostly random and done at spots involving prompt payments. While some informal client - relationship between producers and buyers exist, formal or forward contract arrangements are rare or non-existent. Due to weak or no client relationship, coupled with poor storage facilities, unavailability of transportation services and urgent needs of cash for daily subsistence, potato growers are forced to sell their products at low prices immediately after harvest.

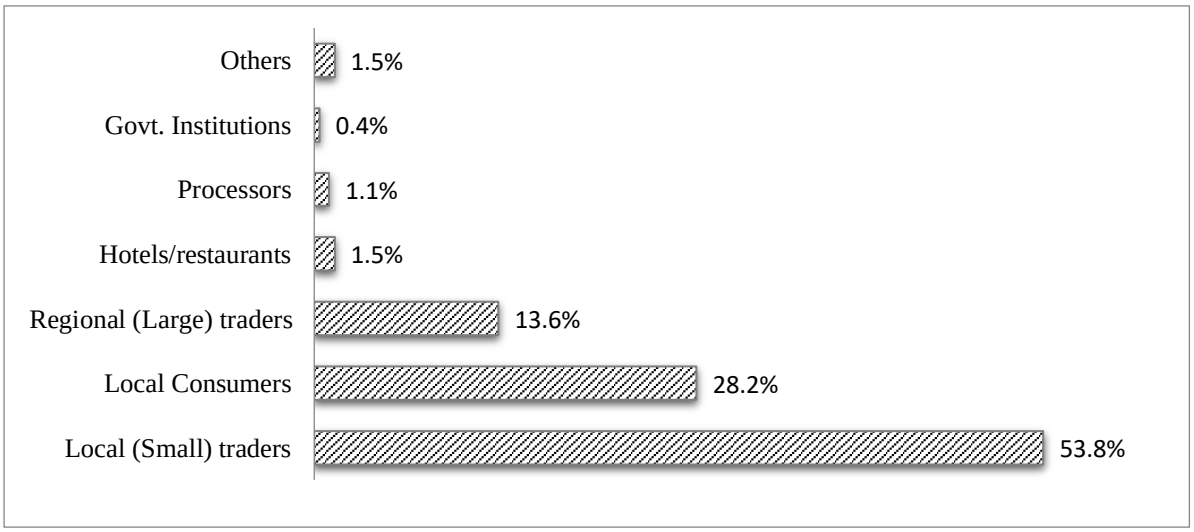


Figure 4: Proportion of Producers Sales of Fresh (Ware) Potato to Different Market Actors (%)
Source: Loyya Consult, 2022

7.3.2 Potato Market Governance, Inclusiveness and Integration

Governances in a product market and value chain show the relative decision power attributing to the different actors on accounts of what, how, how much and when to produce and market. From the quick survey with the wholesalers, retailers and producers, the result shows that the

governance mechanism in the potato value chain is found to be predominantly a 'buyer-driven' type – where small, but highly networked and influential group of vegetable traders (and their affiliate brokers) exercise stronger power - not only over the poor but large number of small producer farmers, local traders, processors, and transporters. These groups also exert considerable resistance and pressure against the regulatory operations of government bodies. Hence, the powerless actors are captives held in the strong grips of these powerful actors - who directly or indirectly control the production, marketing and consumption dynamics. Because of such power relations, the powerless actors are forced to operate as per the wills of the lead actors and eventually, pushed out of the value chain. As such, a significant number of small potato farmers and local traders are confined to informal and spot transactions – not able to penetrate the power network and are constrained from scaling up to the next value chain ladder. Unfortunately, these problems have neither been clearly uttered nor explicitly included in the National Horticultural Development and Marketing Strategy (2024-2033).

Thus, price setting mechanism for potato is often by the absolute power of the leaders (manipulated by the brokers). For potato products a 'weekly price setting' is most common and can also be daily set, while monthly price setting is rare. Price is majorly fixed by brokers for all market actors with some degrees by the traders, and small farmers assume little negotiation power (if not during scarce supply).

Connected to issues on market linkages and reliability among the key actors is the market inclusiveness, resilience and sustainability. Value addition has little incentive to many actors; brokers just fix prices at both farm-gate and wholesale markets without the consent (as a virtue of coordination or inclusiveness) of the other parties and exercise most exclusive power of market decision when the products are naturally moist and easily perishable. In this regard, potato producers suffer as potatoes cannot be held back and stored for long. The brokers' exclusive power also goes to the input market. Markedly, the input cost of production is getting more and more expensive due to inflation in prices of seeds and chemicals (fertilizer, pesticides and herbicides) weakening the capacity of the small producers to afford. The market and its functioning are dominantly, unfairly, and illegally governed by the brokers and powerful traders – where both producers (suppliers) and small traders have no chance to negotiate but are absolutely dictated by the terms of the brokers (regarding quality, quantity, prices including delivery mechanisms).

Survey respondents largely agreed market forces in potato is not working in harmony because prices for the same quantity and quality at different markets; even within short distance radius, differ significantly and fluctuate without any visible difference in the production system - showing the market is not integrated because of distortions by middle actors like brokers. With regards to market segmentation, as long as most producers do not clearly target their products to differentiated buyer groups; but mostly random and at spot transaction without choosing

among potential buyers, the marketing system is not segmented – except for some commercialized cases.

Conclusively, the sharp rising cost of production and brokers' excessive disruption of the market system are particularly unbearable by the small farmers, and thus most of them are gradually withdrawing from producing the commodity - leaving their land either by contracting to commercial farmers or shifting to production of cereals. The implication is that the poor farmers are becoming excluded from the potato business, and being marginalized to benefits.

