



**AVRDC**

**The World Vegetable Center**

**SCOPING STUDY ON VEGETABLES SEED SYSTEMS AND  
POLICY IN ETHIOPIA**

**Final Report**

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## Acronyms

AISCO	- Agricultural Input Supply Corporation
APHRS	- Animal and Plant Health Regulatory Services
ATA	- Agricultural Transformation Agency
ATVET	- Agricultural Technical, Vocational and Education Training
AVRDC	- The World Vegetable Center
BoA	- Bureau of Agriculture
CSA	- Central Statistics Agency
DA	- Development Agent
DUS	- Distinct, Uniform and Stable
EHPEA	- Ethiopian Horticultural Producers and Exporters Association
EHDA	- Ethiopian Horticulture Development Agency
EIAR	- Ethiopian Institute of Agriculture
EIPO	- Ethiopian Intellectual Property Office
ERCA	- Ethiopian Revenue and Customs Agency
ESE	- Ethiopian Seed Enterprise
ETFRUIT	- Ethiopian Fruit- and Vegetables Marketing Enterprise
FGD	- Focus Group Discussion
GTP	- Growth and Transformation Plan
ISSD	- Integrated Seed Sector Development Ethiopia Programme
KII	- Key Informant Interview
MoA	- Ministry of Agriculture
MoFED	- Ministry of Finance and economic Development
NVRC	- National Variety Release Committee
PVP	- Plant Variety Protection
SNNPR	- Southern Nations, Nationalities and Peoples Region
TC	- Technical Committee
VCU	- Value for Cultivation and Use

## Executive Summary

This scoping study is conducted for AVRDC as part of its Humidtropics program, which is implemented together with a number of CGIAR Centers and advanced research institutions. The specific objectives of the study were reviewing the policy and regulatory frameworks, describing different vegetable seed systems and seed distribution channels along with supporting institutions, assessing existing vegetable farming systems, and documenting major opportunities and challenges influencing vegetable seed system and production, marketing and utilization of vegetables for household consumption, domestic agro-processing and for local and export markets.

The data needs for this study were collected from review of literature and primary data from collected from west Shewa zone of Oromia Regional State, Gurage and Hadiya zones and Yem special district of the Southern Nations, Nationalities and Peoples Region (SNNPR). Key informant interview with development agents and horticulture experts, focus group discussion with community members and review of secondary data sources were used to collect the necessary data. The key findings are summarized below:

**Policy and institutions:** The results of the study revealed presence of favorable agricultural development policy and strategies supporting the development of the horticulture sector, including vegetable production, processing and marketing locally and for export. The prevailing conducive policy, suitable agro-climatic conditions, presence of a number of supporting institutions and increasingly improving infrastructure development such as small to medium scale irrigation schemes, road and communication networks, expansion of urbanization, and increasing awareness of the importance of vegetables for health and nutrition constitute the potentials for integrating and expanding vegetable production in the Ethiopian agricultural system.

**The seed system:** the informal seed system is the major source of vegetables for varieties for which released varieties do not exist. The supply of vegetable seeds depends on informal system of farmer-saved seeds particularly for kale, Ethiopian mustard, pumpkin, hot pepper as well as seed potato and sweet potato cuttings for planting. Community-based seed production (also called the intermediate seed system with some regulatory oversight) largely serves seed supply for potato, onion, sweet potato, and to a limited extent tomato. The community-based vegetable seed production (e.g. for onion and potato) involves model farmers, farmers cooperatives, individual seed producers with spirit of entrepreneurship and supported by research centers, bureaus of agriculture, NOGs and seed projects.

The bulk of vegetable seeds (onion, carrot, beetroot, tomato, Swiss chard, lettuce, cauliflower and leek) are exported by private seed importers and parastatal enterprises such as EtFruit and AISCO. The seed import is predominately made from Europe countries like the Netherlands, Italy, Germany and France. Available data shows the quantity of imported vegetables is increasing, primarily because of increasing vegetable production both under rainfed and irrigation. The imported seeds are distributed by local traders, farmers' cooperative/union, bureaus of agriculture, and NGOs. Such seeds are rarely checked for quarantine and quality by the seed regulatory department of the Ministry of Agriculture and the regional bureaus of agriculture.

**Varieties in use:** Most farmers and even some extension agents do not know the types of imported vegetable varieties used by the farmers. But the common varieties grown in the study areas include Copenhagen Market and Holland for cabbage; Nantes for carrot; and Detriot/Detriot Nero for beet root are commonly used. Such varieties are very old, showing that varietal replacement takes quite long time because of lack of regular seed supply and because the seed importers are general purpose traders, who lack technical knowledge and skill. This calls for public-private partnership both at national and international levels as well as business-to-business integration between local seed importers and international commercial vegetable breeding companies so that latest varieties can be introduced with more improved traits such as yield, quality and resistance to diseases and insect pests. Even for the vegetable varieties released (e.g. hot pepper, onion, potato, sweet potato) by the NARS, the varietal replacement period is very long as older varieties are still in production due to the weak variety development program and slow promotion of newly released varieties by the extension system. Whenever there is chance varieties are chosen or replaced for their yielding potential, taste, color, long shelf life, market demand and largely availability of seed.

**Vegetables production:** In the study areas, tomato, onion, hot pepper, and potato are widely grown. From among the four study zones, west Shewa zone followed by Gurage zone are the major vegetable producers both in area (ha) and amount of production. Vegetables are also grown in two seasons, namely the wet season using rainfall as well as irrigation. Over 31% of the total area and 25% of the total production comes from irrigated vegetable production schemes, showing the prospect for several seasons production per annum so as to ensure continuous supply of fresh vegetables. Swiss chard, cabbage, kale, tomato and carrot are among the top five vegetables produced under irrigation in terms of quantity of production. Generally vegetable production is integrated into mixed farming system where different types of crops are produced on the same plot or in a sequence of crop rotation. Vegetable crops such as tomato, beetroot, Swiss-chard, lettuce, carrot, cabbage, onion, garlic, kale, sweet potato and hot pepper are dominantly grown as sole crop whereas vegetables such as Ethiopian mustard and pumpkin are dominantly intercropped with maize. Vegetables are largely produced for sales indicating that it is a means to access food security through market integration and value chain participation. Productivity of vegetable is lower than the potential due to different factors.

**Production constraints:** Vegetable production in the study areas was found to be constrained by shortage of seeds/planting materials, diseases and insect pests, poor postharvest handling and poor linkage to market and market information. This is exacerbated by inadequate seed regulatory frameworks and supply of seeds of poor quality, which are attributed to low capacity and capability for policy implementation as well as unregulated vegetable seed supply. There is no capacity for breeding such important vegetable crops like kale, Ethiopian mustard, and pumpkin. Moreover, there is no systematized seed importation system to access seeds regularly. The vegetable seed system in the country is at infant stage, primarily depending on the informal, community-based seed production and on unregulated seed import.

**Marketing constraints:** vegetables are perishable. This feature exacerbated the poor vegetable market performance. The marketing system is poor, access to market information is limited and so far market linkage is weak or non-existent.

**Recommendations:** List of actions are suggested as shown in section 4.2.



# 1. Introduction

## 1.1 Overview of Importance of Vegetables in Ethiopia

Vegetable production is an important economic activity in Ethiopia, ranging from gardening smallholder farming to commercial state and private farms (Zelleke and Gebremariam, 1991). According to CSA (2012), about 2,710 million tons of vegetables and root and tubers were produced on 541 thousand ha, creating means of livelihood for more than 1 million households in 2010/11. Commercial production of horticultural crops, including vegetables, has also been increasing in recent years because of expansion of state farms (e.g. Ethiopian Horticulture Development Corporation) and increasing private investment in the sector by national and international entrepreneurs (EHDA, 2012). The commercial production is concentrated in the Rift Valley areas of Ethiopia, due to availability of irrigation facility, accessibility and closeness to agro-processing industries. The Ethiopian Horticulture Development Corporation has been carrying out production and marketing activities of horticultural crops since its establishment in 1980 (Yohannes, 1992). The Ethiopian Fruit- and Vegetables Marketing Enterprise (ETFRUIT) is a parastatal trading organization established in April, 1980 under the Horticulture Development Corporation to deal with domestic and export trade of fresh fruits, vegetables, flowers, and processed horticultural products.

Vegetable crops of economic importance that are largely produced in Ethiopia include pepper, kale (Ethiopian cabbage), onion, tomato, pepper, chilies, carrot, garlic and cabbages. Green beans and peas, okra, asparagus, cauliflower, broccoli, celery, eggplant, paprika and cucumbers have recently emerged as important export vegetables (Ethiopian Investment Agency, 2012). Recently crops like green peas, okra, celery and eggplant are also becoming important for private companies for the export market.

Evidently, Ethiopia has favorable climate and edaphic conditions for the production of tropical, sub-tropical and temperate vegetables in the lowlands, midlands, and highlands, respectively (EHDA, 2011). The warm season vegetables such as tomato, onion, capsicum and snap beans are produced in hot semi-arid areas both under rainfed and irrigation (particularly in the Rift Valley), while the highland offers favorable growing conditions for the production of cool season vegetables like kale, cabbage, garlic, shallot, carrot, beetroot (Aklilu, 1997; EHDA, 2011; Hussen and Mulneh, 2013). Vegetable production is practiced both under rainfed and irrigation systems. The irrigated vegetable production system is increasing because of increasing commercial farms and development of small scale irrigation schemes (Baredo, 2012). Ethiopia has a comparative advantage in a number of horticultural commodities due to its favorable climate, proximity to European and Middle Eastern markets and availability of land, water for irrigation and labour (Ethiopian Investment Agency (2012). Hence, the Ethiopian Rural Development Strategy focuses on market-led agricultural development and the government pledges to support market integration and agro-enterprise development (DCG, 2007).

Vegetable products provide nutritional, economic, employment and social benefits. Vegetable production and consumption is increasing in Ethiopia because of increasing export to Djibouti, Somalia, South Sudan, the Sudan, the Middle East and European markets and urbanization (Tabor and Yesuf, 2012). In these countries there is a sustained demand for products such as chillies, onions, and cabbages, resulting in export increase from 25,300 tons in 2002/03 to 63,140 tons in 2009/10 (EHDA, 2011).

The nutritional and health value of vegetables is also well recognized in Ethiopia because vegetables play important roles in human health by way of providing antioxidants such as vitamin A, C and E that are important in neutralizing free radicals (oxidants) known to cause cancer, cataracts, heart disease, hypertension, stroke and diabetes (Demissie et al., 2009; Tabor and Yesuf, 2012).

Vegetables constitute also source of cash income for the households and an opportunity to increase smallholder farmers' participation in the market (Alemayehu et al., 2010). Vegetables are also used as source of raw material for local processing industry. Products like tomato paste, tomato juice, oleoresin and ground spice of Capsicum are produced for exports making a significant contribution to the national economy (Aklilu, 1997; Baredo, 2013). The increasing development of the horticulture industry and the intensive production practices of horticultural crops are creating employment opportunity, especially for women and youth ((Ethiopian Investment Agency, 2012).

## 1.2 Background of the Study

AVRDC – The World Vegetable Center- is a non-profit, autonomous international agricultural research and development Center committed to alleviating poverty and malnutrition in developing countries through increased production and consumption of nutritious and health-promoting vegetables. The Center conducts research and development programmes that contribute to improved incomes and diets in the developing world through increased production and consumption of safer vegetables. The Center, headquartered in Taiwan, was founded in 1971. In the early 1990s, operations were gradually expanded to sub-Saharan Africa (SSA). Regional Center for Africa was established in Arusha, Tanzania in 1992, with sub-regional offices developed later in Mali and Cameroon. In January 2013, the Africa office was strategically splitted into 2 regional offices with the Arusha Center now rebranded as the regional office for East and Southern Africa whereas the Mali office houses the new Regional office for West and Central Africa.

AVRDC is now implementing the Humidtropics program in partnership with the CGIAR Centers (IITA, ILRI, ICRAF, IWMI, CIP, CIAT and Bioversity) and other advanced research institutions (Wageningen University, *icipe*, FARA and Swedish University of Agricultural Sciences). The Humidtropics program is a CGIAR Program on integrated agricultural systems for the humid tropics.

The program is part of a family of 15 CGIAR Research Programs (CRPs) designed to address major global development challenges, and aimed at accomplishing the CGIAR System Level Outcomes:

1. **Reducing rural poverty.** Agricultural growth through improved productivity, market development and income generation has shown to be a particularly effective contributor to reducing poverty, especially in the initial stages of economic development.
2. **Increasing food security.** Access to affordable food is a problem for millions of poor in urban and rural communities and requires increasing global supply of key staples and reducing potential price increases and price volatility.

3. **Improving nutrition and health.** Poor populations spend most of their income on food and suffer from diets that are insufficient in proteins, vitamins and minerals affecting health and development, particularly among women and children.
4. **Sustainable management of natural resources.** Agriculture has a substantial impact on natural resources that must be better managed to supply sustainable ecosystem services, particularly in light of climate change

Over the next 15 years, within selected Action Areas, Humidtropics will contribute towards these outcomes by increasing staple food yields by 60%, increasing average farm income by 50%, lifting 25% of poor households above the poverty line, reducing the number of malnourished children by 30% and restoring 40% of farms to sustainable resource management. In this way, Humidtropics will serve as a model to other agencies seeking to link agricultural systems research to developmental impact.

The program, which is led by the International Institute of Tropical Agriculture (IITA), is aimed at improving overall agricultural productivity, and transforming the lives of rural poor in the humid tropics region, through systems research in the framework of Integrated Agricultural Research for Development. The Humidtropics program is implemented in several countries, including Ethiopia.

This scoping study envisages to assess the opportunities and constraints for future economic development of sustainable vegetable seed system in Ethiopia. It attempts to show the existing national policy and strategy framework, institutional environment and agencies involved in the vegetable seeds production, distribution, flow channel and institutional support system.

### 1.3 Objectives of the Study

The goal of the scoping study is to assess the vegetable seed supply and distribution system and related issues affecting target communities and beneficiaries of the Humidtropics Program with respect to and establishing benchmark indicators for subsequent integrated research and development interventions required to achieve the four system level outcomes of the Humidtropics. It aims at documenting the existing situation of vegetable seed production and distribution and associated critical institutional and policy related bottlenecks in the context of access integration and diversification of vegetables into existing farming systems; including untapped investment opportunities thereof, given the recognition of the higher farm gate values and shorter production cycles of some vegetables.

The specific objectives are to:

- Review the policy and regulatory environment affecting the national vegetable seed sector, including: intellectual property rights, royalty system, cultivar release, importation and exportation (quarantine) and establishment of local and international private seed enterprises;
- Identify institutions/entities (informal seed sector, seed traders, farmers' groups, multinational/local seed companies, NGOs, government) producing and supplying vegetable seed to farmers, and assess their capacity for vegetable breeding, cultivar assessment,

promotion and marketing, quality seed production, seed distribution (as applicable) with a major focus on the Action Sites of the Humidtropics specified for the assignment;

- Determine and describe the various types/channels (i.e., formal, semi-formal and informal) of vegetable seed production and distribution systems of the focus Action Sites of the country of assignment;
- Estimate vegetable seed requirements versus farmer demand for vegetable seed in the study area;
- Assess the current situation of existing vegetable farming systems vis-a-vis the potential for vegetable integration and/or diversification (where appropriate into existing non-vegetable farming systems) within the respective study sites of the Humidtropics from the perspective of the socio-political and economic conditions, power relations, information on most excluded groups and nature of exclusion;
- Understand and document farmers' preference for vegetable type(s) and variety/varieties of the preferred vegetable(s) and criteria for their preference based on their perceptions;
- Understand and document critical bottlenecks and opportunities to improve identified formal, semi-formal and informal seed supply chains, including investment potential in the focus Action Sites; and
- Recommend future strategies for a viable vegetable seed system and distribution within the study area.

## 2. Methodology

### 2.1 The Study Sites

The study was conducted in west Shewa zone of Oromia National Regional State, Gurage and Hadiya zones and Yem-Special Wereda/District of the Southern Nations, Nationalities and Peoples Region (SNNPR) (Table 1) (Figure 1). Ambo and Tokey Kusaye districts were selected in west Shewa zone, while Meskan, Anlemo and Yem-Special districts were selected in the respective zones for conducting the study. Four rural and pre-urban kebeles were included in the study to collect micro data for vegetable production and vegetable seeds demand and production assessment.

**Table 1: List of study sites**

Region	Zone	District/Wereda	Kebele*
Oromia	West Shewa	1. Ambo	1. Gosu Kora <sup>1</sup>
		2. Guder	2. Naga File <sup>1</sup>
SNNPR	Gurage	3. Meskan	3. Inseno Usme <sup>2</sup>
			4. Yimer Wacho <sup>3rd2</sup>
	Yam-Special Wereda	4. Yem Special Wereda	5. Tachignaw Keshele <sup>2</sup>
			6. Sayimafo <sup>2</sup>
	Hadiya	5. Anlemo	7. Layignaw Fonko <sup>1</sup>

\* Kebele is the lowest administrative unit in Ethiopia; 1 suburban; 2 Rural

The study locations are shown in Figure 1. Ambo and Guder are located adjacent to one another and used to be together before few years. The study area falls among the major vegetable producers in Ethiopia (Annex A1).

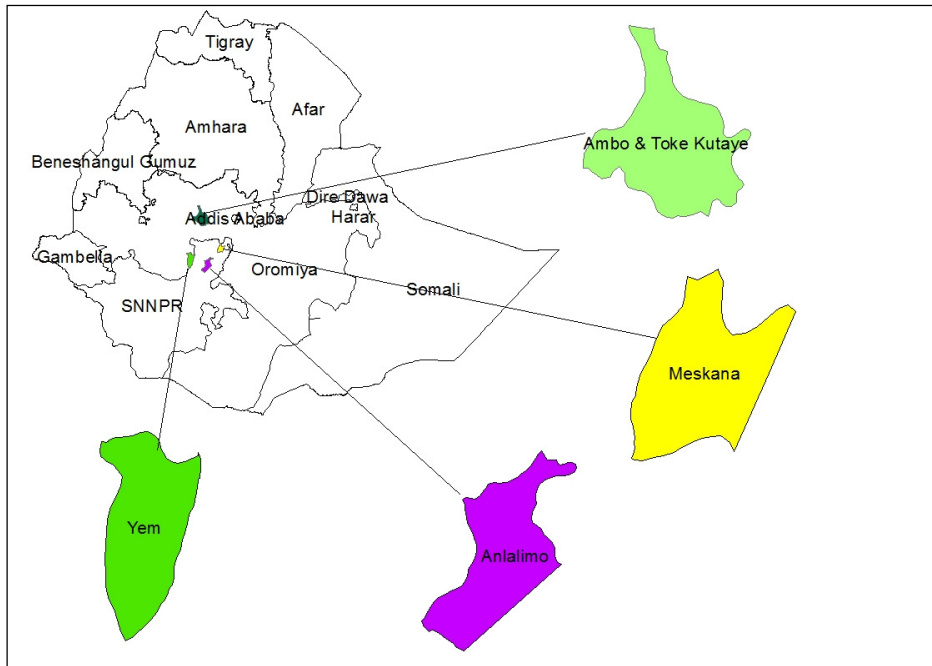


Figure 1. Map of Ethiopia, showing study areas.

## 2.2 Source and Method of Data Collection

The data for this study were collected from different sources; both secondary and primary data sources were used.

**Secondary sources (review):** The secondary data sources were policy and strategy documents, reports and databases of organizations (Holeta and Melkassa Agricultural Research Centers, unpublished reports of EIAR) and the Central Statistical Agency of Ethiopia. Data were also collected from Agriculture offices of the zones and selected districts. In addition, farmers' cooperative associations and cooperative unions in the zones provided data particularly on inputs such as seed and agro-chemicals for vegetable farming. Agricultural Research Centers, Malkassa, Holeta and Bako supplied data on type of vegetables and varieties being grown, as well as vegetables receiving research attention in the country.

**Observations:** Visits were made to various organizations that included cooperatives and cooperative unions, shops, markets and agriculture offices to observe vegetable seed types, and vegetable seed and product handling practices of the agencies.

**Key Informants Interview (KII):** One means of collecting the primary data were interviewing horticulture experts at zone, district and Farmers' Training Centers (FTCs). The experts were interviewed as key informants on seed supply, marketing, use and challenges in vegetables seed

and vegetable production and marketing. In total, 12 Development Agents (DAs) (42% female) and 12 horticulture experts (8% female) were interviewed using the checklist given in Annex 1.

**Focused Group Discussions (FGD):** In each of the selected districts, 2 FGDs were conducted. One-women and one men-group participated in separate discussion session. Discussion focused on sources of vegetable seed and how such seeds are accessed, farming system and overall status of vegetable production and marketing. Opportunities and constraints of vegetable production and marketing were discussed. In total, 118 farmers (45% female) participated in the FGD (Table 2). The discussions were conducted using the checklist prepared for these purpose (Annex 1). The list of the participants in FGD is given in Annex 2. In general, 150 persons were contacted (41% female) to generate the data used for this analysis.