7.3.3 Trends of Market Prices

The result of the survey with stakeholders shows that market prices for potato has been increasing over years mainly because of rising demand for the product, and above other, increasing input prices. These claims are also statistically supported by annual survey results of CSS on producers and retail prices for the products as presented in Figure 5. From the statistics, the most recent (2023) average market retail price for potato was ETB 30.28 per kilogram and the producers' price was ETB 18.93 per kilogram. Because of the traders' dominant power, the potato producers' price is much lower than the retail price that consumers are finally supposed to pay (with 60% gross price margin). The survey result also explains the sharp price increment as of 2021 was partly associated to the decline in the belg/irrigation-based potato production due to decrease in supply partly on the account of the crop being replaced with wheat in some of the irrigated and belg growing areas.

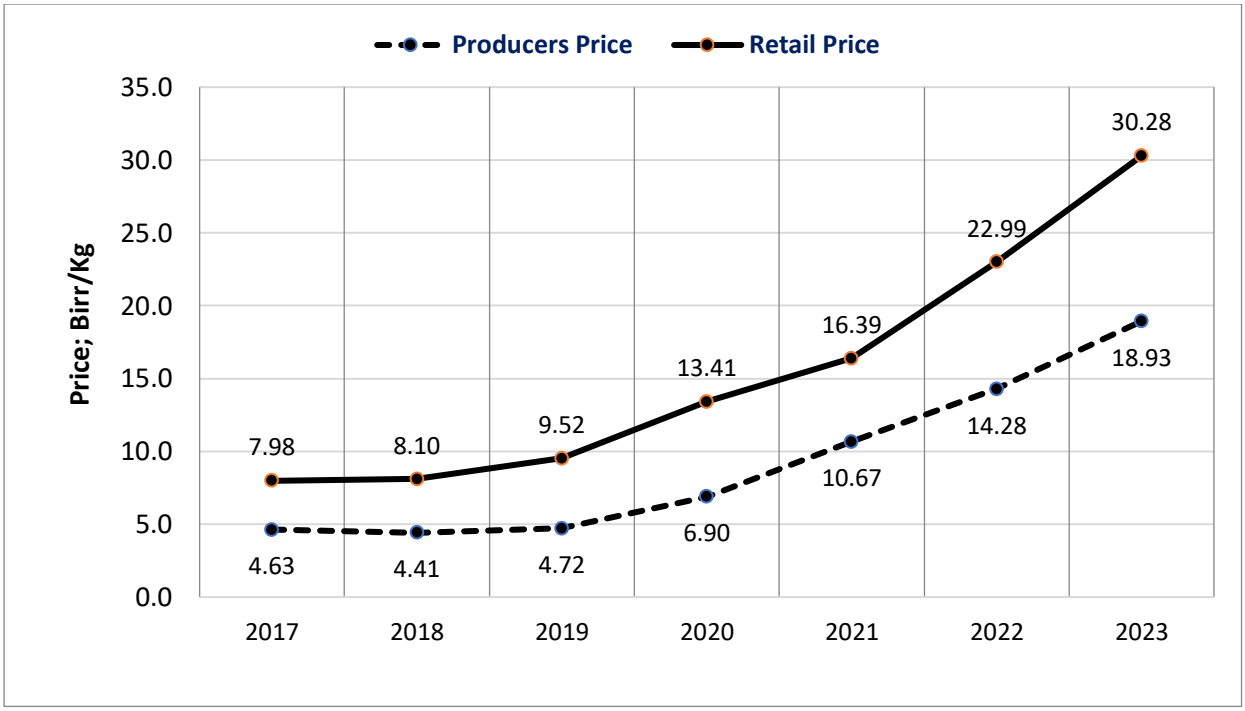


Figure 5: Trends in National Potato Prices (2017-2023), computed from the CSS data

7.3.4 Distribution of Potato Income Benefits to the Value Chain Actors

Each of the potato value chain actors adds value to the product as the product passes from one actor to another. In a way, the actors change the form of the product through processing or improve the grade through sorting, cleaning or washing or create space and time utility. As such the distribution of value addition varies among the potato value chain actors and across locations depending on the amount produced, product prices and the cost incurred.

What is important is how fair is the distribution of benefits (value addition) to potato value chain actors relative to their respective efforts to add value and bring the product to the final consumer. In the potato sub-sector, the most important for the share of the value added is the size of the price margin between the producer's price (farm gate) and retailers/consumer price. While the retail price is usually high (bench marking the Addis Ababa market) with minor difference across locations (e.g., regional capitals), the farm gate prices do significantly vary from location to location- lowest in abundant producing high potential areas. The implication is that those farmers in major potato producing areas benefit least from the share of the value addition while the traders take the opportunity to benefit the highest. Figure 6 shows the chain actors' relative share of cost of value addition and marginal benefits from potato.

More importantly, given the short turnarounds in their operations, local collectors, wholesalers and retailers appear to gain most from potato value. Summing up the total marginal benefits to the traders (local collectors, wholesalers and retailers), they share about 61% of the total, which is unfairly huge amount and that is mainly because of the price margin[3]. Considering the magnitude and duration of investment, the gains to producers are the lowest among the value chain actors. It is well understandable that while producers earn such a low share of total value added and gross margin from 120 days of work to produce potato, traders grasp the bulks of the benefit in about one or two weeks.

[3] *It is also good to note that traders are not as genuine as producers in information provision - underestimate prices and profits as they associate the information with tax.*

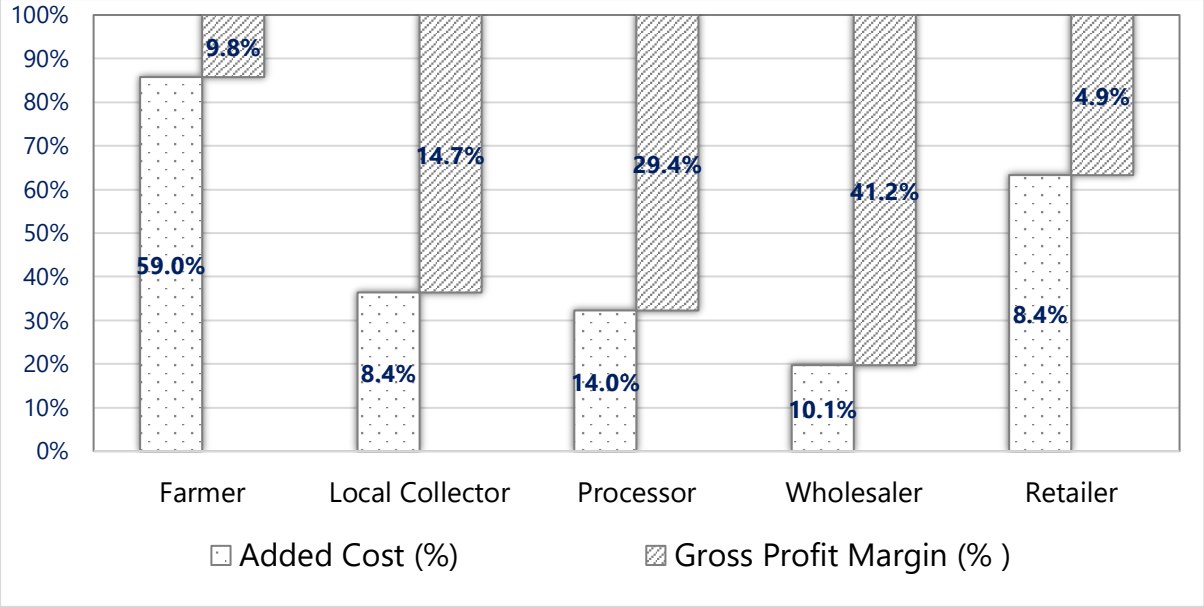


Figure 6: Actors' share in total value chain added costs, and gross profits of potato (%)
Source: Loyya consult (2022) Survey results and own computation

Worth mentioning, the disproportionately high gross marginal benefit to the traders is said to be attributed to the unregulated price mark-ups by commission agents/brokers and the price setting game played by oligopoly lead traders. It is well noted that in areas of high production and abundant supply, producers are least benefitted because of weak negotiation power (risk of bulk management of perishable item), whereas in those relatively low production areas and scarce supply, farmers have a better bargaining power and hence share a good amount of value added.

7.4 Potato Exports and its Contribution to Foreign Exchange Earnings

Agriculture contributes over 75% of total national export earnings, and the share of horticulture to the total export is about 13.4% (MoA, 2024). The ware potato market supply currently moves across the border. Top export destinations of potato are Djibouti and Somalia accounting for over 90% total potato exports. Other regional markets such as Sudan, Yemen and Saudi Arabia import small quantities of potatoes from Ethiopia with potential future expansion to the Middle East. However, available trade data is considered suspect and is known to exclude a large volume of existing trade due to its informality. Survey results of the local key informants, particularly the traders, have also revealed that in some cases, informal (unrecorded) potato trade in Ethiopia accounts for as much as 50 to 60 percent of the total potato exported.

Although not comparably high, the export of potato has been growing substantially since 2019, both in terms of quantity and value. Table 4 portrays the Ethiopia's potato export values over the recent years (2019-2023). The average export earning from potato for the past five years was about USD $13.63 million per annum accounting for 0.45% of total national export income.

The export value of potato has shown significant growth from USD 9.28 million in 2019 to USD 19.44 million in 2022, marking more than two-fold increase in the latest years. Similarly, the total national exports rose steadily from USD 2,683.8 million to USD 3,085.12 million during the same period. The share of potato exports relative to total exports increased from 0.35% to 0.63% in the same period. This trend highlights the growing importance of potatoes in Ethiopia's export economy. The fastest growing export markets for potatoes of Ethiopia between 2021 and 2022. However, the export earnings from potato suddenly declined in 2023 due decline both in volume of export, from 64.62 thousand tons in 2022 to 61.17 thousand tons in 2023, and export price fell from USD $ 0.30/kg in 2022 to USD $ 0.234/kg in 2023 (see the details in Table A4 in the Annex)

Table 4: Value of Ethiopian Potato Exported from 2019 to 2023 (Million USD)

Year of Export	2019	2020	2021	2022	2023	Average
Potato export (a)	9.28	8.67	16.72	19.44	14.05	13.63
Total national export (b)	2,683.8	2,533.3	3,057.6	3,085.1	3,600	2,992.0
Share of potato to total export (a/b in %)	0.35	0.34	0.55	0.63	0.39	0.45

Source (b) Ethiopian Customs Authority (2024) and **(a)** *https://trendeconomy.com/data/h2/Ethiopia/0701*.

It should also be noted that Ethiopia imported seed potatoes (fresh/chilled) mainly from the Netherlands. In 2021, seed potato valued USD 4,850 was imported, but in 2022 that import sharply fell to only USD 263. In 2023, the country imported about 127,115 kg of frozen potato at a value of USD 140,870 largely from United Arabs Emirates that might be also associated to the decline in the potato production in that year. However, this import demand is not expected to grow significantly.

Because of unique tastes and preferences for fresh potatoes and the bulkiness of the product, the Ethiopia potato sector is highly competitive against imports. Potato imports are negligible compared with national production and therefore unlikely to significantly influence domestic consumption and farm-gate prices.

Dwelling with the National Potato and Sweetpotato Development Strategy (MoA-FDRE, 2024), through the effective implementation of the interventions proposed in this strategy, the current potato export revenue can easily be doubled projected at USD $ 36.2 million by 2030 by boosting the volume of exports of fresh and processed potato products (such as frozen chips and chips/crisp (e.g. sun chips) that PEPSICO Food, for example, is planning to export to the countries in the region).