**Table 2: Number of persons contacted for data collection**

Zone	No. of PAs	No. of DAs		Experts		No. of FGD Participants		No. of Traders		Total No. of Persons			No. of Coops/ unions	% Female
		M	F	M	F	M	F	M	F	M	F	Total		
West Shewa	2	1	3			17	16	3	1	21	20	41	2	49
Gurage	2	3				20	20	1	1	24	21	45	2	47
Yem	2	1	2			18	12	1		20	14	34	1	41
Hadiya	1	2	0	0	0	10	5	1		13	5	18		28
Total	7	7	5	11	1	65	53	6	2	89	61	150	5	41

## 2.4 Data Analysis

The data collected from different sources have been coded and entered into SPSS and Excel spreadsheets, the data in excel were imported to SPSS for analysis. The data were triangulated and checked for consistency. Descriptive statistics were used to analyze and present the data. Tabulation of primary data were made for each of the zones regarding vegetable production area, quantity produced and inputs used. Depending on data availability and possibility of aggregating micro level data, results were presented at district or zonal level.

### 3. Findings of the Study

#### 3.1 Review of Policy and Regulatory Environment Affecting the National Vegetable Seed Sector

##### 3.1.1 Development perspective

Policy and legal frameworks create conducive environment for investment in breeding and seed production, providing access to plant genetic resources, protecting breeders' rights, and ensuring seed quality control. The frameworks may follow international standardization and regional harmonization of methodologies that address genetic resource access, intellectual property rights, varietal release, seed certification, and phytosanitary measures for import and export.

In Ethiopia the Government is implementing Growth and Transformation Plan (GTP) for the period 2010/11 up to 2014/15 (MOFED, 2010). Similar to earlier development plans, this policy document continues to stress the leading role of agriculture in the economic development of the country, including the production, local agro-processing, consumption and export of vegetables. Table 3 shows some horticultural crops export target for the period 2010-2015 (EHDA, 2011). The scaling up of successful production and marketing strategies to potential production regions and the creation of a favorable market environment is part of the GTP strategy for the horticultural sector, including vegetables.

**Table 3: GTP horticultural export targets for the period 2010 to 2015 (in million USD)**

Category	Starting year (2010)	Target for 2015
Vegetable exports	75.7	426.5
Fruit exports	17.7	469.2
Herbs exports	2.2	52.5

Source: EHDA (2011)

With the objective of ensuring food and nutrition security and increasing export, the GTP has given due emphasis for the development of the horticulture sector, including vegetables and fruits production (MOFED, 2010). Production and productivity is to be increased by encouraging the private sector to engage in vegetables, fruits and flower production and export as well as strengthening public agricultural extension services and development of small to medium scale irrigation schemes for the smallholder farmers (Alemayehu, 2010). Use of improved seeds and planting materials is taken as a key inputs to achieving the production and productivity increments. Over the past 10 years, production gains have largely resulted from increased area rather than yield increases.

Institutional capacity building is one of the strategy to develop the sector. Such an attempt started with the establishment of the Ethiopian Horticultural Development Agency (EHDA) in June 2008, with the aim to make Ethiopia a leading African country in export-led horticulture by promoting the cultivation of flowers, vegetables, fruits, and herbs for exports (EHDA, 2011). Its main objective is to ensure fast and sustainable growth of the country's horticulture export industry by providing support to the three pillars of development: investment, capacity building (i.e. in pre- and post-harvest management), and marketing and accelerate sustainable growth of horticulture production and productivity, facilitate the export of diversified horticultural products



which meet international standards, and coordinate the development of supporting services. In terms of human resource development a number of Ethiopian universities are offering undergraduate and graduate level degrees in horticulture, some with sub-specialty in vegetables.

The development strategy aims to increase use of well-adapted, high-quality seed and other planting materials so as to improve food security, reduce rural poverty, and transform agriculture into a more productive and profitable sector (MOA and ATA, 2013). However, important policies and strategies that stimulate varietal development and release of vegetable crops to support the development plans are not given due attention.

### 3.1.2 Intellectual Property Rights (IPR)

Ethiopian Intellectual Property Office (EIPO) was established by Proclamation No 320 of 2003 to study, analyze and recommend intellectual property policies and laws. The Plant Breeders' Rights Proclamation (Proclamation No. 481/2006) was developed to encourage plant breeders by offering economic rewards as incentive for their contributions in the agricultural sector, realizing that the utilization of new plant varieties (of all crops) developed through research play a significant role in improving agricultural production and productivity.

However, the Ethiopia Plant Breeders Right (Proclamation No. 481/2006) is not yet implemented and Ethiopia has not yet put in place plant variety protection (PVP) as such, implying that there is no royalty for improved variety/seed use, unless biological factors such as use of hybrid seed dictates purchase of seed every planting season. Discussion made with the Directorate of Animal and Plant Health Regulatory Services (APHRS) of the Federal Ministry of Agriculture revealed that revision of the Plant Breeders Right law and its regulation is ongoing, with the aim to result in PVP so as to motivate investment in plant breeding and seed industry development in the country. The fact that Ethiopia is in the process of becoming a member of the World Trade Organization makes this optimism more likely to be realized.

The national seed policy of Ethiopia was formulated in 1992 and recognizes a healthy seed industry as an important component of agricultural development. The policy also gives due emphasis to: (1) plant genetic resources conservation, (2) involvement of farmers in such conservation endeavors as well as community-based seed production, and (3) capacity development for germplasm and variety development, release and registration as well as capacity for seed regulatory aspects. The seed policy further acknowledges and supports the formal seed system and the informal seed system, including community based seed production.

### 3.1.3 Variety release and registration

Upon satisfying the requirements for Value for Cultivation and Use (VCU) test, crop varieties (including vegetable varieties) are released and registered by the National Variety Release Committee (NVRC) under the patronage of the Directorate of Animal and Plant Health Regulatory Services (APHRS) of the Federal Ministry of Agriculture (MOA, 2012). So far there is no DUS (Distinct, Uniform and Stable) test requirement for variety release and registration in Ethiopia, although the MOA is in process to introduce distinctness, uniformity and stability (DUS) test. Operating since 1982 (Gebeyehu et al., 2001), the NVRC is a standing committee under the Federal Ministry of Agriculture entrusted with the responsibility of variety release and

registration. Members of NVRC are constituted from research institutes, universities and MOA. The NVRC is assisted by ad hoc Technical Committees (TCs) for different crops, which evaluate verification plots and performance trial data (of a minimum of 3 locations x 2 seasons) of candidate crop varieties and make recommendations to NVRC whether the variety can be released or rejected. Members of the TCs are mainly crop specialists consisting of breeder, agricultural extension specialist, crop protection (pathologist or entomologist), agronomist and food scientist. The NVRC deliberates twice per year to review applications for variety release and registration. The APHRS at MOA publishes annually the Crop Variety Register, in which newly released and registered varieties are described and list of previously released and registered crop varieties are included (MOA, 2012). Table 4 shows summary of released vegetable, root and tuber crops up to 2012 by category of releasing institutes, i.e. federal research centers, regional research centers, universities and private seed companies/agents. Although the involvement of the private sector in registering commercial varieties in Ethiopia is a very recent phenomenon, its contribution is high for vegetable crops like cabbage, onion, carrot, tomato and pepper. Regional research institutes/centers and Haramaya university have played a major role in releasing sweet potato and Irish-potato varieties. Overall, the regional research centers released about 36.4% of all vegetable varieties followed by the Federal research centers (29.8%) and private companies (26.4%). Haramaya University contributed 7.4% of the vegetable varieties released, which is limited to sweet potatoes and Irish potatoes. The private sector is doing well in introducing, testing and register mainly varieties of tomato, onion, cabbage, pepper and potato in that order.

**Table 4: Summary of released vegetable, root and tuber crops in Ethiopia**

Crop	Variety releasing institutes				Total	%
	Federal Research Centers	Regional Research Centers	University	Private Companies/agents		
Tomato	10	4	0	9	23	18.85
Pepper	7	2	0	5	14	11.48
Onion	4	0	0	8	12	9.84
Shallot	4	0	0	0	4	3.28
Garlic	3	1	0	0	4	3.28
Lettuce	0	1	0	0	1	0.82
Cabbage	0	0	0	6	6	4.92
Ethiopian mustard	1	0	0	0	1	0.82
Carrot	0	0	0	1	1	0.82
Snap bean	1	0	0	0	1	0.82
Sweet potato	1	21	2	0	24	19.67
Cassava	0	2	0	0	2	1.64
Potato	6	13	7	3	29	23.77
Total	36	44	9	32	122	100.00
%	29.8	36.4	7.4	26.4	100.0	

Adapted from MoA (2012)

### 3.1.4 Importation and exportation of seed and quarantine

The seed standards in Ethiopia have been prepared under the direction of the agricultural product standards committee and published by the Quality and Standards Authority of Ethiopia and implemented by the federal MOA and regional bureaus of agriculture (Atilaw, 2010). Currently, the Authority revised seed standards and prepared field and seed standards for 74 crops and issued for official implementation, including for some vegetables like pepper, tomato and onion.

The APHRS of MOA provides import permit and subsequently quarantine services for imported seeds. Importation of packed vegetable seeds is often not quarantined. Likewise, the seed laboratories that certify seeds of field crops (especially that of hybrid maize) do not involve in vegetable seed certification whether the seed is imported or locally produced. There are more than 10 seed testing laboratories, which are managed by regional bureaus of agriculture (Ambo and Assela seed laboratories in Oromia region; Durbete, Gondar, Debre Markos and Dessie seed testing laboratories in Amhara region; Axum and Mekelle in Tigray region; Durame, and Wolaita in SNNP region). The APHRS provides competence license for applicants qualifying to engage in seed production, processing, import and export of seeds, including vegetable seeds. Access to quality seed sources is limited and vegetable farmers use any available seeds they access to produce vegetables, calling for strengthening seed quality control framework particularly for vegetables and root and tuber crops, in which seed borne diseases can be damaging.

## 3.2 Institutional Context of National Seed System

### 3.2.1 Enterprises in the vegetable business

The Ethiopian Industrial Development Strategy also encourages agriculture-led, export-oriented and labor-intensive industries, including agro-processing vegetables and fruits (Ethiopian Investment Agency, 2012). The Ethiopian investment policy encourages private sector involvement in production, processing, marketing and distribution as well as export of horticultural crops, including fresh vegetables (Ethiopian Investment Agency, 2012). Incentives include amongst others duty free importation of production equipment and an income tax holiday. Access to land is facilitated through EHDA and the regional authorities. At Federal level the Government policies and plans include strategies for the more efficient use of irrigation facilities and the development of new irrigation schemes. However, there are few agencies engaged in vegetable processing. Table 5 presents some agro-processing industries involved in vegetable processing and cottage level processing of vegetables such as hot pepper, which is common in major cities in Ethiopia.

**Table 5: Vegetable processing factories in Ethiopia**

Name	Ownership	Major Products
Melege Wendo Food Processing Factory	Private	Tomato paste
Gondar Food Processing Factory	Private	Tomato paste
Merti Processing Factory	Public	Tomato paste
ECOPIA	NGO	Processing and canning of hot pepper

Source: Ethiopian Investment Agency (2008) and Baredo (2013).

The Federal Ministry of Agriculture has provided licenses for production, processing, import and retail of seeds, including vegetable seeds (Table 6). Some of these companies are involved in vegetable seed import and retails (e.g. Markos PLC, EAR Private limited Company, Chemtex PLC, General Chemical and Trading PLC) but not in production and processing.

**Table 6: Organizations licensed for vegetable seed business in Ethiopia up to 2010**

Organizations	Seed Production	Seed Processing	Seed Import	Seed Retail
Teppo agric and trading PLC			x	x
Hawassa Greenwood	x		x	x
Ethioflora	x			
Ethiopian Seed Enterprise (ESE)	x	x	x	x
Markos PLC			x	x
Axum Green Line			x	x
Sol -Agrow PLC	x		x	x
Elfora PLC	x			
EAR Private limited Company			x	
Chemtex PLC			x	x
Ethio-Veg Fru	x			
ETFRUIT			x	x
Ajmu Import and Export Trading Enterprise			x	x
Kaleab Farm Development	x			x
General Chemical and Trading PLC			x	x
Segel General Trading PLC			x	x
Upper Awash Agro-industry	x			x

The foregoing description reveals that there is favorable policy environment for the development of the horticulture industry, including vegetables, in Ethiopia. However, unlike the production, processing and export areas, the extent of investment in vegetable seed production is very minimum in the country.

#### **i. Local seed enterprises**

There are four public (parastatal) seed enterprises, namely Ethiopian Seed Enterprise (ESE), Oromia Seed Enterprise (OSE), Amhara Seed Enterprise (ASE), and South Seed Enterprise (SSE). None of these enterprises is producing or importing vegetable seed, although vegetable seeds production and importation is within their mandates and establishment objectives. There are about 30-40 small to medium private seed companies/individual producers, largely producing hybrid maize seed, and a few of such small and medium seed producers are engaged in onion seed and seed potato production. Certain groups of farmers are organized into seed producer cooperatives produce seed for local level supply. Some of these seed producer cooperatives are also producing seed potato and onion, which are not certified as such (Table 7). Such cooperatives and individuals are linked with a nearby agricultural research center or university, which gives them technical backstopping in onion seed and seed potato production.

**Table 7: Seed producer cooperatives involved in seed potato and onion production**

Name Cooperative	Wereda/District	Zone	Region	Crop
Gusha	Guagisashikudad	Awi	Amhara	Potato
Zaba-tSION	Jabitahinan	West Gojam	Amhara	Potato
Bete Yohannes	Tachigayinit	South Gondar	Amhara	Potato
Meseret	Tachigayinit	South Gondar	Amhara	Potato
Addis Alem	Frta	South Gondar	Amhara	Potato
Debremawi	Yilmana Densa	West Gojjam	Amhara	Potato
Aradom	Kobo	North Wollo	Amhara	Onion
Meki Batu Union	Duda	East Shewa	Oromia	Onion
Raree Hora	Haramaya	East Harerge	Oromia	Potato
Haqan Gudina	Kersa	East Harerge	Oromia	Potato
Abdi Jalela	Chiro	West Harerge	Oromia	Potato
Burka Gudina	Tullo	West Harerge	Oromia	Potato, Onion
Abdi-Boru	Meta	East Harerge	Oromia	Potato
Malka-Buba	Haramaya	East Harerge	Oromia	Potato
Haji-Faji	Kersa	East Harerge	Oromia	Potato
Handura-Kosum	Kersa	East Harerge	Oromia	Potato
Madda Jannata	Kombolcha	East Harerge	Oromia	Potato
Argada Shaldo	Arsi Negele	West Arsi	Oromia	Potato
Mose Darara	Jeldu	West Shewa	Oromia	Potato
Jalala Gudina	Ambo	West Shewa	Oromia	Potato
Abdi Salan	Jimma Geneti	Horro	Guduru	Oromia
		Wellega		
Jalanne	Jimma Geneti	Horro	Guduru	Oromia
		Wellega		
Jimma Arjo	Arjo	East Wellega	Oromia	Potato
Hambricho-Wassera	Angacha	Kambata Ximbaro	SNNPR	Potato
Bondena-Fandide	Angacha	Kambata Ximbaro	SNNPR	Potato
Mesena	Angacha	Kambata Ximbaro	SNNPR	Potato
Shewit Mesno	Atsbawonberta	Northeastern	Tigray	Potato

Source: ISSD Ethiopia Annual Report (2013)

In addition, SUPHORT Project, funded by Italian Development Cooperation, is supporting seed potato and onion seed production in four weredas- Ejere and Ilu Gelan Woredas in West Shewa Zone of Oromia and Bahir Dar Zuria and Fageta Lekuma Woredas in Amhara. The project is aimed at integrated horticultural development, involving capacity building, small scale irrigation schemes, participatory horticultural research and extension services and market linkage.

#### ii. International private seed enterprises

Some international seed companies register their commercial vegetable and potato varieties in Ethiopia, often linked with local partners (MOA, 2012). The variety for which seed is imported needs to be registered by NVRC. The requirement for registration is one season multi location

testing if the variety is already released and on commercial production in another country. The companies apply for variety registration to MoA. The Ethiopian Institute of Agricultural Research (EIAR) often tests the intended variety for introduction within the agro-ecology intended to be suitable for the crop. Once the variety is registered, companies mostly import seeds of adapted and registered vegetable varieties from the source country, where the variety is already commercialized. Seed potato is produced in Ethiopia. Table 8 shows the list of seed companies registered to import vegetable varieties and years of their registration. Two international seed companies, Pioneer Hi-Bred Ethiopia and Alemayehu Makonnen/Seed Co. are producing and supplying hybrid maize in Ethiopia and are not involved in supply of vegetable seed. Names and contact addresses of seed suppliers are given in Annex 3.0.

**Table 8: Seed companies registered commercial vegetable varieties and seed potato in Ethiopia**

Type of crop	Name variety	Type (HV/OPV)	Year of registration	Seed Company
Tomato	STH-808 (JEWEL)	HV	2012	Vibha Seeds Ethiopia PLC
	STH-805(SYNO)	HV	2012	
Tomato	Galilea	OPV	2011	Hazera Genetics LTD
	Bridget 40	OPV	2011	
	Shanty	OPV	2009	
	Irma	OPV	2009	
Tomato	Rainbow	OPV	2011	Era Agrilink PLC
Tomato	Anna F1	HV	2011	Mogno, Maria Rita
Tomato	Eden F1	HV	2011	Beck, Bunn, Teresa
Tomato	Topspin F1	HV	2011	Bejo Seed Bv-Crop grow Crop Production PLC
Tomato	Barnum	OPV	2011	Markos PLC
Onion	Rosy(SOV 111)	OPV	2012	Vibha Seeds Ethiopia PLC
Onion	Caramelo F1	HV	2012	Impact Mundial Agri PLc
	Sweet Caroline	OPV	2012	
Onion	Red Passion F1	HV	2011	Bejo Seed Bv-Crop grow Crop Production PLC
Onion	Sivan	OPV		Hazera Genetics LTD
	Neptune	OPV	2009	
Onion	Jamber F1	HV	2011	Jones Rick
Onion	Red King	OPV	2011	Markos PLC
Pepper (capsicum spp.)	Capsi(SCH-902F1)	HV	2012	Vibha Seeds Ethiopia PLC
	Spicy(SCH-922F1)	HV	2012	
	SCH-925	OPV	2012	
	Supreme(SCH-942F1)	HV	2012	
Pepper (capsicum spp.)	Serenade	OPV	2011	Hazera Genetics LTD
Cabbage (brassica oleracea)	Rotonda F1	HV	2011	Bejo Seed Bv-Crop grow Crop Production PLC
	Thomas F1	HV	2011	
	Lucky F1	HV	2011	
Cabbage (brassica oleracea)	K500	OPV	2011	Hazera Genetics LTD
Cabbage (brassica oleracea)	Oxylus F1	HV	2011	Carl Scholten
	Victoria F1	HV	2011	
Carrot	Samson	OPV	2011	Bejo Seed Bv-Crop grow Crop Production PLC
Potato	Red Scarlett	OPV	2010	HZPC Holland BV-Solagrow Plc
	Saesar	OPV	2009	
	Mondal	OPV	2009	

Source: Adapted from MoA, 2012

### 3.2.2 Institutions supporting vegetable seeds supply system

A successful vegetable seed system is supported by research for germplasm and variety development, seed multiplication, processing, marketing and distribution, supported by a functional seed quality control and regulatory framework.

#### *i. Research system*

Ethiopia has strong agricultural research programme, operating at federal as well as regional states. Although horticulture (including vegetables, fruits and root and tuber crops) is one of the research programmes, the resources (budget and research staff) allocated to these horticultural crops are not adequate and often less than the resource allocated to grain crops. Potato, tomato, pepper, onion, and sweet potato, in that order, are among the crops for which major emphasis is given (Annex 3.1); although seeds onion and tomato are also imported. Shallot, garlic, and paprika are considered to a limited extent. For other vegetables such as head cabbage, carrot, onion, beet root, lettuce, cauliflower, spinach, and Swiss chard, packed seeds are imported by agricultural product importers largely from European countries such as Denmark and the Netherlands. The identity (hybrid or open-pollinated) of such seeds is seldom known.

In Ethiopia, Melkasa Agricultural Research Center, which is located 117 km southeast Addis Ababa in the Rift Valley, is the main vegetable (tomato, pepper, onion, shallot, snap bean) research center. Debre Zeit Agricultural Research Center is working on garlic and shallot. The other research centers (Holeta, Bako, Adet, Areka, Sinana, and Hawassa) and Haramaya University are more focusing on root and tuber crops such potato, sweet potato, *enset*, taro, yam, and cassava (MOA, 2012).