In general, despite having the largest production potentials, Ethiopia has not significantly penetrated the export market of the eastern African and the Middle East to date. To do so, the government must rethink the actual social and economic significance of the sub-sector and give policy direction for research and development. The private sector must be strongly

encouraged to substantially involve in the production of potato and meet volume and quality requirements of the potential markets in East Africa and the Middle East. Interestingly, to ensure the continued growth of the potato sub-sector through increased, exports, income, employment and food security, the MoA and Horticulture Development Sector has been working in collaboration with the COMESA – East African Community Horticulture Accelerator (CEHA) initiative to enhance the growth of the Horticulture Sector in Eastern and Southern Africa. While the project aims to accelerate the growth of the fruit and vegetable subsector of the COMESA and EAC regions, the priority value chains over the short term are **avocado, onion, and Irish potato** in Ethiopia, Kenya, Rwanda, Tanzania, and Uganda (EAC, 2021).

8 Contribution of Potato to Employment Opportunities

The potato industry is labor intensive in nature. Along their respective value chains, from cultivation and harvesting to processing, packaging, and distribution, this crop supports a range of economic activities and provides livelihoods for farmers, workers, and entrepreneurs involved in the industry. The expansion of potato cultivation has led to increased labor demand, particularly in rural areas where employment opportunities are often limited. That means, beyond its food and nutritional significance, potato plays a significant role in the employment of millions of households in rural and urban areas creating special economic opportunities for women and youth societal groups.

The livelihoods of about 21.67 million people (14.18 in potato and 7.49 in sweetpotato respectively directly depends on the production and subsequent value chain activities (MoA-FDRE, 2024; CSA, 2022). Through developing the existing value chain activities and creating new business opportunities, the number of people employed by the interventions targeting potato and sweetpotato is expected to increase by an estimated from 10 to 20% by 2030. This will be an impetus to the ongoing effort of the Ethiopian government to reduce the unemployment rate in the country.

CSA's (2008) agricultural sample survey estimated the number of smallholder potato grower at 1,386,670 in 2006/07 production year. The recent CSS data (2023) shows, however, that the number of small farmers growing the crop has nearly tripled. As mentioned in section 6.2, the CSS reported that there are approximately 4.33 million households involved in potato production during the meher (main) and belg (short) seasons. About 15% of the potato growers are female headed households. In all parts of the country, both male and female household members participate all through potato production to marketing activities, in which on average 3.5 household members participate. That means, an estimated 15.16 million

people are directly engaged in the potato farm production[4]. This estimation is closer to the CSA (2022) survey that explains the income of approximately 14.18 million people in Ethiopia directly depends on potato production and its associated value chain activities.

The potato sub-sector has a strong multiplier effect; however, data on the size of employment opportunities along the value chain is not available. From the results of the quick survey with producer and market agents (wholesalers and retailers), it was roughly estimated that directly or indirectly about 1.5 million people are employed in local marketing and export activities, 550 thousand in transporting, and 320 thousand in the industrial and consumption processing (hotels and cafes) (Figure 7). These add up to 2.37 million people being employed in potato marketing and processing activities (indeed further detailed investigation is necessary).

This implies that in addition to the 15.16 million people directly engaged as potato growers in 2023, the sub-sector contributes employment opportunity for another 2.37 million people along its value chain that adds up to 17.53 million people at the national level. MoA-FDRE (2024) estimated 21 million people are directly employed in the production and subsequent value chain activities of potato and sweetpotato sub-sectors, which given that sweetpotato shares only a small proportion of the labor share, our estimation for potato is roughly close to each other. By enhancing the existing value chain activities and creating new business opportunities, it is estimated that employment in this sector could increase by 10 to 20% in the coming five years. This growth aligns with the Ethiopian government's ongoing efforts to reduce the national unemployment rate, highlighting the significance of the potato sector not only as an economic driver but also as a crucial source of livelihood for millions.

[4] *The MoA also reported that, about 372,320 households practice irrigation based potato farming. In addition, particularly in high production areas, each producer hires an average of 105 labor days from their localities for production process and harvesting. These figures are conservatively excluded from consideration due to lack of adequate evidence and to avoid any double counting. For instance, belg practitioner can at the same time practice irrigation farming.*

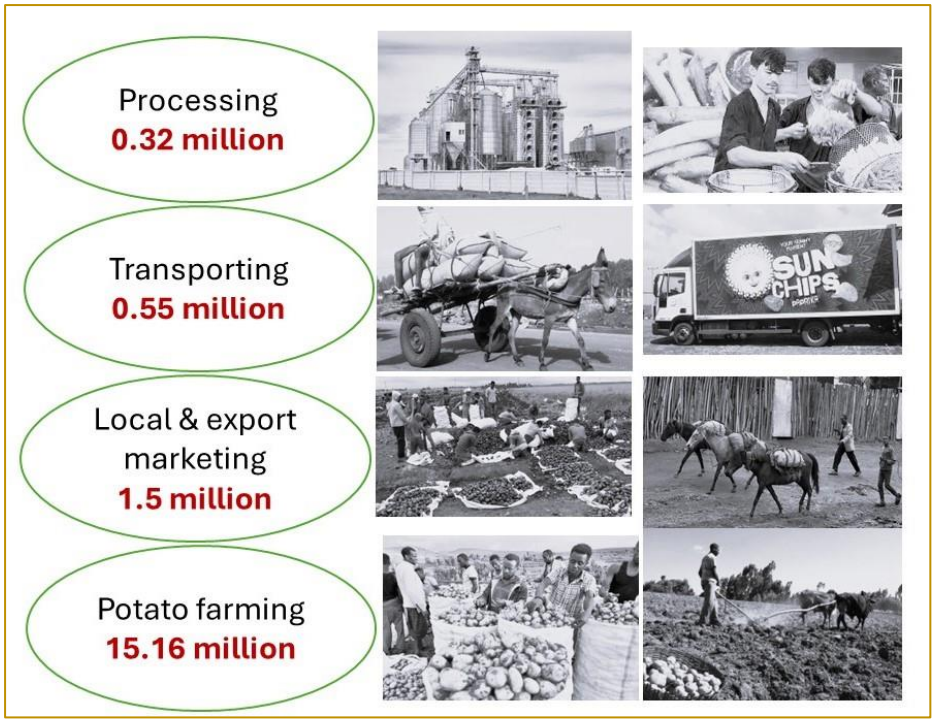


Figure 7: Summary of the Current Contribution of Potato Subsector to Employment in Ethiopia

9 Contribution of Potato to the National Economy

9.1 Valuation Approach

The International Standard Industrial Classification (ISIC) was applied to compute the contribution of potato to the national income of Ethiopian (GDP). ISIC provides a systematic framework for categorizing economic activities in an internationally comparable and standardized way. The ISIC classification is essential for understanding sector's contribution to total economy and for implementing policies aimed at enhancing productivity and value addition. To be consistent with the national income accounting system, this ISIC adapting from the Ministry of Planning and Development National Account Statistics of Ethiopia.

Based on the ISIC, the contribution of a sector to the national income of a country (measured in Gross domestic product, GDP) is derived from gross value addition (GVA) of that sector. Value addition is the difference in sales price and cost of inputs (raw materials) at each stage of the value chain. In this case, GVA of potato provides a value (in Birr) for the amount of the product produced in Ethiopia, minus the cost of all inputs and raw materials that are directly attributable to it.

Employing the ISIC Rev.4 the product approach estimation technique was undertaken to calculate the contribution of potato to the national income. The GVA for potato was computed at Constant Basic Price by decomposing the value addition of the agriculture and allied economic activities. Double deflation method was employed, which involves adjusting both

the Gross Value of Output (GVO) and Intermediate Consumption (IC) for inflation to derive real values. This process entails deflating the current prices of both outputs and intermediate inputs using the price corresponding to a specific base year for the product and input category. The following formula was used to estimate the GVA of potato based on the recent five years data (2019-2023).

Gross value addition (GVA) = GVO at producer s price –IC at purchaser's price; then,
GVA= ∑(Quantity × base year producer's prices) - ∑(Quantity ×base year purchaser's prices)

9.2 Contribution of Potato to the National Income

The estimation result shows that the contribution of potatoes to the Ethiopian economy is found to be significant. The five years average shows that potato contributes to the national income of GVA of 18.7 billion birr per annum and it contributed on average of 2.7% to agricultural GVA and 0.9% to the national GDP, which is very significant.

Also note that as the lion's share of the agricultural value added originates from the small farmers, the GVA of 18.7 billion Birr from potato means its partial contribution relative to all incomes from grains, vegetables, root crops, tubers, livestock products and allied agricultural income sources. Assuming 4.33 households participate in potato farming (indicated in section 6.2), their average annual income from this crop can be approximated at ETB 4,322 in real terms.

However, the contribution of potato was declining from 20.58 billion in 2019 to 17.4 billion in 2023. In a same fashion, its share to the agricultural GVA was gradually declining from 3.3% in 2019 to 2.2% in 2023 and to GDP from 1.1% to 0.7% to GDP during the same period (Table 5).

Table 5: Potato Contribution to Ethiopian Economy (billions of Birr) between 2019 and 2023

Description	2019	2020	2021	2022	2023	Average
National GDP	1,875.9	1,989.6	2,114.2	2,248.7	2,409.9	2,127.7
GVA Agriculture	623.8	650.3	686.4	728.4	774	692.58
GVA potato	20.58	19.70	17.97	17.98	17.40	18.72
Potato Contribution to GVA Agriculture (%)	3.3	3.0	2.6	2.5	2.2	2.7
Potato Contribution to national GDP (%)	1.1	1.0	0.8	0.8	0.7	0.9

Source: Computed from CSS databased and based on MoPD Income Accounting

As discussed earlier, contradictory to the MoA's National Potato and Sweetpotato Development Strategy (2024-2030), due to the extra focus of the government on irrigated wheat production, significant number of farmers were forced to shift their land and associate resources away from potato production. From the survey result with key stakeholders, such a production shift from potato to wheat under irrigated production system was economically

not viable and has huge opportunity cost for the smallholders, which also automatically reflects a benefit forgone to national income.

10 Challenge and Gaps in the Enabling Environment

The challenges constraining the development of the potato sub-sectors are many and complex. Any of the challenges that impact the production, post-harvest management and marketing of potato can have spontaneous adverse effects on the entire matters of food security, employment and income generation at household and national levels. Lack of access to quality seed, absence of improved storage facilities and inefficient market system are among the top and main concern of the stakeholders. These challenges and related gaps are discussed in this section.

1. Lack of Quality Seed and Chemicals

Farmers have been confronted with limited supply of inputs (quality seeds, fertilizers, fungicides, etc.) that always fall to satisfy their demand due to unavailability, untimely supply, high price, and poor quality of the production inputs compromising the quantity and quality of the produce along the potato value chain.

- While seed quality and availability is a key to a successful harvest in Ethiopia, underdeveloped formal potato seed system is a critical factor. Farmers are confronted with different types of seed insecurity: poor seed quality, lack of availability, limited access to high-quality seed, lack of access to preferred and adapted varieties, and inefficient seed systems (FAO, 2016; Bentley et al., 2018). More than 90% of seed potatoes in developing economies is produced in the farmer-based category and is considered to be of poor quality (Thomas-Sharma et al. 2015). Neither a government entity nor private sectors are adequately engaging and addressing the problem of quality potato seed supply. Varietal mix-up, poor storage conditions, prevalence of diseases and pests and poor knowledge of seed selection (Hirpa Tufa, et al. 2016) are among the challenges. Innovative, affordable and efficient quality seed multiplication techniques have not been developed and promoted to meet the high demand for quality seeds of all classes.

- The prevalence of pests and diseases, and lack of pertinent pesticides and/or knowledge of application are critical limiting factors.