Ethiopia follows the OECD seed generation (breeder seed, pre-basic, basic and certified seed) system of seed production. Research Centers are largely responsible for the first three generations, while the public seed enterprises, private (often small to medium), and seed producer cooperative/unions are producing certified seed. A number of NGOs and seed programmes are also involved in community based seed production.

But all are largely involved in grain crops, cereals, pulses and oilseeds seed production. Virtually no public seed enterprise is involved in vegetable seed production. Research centers are contributing to seed production of tomato, pepper and onion as well as seed potato. Seed programmes, FAO, NGOs and community-based seed production consider seed potato production as well as distribution of seed, including vegetable seed.

Locally produced vegetable seeds like onion are sold mainly by the producers to the farmers directly as they are in the same area and the remaining part is sold through stockiest in major vegetable production areas. Dominant vegetable seeds/varieties known to farmers are Bombay Red for onion.

#### *ii. Public extensions services*

The regional bureaus of agriculture (having structure down up to village level) supports vegetables seed production and marketing in terms of facilitating input supply (seeds, fertilizers and pesticides), technical support in use of improved production practices and small and medium scale irrigation scheme development. Regions employ experts along thematic areas such as



vegetable experts. As the structure goes down, the extension personnel become general agriculturalist like crop or livestock or natural resources. This mainstreaming emanates from the curricula of the Agricultural Technical, Vocational and Education Training Colleges (ATVET) from where the DAs graduate. The extension system provides technical backstopping to smallholder farmers and cooperatives to increase production and productivity through the use of improved varieties and yield increasing inputs such as fertilizer and compost. Vegetables are a component of the list of mandate crops considered in the extension system.

### ***iii. Ethiopian Horticulture Producer-Exporters Association***

The Ethiopian Horticultural Producers and Exporters Association (EHPEA) was established in 2002 as a non-profit, Non- government organization to facilitate and support development of horticulture (i.e. vegetables, fruits and flowers) sector in Ethiopia. Having more than 90 members and affiliated to the Ministry of Trade and Industry, EHPE has established network with the Department Fund for International Development (DFID), CBI in Netherlands and the French Development Cooperation. In Addition it has developed linkages with the different government organizations, Ethiopian Airlines and local banks. It has also explored linkages with business enterprises in Africa, Middle East, Europe and the USA in order to enhance development of horticulture industry in Ethiopia for export market.

### ***iv. Private sector***

The scoping study reveals that vegetable seeds are largely supplied by government parastatal companies such as the Ethiopian Fruit and Vegetable Marketing Enterprise (Efruit) and Agricultural Inputs Supply Corporation (AISCO). Important private sectors involved in vegetable seeds import and seed supply are Markos PLC, General Chemicals and Trading PLC, Era Agrilink PLC, and Harvest General Trading. The majority of the seed is channeled to the retailers and cooperatives/unions in the major horticultural crop producing areas. For instance, Efruit supplies the Nantes variety of carrot from Dutch companies and distributes from its store in Addis Ababa to its branches in regional towns, seed retailers and farmers in different parts of the country (Tabor and Yesuf, 2012). The seed quality from such government sources is reported to be of high germination and true-to-type. Private companies dealing with agricultural input supply and licensed traders also import packed vegetable seeds from Dutch companies such as Proseed, Backer Brathors and Top Harvest (Tabor and Yesuf, 2012).

### ***v. Cooperatives and Cooperative Unions***

In Ethiopia, cooperatives and cooperative unions considered as a means to increasing the bargaining power of smallholder farmers to increase their share in agricultural inputs marketing. Cooperatives and unions provide alternative marketing channel to smallholder farmers to market their products and stabilize market price. Cooperatives and unions also provide vegetable inputs such as seed, fertilizers, pesticides and farm tools to producers. In effect cooperatives started to play crucial role in vegetable seeds marketing.

#### *vi. Non-Governmental Organizations (NGOs)*

In Ethiopia some Non-government organizations like Kale-Hiwot, Vita, World Vision Ethiopia, SOS-Sahel, Sasakawa Global Africa, International Development Enterprise (IDE), Food for the Hunger Ethiopia (FHE) and many others are supporting vegetable producing farmers in the area of inputs supply (seeds and fertilizers), small irrigation scheme (IDE), capacity building, and knowledge management such as experience sharing visits and sharing market information. NGOs also attempt to create market linkage for vegetables producers, although the problem of vegetable marketing is still a challenge.

#### *vii. Commercial farms*

Private commercial and parastatal farms in Ethiopia involved in vegetable seed importation, vegetable production, processing and export both as fresh and processed products. The major private farms include Ethio-Flora PLC, Ethio veg fru, and Jittu Horticulture, while the parastatal farms include ETFUIT, Horticulture Development Corporation and Upper Awash Agro-industries. Both groups of farms are located in the Rift Valley. Major vegetables produced for export include green peas, baby corn, okra, fine and bobby beans, asparagus, cucumber, tomatoes, egg plant, German and Chinese cabbages, paprika, radish, carrot, cauliflower, broccoli, cabbage, and kohlrabi.

#### *viii. Horticultural Society of Ethiopia*

The Horticultural Society of Ethiopia holds its biennial conference, when different research and development reports are presented and discussed in the presence of its members and relevant stakeholders. The proceedings of the conference are regularly published, in which the full write-up of the presented papers are published (Derso et al. 2012).

### **3.3 Vegetable Seed Production, Supply, and Distribution System**

The five-year strategy of the MoA and ATA for the transformation of the Ethiopian seed System (including vegetable seed system) recognizes three seed systems in Ethiopia (MoA & ATA, 2013):

1. An informal system in which farmers engage in their own seed selection, farm-saved seed and local exchange or purchase;
2. A nascent intermediate system centered on community-based seed production with high technical support from research, NGOs and seed projects and some regulatory oversight from bureaus of agriculture; and
3. A formal system in which commercial firms and parastatal organization, working with crop breeders, multiply and distribute improved varieties to farmers

The following sections describe type of vegetables predominately entertained under each of these systems in the context of Ethiopia in general and the study areas in particular.

### 3.3.1 The informal seed system

In the informal seed system farmers save seed and/or access seed through exchange, barter, gift, and local market as major sources of seed they use. In the study areas such means of accessing vegetable seeds hold for Ethiopian kale (*Brassica carinata*), Ethiopian mustard (used as vegetable at early stage of development and as oilseed when matures), pumpkin, and garlic, as well as to some degree for hot pepper, sweet potato, and Irish potato (Table 9). Seeds provided through this chain face limitations in terms of quality planting materials, diseases, virus and consequently low yield.

**Table 9: Type of vegetables in the study area for which the informal seed system is a major source**

No	Type of vegetables	Varieties grown in the study area	Major sources of seed
1	Kale ( <i>Brassica carinata</i> )	Local (all three districts)	Own, local market and other farmers
2	Ethiopian mustard	Local (all districts)	Own, local market and other farmers
3	Pumpkin	Local (all districts)	Own, and other farmers
4	Garlic	Local (all districts)	Own, local market and other farmers
5	Hot pepper	Improved (Marekofana), Bako local	Own, local market, cooperative/union, BoA
6	Sweet potato	Improved (White Star, Cemesa) and also local varieties	Own, BoA, other farmers
7	Potato	Improved (Gudene, Jalene, Menagesha) and local (Shashamane)	Own, local market, cooperative/union, BoA other farmers
8	Tomato	Improved: Koshoro and Roma VF (Ambo, Guder, Yem, Anlemo), Galilea (Meskan), Marglobe (Anlemo)	Own, local market, cooperative/union, BoA, NGO, other farmers

Source: Own assessment

For kale (*Brassica carinata*) (also known as Yeabesha gomen) and pumpkin, there is no record of released variety from the national research system (Refer to Table 4 and Annex 3.1) and also no seed import, indicating that the production of these vegetables is based on local varieties and farmers' indigenous knowledge in genetic resources conservation, selection, production and use. Nearly a similar case holds for garlic and shallot, except for the release of few varieties for both, and injected into production system through variety evaluation, demonstration and promotion activities by research and subsequent use of farm-saved planting materials. For sweet potato and Irish potato, although there are a number of released varieties (Refer to Table 4 and Annex 3.1), the farmers maintain their own planting materials for quite long period (often more than 5 planting seasons) once they obtain released varieties through the intermediary system. Farmers in the study are also known to save their own tomato seed, though to a limited extent.

### 3.3.2 Intermediate (semi-formal) seed system

This system involves community based seed production by a group of organized farmers in the form of cooperatives, model farmers, and/or individuals with spirit of entrepreneurship (e.g. Photo #1). In the study area as well as across Ethiopia, seeds of onion, pepper and tomato, seed potato tubers, and sweet potato cuttings are largely produced under the intermediate seed system

(Table 10). It is interesting to note that onion and tomato seeds production is becoming common in Ethiopia. However, such seeds do not go through the formal certification process.



Photo#1: Onion seed production by individual seed producer, Guder, west Shewa Zone, Oromia, Ethiopia (photo by study team).

**Table 10: Crop varieties commonly grown in the study areas\***

Vegetable	Variety	Seed source/planting materials
Tomato	Koshoro and Roma VF (Ambo, Guder, Yem, Anlemo), Galilea (Meskan), Marglobe (Anlemo)	Own, local market, cooperative/union, BoA, NGO, seed producer farmers
Onion	Bombey red (mainly), Adama red, red creole (Meskan)	Individual seed producers, cooperative/union, BoA
Hot pepper	Marekofana (south), Bako local (west Shewa)	Individual seed producers, cooperative/union, BoA
Sweet potato	Local and also improved (White Star, Cemesa)	BoA, other farmers, own
Potato	Gudene, Jalene, Menagesha, Local (shashamane)	Individual seed producers, cooperative/union, BoA

\* Although there is variation in scope of production, the same types of vegetables are grown the study areas.

Source: Own scoping study

Often intermediate system/community-based seed production system benefits from strong support from public organizations such as research centers, universities, bureaus of agriculture, NGOs, and seed development programs (Figure 2). Often a variety is developed and released by the national research system. Farmers access such improved varieties through technology transfer and dissemination mechanisms (participatory variety evaluation, demonstration and promotion) of the research centers, which is commonly followed by community-based seed production and distribution by individuals and farmers’ cooperatives. Farmers often access seeds

of onion, hot pepper, and tomato, Irish potato seed tubers, and sweet potato cuttings through this chain. For instance, seeds of the two common varieties (Adama Red and Bombay Red) of onion are increasingly produced at local level and Malkasa Research Center gives technical support towards quality seed production of onion, tomato and pepper (Desalegn et al., 2012). Similarly, in west Shewa zone, seed potato producer cooperatives like Darara and Jalala Gudina as well as a number of model farmers are producing and distributing seed potato within and outside the zone. The cooperatives are supported by Holeta Agricultural Research Center and the Integrated Seed Sector Development Programme (ISSD), financed by the Dutch Government.

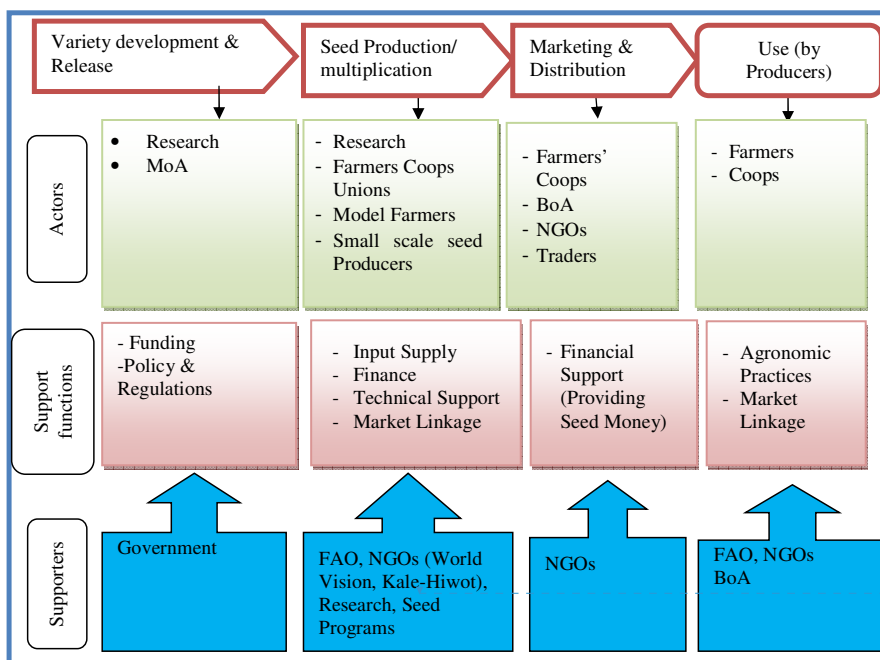


Figure 2: Community-based vegetable seed chain

### 3.3.3 The formal seed system

In Ethiopia, to a large extent, vegetable seed demand is met through imported commercial seeds, which is imported mainly by private seed importers and parastatal enterprises such as ETfruit and AISCO. In 2012 alone, a total of 128 ton of different vegetable seeds was imported (Table 10), which is more than 50% increase compared to the 2010 import (84 ton) and 276% increase relative to 2004 import (Hassena and Desalegn, 2011). The increase in import of vegetable seed is attributed to expansion of irrigated vegetable production both for local consumption and export. This implies that there is substantial demand for vegetable seed and consequently

increase of vegetable production in Ethiopia. The bulk of the imported seed is from the Netherlands (more than 80% of the quantity and 64% of the value), followed by Italy, Germany and France in terms of share of quantity. Import of vegetable seeds from Israel accounts for 20% of the value (Table 11).

**Table 11: Amount and value of vegetable seed imported from country of consignment in 2012**

Country (Consignment)	Quantity (Ton)	CIF Value ('000 USD)	% of quantity	% of value
Belgium	0.08	70.75	0.06	2.1
France	3.6	64.68	2.81	1.9
Germany	3.84	74.03	3.00	2.2
India	2.58	24.24	2.02	0.7
Israel	1.16	690.87	0.91	20.5
Italy	11.94	216.31	9.34	6.4
Kenya	0.01	14.44	0.01	0.4
Netherlands	103.6	2,169.94	81.01	64.4
Niger	0.07	13.52	0.05	0.4
Spain	1.02	29.45	0.80	0.9
Thailand	0	0.01	-	0.0
Total	127.89	3,368.24	100.00	100.0

Source: Adapted from [www.erca.gov.et.com](http://www.erca.gov.et.com)

The most common vegetables for which imported seeds are used in the study area include onion, carrot, tomato, cabbage, beet root, and Swiss-chard, (Table 12). The extent of production of leek, cauliflower, green beans and paprika is limited in the study areas.

**Table 12: Distribution channels of vegetable crops for which seed is largely imported**

Vegetables	Traders	Cooperative /Union	BoA	NGO	Other farmers
Tomato	X	x	x	x	x
Beet root	X	x	x		
Swiss chard	X	x	x		
Lettuce	X	x	x		
Carrot	X	X	x		
Cabbage	X	X	x		
Irish Potato	X	X	x		x
Onion	X	x	x	x	
Cauliflower	X				
Leek	X				
Paprika	X				
Green beans	X				x

Source: FGD group in the study areas

General purpose traders, cooperatives, BoA and NGOs are the major distributors of the imported seeds. In general, traders were reported to be more efficient in vegetable seed distribution than cooperatives/cooperative unions. Figure 3 illustrates the proportion of tomato seeds distributed by different actors in the study areas.

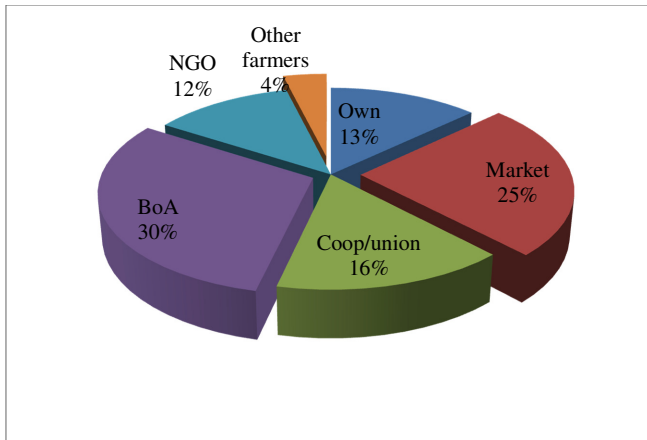


Figure 3: Proportion of tomato seed supplied by different sources in the study areas.

Figure 4 depicts the major actors, support functions and support providers for seed chain of imported vegetable varieties. Indeed, this chain is the sole means of accessing vegetable seeds such as cabbage, lettuce, Swiss chard, carrot, beet root, leek, cauliflower, paprika, and celery as well as large part of tomato and onion seeds in Ethiopia in general and in the study areas in particular.

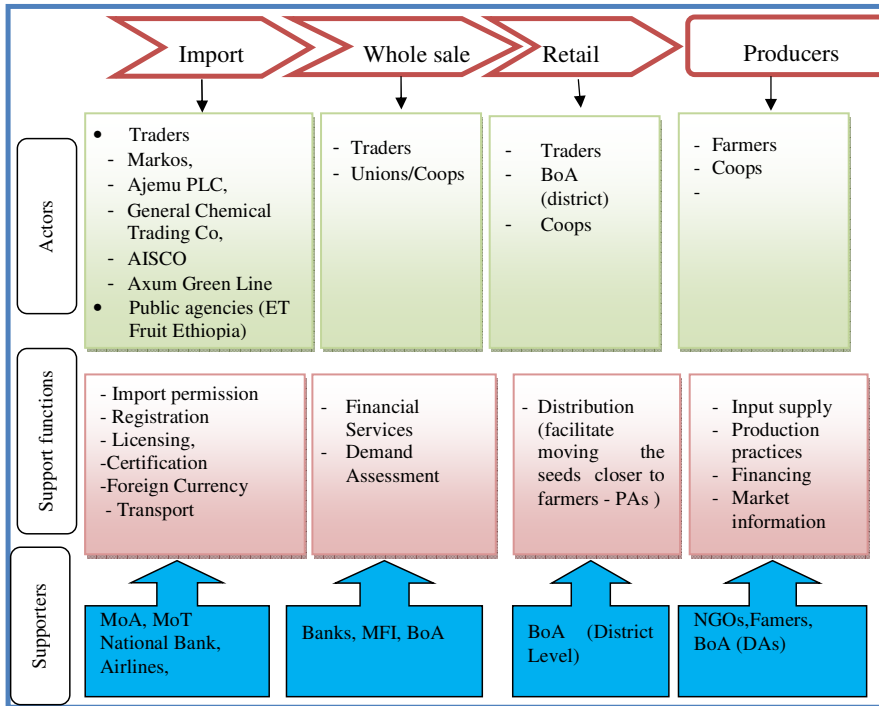


Figure 4: Seed chain for imported vegetable varieties

Retail seed traders in the zonal capital towns and districts of the study area play a great role in buying from the importers/whole sellers in Addis Ababa and then retail at local levels. Figure 5 shows the number of seed traders interviewed in the zone capital town of the study areas.

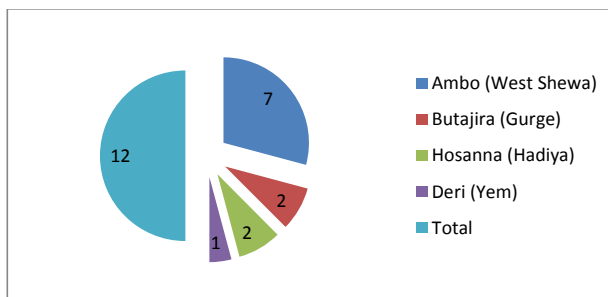


Figure 5: Number of vegetable seed traders in the capital town of the zones



Moreover, interview with grassroots development and subject matter specialists in the study areas revealed that the imported seeds are distributed by farmers' cooperative unions (e.g. Timiret Union in Meskan District, Gurge Zone), district office of agriculture, traders serving as retailers for the seed importers, and NGOs (e.g. SOS Sahel, Kale-Hiwot, World Vision and Food for the Hunger Ethiopia). Such seeds often come in packed aluminum bags and/or cans. Interview with an informant (Ambachew Amare, chair person of Timiret Cooperative Union in Meskan district of Gurge zone), revealed that the union purchases tomato seed from Greenlife PLC and, cabbage seed from AISCO and then distributes to its member primary cooperatives and individual farmers. It is also interesting to note that a recently established Farm Service Center by an investor (Gadissa Gobena Commercial Farm PLC) is supplying imported (from European seed companies such ProSeed and Top Harvest) vegetables seeds like onion, cabbage, tomato and Swiss chard in Ambo, the capital city of West Shew Zone with the support of USAID. Although just established there are other five such Farm Service Centers in different parts of Oromia (<http://www.cfspethiopia.org/>). Such centers are meant to supply all agricultural inputs (including vegetable seeds) in one-window shopping system to the farmers.

#### 3.3.4 Vegetable seed and variety replacement period

Although farmers are forced to buy fresh seed every cropping season because of biological necessity for vegetables like onion, cabbage, carrot, lettuce Swiss chard, beet root, and leek, the variety replacement period is quite long as old varieties are still in cultivation (Refer to Table 9; Tabor and Yesuf, 2012). Worsening the situation, during the interview, it was noted that even most development agents (who provide extension services to farmers) do not exactly know the names of varieties the farmers are growing. Some of the farmers also do not know by name what type of varieties they are growing. But those knowing the varieties they grow responded that Galilea, Koshoro, Roma VF, Sambad Sana and Marglobe are the tomato varieties they grow in different parts of the study areas. Copenhagen Market is the only cabbage variety grown across all the study area. They also responded that varieties such as Jalene, Gudane and Menagesha are among the improved potato varieties (some of them released before 12 years/refer to Annex 3.1). Sako and Shashamane are among the local potato varieties grown in the study areas. Regarding hot pepper, Mareko Fana and Bako locals are commonly grown, which are very old varieties (refer to Annex 3.1). Bombay Red, Adama red, Red Creole and Galamso are commonly grown onion varieties.

Although farmers were not able to mention the names of carrot and beetroot varieties they grow, it was noted from the seed container that Nantes for carrot and Detriot/Detriot Nero for beetroot are the varieties being grown across all the study areas. In the case of vegetable crops such as kale (called *Kurumbo* at Yem), garlic, sweet potato, hot pepper and in some cases potato local varieties are dominantly grown in the study areas.

Limited access to newly released vegetable varieties was mentioned as reason for less frequent replacement period of imported varieties. More than 50% of respondents in the study areas replaced vegetable varieties after 3-5 years period.

Farmers in the study areas responded that they replace vegetable varieties whenever there is a chance to do so (Table 13). The main reasons for replacing varieties include availability of seed, yield advantage (e.g. tomato, cabbage, and potato), expectation for long shelf life (e.g. tomato

and cabbage), early maturity (e.g. tomato and onion), tolerance to diseases (e.g. tomato, beetroot and potato), taste/market preference (e.g. tomato, onion, potato, sweet potato), fetching better price (e.g. tomato, onion and sweet potato), better local adaptation (e.g. onion and beetroot).

**Table 13: Proportion of respondents to reasons for replacing vegetable varieties (%)**

Vegetables	Reason for replacing varieties				
	Market demand	Susceptibility to diseases	Availability of seed	R&D	Yield potential
Tomato	29	14	21	21	7
Cabbage	0	0	64	0	0
Onion	7	0	29	7	7
Hot pepper	0	0	29	0	0
Beet roots	0	0	29	0	0
Carrot	0	0	14	0	0
Sweet potato	0	0	14	0	0
Irish potato	7	7	21	0	29

### 3.3.5 Seed demand and price

The quantity of vegetable seeds demanded and used were collected from the zonal and district agriculture officers. These figures are based on estimates of area covered by vegetables and the seeding rate. For some vegetable seeds which come through the informal system, such as kale (*Brassica carinata*), Ethiopian mustard, sweet pepper, sweet potato and pumpkin, there is no data on seed/seedlings demanded and used. As discussed earlier, there is neither released varieties of these vegetables from the national research system nor seed importation for these crops, suggesting that farmers are depending on their own land races. Table 14 shows the extent of vegetable seed demand and use in the study areas. For most of the vegetables, the seed demand seems met while for few of them (cabbage, onion and Swiss chard), there is seed shortage.

**Table 14: Vegetable seed demand and seed used during 2012 cropping season and average price**

Type of vegetables	Amount of seed demanded (kg)*	Amount of seed used (rain-fed) (kg)*	Amount of seed used (irrigated) (kg)*	Total seed used	% seed used of the demand	Average seed price (birr/kg)*
Tomato	305	55	250	305	100	1,750
Cabbage	292	81	199	280	96	522
Onion	23,854	15,725	7,957	23,682	99	521
Garlic	38,198	20,379	17,819	38,198	100	50
Hot pepper	1,493	1,387	106	1,493	100	63
Beetroot	4,117	2,155	1,962	4,117	100	501
Swiss-chard	252	20	60	80	32	110
Lettuce	144	60	84	144	100	138
Carrot	612	236	376	612	100	933
Potato	2,563,936	1,196,879	1,367,057	2,563,936	100	109
Leek	2,095	686	1,409	2,095	100	-

\*Seed demand and use data is average of only three districts (Ambo, Meskan and Anlemo)

Cost of vegetable seeds vary significantly with higher costs for imported varieties such as tomato and carrot (Table 14). The price of Irish potato seems lower than the price of ware potato showing that farmers use inferior quality potato (in terms of size) for seed (Emana and Nigussie, 2011).

### 3.3.6 Preferred vegetables and varieties in the study areas

Table 15 shows some of the preferred vegetable varieties in the study areas as indicated by focus group discussants. Close to 60% of the participants indicated that local variety of kale (*Brassica carinata*) is preferred; of course there is no released variety for this important vegetable crop by the NARS and seed import. Koshoro and Galilea are preferred tomato varieties by about two-third of the respondents' in the study areas. For cabbage, Holland and Copenhagen Market constituted about a third of the preferred varieties. As expected Bombay Red and Adama Red are the most preferred onion varieties in the study areas. Bombay Red is said to be early maturing (about 3 months) and has short shelf life, suitable for local market, while Adama Red is late (over 4 months) maturing and has long shelf life, suitable for export market. Mareko Fana is the most popular hot pepper variety. Gudane and Jalene are the most preferred varieties of Irish potato.

**Table 15: Proportion of FGD participants preferring particular vegetable variety (%)**

Variety preferred	Tomato	Cabbage	Kale	Onion	Garlic	Hot pepper	Beet roots	Carrot	Sweet potato	Irish Potato
Local	-	25	58	-	8	17	8	17	8	8
Bombay red	-	-	-	42	-	-	-	-	-	-
Adama red	-	-	-	17	-	-	-	-	-	-
Koshoro	33									
Galilea	33									
Galamso	-	-	-	8	-	-	-	-	-	-
Lucha	-	-	-	-	8	-	-	-	-	-
Holland	-	25	-	-	-	-	-	-	-	-
Copenhagen Market	-	8	-	-	-	-	-	-	-	-
Italy	-	-	-	-	-	-	8	-	-	-
Gudane	-	-	-	-	-	-	-	-	-	17
Jalane	-	-	-	-	-	-	-	-	-	17
Marekofana	-	-	-	-	-	25	-	-	-	-
Do not know	17	33	-	17	8	-	25	8	-	25

Source: FGD in the study districts

For each of the vegetable crops, varieties are preferred due to different attributes (Table 16). The major attributes for tomato include low perishability, yield advantage, taste and fetching premium price. Although head size and perishability are important attributes in selecting cabbage varieties, the availability of seed is the overall governing factor for taking up a variety for production. Fast growth and tolerance to disease are important attributes for preferring different local varieties of kale (*Brassica carinata*), even if availability of seed dictates the type to grow. Color and market demand are the key attributes for selecting different varieties of onion.

Availability of planting materials and size are important for garlic, which is quite logical in the view of the fact that no organization is supplying planting materials for garlic in the country. The key factors for selecting hot pepper varieties are yield advantage, color, size of the pod and market demand. In general, availability of seed/planting materials determines what type of vegetable variety to grow in most cases, implying the critical shortage of improved seed supply.

**Table 16: Proportion of FGD participants by reasons of preferring a variety (%)**

Type	Variety	Attributes											
		fast growth	disease tolerance	Color	size	taste	high price	high yield	less perishability	Seed Availability	Does not bolt early	adaptation	demand
Tomato	Koshoro	-	-	-	-	-	-	50	25	25	-	-	-
	Galilea	-	-	-	-	25	25	-	50	-	-	-	-
Cabbage	Holland	-	-	-	33	-	-	-	67	-	-	-	-
	Local	-	-	-	-	-	-	-	-	100	-	-	-
	Copenhagen mkt	-	-	-	-	-	-	-	-	100	-	-	-
Kale ( <i>Brassica carinata</i> )	Local	14	14	-	-	-	-	-	-	71	-	-	-
Onion	Galamso	-	-	100	-	-	-	-	-	-	-	-	-
	Bombay red	-	-	20	-	-	-	-	-	-	-	-	20
	Adama red	-	-	50	-	-	-	-	-	-	-	-	50
Garlic	Lucha	-	-	-	100	-	-	-	-	-	-	-	-
	Local	-	-	-	-	-	-	-	-	100	-	-	-
Hot pepper	Local	-	-	-	-	-	-	50	-	50	-	-	-
	Marekofana	-	-	33	33	-	-	-	-	-	-	-	33
Beetroots	Italy	-	-	100	-	-	-	-	-	-	-	-	-
	Local	-	-	-	-	-	-	-	-	100	-	-	-
Carrot	Local	-	-	-	-	-	-	-	-	100	-	-	-
Sweet potato	Local	-	-	100	-	-	-	-	-	-	-	-	-
Irish Potato	Gudane	-	-	-	100	-	-	-	-	-	-	-	-
	Jalane	-	50	-	-	-	-	50	-	-	-	-	-
	Local	-	-	-	-	-	-	-	-	100	-	-	-

Source: FGD with community members

### 3.4 Vegetable Production System in the Study Sites

In all zones different types of vegetable crops are produced as an integral part of farming systems of the study sites. However, certain vegetable types are dominant in specific districts. Subjective assessment of dominance of vegetable types in the study districts were made by asking them to rank the top five vegetables. The ranking made by the communities and experts were consistent. In terms of geographic coverage, tomato, onion, cabbage and Irish potato are top ranking vegetables (Table 17). Kale (*Brassica carinata*) is dominant in Gurage and Hadiya zone in general and Meskan and Anlemo districts in particular. The major production systems, area covered and outputs are discussed in the sub-sequent sections.

**Table 17: Rank of vegetables by relative dominance in the farming system**

Vegetables	Rank of dominance of vegetable production				
	Guder	Ambo	Yem	Mesken	Anlemo
Tomato	1	2	1	1	3
Sweet potato	4				
Cabbage	3	3	4	4	2
Onion	2	1		2	4
Hot pepper	5			3	
Beet root		4	3	5	5
Irish Potato		5	2	3	1
Garlic		2	5		
Carrot			4		
Kale ( <i>Brassica carinata</i> )			1	2	1

Note: 1 is most widely grown followed by the 2, etc

#### 3.4.1 Production system

Information on what type of vegetables are grown in the study sites were collected from different sources: community members through FGD, DAs and experts through KII and secondary data sources from the district offices. The feedbacks received from these sources are consistent. Vegetable production is integrated into mixed farming system where different types of crops are produced on the same plot or in a sequence with other crops in a rotation. Depending on availability of land and crop suitability for intercropping, some vegetables are grown either as sole or intercropped with other vegetables or cereals (Table 18). Vegetable crops such as tomato, beetroot, Swiss-chard, lettuce, carrot, cabbage, onion, garlic, kale, sweet potato and hot pepper are dominantly grown as sole crop whereas vegetables such as Ethiopian mustard and pumpkin are dominantly intercropped with maize and other annual or perennial crops. In general, integrating vegetable production in a farming system, has great contribution to food and nutrition security as the vegetables create complementarity with other associate crops especially garden plants.

**Table 18: Vegetables production system in selected districts**

Vegetables	Guder		Ambo		Yem		Meskan		Alnemo	
	1*	2*	1	2	1	2	1	2	1	2
Tomato	x		x		x		x		x	
Beet root	x		x		x		x		x	x
Swiss chard	x		x		x		x		x	
Lettuce	x		x		x		x		x	
Carrot	x		x		x		x	x	x	
Ethiopian mustard		x		x	x	x	x	x		x
Pumpkin		x	x	x	x	x	x			x
Sweet potato	x		x		x	x	x		x	
Cabbage	x		x		x		x		x	x
Irish Potato	x		x		x	x	x		x	
Kale									x	x
Onion	x		x		x		x		x	
Garlic	x		x		x		x		x	
Hot pepper	x		x		x		x	x	x	
Green beans				x			x			
Sweet pepper					x					

\*Note: 1= sole; 2= intercropped

Source: FGD in the respective districts

Vegetables are also grown in two seasons, namely the wet season using rainfall as well as irrigation during the dry season. Vegetables such as pumpkin, hot pepper, sweet potato, and some others are grown predominantly using rainfall. Vegetables such as green beans, Irish potato, kale, cabbage, tomato and onion have high market value to offset high irrigation based vegetable production cost. Production using irrigation system is important since farmers can adjust harvest time to market demand which is high during dry season. It was indicated that since farmers follow similar strategy, there is severe competition in selling their products. Irrigation based production also enables them schedule production pattern to control disease and pest infestation.

### 3.4.2 Area allocated to vegetable production

Irrigable land as well as rainfed agricultural land are used for vegetable production. In the study zones (namely west Shewa, Yem, Gurage and Hadiya), a total of 85,827 ha was allocated to vegetable production during 2012 production year. The land allocated to vegetables is the largest in west Shewa zone followed by Gurage zone (Figure 6). On average, about 35% of the vegetable area in the zones was irrigated during the production year. The proportion of irrigated vegetable land ranges from 23% in Gurage zone to 45% in west Shewa zone. Yem is a special district and comparatively it has smaller area under rainfed as well as irrigated vegetables. The largest proportion of vegetable area in the study districts (58%) was irrigated during the 2012 production season (Annex 3.2).

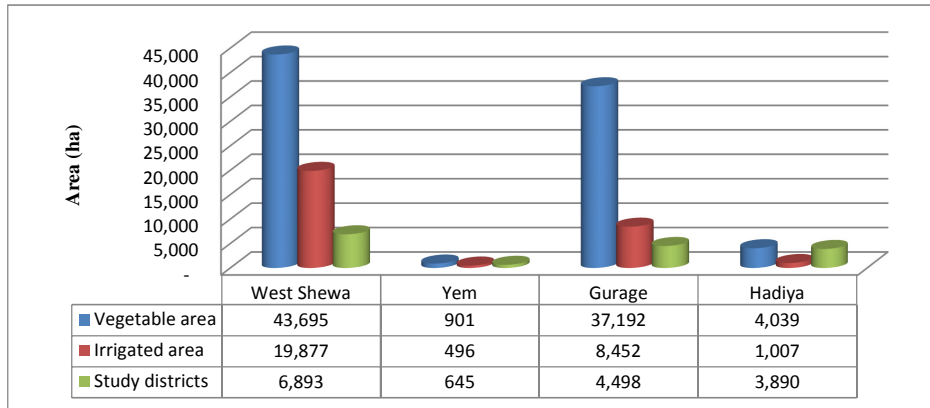


Figure 6: Total land allocated to vegetables and irrigated area in the study zones and share of the study districts.

In west Shoa zone, vegetables such as potato, onion, cabbage, Ethiopian mustard and garlic are dominant vegetables produced using rainfall, accounting for 72% of the total area allocated for rainfed vegetable production. In Gurage zone, Irish potato alone accounted for 78% of the rainfed vegetables. Irish potato and sweet potato occupied the largest share (77%) of area allocated for rainfed vegetable production in Yem special district. In Hadiya zone, cabbage, beetroot and carrot together accounted for 69% of the total area allocated for rainfed vegetable production. Table 18 shows the land allocated to different vegetables under rainfall and irrigation systems during the 2012 production season.

In west Shoa Zone, the largest area (74%) of irrigable vegetable land was allocated for potato, onion and tomato production. In Gurage zone, the largest area of irrigable vegetable land was allocated for kale, onion tomato and potato production, the four crops covering 79% of the total area allocated for all vegetables production using irrigation. At Hadiya zone vegetables such as tomato, cabbage and onion together shared 64% of the total land allocated for vegetables production using irrigation. In all the four zones, vegetables such as cassava and pumpkin were not grown under irrigation. The zonal data shows that sweet pepper is produced under irrigation but the study districts did not report that this crop under irrigation.

The study zones consist of 46 districts i.e. 20 in west Shewa, 1 in Yem, 15 in Gurage and 10 in Hadiya. The five study districts account for 18.6% of the total vegetable areas in the zones and 31.2% of irrigated vegetable area of the zones. This clearly shows that the study districts are high vegetable potential areas of the zones. More importantly, more than one-fifth of the most important vegetables such as tomato, cabbage, kale, hot pepper, beetroots, and Swiss-chard which are largely produced for market are supplied from the sample districts (Table 19).



**Table 19: Area under vegetable production in the study zones**

Type vegetable	Vegetable area in the zones (ha)							% of study districts	
	West Shewa	Yem	Gurage	Hadiya	Total	Total irrigated	% irrigated	Total area	Irrigated
Tomato	3,975	80	1,684	1,240	6,979	5,308	76.1	39.5	44.5
Cabbage	3,833	29	939	1,488	6,289	2,331	37.1	28.7	55.5
Kale	-	61	3,684	-	3,745	2,064	55.1	39.5	56.2
Onion	7,045	20	2,066	947	10,078	5,452	54.1	17.6	22.3
Garlic	2,868	31	1,339	251	4,489	1,388	30.9	11.6	14.6
Hot pepper	1,981	4	8,031	-	10,016	1,338	13.4	26.2	15.9
Sweet pepper	-	-	-	304	304	304	100.0	-	-
Beet root	2,240	36	338	1,184	3,798	1,594	42.0	20.6	27.3
Swiss-chard	152	-	150	238	540	216	40.0	20.6	49.1
Lettuce	168	-	62	-	230	160	69.6	5.2	4.4
Carrot	1,946	35	501	836	3,318	1,231	37.1	21.8	30.5
Cassava	-	-	96	-	96	-	-	-	-
Ethiopian mustard	3,418	25	30	-	3,473	856	24.6	1.3	-
Pumpkin	-	-	120	-	428	-	-	100.0	-
Sweet potato	1,764	145	681	71	2,560	849	33.2	16.7	16.7
Potato	14,307	436	17,713	224	22,631	9,730	43.0	11.3	16.3
Total	43,695	901	37,192	4,039	85,827	29,832	34.8	18.6	31.2

Source: Offices of Agriculture of the respective zones and the District

The results of the FGD indicates that almost all farmers are engaged in the production of at least some vegetables. In all the study districts most of the households grow the major economic vegetables. The area a household allocates for the production of these crops vary and often it is very small. The average household area allocation for vegetables production in the five districts ranged between 0.11 ha at Meskan to 0.19 ha at Ambo. At Guder/Toke Kutaye district, an average of 0.38ha of land was allocated for tomato production per household which is much higher than the area allocated to other vegetables. Very small land size is allocated for production of beetroot as well as hot pepper production. At Ambo district, onion production is most common, occupying an average of 0.5ha of land whereas only 0.25 ha was allocated for each of tomato, cabbage and garlic. At Yem special district, the largest area per household (0.25 ha) was allocated for Irish potato followed by tomato (0.22 ha) and garlic (0.21 ha) production. In this district, the smallest land of about 0.01 ha was allocated for lettuce and Swiss-chard production. Pepper is a dominant vegetable at Meskan district occupying 0.26ha per household. Onion is the second important vegetable with 0.23ha per household. The average area households allocate to other vegetables like Swiss-chard (0.02 ha), carrot (0.04 ha) and Ethiopian mustard (0.04 ha) is very small. Irish potato is a major vegetable produced by households at Anlemo district with about 0.5 ha per household. The second largest area was allocated to tomato with an average size of 0.25 ha per household. Here too, the smallest plot size of about 0.06 ha (each) was allocated for carrot, sweet potato, Swiss-chard and lettuce production.

### 3.4.3 Production and productivity

According to the Zonal Agriculture Offices of the study areas, about 1.28 million ton of vegetables were produced during the 2012 production year. The data on production was extrapolated from the productivity estimates made by the respective zones. The data shows that about 0.5 million ton or 39% of the vegetable production was from irrigated farming (Table 20). About 25% of the irrigated vegetable products are coming from the study districts. As shown in Annex 3.3, the major share of vegetable products (70%) in the study districts comes from irrigated field. However, there is variation among the zones and districts in terms of irrigation potential and use. The quantity of total vegetables produced in Gurage zone was 102.6, 13.4 and 12 times higher than the amount produced in Yem special district, west Shoa and Hadiya zones, respectively. In west Shoa zone, vegetables such as potato, onion, Ethiopian mustard, cabbage and beetroot together make the largest share (85%) of the total vegetables under the rainfed system whereas the amount of Swiss-chard, carrot and lettuce is only 1% of the total production.