2. Poor Harvesting and Post-Harvest Management

- Most farmers also have limited access to inexpensive and labor-saving farm machinery and implements, lack of postharvest infrastructure and limited knowledge about post-harvest handling and processing,

- Poor transportation and marketing infrastructure is a common feature in most potato producing areas across Ethiopia. Overall, the poor state of storage facilities (at farm and market centers) and lack of feeder roads (expressly during wet season) contributes to low product quality, high transport costs and high postharvest losses. This results in low competitiveness in the local markets and global exports and ultimately low income to the value chain actors.

3. Poor Product and Input Market Systems

- The problems highlighted under 1 and 2 above have further challenged the farmers to meet the demand requirement of the processors to supply fresh potato of the right quality and in required quantity in a sustainable manner.

- The market system, both for inputs and outputs, is generally inefficient, underdeveloped and severely manipulated due to traders' oligopolistic dominant power and the heavily involvement of brokers. This situation perpetually exposes farmers to income risks from the potato production limiting their business profitability and growth. For instance, the high mark-ups at the source and retail markets are indicative of traders unfair benefit shares and the presence of multiple layers of brokers at both ends of the value chain. While traders generally reap the largest benefit share with little investment in short period, potato producers share the least benefit with large investment and over a long working period.

- It also happens that with so many powerful brokers along the value chain, formal market organization and contract enforcement is near impossible and hence marketing innovation remains depressed. Unfortunately, the roles of cooperatives and unions are unsatisfactory, and regulatory system for potato marketing and quality standards is limited or non-existent. At the current levels of return, most producers may not continue to invest in more expensive but quality potato technologies unless corrective measures are taken to the product and input market systems.

4. Lack of adequate and reliable statistical data

- Statistical data on root and tuber crops in general are inadequate or missing. Annual data on production, consumption, post-harvest losses, trade volume, market prices, and contribution to national economy and job creation are either underreported or incomplete. This creates difficulty to develop proper plan/strategy and mobilize resources for research and development of the sub-sector.

5. Lack of knowledge and/or underestimating the value of Potato

- There seem stakeholders do have inadequate knowledge or understanding about the diverse nutritional values and multiple contribution of potato to households and national socio-economy.

- Government's effort is weak to promote the production as a source of nutritious food, employment opportunity, and foreign exchange earnings.

6. Inadequate policy attention

- Implementation of policies and strategies is generally weak. Whereas national macro-economic development polices, and sector strategies (e.g., Horticultural Development Strategies 2024-2033) duly consider the relevance of enhancing the horticultural development, there are apparent limitations in the implementation process of the strategies, directives, and standards (e.g., for seeds and inputs). More disappointingly, the MoA's 10 in 10 development program completely overlooks potato from its development activities. Thus, it has persuaded the other development partners not to effectively/adequately support the potato value chain.

- Apparently, there is a strong policy directive and flagship programs for the expansion of cereal crops. Unfortunately, this aggressive expansion of wheat production under rain-fed and irrigated production systems in traditionally potato growing belts may further diminish potato production unless the cropping system is intensified with the integration of crops with high economic, agronomic and nutritional values.

- Despite the seriousness of the market problems, the regulatory bodies at federal and regional levels seem silent in designing and implementing actionable strategies for a more efficient and faire market system.

7. Weak investment in research and development

- Despite multiple socio-economic opportunities and the presence of suitable soils and favorable agro-ecological conditions, limited investment in research and extension services has profoundly hindered the development of the root and tuber crops sub sector in general and potato in particular. This is inferred by the limited budget allocation by the government and donors for sub-sector including potato (MoA-FDRE, 2024).

- Potato production is characterized by subsistent and suboptimal production practices. Lack of quality seed, poor agronomic practices (i.e. suboptimal and improper use of inputs – especially fertilizer and seed) and prevalence of diseases and pests result in low productivity and product quality. Farmers' level of awareness and rate of adoption of improved technology is low even for those available

improved varieties, pest management, crop husbandry, and postharvest management (Abebe, 2019). Furthermore, varieties with processing qualities and industrial products such as starch, flour, chips, crisps, etc., are lacking. This is mainly because of limited resource allocated by government and donors to support the development and dissemination of improved production and post-harvest management technologies and practices. Collaboration, coordination, and linkage among the stakeholders are generally weak, limiting information exchange, and research and extension services related to the crop.

11 The Future Prospects of Potato Development

The formulation of the seven-year National Potato and Sweetpotato Development Strategy (2024-2030) aimed at overcoming the abovementioned challenges and unleashing the potential of the sub-sector in Ethiopia is highly commendable. Among others, institutional and research support were key areas of intervention emphasized to effectively benefit from the growth of the potato production. Supporting research and extension has no alternative to increasing technology generation, dissemination, and improving adoption by the end users (farmers, seed multipliers and processors) to increase productivity and production. Strongly supporting the sub-sector in strengthening institutional, legal and regulatory frameworks has been underlined. With the prospect of a well-articulated implementation framework, the strategy aims at increasing incomes of the value chain actors, improving the food and nutrition security, creating jobs, boosting exports, and transforming the sub-sector and impacting the broader economy by the end of the strategy period (MoA-FDRE, 2024). Our projection also ratifies the strategy document of the ministry to achieve at the following targets:

1. ***Increase production and productivity****:* Within the strategy, focus has been rendered to increasing potato production from the current 6.0 to 11.2 million tons by 2030, by increasing the area under cultivation to 675,000 ha, and potato yield from the current 13.6 to 16.6 t/ha through accelerating the adoption of improved varieties and use of improved pre- and post-harvest technologies and management practices.

2. ***Increase consumption****:* It is also envisioned to double the national per capita consumption of potato so that the society would benefit from the food and nutritional values of potato at large.

3. **Supply to industries:** The strategy further intends to increase the supply of potatoes to the processing industries from the current 18,000 tons to 150,000 tons per annum to meet the raw material needs of the existing and potential new processing industries.

4. ***Job creation****:* Moreover, jobs will be created by 20%, particularly for women and youth, across potato value chains, increasing the livelihoods of people from 17.5 million to 21 million.