Irish potato is the most important vegetable produced in all of the zones. Kale (*Brassica carinata*) is the second most important vegetable produced in Gurage zone. It is not a common vegetable in west Shewa. This indicates that certain zones and districts focus on certain vegetables which have comparative advantage. It is also explained by the production and consumption culture of the society.

**Table 20. Vegetable production in the study zones (qt) and relative share of the sample districts (%)**

Type of vegetable	Total production of the zones (ton)					% of study district			
	West Shewa	Yem	Gurage	Hadiya	Total	Total irrigated	% irrigated	Total production	Production from irrigated area
Tomato	17,572.60	964.30	51,716.40	27,356.40	97,609.70	82,995.30	85	36	36
Cabbage	13,396.50	327.50	22,590.00	30,048.20	66,362.20	34,135.10	51	37	52
Kale	-	475.80	116,586.80	-	117,062.60	53,184.60	45	25	43
Onion	40,103.00	234.80	53,624.00	14,294.90	108,256.70	88,787.20	82	20	18
Garlic	5,487.10	364.50	20,592.70	3,467.40	29,911.70	12,470.30	42	10	12
Hot pepper	3,190.50	-	14,948.00	-	18,138.50	9,050.00	50	26	27
Sweet Pepper	-	-	-	277.80	277.80	277.80	100	-	-
Beet root	6,845.90	371.80	7,234.10	22,009.70	36,461.50	14,339.50	39	27	42
Swiss-chard	241.40	-	2,901.40	4,489.80	7,632.60	1,785.70	23	24	98
Lettuce	873.30	-	1,178.30	-	2,051.60	1,021.70	50	10	10
Carrot	2,637.20	343.80	12,631.30	16,028.20	31,640.50	16,807.70	53	26	29
Cassava	-	-	1,728.00	-	1,728.00	-	-	-	-
Ethiopian mustard	9,288.30	10.00	30.00	-	9,328.30	2,764.90	30	-	-
Pumpkin	-	-	1,680.00	-	1,680.00	-	-	1	-
Sweet potato	1,491.80	759.40	18,103.00	1,610.90	21,965.10	5,813.30	26	11	12
Potato	155,236.60	5,453.80	572,131.70	5,152.00	737,974.10	178,857.00	24	4	12
<b>Total</b>	<b>256,364.20</b>	<b>9,305.70</b>	<b>897,675.70</b>	<b>124,735.30</b>	<b>1,288,080.90</b>	<b>502,290.10</b>	<b>39</b>	<b>14</b>	<b>25</b>

The productivity of vegetables depends on the production system. It was indicated that yield of sole cropping and irrigated system is higher than the yield of vegetables when grown as intercropped and rainfed. For vegetables such as kale (*Brassica carinata*), Swiss chard, lettuce, sweet potato and potato the productivity was higher under rainfed than under irrigation (Table 21). However, with crops such as tomato, cabbage, onion, garlic, hot pepper and carrot productivity was rather higher under irrigation than under rainfed condition. This could be due to the high disease incidence during the rainy season for this crops. Yield of the most common vegetables were also estimated by the farming communities involved in the focus group discussions. The average yield of these vegetables in the study districts is skewed to the right as compared to the district averages. This could be due to either the relatively good potential of the study kebeles or perhaps estimation bias by experts at district level.

**Table 21: Productivity of vegetables under irrigated and rainfed production systems (ton/ha)**

Type of vegetable	District averages		Average of Sample kebeles
	Rainfed	Irrigated	
Tomato	14.3	12.5	19.2
Cabbage	13.5	13.8	21.6
Kale	20.9	19.8	21.8
Onion	10.4	13.3	17.4
Garlic	4.9	7.1	3.9
Hot pepper	1.8	11.3	11.6
Sweet pepper	7.8	-	
Beet root	11.0	13.8	15.0
Swiss-chard	19.0	16.5	
Lettuce	19.0	15.0	
Carrot	9.8	13.2	14.7
Ethiopian mustard	8.3	-	
Pumpkin	0.6	-	
Sweet potato	7.1	12.2	17.0
Potato	12.3	13.4	
Leek	6.7	6.3	

Source: Computed from district data; \* CSA (2011).

Generally, the average productivity of all the crops were by far lower than the yield potential of the crops recorded in research centers under good management practices (Table 22). With vegetable crops such as tomato, onion, carrot, beetroot, Swiss chard and lettuce, the lower productivity cannot be ascribed to the use of low yielding cultivars since in all cases seeds of improved varieties are used by the farmers. The low yield observed with the aforementioned vegetable crops, however, may be related to diseases and insect pest incidences, moisture stress, lack/suboptimal uses of inputs such as fertilizers and chemicals. See also Annex 3.4 for district level yield.

**Table 22: Yield performance of some vegetable and root crops under farmers, private and research management conditions**

Crop	Yield (ton/ha)		
	Farmers field	Private farm	Research
Cabbage	7.09	23.22	35-40
Ethiopian mustard (when used as vegetable)	8.31	6.67	15-20
Green pepper	7.68	8.28	15-20
Red pepper	1.66	1.89	2.5-3
Onion	9.53	14.93	35-45
Garlic	11.04	11.79	10-15
Potato	7.98	18.98	50-60

Source: Desalegn (2010)

### 3.4.4 Purpose of vegetable production

Vegetables are produced for different purposes. In the study sites, communities were asked why they produce vegetables and associated values. The results show existence of economic, consumption/nutritional, social and medicinal values which trigger vegetable production and consumption.

#### *i) Economic values:*

Vegetables in the study sites are largely produced for sales. Farmers sell vegetables to generate cash income which is needed for financing inputs of agricultural production including purchase of vegetable seeds for the next season planting and inputs of other crops. Farm and household assets such as livestock, irrigation water pump, development of shallow wells for irrigation water supply, spraying equipments, farm equipment, house construction, household furniture, etc are purchased using income generated from sales of vegetables and other products. In the study sites, vegetables like tomato, cabbage, onion, garlic, hot pepper, beetroots, Swiss chard, lettuce, and potato are mainly produced for the market (Table 23).

**Table 23: Proportion of experts stating the purpose of vegetable production in all sites (%)**

Vegetable	Mainly for consumption	Mainly for sale	For consumption and sales equally
Tomato	0	88	13
Cabbage	0	79	21
Kale	46	23	31
Onion	8	79	13
Garlic	9	70	21
Hot pepper	29	52	19
Sweet pepper	25	42	33
Beet roots	0	87	13
Swiss chard	13	79	7
Lettuce	12	71	17
Carrot	0	83	17
Cassava	50	0	50
Eth-mustard	46	48	6
Pumpkin	53	19	28
Sweet potato	28	39	33
Potato	6	67	28

Source: KII with experts in study sites

#### *ii) Consumption/Nutrition*

All households producing vegetables also consume them. But only some of the vegetables are produced with the main purpose of consumption. As shown in Table 21 above, kale, pumpkin, Ethiopian mustard, and cassava (tuber) are largely produced for consumption. Sweet potato (tuber) is considered as food security crop since it withstands moisture stress. In the study site, it was indicated that sweet potato is predominantly the crop of the resource poor. Although the

poor also grows other vegetables, the scale of production is low and the purpose is largely consumption. The major reason for this is lack of capital to access vegetable seeds, irrigation facilities, and other inputs like fertilizer and chemicals the price of which is unreachable for the resource poor people. As shown in Table 24, the rich and medium wealth group households produce a variety of vegetables largely for sales while a portion is also consumed. Except with garlic and potato which are produced only by rich and medium class farmers all the other vegetables were produced by all income classes.

**Table 24: Production of vegetables by various income groups**

Vegetable type	Wealth status		
	Rich	Medium	Poor
Tomato	x	x	x
Cabbage	x	x	x
Kale	x	x	x
Onion	x	x	x
Garlic	x	x	
Hot pepper	x	x	x
Beet roots	x	x	x
Carrot	x	x	x
Sweet potato			x
Irish Potato	x		

Source: KII and FGD

The FGD participants and horticulture experts also understand the nutritive value of vegetable production. However, specific nutritive value of vegetables is not well known to farmers. Moreover, most of the DAs who are supposed to promote adoption of vegetables do not know the specific nutritive value of the crops (Table 25).

**Table 25: Proportion of DAs indicating nutritional value of vegetables (%)**

Vegetable	Nutritional value			
	Vitamins	Carbohydrate	Do not remember exactly	Protein
Tomato	33	-	25	8
Cabbage	33	-	25	-
Kale	33	-	-	-
Onion	8	-	16	-
Garlic	-	-	8	-
Hot pepper	8	-	-	-
Sweet pepper	-	-	8	-
Beet roots	-	-	8	8
Carrot	8	-	16	-
Potato	-	33	-	-

Source: KII with DAs in the study sites

### iii) Social value:

Development agents and farmers (through FGD) were interviewed whether they knew the social value of vegetable crops commonly produced in their area. About 42-50% of the interviewed development agents responded that vegetables such as tomato, cabbage, kale, onion and potato are usually given as a gift or present to relatives or neighboring as means of social support. This occurs mainly when the relatives or neighbours do not have own access to such vegetables. As an objective of production, the social value is not given much attention.

### iv) Medicinal value

About 25% and 8.3% of the respondents stated that kale and cabbage play the role of anti-constipation, respectively. Another 8.3% of the respondents also stated that onion, garlic and sweet pepper have medicinal value although they do not know exactly what it is. Carrot has medicinal value for 25% of the respondents while garlic is considered as medicine for preventing various diseases such as common cold.

### 3.4.5 Role of gender in vegetable production

Assessment of the role men, women and children play in vegetable production and marketing indicates that men and women are highly engaged in different vegetable production activities. About 67% and 75% of the respondents indicated that the role of women is high in transplanting and harvesting, respectively. The majority of the respondents (75%) indicated that men are highly involved in vegetable nursery management, harvesting and marketing (Table 26). Men are largely involved in marketing of large quantities of potato, tomato, onion and cabbage, while women are mainly involved in marketing of these and other leafy vegetables. High engagement of men in vegetable sales is also associated with high control of income generated from vegetable production. Children involve in farm activities such as nursery management (including weeding and irrigating) while their role in vegetable marketing is the least.

**Table 26: Proportion of respondents on women, children and men role in vegetable production and marketing (%)**

Role	Women			Children			Men		
	Low	Medium	High	Low	Medium	High	Low	Medium	High
Nursery management	17	42	42	33	50	17	8	17	75
Transplanting	17	17	67	42	50	8	8	42	50
Agronomic practices	-	58	42	67	25	8	-	33	67
Harvesting	-	25	75	67	25	8	-	25	75
Marketing	17	42	42	75	17	8	17	8	75

### 3.4.6 Post-harvest handling

The value of vegetables produced is determined by how the product is handled and transported. Post-harvest handling starts on the farm immediately after harvesting. Throwing the product during harvesting results in physical damage, lowering the product quality. Sorting products of

different size and quality makes the product more attractive to the buyers. Vegetables can easily be damaged during transporting. These quality assuring techniques are not to the standard in the country in general and in the study sites in particular. There is no cold transportation system for vegetables. The products are loaded on trucks or put in sacks and transported to the market. Warehouses are not organized in the way vegetables are preserved for reasonably longer time.

In the study sites, sorting of vegetables is done by most of the producers. Sorting is bases for setting relative grade by the sellers and buyers, though there is no quality standard for vegetables in the country, against which the farmers' practices are compared. Some farmers also wash vegetables like beetroots, carrot and potato. But most of the farmers sell these products unwashed (Table 27).

**Table 27: Proportion of respondents indicating post harvest handling of vegetables in the study sites (%)**

Vegetables	Post-harvest handling				
	Sorting	Grading	Packing	Washing	Curing
Tomato	71	71	0	7	0
Cabbage	36	36	0	0	0
Kale	0	0	0	0	0
Onion	50	50	0	0	29
Garlic	14	7	0	0	21
Hot pepper	29	29	0	0	14
Beet roots	29	29	0	21	0
Carrot	7	7	0	14	0
Sweet potato	14	14	0	0	0
Irish potato	36	36	0	3	7

Source: FGD with communities and KII with experts

Along vegetables value chain, some products like tomato are processed and canned as tomato sauce or ketchup while pepper, onion and garlic are dried and processed to produce '*berbere*'<sup>1</sup> (pepper powder) which is used for making traditional relish like '*wat*' (stew) in Ethiopia. Irish potato is processed into chips in cafe, restaurant and along roadsides. Large scale potato processing for commercial sales is limited. There is no processing or packing of leafy vegetables as such at farm level. It is, however, encouraging to see that supermarkets started to pack leafy vegetables and sell at premium prices in Addis Ababa.

### 3.4.7 Constraints of vegetable production

Production of vegetables has been constrained by biotic and abiotic factors. The constraints could be categorized under (i) natural factors, (ii) institutional and policy factors, (iii) market factors.

<sup>1</sup> *Baltina* houses (local processors) clean, dry, chop and grind pepper mixed with onion, garlic, ginger and other spices to make pepper. Some *Baltina* houses sell the processed product to super markets while others sell in informal markets.



### *i) Natural factors*

The natural factors identified here include the perishable nature of vegetables, disease, pest, and extreme moisture levels (i.e. high during rainy season, and shortage during dry season). The results of the study shows that significant number of the key informants and participants of the FGD stressed the significance of post-harvest losses which occurs due to perishable nature of vegetables and lack of appropriate post-harvest product management. Diseases and insect pest also affect vegetables resulting in high pre-harvest loss. Inadequate or erratic rainfall or lack of irrigation water also result in low moisture stress, causing yield reduction.

As shown in Table 28, tomato was among the most significantly affected crops by diseases (97%), post-harvest loss (82%) and low moisture stress (68%) as responded by the development agents, vegetable experts and FGD participants. Cabbage and onion follow tomato in terms of susceptibility to moisture stress (55%) and post-harvest loss (44%).

Late blight and bacterial were reported as important disease that affects potato and tomato in the study areas. There was no disease incidence mentioned to constrain the Ethiopian mustard production, although aphids were reported to cause heavy damage to the vegetative leaf used as vegetable. Only, 8% of the experts interviewed mentioned carrot to have been suffering from disease and pests. Powdery mildew was among the carrot diseases mentioned by the experts. Garlic, beetroot, carrot and Ethiopian mustard were among the crops having no problem of post-harvest losses, as far as transportation distance is not too long. However a serious garlic rust problem was mentioned. Except with tomato no weed problem as a biotic factor was mentioned to have affected vegetable production in the study area. Some examples are high infestation of late blight in tomato and potato; rotting of bulb in onion; rust in garlic and mildews in carrot. High insect pest attack is also reported in cabbage during the dry season (by aphids) and onion (by thrips).

### *ii) Institutional and policy factors*

The major institutional constraints affecting vegetables production refer to lack of access to improved vegetable varieties especially for potato, sweet potato, hot pepper and tomato; lack of vegetable seed certification/regulatory system ultimately resulting in the use of uncertified poor quality seeds by farmers. This has an impact on the overall production (encountered with onion seed) and lack of institutionally coordinated (e.g. as through cooperatives/union, MoA) seed supply system in some districts (Guder and Ambo) of the study area.

Other factors include fragmented nature of vegetable farms creating inconvenience for coordinated market linkage creation and lack of policy initiatives to address the issue. Despite the fact that government planned to develop small scale irrigation, which is often used for vegetable production, there is no sufficient irrigation water in some districts (Guder/Toke Kutaye, Ambo, Yem) resulting in conflict among farmers associated with periodic shifting of irrigation water use.

### *iii) Market problem*

Vegetable products are sold at local markets in village and district capital. Lack of reliable market in all the zones appears to be the major bottleneck of vegetable farming. Discussions

particularly with producers and traders revealed that the existing market condition and production planning doesn't suit the nature of vegetable products where farmers reported extremely low prices particularly for onion and tomato. Producers and local traders lack reliable market information. Brokers and wholesalers in the terminal market determine prices and even sometimes refuse buying harvested products. Due to the perishable nature of vegetables, producers are forced to sell the products at low prices and in some cases in abandonment of products in the market due to lack of buyers.

The largest proportion of respondents also indicated that tomato suffers from market problem (82%) while cabbage (54%) and onion (50%) are also largely affected by market problem (Table 28). The situation is aggravated by perishability of the products.

Moreover, there is limitation in infrastructure such as appropriate post-harvest handling and storage and road especially at Yem special district and Anlemo District in Hadiya zone.

**Table 28: Percentage of experts, DAs and FGD participants mentioning factors affecting vegetable crops production**

Vegetable type	Abiotic factors			Biotic factors				
	Low Moisture stress	Market problem	Postharvest loss	Frost	Disease	Insect	Weed	Seed impurity
Tomato	68	82	82	0	97	44	8	8
Cabbage	55	53	44	0	31	52	7	0
Kale	16	23	5	8	2	18	0	0
Onion	37	50	24	8	52	29	7	8
Garlic	5	13	0	0	13	8	2	0
Hot pepper	10	8	8	0	21	8	2	0
Sweet pepper	13	11	3	0	11	11	2	0
Beet roots	15	5	0	0	3	13	0	0
Carrot	10	5	0	0	8	0	0	0
Potato	27	29	16	0	37	6	0	0

### 3.5 Vegetable Marketing System

#### 3.5.1 Quantity marketed

As discussed above, one of the major purpose of producing vegetables is for marketing. As shown in Table 29, more than 65% of all major vegetable products produced during the 2012 production year were for sales. The responses of different respondents is also consistent and conclusive (Annex 3.5). This implies that vegetables provide good cash income generating opportunity for the farming community to access food (by selling it and buying food) and live a better life. This is, however, conditional on overcoming the constraints stated above.

**Table 29: Proportion of vegetables sold in four districts in 2012 (%)**

Vegetable	Guder	Yem	Meskan	Anlemo	Overall average
Tomato	92.5	85.0	86.3	62.5	83.5
Beet root	95.0	85.0	92.0	75.0	87.3
Swiss chard	95.0	87.5	90.0	90.0	90.0
Lettuce	95.0	87.5		90.0	90.0
Carrot	95.0	88.8	92.7	75.0	88.5
Eth. mustard	62.5	50.0	88.3	55.0	65.7
Pumpkin	62.5	70.0	77.5	60.0	70.5
Sweet potato	60.0	65.7	76.7	75.0	68.6
Cabbage	92.5	78.8	88.8	67.5	82.5
Irish potato	75.0	55.0	81.3	50.0	66.3
Kale		60.0	75.0	65.0	67.8
Onion	92.5	78.8	91.3	70.0	83.8
Garlic	100.0	73.8	94.0	90.0	84.8
Hot pepper	87.5	60.0	87.0	70.0	75.3
Sweet pepper		70.0			70.0
Green beans			98.0		98.0

Source: FGD made with community members (2013)

### 3.5.2 Marketing channel

Producers sell vegetables through different channels for all vegetable types. The shortest channel is when they sell it to consumers as shown in Figure 7 (Channel 4). They also sell to local collectors or wholesalers or retailers. At Yem and Anlemo districts, the marketing channel is short and the products are sold at village markets or district markets. No retailers involve in vegetable marketing in those districts. In Meskan district, products reach urban areas to be sold in open markets though few retailers operate. In this case, producers sell the product to consumers and retailers as well as wholesalers coming from markets outside the district. There are approximately 12 vegetable traders at Buta Jira, the capital of Meskan district. These traders transport the product to other markets including Addis Ababa, when the supply is peak. At Ambo district, about 4 wholesalers take part in vegetable marketing serving as supply source to retail shops and hotels in the town.

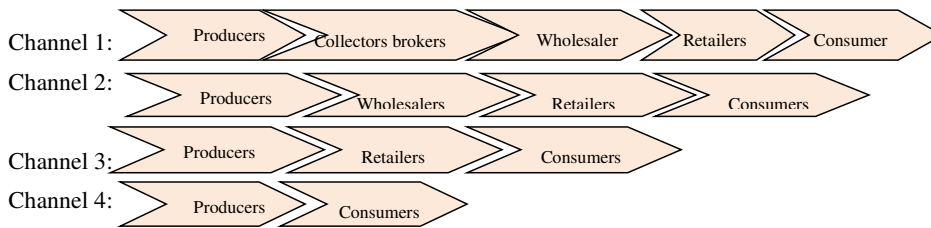
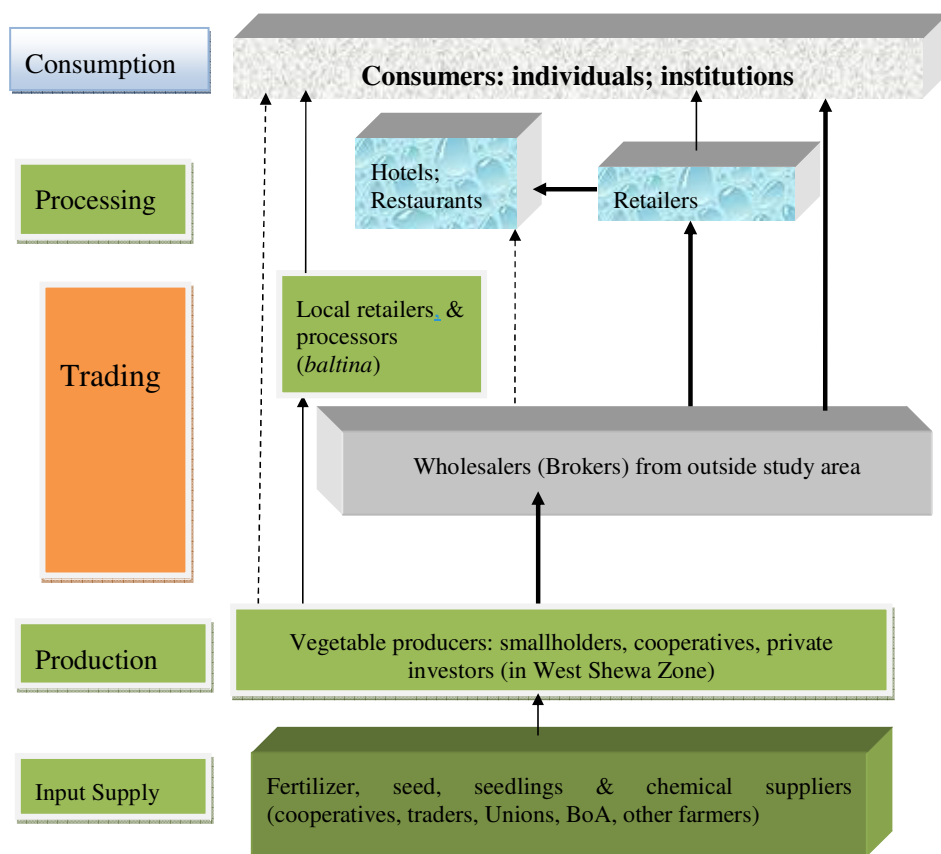


Figure 7: Vegetables marketing channel

### 3.5.3 Overview of vegetables value chain

Various vegetable crops grown in the selected districts are covered in this study. The functions involved along the value chains of various vegetables in the districts are more or less similar. Differences appear in the channels the products pass through in the trading functions and actors assuming different roles. Hence, mapping of value chain functions is considered to show the relationships and integrations of the processes and activities performed along the value chain. Major functions include input supply, production, trading, processing and consumption. Figure 8 displays the functions or processes in vegetables value chain, the activities performed under each of the functions and the actors among the value chains.



Source: Own sketch based on data collected

Figure 8: Value chain map and channel of vegetables

#### **Functions along the value chain and major actors:**

**Input supply:** Inputs such as seeds, fertilizer, and pesticides are supplied by farmers' cooperatives/unions, traders and other farmers. Farmers also save seeds of some of the vegetables. District level agriculture offices in Yem, and Meskan districts engage in input supply activities. Seeds of improved varieties are supplied by private traders and cooperatives or unions. Farmers also exchange seeds saved from last season's production. Limited number of private investors in the Rift Valley also produces vegetable seeds and sells to farmers, or NGOs which purchase seed and distribute to farmers through development programs.

**Production:** Production involves agronomic and farm management practices to transform inputs into outputs. Smallholder farmers are the main actor in this process. Farmers also involve in post harvest management and marketing of the products. Very few private investors also engage in vegetable farming around urban areas (case of Ambo and Guder districts).

**Marketing/Trading:** This function is carried out by producers, retailers and whole sellers from outside the study areas. For commodities coming from the study areas, however, all marketing activities, are handled either by retail shops mixing vegetables with fruits or farmers sell the products in open markets. At Anlemo and Yem (special) districts there are no retailers in the marketing functions. Wholesaler participation is for limited commodities (onion, potato, and garlic). In both Ambo and Buta jira towns there are also retailers selling vegetables to urban consumers.

**Processing:** Processing of vegetables in the sense of preserving and value addition is not as such practiced in the study areas. Processing function is undertaken by hotels or restaurants in which case fresh and cooked vegetables are sold to consumers. In major towns of the study areas, very few individuals process potato in to chips to sell it on roadsides.

**Consumers:** Consumers are the urban and rural dwellers who buy and consume vegetables. Consumption by village market participants and farmers themselves absorbs good volume of the produces. In terms of consumers groups, FGD participants in Anlemo district expressed their perceptions that vegetables are for urban people implying that vegetables are produced for sale.

#### **3.5.3 Price of vegetables**

The average prices of vegetable products at the district towns is given in Table 30. The data shows clear difference among the districts in terms of vegetable prices. Partly this variation occurred due to lack of controlling seasonal price variation in the sense that respondents' response may be influenced by the price event at a particular time while others may be speaking of different time. The attempt to get average price, therefore might have certain limitation.

Garlic and hot pepper attract good prices. Other vegetables like tomato, cabbage and onion also attract good price, but suffer from high price volatility.

**Table 30: Common price of vegetables in the study districts (ETB/ton)\***

Top 5 vegetables	Guder	Ambo	Yem	Meskan	Anlemo	All districts
Tomato	4,090	2,250	4,750	4,500	4,130	4,110
Cabbage	2,250	1,630	3,310	2,600	1,200	2,380
Kale			7,000	630	530	1,660
Onion	5,000	4,500		4,000	6,000	4,630
Garlic		8,000	14,000			10,000
Hot pepper	6,250			10,000		8,500
Beetroots		2,000	2,150		1,600	1,900
Carrot			3,670			3,670
Sweet potato	2,400					2,400
Irish potato		2,500	2,900	3,000	1,400	2,640

\*1USD ≈ 20 ETB (current exchange rate)

### 3.6 Opportunities and Challenges

In this subsection, highlight of the opportunities and challenges for vegetable production will be discussed with emphasis on vegetable seed system.

#### 3.6.1 Opportunities

Ethiopia provides a wide range of opportunities for the development of the horticulture industry, including vegetable production, processing, marketing and consumption (home, local and export market). These opportunities are:

##### *i. Presence of an enabling policy environment*

Ethiopia has stable political system with strong agricultural development policy and commitment for implementation, creating favorable policy environment for smallholder agricultural development and private commercial farms, including vegetables production for local consumption, agro-processing and local and export markets. The investment policy of the country also promotes and incentivizes investment in high value horticultural crops such as vegetables both by local and international entrepreneurs. Moreover, there is vivid public investment in infrastructure in terms of irrigation (especially small and medium scale irrigation schemes), road and utilities (e.g. communication) as well as air freight for agricultural product export. Consequently, there is increasing investment in horticultural crops in Ethiopia nowadays.

##### *ii. Human capital*

Human resource development in the area of horticulture, including vegetables, is also increasing because of the expansion of university level trainings. The number of first and second degree graduates is increasing over time. Despite limited specialization of the development agents on vegetables, government is assigning extension staff to *kebele* level to support farmers. NGOs and development programs also provide capacity building training for farmers. Wage labor is also

adequately available to support commercial production and agro-processing of horticultural crops, including vegetable products.

***iii. Increasing demand for horticultural products***

There is increasing trend for horticultural products because of increasing population, urbanization, awareness of the public about the health value of horticultural crops like vegetables and fruits. It has also been indicated that per capita income is increasing, stimulating consumption of healthy and nutritious food. In big cities like Addis Ababa, there is increasing consumption of vegetable based diets, especially during lunch time, because of the soaring price for cereal and livestock product diets, as well as improved awareness of the population about healthy diets. The demand for agro-processing and export is also quite substantial. The high demand for horticultural products naturally increases the demand for improved seeds of different vegetable crops so as to boost local production (refer to Table 10).

***iv. Existence of suitable agro-climatic conditions for production of horticultural crops, including vegetables***

Ethiopia has diverse agro-ecologies for production of cool season vegetables like cabbage, onion, carrot, beetroot, Swiss chard, kale and Ethiopian mustard and warm season vegetables like tomato, hot and sweet pepper.

***v. Existence of institutions supporting the development of the horticulture sector***

In Ethiopia, there are a number of public organizations supporting the development of horticulture, including vegetables. Notable ones include, Ethiopian Horticulture Development Agency, Ethiopian Horticulture Producers-Exporters Association, Ethiopian Fruit and Vegetable Marketing Enterprise, Ethiopian Horticulture Development Corporation, national agricultural research system operating in decentralized system, Ministry of Agriculture and regional bureaus of agriculture as well as a number of vegetable seed importers with their own distribution channels. The regional bureaus of agriculture also play key roles in developing and promoting irrigated vegetable production, which increases vegetable seed use.

***vi. Increasing registration of commercial vegetable varieties in Ethiopia***

As it is evident from section 3.2 (e.g. Table 6), increasing number of international and local private agents are getting tested and registered commercial vegetables in Ethiopia, increasing the chance of boosting vegetable production using high yielding improved varieties, seeds of which can easily be imported and/or produced in the country.

***vii. Existence of vegetable seed importers and distributors***

Increasing number of agro-companies is importing and distributing commercial vegetable seeds in the country (refer to Table 6 and Table 7). Since there are a number of stockiest in different part of the country, the imported seed is easily distributed to the major vegetable producing areas and respond easily to the demand. In general, this is the only seed sector in Ethiopia that is led by

the market forces (Hassena and Desalegn, 2012). Farmers' cooperatives and cooperative unions are commonly found throughout Ethiopia, facilitating the supply of inputs such as vegetable seeds, fertilizers, farm tools and marketing of horticultural products, including vegetables. Micro-finance institutions, in turn, play great role in providing access to credit to the cooperatives and cooperative unions. In some areas, microfinance institutions also provide credit for investment in irrigation facilities which is meant for vegetable production.

### 3.6.2 Challenges

The development of horticulture in general and vegetable production and marketing in Ethiopia is constrained by a number of factors:

#### *i. Policy implementation gap*

Even if Ethiopia has seed law (Seed Proclamation 2012), Plant Protection Decree no. 56/1971 and, Plant Quarantine Regulation No. 4/1992, the implementation capacity (e.g. facilities such as laboratory, logistics, and budget) and capability (knowledge and skill gap) are very much constraining. Lack of seed quality assurance mechanism often results in disease and insect pest outbreak (Damte, 2012) and poor quality seed distribution to farmers (Desalegn et al., 2012; Tabor and Yesuf, 2012), discouraging farmers to buy and use vegetable seeds. The process of Ethiopia's regional harmonization of seed regulation with eastern African countries is not yet completed and as result there is no free seed trade between Ethiopia and other eastern African countries (refer to Atilaw, 2010). Similarly, plant breeders right is not yet implemented, retarding private investment in plant breeding, including vegetable breeding and introduction of commercial varieties from abroad by international seed companies.

#### *ii. Inadequate vegetable seed regulatory frameworks, quality control and certification*

Vegetable seeds and propagating materials are often not inspected and certified for quality by APHQS of the MOA. As a result, quality vegetable seeds and propagating materials are not supplied to growers, resulting in poor germination and infection by seed borne diseases as well as viruses.

#### *iii. Limited public institutional capacity and capability supporting efficient and regular vegetable seed supply*

##### **a. Low public vegetable breeding capacity**

Although Ethiopia has strong national agricultural research system (NARS), the research capacity and capability is low in which case the seed supply predominately depend on imported seed (Tabor and Yesuf, 2012). As such the NARS neither has enough capacity for germplasm and variety development nor connected to other external sources for cool season vegetable crops such as kale, Ethiopian mustard, pumpkin, carrot, cabbage, beet root, lettuce, and Swiss chard (Mengistu et al., 2003), implying low capacity for breeding climate resilient vegetable varieties to cope with climate change.



#### **b. Low public capacity for vegetable seed production**

Ethiopian Seed Enterprise is involved in limited production of onion, hot pepper and potato seed. Despite the existence of three more regional public seed enterprises in the country, none of them is engaged in production, processing, marketing and distribution of vegetable seeds or export of such seeds. Indeed, there is inadequate technical knowledge for most vegetable seed production compared to production of seeds of field crops (Mengistu et al., 2003; Tabor and Yesuf, 2012). This is despite existence of favorable climatic and agro-ecology in the highlands of Ethiopia for the production of cool season vegetable seeds (Asredie et al., 2008).

#### **c. Limited and irregular supply of quality vegetable seeds and propagating materials**

The supply of seed potato, sweet potato cuttings for planting and seeds of onion, hot pepper and tomato is often done by research centers and through community-based seed production supported by NGOs and externally funded projects. This often results in limited and irregular supply of quality vegetable seeds and propagating materials.

#### **d. Limited extension services for vegetable seed production**

There is inadequate capacity and low attention given to extension services for vegetable seed promotion and consequently vegetable production. As a result, a number of farmers in the study areas and extension agents do not even know the name of the vegetable varieties commonly grown in the study areas.

#### ***iv. Inefficient seed importation and distribution system***

The importation and distribution of most vegetable seeds to farmers is through general agricultural product importers and exporters, local traders/sub-agents, and NGOs having no technical knowledge about seed and seed storage facilities. Importers are also constrained by shortage of foreign currency to import vegetable seeds regularly. This results in shortage and irregular seed supply and high seed price.

#### ***v. High post-harvest losses***

Post-harvest losses of vegetables is high primarily because of poor post-harvest handling, storage structures and transportation facility as well as poor market linkage and market information in rural areas, including the study areas.

#### ***vi. High incidence of diseases and insect pests***

Diseases and insect pests are causing huge losses because there are no alternative resistant varieties and the same variety is being used for long years ( $\geq 5$  years), poor crop protection practices on the part of the farmers and low capacity of bureaus of agriculture to provide services in crop protection.

#### ***vii. Poor vegetable marketing and value chain development***

Smallholder farmers in the rural areas are often poorly linked to market and do not adequately access market information. Often middlemen do make good business in vegetable market than producers, limiting the motivation of farmers to expand vegetable production with high input use such as fertilizers and pesticides. Vegetable value chain is not developed. How the farmers' margin can be increased should also be better understood.

***Viii. Weak linkage and integration among stakeholders***

Although there are many public, private, NGOs and development partners working across the entire value chain of vegetable seed system as well as production and marketing, there is low degree of linkage and integration. As a result, there lack of complementation and synergy among the efforts to develop the horticulture development, including vegetable seed system in Ethiopia.

## 4. Conclusions and Recommendations

### 4.1 Conclusions

Vegetable production plays crucial role in the Ethiopia economy. It also has got due policy attention from the government. As a result there is steady increase in vegetable production over the last years. Much of the increased production comes as a result of area expansion and increase in small scale irrigation, enabling two or more production/year. But the implementation of the policy on seed system development, variety development, seed multiplication and distribution and quality control is weak or lacking. The vegetable seed system is mainly based on informal system where farmer saved seeds are used for own production for some of the vegetables for which improved varieties are not available. Research released varieties are disseminated through intermediate systems through which varieties are demonstrated, multiplied and distributed by groups of farmers or motivated private farmers. This community-based seed system is not subject to proper quality regulation.

Moreover, despite the presence of the seed law and quarantine measures, the quality assurance and seed certification for vegetable seed is inexistent as the bulk of vegetable and root and tuber crops seed comes from the informal and imported, and then distributed without check up for quality. In other words, the seed standard and certification system is not in place to regulate the quality of seeds and planting materials of those economically important horticultural crops, including vegetable seeds, seed potatoes and sweet potato cuttings for planting.

The national research system is playing significant role in variety development, variety promotion and seed supply for such vegetable crops like onion, potatoes, pepper, and tomato and to a limited extent garlic and shallot. However, cool season vegetable crops such cabbage, carrot, beet root, carrot, lettuce and Swiss Chard are not given due attention largely due to limited access to germplasm as well as low technical capacity and capability to work on these vegetables. As a result the bulk of seed for these vegetables is imported by parastatal enterprises and private companies. The extent of such import is increasing at increasing rate over the last decade, showing the potential for investing in vegetable seed production, processing, marketing and distribution in Ethiopia. Plant breeding capacity is virtually lacking for important vegetables like kale, Ethiopian mustard, and pumpkin. For the cool season crops increasing number of private companies are registering varieties after adaptation test, followed by seed import for registered commercial varieties such as tomato, onion, and cabbage, suggesting increasing private invest in vegetable seed system

Vegetables are integral part of the farming system in Ethiopia. They are grown as sole or intercropped, rainfed or irrigated. High value vegetables which are also susceptible to disease during the rainy seasons are preferably grown in the irrigated system during the dry season. This also provides opportunity for supplying vegetables to the market at relatively higher prices. Vegetables are produced for consumption, sales (mainly), medicinal and social values. The largest portion of most of vegetables are sold. The demand for vegetables is also growing, implying the need for concerted effort to improve productivity through sustainable supply of high yielding vegetable varieties. Currently, farmers use seed variety which they just found in the market as they lack alternatives. The knowhow of varieties is low with farmers and even with development agents who technically support farmers. Most farmers also replace varieties after many years (more than 3-5 years) conditioned on availability, yield potential, disease resistance, taste, price or demand for the product. The replacement procedure seems not based on scientific

grounds but based on farmers perceptions. Thus, the actual yield is much lower than the potential yield of vegetables. Biotic and abiotic factors affecting vegetable production have been identified.

Vegetable marketing is also constrained by lack of market information, poor market linkage, low institutional support, lack of value chain development to benefit the smallholders, etc. The marketing system for vegetable seed seems relatively better organized than the output market. It is therefore necessary to look into the whole vegetable system development applying value chain development approach.

#### **4.2 Recommendations for intervention for vegetable sector development**

This scoping study has shown that there are a number of opportunities and constraints influencing the development of vegetable seed system and vegetable production and marketing in Ethiopia. Based on field study in selected study areas and reviewing existing literature, the following interventions are recommended in order to fully exploit the opportunities and minimize the outstanding challenges. It is believed that implementing the suggested interventions will enhance the supply of quality vegetable seed, which will substantially contribute to increased productivity.

- i. Strengthen the vegetable seed quality control and assurance system to ensure inspection and certification of vegetable seeds. This calls for developing the capacity and capability of the seed regulatory systems of the Federal Ministry of Agriculture and regional bureaus of agriculture, including seed laboratories in the country.
- ii. Increase research capacity and capability for germplasm and variety development of major vegetable crops. The neglected traditional vegetables such as kale and Ethiopian mustard need to be given due attention in terms of germplasm and variety development and seed production.
- iii. Build upon initiatives of the NARS for cool season vegetable seed production in the highland parts of the country by identifying suitable locality, season of planting and developing seed production guidelines so that interested investors will seize the opportunity
- iv. Enhance both public and private engagement in vegetable technology generation, seed multiplication, marketing and distribution in order to fully exploit the climatic and agro-ecological factors suitable for vegetable production in the country and meet the export demand for fresh vegetables. There is special need to develop seed system (from germplasm and variety development to seed marketing and distribution) for vegetable crops in Ethiopia. This calls for transformation of the seed supply system from informal to more formal type through system establishment and capacity development.
- v. Promote public-private partnership among NARS, international vegetable research and development centers, and commercial vegetable breeding and seed companies in order to access germplasm and commercial varieties for such important vegetables like kale, pumpkin, cabbage, cauliflower, carrot, beetroot and Swiss chard
- vi. Finalize regional seed harmonization so that variety registration and seed import-export between Ethiopia and eastern African countries can easily take place.
- vii. Develop clear regulation and directives for registration of commercial varieties by private investors so that more number of varieties of different vegetable crops can be introduced and produced in the country

- viii. Organize clear guidelines for the importation and distribution of quality vegetable seed to meet demand adequately
- ix. Strengthen the quarantine measure to minimize introduction of disease, insect pests and noxious weeds
- x. Improve the technical knowledge and skill of farmers and development agent in vegetable production, seed promotion and crop protection measures by providing trainings in improved production and use of quality inputs.
- xi. Expand further irrigation facility and focus on economic use of irrigation water by shifting from flood and furrow irrigation to drip and sprinkler irrigation methods.
- xii. Increasing public and private sector investment in irrigated vegetable production to increase the supply of vegetable, which in turn will increase the demand for vegetable seed.
- xiii. Develop improved and affordable storage structures to prolong shelf life and minimize post harvest losses and perishability.
- xiv. Build the capacity of farmers cooperatives/unions to engage more on vegetable seed production and marketing. Address their capacity limitations. This also requires integrating them into the vegetable value chain so that the margin of the farmers could improve. This action benefits from more knowledge generation in the vegetable value chain and capacity constraint studies.
- xv. It appears that the database of the zones and districts are based on estimates. Establishing vegetable production database and sharing mechanism is suggested.