5. ***Increase income of the growers:*** The strategy also aspires to ensure fair income distribution among value chain actors, increasing income for the growers from the current USD 2,332 to 2,932 per hectare for potato through improved productivity, reduced post-harvest loss and improved market linkage.

6. ***Promoting export and national income***: The strategy will help to diversify Ethiopia's exports by increasing potato exports from the current about 60,000 tons to 120,000 tons by 2030. This could double earnings from potato to USD 36.2 million. The contribution of this crop to the total national income could rise to USD 1.68 billion in 2030.

In summary, if the proposed interventions are implemented through coordinated efforts of the value chain actors, the strategy will have far-reaching benefits, encompassing food and nutrition security, economic development, poverty alleviation, agricultural diversification, technology transfer, environmental sustainability, and knowledge development. By focusing on the specific needs and challenges of the sub-sector, Ethiopia can exploit its potential for growth, and socioeconomic advancement.

12 Conclusion and Recommendations

12.1 Conclusion

In Ethiopia, potato is grown in small-scale mixed farming systems, most dominantly in cool, high-altitude areas with great adaptability to a wide variety of climates. The highlands also offer favorable climatic and edaphic (soil) conditions. It has a short growth cycle, maturing in about 100 - 120 days which allows farmers to grow and harvest potato up to three times a year under rainfed and irrigated systems. This, coupled with high productivity, makes the potato a suitable crop for places where land is limited, and labor is abundant such as in Ethiopia.

Evidently, given its much higher productivity per unit area than commonly grown cereals, and fairly good nutritional values (high in vitamins, minerals, antioxidants, fibers and resistant starch), and that it has a short life cycle makes potato among the most preferred crops in addressing food and nutrition insecurity problems. Its consumption has gained growing acceptance across the different socio-economic groups in rural and urban areas due to its versatility to meet the growing food demand caused by rapid population growth in Ethiopia.

Besides directly supporting Ethiopian smallholder farmers as a source of food and cash income, potato has other multiple benefits such as (i) creating employment and income opportunities for farmers and other multiple actors including seed multipliers, input dealers, aggregators, transporters, wholesalers, retailers, processors, and consumers; and (ii) further contributing to the national income and export earnings. It is known to be nutritionally balanced food crop, which provides a high calorie intake and a substantial amount of minerals and vitamins. Thus, given the manifold benefits and importance of potatoes, the MoA's formulation of the National Potato and Sweetpotato Development Strategy to promote its commercialization should be appreciated.

In conclusion, the country can immensely maximize the multiple benefits of potato sub-sector through enhancing its productivity using technological innovation, as the yield gap is high, and through horizontal expansion as suitable land is abundantly available. Nevertheless, the subsector is relatively undeveloped and faced with complex challenges that calls for urgent interventions.

12.2 Recommendations for Intervention

Improving the contribution of potato sub-sector to food security, employment and household income as well as to the national economy heavily depends on addressing the root cause of the problems. For instance, any factor that affects the production and marketing aspects of the potato sub-sector can unfavorably shake the entire spectrum of its subsequent multiple benefits, say, food security, employment, export and national income.

The main bottlenecks to the potato subsectors are related to lack of improved quality seed and other inputs, poor infrastructure, inefficient market systems, and weak investment in research and development. Inadequate implementation of policies, programs and strategies are persistent development gaps. The following intervention areas are thematically recommended.

1. Improved availability and supply of inputs

Potato's support to food security can be achieved through improved productivity and production, either by increasing yields or expanding production areas, combined with technologies that reduce post-harvest losses. The yield gap expressed as the difference between actual yield in farmers' fields and the attainable yield—using best agricultural practices—leaves a great potential for improvement. Much improvement is needed in agronomic practices, quality seed production, and development and delivery of varieties that can meet farmers and consumers preferences and are tolerant/resistant to abiotic and biotic stresses (Birch et al. 2012). The problems of modern input availability and supply are associated with technology generation/dissemination and market system.

- While further development and dissemination of improved potato technologies (varieties, agronomic practices and pest and disease protection) should be a continuous process, improving the market systems for quality seed, chemicals and fertilizer are urgent.

- Encouraging the involvement in and enhancing the capacity of institutions, private sectors and progressive farmers for the seed multiplication and distribution activities,

- Enhance adoption rate of improved potato technologies by producers through awareness creation and improving access to information and the required inputs.

2. Improved storage and road infrastructure

- Reduction of postharvest losses is reported as a critical component of ensuring future global food security (Aulakh et al., 2013). Lack of appropriate storage facilities for vegetables and root crops, at farm level and market center, is a never ending problem regardless of its critical importance in post-harvest management – diminishing the quality and quantity of the products available for home consumption, market supply and further to the overall national food security and economic benefits. Therefore, to sustain food and nutrition security, food availability needs to be increased via reduction of quantitative and qualitative losses after harvest. The issue of storage problem should call for technological revolution and serious attention of the government and development partners to improve food and nutrition security.

- Paving all-weather feeder roads, particularly in high potential areas will ease fast conveyance of inputs and the product to the farm and from the farm at the right time maintaining the required quality. The implication of improving storage facilities and transport system for market improvement will also be significant.

3. Improving Policy Environment – Market, Research and Development

- Since long ago, efforts have been made to improve farmers' access to fair market through cooperative/unions, yet the market problems remain ever challenging particularly for horticultural products. Thus, the market approach through cooperative/union should be revisited, and alternative strategy be developed. It needs to establish a new policy environment to mitigate a market dominance of few traders (mainly brokers and local collectors) by creating competitive market environment such as encouraging new market entrants through creating access to finance for marketing. Therefore, government should take strong responsibility to establish an innovative market system as a serious policy agenda to increase market efficiency and realize fair share of the benefit to the farmers. The government should, therefore, focus on strong

capacity development to establish and monitor quality standards and market regulatory systems.

- Appreciating the contribution of this product to food security, employment, income generation and foreign exchange earnings, the MoA should revisit its program to consider potato as one of the top priority commodities in its development agendas. As regards, the existing institutional capacities in research and development do not seem adequately strong to enhance the development of the potato sub-sector. Therefore, allocating adequate budget in research and extension service, and coordinating development partners to support this commodity deserve paramount importance.

4. Improving Access to Reliable Data

- In line with the intervention proposed in the National Potato and Sweetpotato Development Strategy, also it is strongly suggested that the proposed interventions are implemented to strengthen the capacity of the Ethiopian Statistics Service (ESS). This enhances the ability to collect, analyze, and disseminate accurate and up-to-date data related to production area, farm management, consumption, post-harvest losses, trade volume, market prices, job creation, and value-added products of roots and tubers and specifically for potato.

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14 Annex: Detailed Statistical Tables

Table A1: Total Cropland Area (thousand Hectares)

Crop/Year	2019	2020	2021	2022	2023	Average	Share of crop land (%)
Cereal	12,273.39	12,395.28	11,567.82	11,727.60	11,564.14	11,905.65	59.53%
Pulses	2,154.56	2,093.18	2,119.51	2,187.60	2,201.61	2,151.29	10.58%
Oilseeds	1,048.21	1,115.41	944.52	806.85	750.94	933.19	4.59%
Vegetables	460.11	457.54	443.17	489.60	503.03	470.69	2.31%
Root crops	804.04	821.41	864.32	773.23	768.60	806.32	3.96%
Fruit crops	2,423.36	2,420.72	2,296.74	2,265.71	2,245.82	2,330.47	11.46%
Stimulant crops	1,466.14	1,388.29	1,352.25	1,235.74	1,207.38	1,329.96	6.547%
Industrial Crop	253.60	956.25	255.53	226.03	384.94	415.27	2.04%
Total	20,883.41	21,648.08	19,843.85	19,712.36	19,626.46	20,342.83	100%
Potatoes	442.50	437.21	443.20	420.59	414.55	431.61	2.12%
Share of crop land (%)	2.12%	2.02%	2.23%	2.13%	2.11%	2.12%	

Source: Central Statistics Service Annual Agricultural Sample Survey

Table A2: Potato Production (Thousand Tons)

Production system	2019	2020	2021	2022	2023	Average
Meher	1,044.44	924.53	1,141.87	1,309.57	1,426.18	1,169.32
Belg	3,529.91	3,529.91	2,909.85	2,876.07	2,696.54	3,108.46
Irrigation	1,886.46	1,731.92	1,590.04	1,459.78	1,340.20	1,601.68
Large Farm	1.68	1.45	1.21	0.81	0.64	1.16
Total	**6,462.49**	**6,187.82**	**5,642.97**	**5,646.24**	**5,463.56**	**5,880.62**

Source: Central Statistics Service Annual Agricultural Sample Survey

Table A3: Crop Production (thousand tons)

Crop/year	2019	2020	2021	2022	2023	Average production	Contribution
Cereal	31,226.18	33,142.67	31,052.85	31,613.59	31,892.15	31,785.49	46%
Pulses	3,541.57	3,533.01	3,566.25	3,586.02	3,616.54	3,568.68	5%
Oilseeds	1,035.78	1,086.78	929.32	766.70	701.14	903.94	1%
Vegetables	3,620.11	3,614.85	3,047.23	4,044.93	4,333.60	3,732.15	5%
Root crops	13,185.60	13,316.74	12,614.23	11,403.96	10,996.98	12,303.50	18%
Fruit crops	7,774.32	7,791.66	6,835.31	7,715.72	8,304.04	7,684.21	11%
Stimulant crops	972.60	945.51	1,099.33	966.22	971.53	991.04	1%
Industrial Crop	8,091.12	8,384.23	8,245.16	7,445.48	7,300.59	7,893.32	11%
Total	69,447.28	71,815.45	67,389.69	67,542.64	68,116.57	68,862.33	100%
Potatoes Production	6,462.49	6,187.82	5,642.97	5,646.24	5,463.56	5,880.62	
Potatoes Contribution	9.3%	8.6%	8.4%	8.4%	8.0%	8.5%	

Source: Central Statistics Service Annual Agricultural Sample Survey

Table A4: Potato export for the period of 2019-2023

Year	Volume in tone	Unit price USD/kg	Value in USD
2019	32,916.01	0.28	9,275,123.84
2020	37,098.86	0.23	8,671,770.84
2021	62,392.50	0.27	16,720,188.71
2022	64,619.57	0.30	19,435,008.23
2023	61,169.23	0.23	14,049,659.91
Average	**51,639.23**	0.26	**13,630,350.31**

Table A5: Assumptions and Computation of the Per capita Consumption

No	Descriptions	Average Tons (2019-2023)
1	Total production	5,880,600
2	Less wastage (20%)	(1,176,120)
3	Net available for use (1-2)	4,704,480
4	Seed (11.5%)	541,015
5	Consumption (64.8%)	3,048,503
6	Market (23.7%)	1,114,962
	6.1. Export (average)	51,639
	6.2 Local sales	1,063,323
7	domestic consumption (5 + 6.2)	4,111,826
9	Consumption per capita (kg)	32.5
10	Rural (kg)	34.4
11	Urban (kg)	26.2

Table A6: Population distribution in Urban and Rural and Potato Consumption

Description	Percentage %	Total population (million)	% potato consumption @
Rural population	76.84	97.2	81.36
Urban population	23.16	29.3	18.64
Total pop million	100	126.5	-

CSS (2023), @ CSA expenditure survey 2015/2016

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The International Potato Center (CIP) was founded in 1971 as a research-for-development organization with a focus on potato, sweetpotato and Andean roots and tubers. It delivers innovative science-based solutions to enhance access to affordable nutritious food, foster inclusive sustainable business and employment growth, and drive the climate resilience of root and tuber agri-food systems. Headquartered in Lima, Peru, CIP has a research presence in more than 20 countries in Africa, Asia and Latin America.
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