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## Annexes:

### Annex A1: Potential Areas for Vegetable Production in Ethiopia.

Vegetable production is booming in Ethiopia because of expansion of small scale irrigation and increasing demand both for local and export market. The following areas are known for their major vegetable Production

1. Rift Valley areas in East Shewa Zone of Oromia
2. East and West Harerge Zones of Oromia (export to Djibouti and Somalia)
3. West Shewa Zone of Oromia, Particularly for potato
4. Gurge and Hadiya Zones of SNNPR
5. West and East Gojam Zones of Amhara
6. North Welo Zone of Amhara
7. Northern Zone of Tigray, particularly for potato

## Annex 1: Data Collection Instruments

### 1.1 Checklist for Development Agents

#### 1. Identifiers

- a. Name of the respondent: \_\_\_\_\_
- b. Location/District: \_\_\_\_\_ PA/Kebele \_\_\_\_\_
- c. Age of the respondent: \_\_\_\_\_
- d. Institutional affiliation and service years of the respondent \_\_\_\_\_ & \_\_\_\_\_
- e. Sex of the respondent: [ ] Male [ ] Female
- f. Education level of the respondent: [ ] 6th grade or less [ ] 7th to 12 grade [ ] certificate [ ] diploma [ ] first degree

#### 2. Production of vegetables and seed source in the area:

Vegetables	Produced? Yes=1; No=2	Rank of dominance for the top 5 vegetables	Common Production system (sole=1; intercropped=2)	Sources of seed (own=1; market=2; Coop/union=3; MoA=4; research=5; NGO=6; others=7)	Main Purpose for growing (consumption=1; sales=2; both=3)
Tomato					
Cabbage					



Vegetables	Produced? Yes=1; No=2	Rank of dominance for the top 5 vegetables	Common Production system (sole=1; intercropped=2)	Sources of seed (own=1; market=2; Coop/union=3; MoA=4; research=5; NGO=6; others=7)	Main Purpose for growing (consumption=1; sales=2; both=3)
Kale					
Onion					
Garlic					
Hot pepper					
Sweet Pepper					
Cauliflower					
Green beans					
Beet root					
Swiss-chard					
Lettuce					
Carrot					
Eggplant					
Cassava					
Ethiopian mustard					
Okra					
Pumpkin					
Sweet potato					

3. For the top 5 ranking vegetables, list major support/s you provide to vegetable growers

No.	Top 5 Vegetables	Assist in Production activities/practices (1)	Assist input delivery (2)	Provide market information (3)	Other supports (list)
1					
2					

3. How do the various supports you provided in vegetable production manifested?

- Improved productivity
- Increased land coverage/production
- increased participants in the sub-sector
- adoption of new varieties

[ ] No significant change

4. Rating role of women, children and men engagement at various stages of vegetable business

Group	Rate of engagement at various stages of vegetable business				
	Nursery management less=1; average=2; high=3	Transplanting less=1; average=2; high=3	After care (irrigation, Weeding, Cultivation) less=1; average=2; high=3	Harvesting less=1; average=2; high=3	Marketing less=1; average=2; high=3
Women					
Children					
Men					

Values of top 5 vegetables in the area (list under each)

No.	Top 5 Vegetables	Nutritional value	Medicinal value	Religious value	Social value
1					
2					
3					

8. Major constraints of vegetable production in your area

Top 5 vegetables	Abiotic				Biotic			
	Moisture related	Market	Perisheability (high post harvest loss)	Others (list)	Diseases	insects	Weeds	Others (list)
1.								
2.								

10. Explain the farming system that involves vegetables. What are the cropping pattern that involve vegetables?

For the top 5 ranked above, discuss the following questions.

11. Explain the channel of seed flow (from source to the farmer). Who are the chain actors?

12. What purposes of vegetable production are done in the area? Distinguish those mainly produced for consumption, those mainly produced for sales.
13. Who are the buyers of vegetable products?
14. Explain the marketing channel of vegetables (possibly show the share of the different buyers)

## 1.2 KII for Vegetable Experts

### 5. Identifiers:

- a) Name of the respondent: \_\_\_\_\_
- b) Age of the respondent: \_\_\_\_\_
- c) Sex of the respondent:  Male  Female
- d) Education level of the respondent:  6th grade or less  7th to 12 grade  certificate  diploma  first degree  second degree
- e) Current occupation and office of the Respondent: \_\_\_\_\_ & \_\_\_\_\_
- f) Marital status of the respondent  married  single  widowed  divorced
- g) Location/District : \_\_\_\_\_ City/town \_\_\_\_\_

### 6. Which vegetable crops are commonly grown in your area (you may provide rank based on production)

Vegetables	Produced? Yes=1; No=2	Rank of dominance for the five top vegetables	Common Production system (sole=1; intercropped=2)	Sources of seed (own=1; market=2; Coop/union=3; MoA=4; research=5; NGO=6; others=7)	Main Purpose for growing (consumption=1; sales=2; both=3)
Tomato					
Cabbage					
Kale					
Onion					
Garlic					
Hot pepper					
Sweet Pepper					
Cauliflower					
Green beans					
Beet root					
Swiss-chard					
Lettuce					

Carrot					
Eggplant					
Cassava					
Ethiopian mustard					
Okra					
Pumpkin					
Sweet potato (leaf)					

7. Major constraints in Vegetables production and Marketing in your area

No.	Top 5 Vegetables	Lack of know how in production and use (1)	Lack of the required inputs (land) (2)	Lack of improved inputs such as seed (3)	Less emphasis to the subsector (4)	Lack /unsatisfactory R&D in the area (5)	Others (list)
1							
2							

8. Replacing varieties in vegetable farming/business?

No.	Top 5 Vegetables	How often varieties replaced: < 2 years = 1; in 3-5 years = 2; in 6-9 years = 3 ; in > 10 years= 4	Reasons for replacing the varieties: market preference/demand =1; price (low) =2; Susceptibility to disease and other factors =3; availability = 4; R & D/ technology push =5; other reason/s (List)
1.			
2.			

3. How do you evaluate the effectiveness of vegetable seed certification process in Ethiopia?

effective  not effective  I have no idea  other comment: \_\_\_\_\_

4. Which channel for information dissemination about newly developed improved varieties of vegetable crops is more appropriate and why?

Agricultural Research Centers  NGOs  Private investors  media (public)  farmers to farmers

Other: \_\_\_\_\_

**Reasons**

:

\_\_\_\_\_

\_\_\_\_\_

5. Extent of improved varieties use in your area ( in view of potential and in comparison with other areas) and the reasons if the extent is unsatisfactory

No.	Top 5 Vegetables	Satisfactory = 1, Unsatisfactory = 2	Reasons for unsatisfactory use
1			1. 2.
2			

**6. Major production constraints (mark for each crop) of vegetable crops**

Top 5 vegetables	Abiotic				Biotic			
	Moisture related	Market	Perisheability (high post harvest loss)	Others (list)	Diseases	insects	Weeds	Others (list)
1.								
2.								

7. Any other comment for the growth of vegetable business (production and marketing) in your area \_\_\_\_\_  
\_\_\_\_\_

**1.3 KII for Traders**

**1. Identifiers**

- a. Name of the respondent: \_\_\_\_\_
- b. Location/District: \_\_\_\_\_ Town \_\_\_\_\_
- c. Age of the respondent: \_\_\_\_\_
- d. Institutional affiliation and service years of the respondent \_\_\_\_\_ & \_\_\_\_\_
- e. Sex of the respondent: [ ] Male [ ] Female
- f. Education level of the respondent: [ ] 6th grade or less [ ] 7<sup>th</sup> to 12 grade [ ] certificate [ ] diploma [ ] first degree

**2. Vegetable crop and seed market in your area (City/town)**

	Vegetable crop (output) market	Vegetable seed Market

Vegetables	Commodity traded? Yes=1; No=2	Rank of dominance (1=most dominant, 2= second, etc.	Destination market (Local=1; Central=2 export =3 )	Proportion (%) to Destination market			Seed Source Local (home) = 1; External (import) = 2; Both = 3 (for top 5)	Supply condition Shortage = 1; Surplus = 2; Balanced =3 (for top 5)
				Local	Central	export		
Tomato								
Cabbage								
Kale								
Onion								
Garlic								
Hot pepper								
Sweet Pepper								
Cauliflower								
Green beans								
Beet root								
Swiss-chard								
Lettuce								
Carrot								
Eggplant								
Cassava								
Ethiopian mustard								
Okra								
Pumpkin								
Sweet potato (leaf)								

3. For Top 5 Vegetables, ask estimated quantity traded by this trader in qt. Average buying price? Average selling price?
4. How many such traders operate in the market? At least estimate.
5. If you are seed supplier who are your suppliers?  
 local market/shops  central market (Addis)  research center  Cooperatives  import  other source: \_\_\_\_\_
6. Type of seeds of vegetable varieties you commonly trade?  improved  local  both
7. What determines the extent of supply of the variety commonly available on market?  
1=[  ] price 2=[  ] demand 3=[  ] productivity (performance) 4=[  ] Availability 5=[  ] other reason \_\_\_\_\_

8. Are the seeds you trade certified by certification body? 1=  Yes 2=  No 3.  I have no idea
9. How do you evaluate the market trend for vegetable seed **demand** over the past 2-5 years  
 1= Increasing 2= no change 3= Declining
10. If declining (Q7) what are the underlying factors?  
 1= availability 3= cost  
 2= decline of demand 4= other factor \_\_\_\_\_
11. How do you evaluate the market trend of vegetable produces?  
 1= Increasing 2= no change 3= Declining
12. If declining (Q9) what are the underlying factors  
 1= Low production (area) coverage  
 2= Low productivity (yield)  
 3= Low market incentive  
 4= Lack/shortage of improved seed  
 5= other factor \_\_\_\_\_

For the top 5 ranked above, discuss the following questions.

- 13. Explain the channel of seed flow (from source to the farmer). Who are the chain actors?
  - 14. What purposes of vegetable production are done in the area? Distinguish those mainly produced for consumption, those mainly produced for sales.
  - 15. Who are the buyers of vegetable products?
  - 16. Explain the marketing channel of vegetables (possibly show the share of the different buyers)
- 
- 17. What are the major bottle necks of vegetable business/trade?
    - Seed: \_\_\_\_\_
    - Product: \_\_\_\_\_
- 
- 27. What are the opportunities and Threats in vegetable business in your area
    - a. Opportunities \_\_\_\_\_
    - b. Threats : \_\_\_\_\_



**1.4 KII for Cooperatives/unions**

1. Identifiers Date: \_\_\_\_\_

- a. Name of the coop/coop union: \_\_\_\_\_
- b. Location of the coop/coop union: \_\_\_\_\_
- c. District: \_\_\_\_\_ Kebele: \_\_\_\_\_

2. What is the service coop/coops union provide to the vegetable production sub-sector.

- Input supply (seed, fertilizer, chemicals)
- Buy and sale vegetable crops
- provide assistance in marketing and production
- other \_\_\_\_\_

3. If you have role in vegetable seed supply

Vegetables	Rank the vegetable seeds the coop supplies	Quantify the seed supplied for the last season (kg)	Type of variety for which seed was supplied Local =1, Improved =2	Seed source for the coop (where did you buy)? 1= local market, 2 =central market, 3 = Research center, 4 = other coop , 5 = import	Direct seed customer (to who do you sell)? 1= farmers, 2= traders 3= others	Selling price (Birr/unit, specify unit)
Tomato						
Cabbage						
Kale						
Onion						
Garlic						
Hot pepper						
Sweet Pepper						
Cauliflower						
Green beans						
Beet root						

Vegetables	Rank the vegetable seeds the coop supplies	Quantify the seed supplied for the last season (kg)	Type of variety for which seed was supplied Local =1, Improved =2	Seed source for the coop (where did you buy)? 1= local market, 2 =central market, 3 = Research center, 4 = other coop , 5 = import	Direct seed customer (to who do you sell)? 1= farmers, 2= traders 3= others	Selling price (Birr/unit, specify unit)
Swiss-chard						
Lettuce						
Carrot						
Eggplant						
Cassava						
Ethiopian mustard						
Okra						
Pumpkin						
Sweet potato (leaf)						

4. Seeds of which vegetable varieties does the coop/coops union usually carries in vegetable business?

Vegetables	List the name of varieties for the 5 top vegetables in the order of importance
Tomato	
Cabbage	
Kale	
Onion	
Garlic	
Hot pepper	
Sweet Pepper	
Cauliflower	
Green beans	
Beet root	
Swiss-chard	
Lettuce	

Vegetables	List the name of varieties for the 5 top vegetables in the order of importance
Carrot	
Eggplant	
Cassava	
Ethiopian mustard	
Okra	
Pumpkin	
Sweet potato (leaf)	

5. What is the reason to carry the variety preferred above?  
 1=[ ] profitable      2=[ ] easily accessibility /availability      3=[ ] has high demand      4=[ ]  
 other:\_\_\_\_\_
6. Are the seeds you supply certified by seed certification body?  
 1= [ ] Yes    2=[ ] No      3=[ ] I have no idea
7. From where does the coop/coops union get information about newly developed improved varieties of vegetable crops?  
 1=[ ] Agricultural Research Centers    2=[ ] NGOs    3= [ ] Private investors    4=[ ] media  
 5=[ ] Other:\_\_\_\_\_
8. How do you rate the vegetable seed demand by your customer  
 1= [ ] very low      2= [ ] low      3= [ ] medium    4= [ ] high      5= [ ] very high
9. What does the Seed demand/ supply trend shows over the last 5 years?  
 1= [ ] showed increasing trend    2=[ ] showed decreasing trend    3=[ ] Showed no change

### 1.5 Checklist for Focus Group Discussion

**Participants: 8-10 Producers of vegetables in each selected kebele;**

1. Identifiers      Date:\_\_\_\_\_

- a. Location/District: \_\_\_\_\_ PA/Kebele \_\_\_\_\_
- b. List of participants and gender: \_\_\_\_\_
- c. No. of households in the PA? \_\_\_\_\_
- d. Average area under crop per household in the PA= \_\_\_\_\_ ha
- e. Average area under vegetables production (total) per household in the PA= \_\_\_\_\_ ha

2. Production of vegetables and seed source in the area:

Vegetables	Produced? Yes=1; No=2	Rank of dominance (1=most dominant, 2= second, etc	Production system (sole=1; intercropped=2 )	Average area allocated per HH (ha)	Source of seed (own=1; market=2; Coop/union=3; MoA=4; research=5; NGO=6; others=7)	Purpose for growing (consumption=1; sales=2; both=3)
Tomato						
Cabbage						
Kale						
Onion						
Garlic						
Hot pepper						
Sweet Pepper						
Cauliflower						
Green beans						
Beet root						
Swiss-chard						
Lettuce						
Carrot						
Eggplant						
Cassava						
Ethiopian mustard						
Okra						
Pumpkin						
Sweet potato (leaf)						

3. Proportion (%) of vegetable consumed \_\_\_\_\_; sold \_\_\_\_\_

4. Proportion of seed supply by source (own saving \_\_\_\_\_ ; market \_\_\_\_\_; Coop/union \_\_\_\_\_; MoA \_\_\_\_\_ research centers \_\_\_\_\_; NGO \_\_\_\_\_; others \_\_\_\_\_)

5. For the top 5 ranking vegetables, ask the following

No.	Top 5 Vegetables	Variety preferred (list)	What are the criteria for choice of variety (fast growing; disease resistance, color; size, taste, high price; high yield, less perishability, availability, know how, others?) list and explain
1			
2			

6. For the top 5 ranking vegetables, ask the following

No.	Top 5 Vegetables	% of HHs growing	Amount of seed needed (kg/ha)	Seed price (Birr/kg)	Yield (qt/ha)	Producers output (Birr/qt)
1						
2						

7. For the top 5 ranking vegetables, what category of the society involve in the production?

No.	Top 5 Vegetables	Based on wealth status (1= rich; 2=poor; 3= all)	Gender (1= Female; 2=Male)	Social status (1= marginalized; 2= any social group; 3=leaders; 4=elites)
1				
2				

8. For the top 5 ranking vegetables, ask the following.

- a. Any support obtained for vegetable farming (*choice of varieties, sources and use of varieties, performance condition, market information*)
- b. Support Providers : *DAs , other farmers, NGOs, research institutions ....( availability and reliability)*

c. Inputs and sources **in the production of vegetable seed**

- i. Vegetable varieties used (*improved, local*) (*extent in each category for the last season*)
- ii. Sources of basic seeds (*farm saved; market: local, central, import; research centers, coops/coops union, neighbor....*) *and relative contribution of the various sources- qualitative/relative figures*
- iii. Problems with seeds (*price, quality, availability*) *and use (user friendly/complete package)*
- iv. Problems related to seed suppliers (*availability/access, consistency, reliability*)
- v. Practice and possibility of changing varieties (*how often, reasons: market, yield, disease .....*)
- vi. Knowledge and use of seeds passed through seed certification procedure

d. Possible causes of vegetable loss (Quality and quantity) in production stage

**9. Post harvest handling techniques you apply (write down the specifics)**

No.	Top 5 vegetables	Sorting (how?)	Grading (which grades?)	Packing (how?)	Washing (yes/No)	Curing (Yes/No)
1						
2						
3						

**8. Major production constraints of vegetable production in your area**

Top 5 vegetables	Abiotic			Biotic		
	Moisture related	Market	Perisheability (high post harvest loss)	Diseases	insects	Weeds
1.						
2.						

9. Seed Marketing (for the top 5 vegetables):

- a) Distance to the nearest market/town (*Walking time.....*) *where seed is purchased?*
- b) Type of seed supplied (improved/high yielding or local)

- c) Who are involved in seed production? (*smallholder, investors, union/cooperatives, research centers, FTCs*)
- d) Who are the seed chain actors?
- e) What are the roles/functions of the seed chain actors (producers, traders, processors) Explain?
- f) where does the seed come from? Draw the seed marketing channel and specify the routes.
- g) what percent of the seed comes from where?
- h) what percent of the seed is handled by each supplier?
- i) Possible causes of loss (Quality and quantity) in marketing.

10. Value of top 5 vegetables in the area (list under each)

No.	Top 5 Vegetables	Nutritional value	Medicinal value	Religious value	Social value
1					
2					
3					

### 1.6 Secondary data collection format

#### A: Secondary Data Collection from Districts (Please fill for the selected district)

Region: \_\_\_\_\_ Zone: \_\_\_\_\_ District: \_\_\_\_\_

Date data recorded: \_\_\_\_\_

No. of kebeles in the District: \_\_\_\_\_

No. of kebeles where vegetable is cultivated: \_\_\_\_\_

Irrigated area in the district: \_\_\_\_\_ ha

Area covered by vegetables in the district: \_\_\_\_\_ ha

#### 1. Area and production of major vegetables by district during the last production season (Rainfed and irrigated)

Vegetables	Area- rainfed (ha)	Production-rainfed (qt)	Area- irrigated (ha)	Production-irrigated (qt)
Tomato				

<b>Vegetables</b>	Area- rainfed (ha)	Production-rainfed (qt)	Area- irrigated (ha)	Production-irrigated (qt)
Cabbage				
Kale				
Onion				
Garlic				
Hot pepper				
Sweet Pepper				
Cauliflower				
Green beans				
Beet root				
Swiss-chard				
Lettuce				
Carrot				
Eggplant				
Cassava				
Ethiopian mustard				
Okra				
Pumpkin				
Sweet potato (leaf)				
Others that one may come across				

**2. Amount of seed used for the production of vegetables**

- Farmers' cultivars (**FCs**): List by name, original source, how long it has been under cultivation with a farmer (Please give us document on these or give expert opinion)



Vegetables	Amount of vegetable seed demanded (kg)	Amount of vegetable seed supplied (kg)	Vegetable seed-used last one year-rainfed (kg)	Vegetable seed used during last one year-irrigated (kg)	Seed price-rainfed (Birr/kg)	Seed price-irrigated (Birr/kg)	Variety used (OPV/HVs) with original source: (1=Research, 2=Farmers, 3=Imported)
Tomato							
Cabbage							
Kale							
Onion							
Garlic							
Hot pepper							
Sweet Pepper							
Cauliflower							
Green beans							
Beet root							
Swiss-chard							
Lettuce							
Carrot							
Eggplant-African							
Eggplant -Exotic							
Cassava							
Ethiopian mustard							
Okra							
Pumpkin							
Sweet potato (leaf)							
Others that one may come across							

3. Total fertilizer applied to vegetable plots (last production season): \_\_\_\_\_qt urea; \_\_\_\_\_qt DAP

4. Total pesticides/fungicide/herbicide applied to vegetable plots: \_\_\_\_\_kg power and \_\_\_\_\_lt liquid \_\_\_\_\_birr

5. Constraints in production including financial accessibility, technology constraint, etc for each crop (Please give us any document on these or give expert opinion). Please explain

**B: Secondary Data Collection at Zone level**

---

**1. Area and production of major vegetables by district during the last production season (Rainfed and irrigated)**

Vegetables	Area- rainfed (ha)	Production- rainfed (qt)	No. of districts the vegetable grows in	Area- irrigated (ha)	Production- irrigated (qt)	No. of districts the vegetable grows in
Tomato						
Cabbage						
Kale						
Onion						
Garlic						
Hot pepper						
Sweet Pepper						
Cauliflower						
Green beans						
Beet root						
Swiss-chard						
Lettuce						
Carrot						
Eggplant						
Cassava						
Ethiopian mustard						
Okra						
Pumpkin						
Sweet potato (leaf)						
Others that one may come across						

## 2. Amount of seed used for the production of vegetables

- Farmers' cultivars (FCs): List by name, original source, how long it has been under cultivation with a farmer (Please give us document on these or give expert opinion)

Vegetables	Amount of vegetable seed demanded (kg)	Amount of vegetable seed supplied (kg)	Vegetable seed- used last one year-rainfed (kg)	Vegetable seed used during last one year-irrigated (kg)	Seed price-rainfed (Birr/kg)	Seed price-irrigated (Birr/kg)	Variety used (OPV/HVs) with original source: (1=Research, 2=Farmers, 3=Imported)
Tomato							
Cabbage							
Kale							
Onion							
Garlic							
Hot pepper							
Sweet Pepper							
Cauliflower							
Green beans							
Beet root							
Swiss-chard							
Lettuce							
Carrot							
Eggplant-African							
Eggplant -Exotic							
Cassava							
Ethiopian mustard							
Okra							
Pumpkin							
Sweet potato (leaf)							

<b>Vegetables</b>	Amount of vegetable seed demanded (kg)	Amount of vegetable seed supplied (kg)	Vegetable seed- used last one year-rainfed (kg)	Vegetable seed used during last one year-irrigated (kg)	Seed price-rainfed (Birr/kg)	Seed price-irrigated (Birr/kg)	Variety used (OPV/HVs) with original source: (1=Research, 2=Farmers, 3=Imported)
Others that one may come across							

3. Total fertilizer applied to vegetable plots (last production season): \_\_\_\_\_qt urea; \_\_\_\_\_qt DAP
4. Total pesticides/fungicide/herbicide applied to vegetable plots: \_\_\_\_\_kg power and \_\_\_\_\_lt liquid \_\_\_\_\_birr
5. Constraints in production including financial accessibility, technology constraint, etc for each crop (Please give us any document on these or give expert opinion). Please explain

**Annex 2: List of FGD participant community members by sex**

Zone	District	Kebele	Sr. No	Name	Sex
West Shewa	Ambo	Gosu-Kora	1.	Asfaw Hordefa	Men
			2.	Tadesse Talila	
			3.	Megersa Kassahun	
			4.	Deressa Dandena	
			5.	Workine Dendena	
			6.	Olana Kenea	
			7.	Mamo Bedada	
			8.	Nigussie Likassa	
			9.	Tessema Gadissa	
			10.	Tolessa Merga	
			1	Tayitu Ulfeta	Women
			2.	Buguli Abdissa	
			3.	Kuneshi Fufa	
			4.	Adanech Taddese	
			5.	Kennatu Mulisa	
			6.	Woyinshet Megersa	
			7.	Chorqitu Iddessa	
			8.	Gadissa Tolera	
			9.	Bekelu Tolesa	
West Shew	Toke Kusaye/ Guder	Nega File	1.	Keneni Gemechu	Women
			2.	Workitu Lelisa	
			3.	Mamitu Gelalcha	
			4.	Shibere Milkessa	
			5.	Belaynesh Dhaguma	
			6.	Worki Fekane	
			7.	Mestawot Abay	
			1	Gutema Geleta	Men
			2	Tesfaye Gutema	
			3	Mulisa G/Mariam	

Zone	District	Kebele	Sr. No	Name	Sex		
			4	Abera Tafese			
			5.	Abebe Degefa			
			6.	Tolesa Dandena			
			7.	Mulugeta Tadesse			
Yem special- district	Yem special- district	Tachignaw Keshele	1	Habtamu Bezabih	Men		
			2	Fitsame G/mariam			
			3	W/Yesus Gashe			
			4	Alemu Sanbi			
			5	Gebre G/Mariam			
			6	Tikimu Eshetu			
			7	Mulu Roba			
			8	Mekonon Gezmu			
				1.	Adanech Bulga	Wom en	
				2	Wubitu W/Mariam		
				3	Wubalem W/Senbet		
				Saymafo	1	Felekech Godesa	Women
					2	Bogalech Gashe	
					3	Amarech Kidane	
					4	Aberash Musa	
					5	Biranesch Habte	
					6	Eshelech W/Giorgis	
					7	Aberash Gelaye	
					8	Felekech Gisa	
					9	Terefech Muras	
			1	Shegute Gojam	Men		
			2	Tezazu W/Yesus			
			3	Eliyas Gashe			
			4	Mulatu G/Michael			
			5	Wondimu Rago			
			6	Halile Habte mariam			
			7	W/Giorgis Sori			
			8	Tenahun W/Yesus			
			9	Birhanu Sidan			

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Zone	District	Kebele	Sr. No	Name	Sex	
			10.	Fikadu Mecha		
Gurage	Meskan	Inseno Usme	1	Zekiyu Badurga	Men	
			2	Kuraz Elmeto		
			3	Kedir Shifa		
			4	Mulugeta Sadano		
			5	Kemal Hasan		
			6	Mulune Legesse		
			7	Amare Demeke		
			8	Tamene Ferenja		
			9	Musa Badurga		
			10	Nigussie Tadesse		
			1	Bederiya Nuri	Women	
			2	Rukiya Negash		
			3	Felekech Mustefa		
			4	Meselech Atecho		
			5	Meselech Ashenafi		
			6	Gete Zikargashew		
			7	Kedija Kemal		
			8	Lela Awel		
			9	Jemila Bedewe		
			10	Rukiya Jemal		
			Yimer Wacho 3rd	1	Mulunesh Ahimed	Women
				2	Amarech Ashenafi	
				3	Asegash Bonsa	
				4	Shewaye Doba	
				5	Belaynesh Hussien	
				6	Mule Denboba	
				7	Gudise Abera	
				8	Hulager Tesfaye	
				9	Beletech Kifle	
				10.	Beshu Muhudi	
		1	Beharu Lilato	Men		
		2	Tesfaye Dejene			

Zone	District	Kebele	Sr. No	Name	Sex				
			3	Geremu Lejato					
			4	Abege Tegene					
			5	Tuna Shemsu					
			6	Heliso Lire					
			7	Damto Kufa					
			8	Teshome Gebru					
			9.	Gutema Obse					
			10.	Bilkat Dejene					
			Hadiya	Anlemo		Layignaw Fonko	1	Buzna Egero	Men
							2	Tumsi-do Tuluro	
3	Melese Fitebo								
4	Erwaro Abdela								
5	Lamebo Erda								
6	Alemayo Wondimu								
7	Tariku Asfaw								
8	Derilo Lamancho								
9	Erdelo Lonsenko								
10	Abinet Lire								
Layignaw Fonk	1	Amarech Lanpiso			Women				
	2	Abebech Yasin							
	3	Abebech Hisa							
	4	Alemitu Mikoro							
	5	Alemitu Kibamo							



## Annex 3: Tabulated Results

### Annex 3.0: List of seed companies with their contact addresses

Name of Seed Company	Type	Contact person	e-mail	Telephone
Ethiopian Seed Enterprise	Public	Dr. Tafes Geberu	Tafesse004@yahoo.com	0911511553
Oromia Seed Enterprise	Public	Mr. Kédir Nefo	kedirnefob@gmail.com	0913645254
Amhara Seed Enterprise	Public	Dr. Abera		0918341591
South Seed Enterprise	Public	Mr. Debebe Gashawbeza	gashdebebe@yahoo.com	0911942318
Greenlife Trading	Private, seed agent	Mr. Derese Fikru	Derede.fikru@gmail.com	0911841371
Markos	Private, seed importer	Mr. Markos		0111273319
AISCO	Parastatal, seed importer	Mrs. Sebele	aiso@ethionet.et	0114425628
ETFRUIT	Parastatal, seed importer	Mrs. Sebele		0115517005 0115519192
Ethiopian Seed Growers and Processors Association	Association	Mr. Melaku Admassu	Melaku.Admassu@pioneer.com	0911238754
Ajmu Import Trading Enterprise	Private Seed importer	Mrs. Leula		0111110388
JITTU HORTICULTURE PLC	Private Seed importer	Mrs. Enat		0116189313
CHEMTEX PLC	Private Seed importer			011 5519557 0115532033
Meki Batu Union	Cooperative union, seed producer	Tewlde Fekremariam		0221180408 0221181054
ELFORA AGRO-INDUSTRIES PLC	Private, seed importer			0116450361
Zi-Andata	Private Seed Producer	Mr. Tariku		0911214753
Ethio Agr-CEFT		Mr. Kebede Made/Adane	Email: ethioagriceft@ethionet.et info@ethioagriceft.com	0116615572 0912 617747
Segel General Trading PLC	Private, seed importer			011 1571660
Upper Awash Agro-industry Enterprise	Parastatal, seed importer	Mr. Girma Bayu		0114423000 0912170738

**Annex 3.1: List of vegetables, potatoes and sweet potatoes released by the national agricultural research system of Ethiopia, 1980-2012**

Vegetable crop	No	Variety	Year of release	Releasing Institution
Tomato	1	ARP tomato d2	2012	EIAR/MARC
	2	Chali	2007	EIAR-MARC
	3	Cochoro	2007	EIAR-MARC
	4	Miya	2007	EIAR-MARC
	5	Laku	2006	OARI-BARC
	6	Woyno	2006	ARAR- SRARC
	7	Mersa	2006	ARARI- SRARC
	8	Sirinka I	2006	ARARI- SRARC
	9	Bishola	2005	EIAR-MARC
	10	Fetan	2005	EIAR-MARC
	11	Eshet	2005	EIAR-MARC
	12	Metadel	2005	EIAR-MARC
	13	Melkashola	1998	EIAR-MARC
	14	Melkasalsa	1998	EIAR-MARC
Pepper (Capsicum spp.)	1	Melka Shote	2006	EIAR-MARC
	2	Melka Awaze	2006	EIAR-MARC
	3	Oda Haro	2005	OARI-BARC
	4	Melka Zala	2004	EIAR-MARC
	5	Melka Dima	2004	EIAR-MARC
	7	Melka Eshet	2004	EIAR-MARC
	8	Mareko Fana	1984	EIAR-MARC
	9	Bako local	1984	OARI-BARC
	Onion	1	Nafis (Franciscana)	2011
2		Nasik Red	2004	EIAR-MARC
3		Adama Red	1980	EIAR-MARC
4		Melkam (Pusa Red)	1998	EIAR-MARC
Shallot	1	Minijar	2009	EIAR-DZARC
	2	Yhera	2005	EIAR-MARC
	3	Negele	2004	EIAR-DZARC
	4	Huruta	1997	EIAR-MARC
Garlic	1	Kuriftu	2010	EIAR-DARC
	2	Qoricho	2006	OARI-SARC
	3	Bishoftu Netch	2000	EIAR-DARC
	4	Tseday	2000	EIAR-DARC
Lettuce	1	Tesfa/Maya	2012	TARI-MARC
Snap bean	1	BC4.4	2012	EIAR-MARC
Sweet Potato	1	Tola	2012	OARI-BARC
	2	Ma`e	2010	EIAR-WARC

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Vegetable crop	No	Variety	Year of release	Releasing Institution
	3	Jari	2008	ARARI- SRARC
	4	Birtukanie	2008	ARARI- SRARC
	5	Barkume	2008	Haramaya University
	6	Adu	2007	Haramaya University
	7	Balo	2006	OARI-BARC
	8	Dimtu	2005	OARI-BARC
	9	Ordollo	2005	SARI-AwARC
	10	Kerso	2005	SARI-AwARC
	11	Tulla	2005	SARI-AwARC
	12	Kulfo	2005	SARI-AwARC
	13	Temesgen	2004	SARI-AwARC
	14	Beletech	2004	SARI-AwARC
	15	Belela	2004	SARI-AwARC
	16	Awassa-83	1998	SARI-AwARC
	17	Budo	1997	SARI-AwARC
	18	Falaha	1997	SARI-AwARC
	19	Kudadie	1997	SARI-AwARC
	20	Damota	1997	SARI-AwARC
	21	Bereda	1997	SARI-AwARC
	22	Guntutie	1997	SARI-AwARC
	23	Koka 12	1990	SARI-AwARC
Sweet potato	24	Koka 6	1990	SARI-AwARC
Yam	1	Lalo	2012	OARI-BARC
	2	Bulcha	2012	OARI-BARC
	3	Aw-004/00	2010	SARI-AwARC
Taro ( <i>Colocasia esculenta</i> )	1	Kiyag	2005	EIAR-JARC
	2	Boloso-1	2004	EIAR-JARC
	3	Denu 33/79	2000	EIAR-JARC
Cassava	1	Qulle	2005	SARI-AwARC
	2	Kello	2005	SARI-AwARC
Potato	1	Milki	2012	OARI-SARC
	2	Moti	2012	OARI-SARC
	3	Bubu	2011	Haramaya University
	4	Belete	2009	EIAR-HARC
	5	Dancha	2009	SARI-AwARC
	6	Kulumsa	2007	EIAR-KARC
	7	Hundee	2006	OARI-SARC
	8	Ararsa	2006	OARI-SARC
	9	Gudanie	2006	EIAR-HARC
	10	Gabbisa	2005	Haramaya University

Vegetable crop	No	Variety	Year of release	Releasing Institution
	11	Shonkolla	2005	SARI-AwARC
	12	Bulle	2005	SARI-AwARC
	13	Challa	2005	Haramaya University
	14	Mara Charre	2005	SARI-AwARC
	15	Gera	2003	ARARI-ShARCA
	16	Gorebela	2002	ARARI-ShARCA
	17	Guasa	2002	ARARI-AdARC
	18	Jalenie	2002	EIAR-HARC
	19	Degemegn	2002	EIAR-HARC
	20	Zemen	2001	Haramaya University
	21	Bedessa	2001	Haramaya University
Potato	22	Zengena	2001	SARI-AwARC
	23	Chirro	1998	Haramaya University
	24	Wechecha	1997	EIAR-HARC
	25	Awash	1991	EIAR-HARC
	26	Alemaya 624	1987	Haramaya University

Source: Adapted from MoA, 2012

### Annex 3.2: Area under vegetable production in the study districts (ha)

Vegetables	Ambo (west Shewa)			Guder (west Shewa)			Yem			Meskan (Gurage zone)			Anlemo (Hadiya)			Total			
	Rainfed	Irrigated	Total	Rainfed	Irrigated	Total	Rainfed	Irrigated	Total	Rainfed	Irrigated	Total	Rainfed	Irrigated	Total	Rainfed	Irrigated	Total	% irrigated
Tomato	83	181	264	85	1,113	1,198	-	80	80	30	336	366	200	652	852	398	2,362	2,760	85.6
Cabbage	145	218	363	135	307	442	12	17	29	33	257	290	185	495	680	510	1,294	1,804	71.7
Kale	-	-	-	-	-	-	-	61	61	100	489	589	220	610	830	320	1,160	1,480	78.4
Onion	155	62	217	160	339	499	4	16	20	50	419	469	190	381	571	559	1,217	1,776	68.5
Garlic	150	133	283	126	32	158	14	17	31	21	17	38	5	4	9	316	203	519	39.1
Hot pepper	105	12	117	99	36	135	-	4	4	2,207	165	2,372	-	-	-	2,411	217	2,628	8.3
Beet root	100	58	158	100	77	177	18	18	36	25	78	103	104	204	308	347	435	782	55.6
Swiss-chard	-	-	-	-	-	-	-	-	-	5	15	20	-	91	91	5	106	111	95.5
Lettuce	-	-	-	-	-	-	-	0	0	5	7	12	-	-	-	5	7	12	58.4
Carrot	106	63	169	96	18	114	19	16	35	18	64	82	110	215	325	349	376	725	51.9
Ethiopian mustard	-	-	-	-	-	-	25	-	25	-	-	-	-	-	-	25	-	25	0.0
Pumpkin	-	-	-	-	-	-	-	-	-	20	-	20	-	-	-	20	-	20	0.0
Sweet potato	-	-	-	272	46	318	60	85	145	14	12	26	-	-	-	346	142	488	
Potato	390	439	829	492	661	1,153	253	183	436	30	81	111	-	224	224	1,165	1,588	2,753	57.7
Leek	98	201	299	-	-	-	-	-	-	-	-	-	-	-	-	98	201	299	67.3
Total	1,332	1,367	2,699	1,565	2,629	4,194	405	496	901	2,558	1,940	4,498	1,014	2,876	3,890	6,874	9,308	16,182	57.5

**Annex 3.3: Quantity of vegetables produced in the study district (ton)**

Vegetables	Ambo (west Shewa)			Guder (west Shewa)			Yem			Meskan (Gurage zone)			Anlemo (Hadiya)			Total			
	Rainfed	Irrigated	Total	Rainfed	Irrigated	Total	Rainfed	Irrigated	Total	Rainfed	Irrigated	Total	Rainfed	Irrigated	Total	Rainfed	Irrigated	Total	% irrigated
Tomato	340	1,084	1,424	1,702	9,576	11,278		964	964	600	7,810	8,410	3,040	10,106	13,146	5,682	29,541	35,223	84
Cabbage	479	1,089	1,568	2,334	1,832	4,166	162	166	328	660	5,798	6,458	3,256	8,910	12,166	6,891	17,795	24,685	72
Kale								476	476	2,000	9,316	11,316	4,686	13,185	17,871	6,686	22,977	29,663	77
Onion	353	416	769	2,397	2,923	5,320	52	183	235	1,250	9,078	10,328	1,786	3,620	5,406	5,838	16,219	22,057	74
Garlic	540	775	1,315	596	226	822	189	176	365	189	225	414	38	36	74	1,552	1,437	2,989	48
Hot pepper	735	22	757	137	248	385				1,391	2,185	3,576				2,263	2,455	4,718	52
Beet root	350	28	378	1,086	512	1,598	221	150	372	450	1,831	2,281	1,726	3,468	5,194	3,834	5,989	9,823	61
Swiss-chard										95	198	293		1,547	1,547	95	1,745	1,840	95
Lettuce										95	105	200				95	105	200	52
Carrot	345	242	586	660	159	820	226	118	344	360	775	1,135	1,815	3,655	5,470	3,406	4,949	8,355	59
Ethiopian mustard							10		10							10		10	-
Pumpkin										12	#VALUE!	12				12		12	-
Sweet potato				1,362	417	1,779	759		759	350	256	606				2,471	673	3,144	21
Potato	2,730	9,891	12,621	5,907	5,022	10,929	4,934	520	5,454	750	717	1,467		5,152	5,152	14,320	21,302	35,623	60
Leek	659	1,275	1,933													659	1,275	1,933	66
Total	6,530	14,820	21,350	16,181	20,917	37,098	6,553	2,752	9,306	8,202	38,293	46,495	16,347	49,678	66,026	53,813	126,460	180,274	70

**Annex 3.4: Yield of vegetables in the selected districts of the study districts (ton/ha)**

Top 5 vegetables	Guder	Ambo	Yem	Meskan	Anlemo	All districts
Tomato	9.7	6.6	17.4	36.0	20.0	19.2
Cabbage	11.6	10.0	21.5	40.0	25.0	21.6
Kale	-	-	40.0	26.7	8.5	22.8
Onion	15.0	7.0	-	30.7	3.2	17.4
Garlic	-	3.0	5.6	-	-	3.9
Hot pepper	13.0	-	-	10.7	-	11.6
Beet roots	-	6.0	18.4	-	16.0	15.0
Carrot	-	-	14.7	-	-	14.7
Sweet potato	17.0	-	-	-	-	17.0
Irish Potato	-	8.0	20.9	30.0	4.0	17.9

Source: FGD with community members

**Annex 3.5: Proportion of vegetables sold in the study area as stated by different informants (%)**

Vegetable Type	DAs	FGDs	Experts	Average
Tomato	79.63	83.46	91.67	84.92
Cabbage	78.13	82.50	75.00	78.54
Kale	61.43	67.78	16.67	48.62
Onion	82.13	83.75	83.33	83.07
Garlic	72.50	84.78	72.73	76.67
Hot pepper	79.13	75.25	50.00	68.13
Sweet pepper	66.25	70.00	33.33	56.53
Green beans	-	98.00	-	32.67
Beet roots	80.00	87.33	91.67	86.33
Swiss chard	81.00	90.00	87.50	86.17
Lettuce	84.67	90.00	75.00	83.22
Carrot	83.50	88.45	90.91	87.62
Eth-mustard	74.29	65.67	62.50	67.48
Pumpkin	76.43	70.45	27.27	58.05
Sweet potato	81.00	68.57	33.33	60.97
Potato	77.14	66.25	55.56	66.32