

Opportunity, Problems and Production Status of Vegetables in Ethiopia: A Review

Research Article

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Abstract

Vegetables provide an abundant and inexpensive source of energy, body-building nutrients, vitamins and minerals. This review paper was aimed to recognize opportunities, constraints and potentials in Ethiopia for production of vegetables. Major opportunities and potentials existing in the country for production of vegetables were reviewed and described. Policies and incentives of the government to attract both foreign and domestic investors engaged in vegetable production were found to be attractive. Ethiopia has a comparative advantage in production of horticultural commodities on account its favorable climate, proximity to European and Middle Eastern markets and cheap labor. Low cost, disciplined and trainable Labor force and the size of its domestic market and the numerous river basins affording great potential for irrigation. The status of vegetable production including indigenous one and consumption in the country yet need further improvement. Recently, despite of the ups and downs observed, the demand for vegetables especially for export is increasing. In general, the drawback to this sector in Ethiopia mainly include social and cultural habits of the population like cereal based food habit, dietary preferences for meat and other animal products, and distaste for vegetable crops, lack of consumer awareness, economic reasons of the local consumers, absence of nutrition intervention programme using vegetables. However, due to perishable nature and biological nature of vegetables production process, vegetables productions are risky investment activities. The constraints of horticultural production including vegetables production could be categorized in to Farmer related, institutional, natural and infrastructure related factors.

Keywords: Production; Opportunity; Constraints; Vegetable

Introduction

A group of crops known as “vegetables” consists of more than 200 plant species all over the world as cited by Haile, 2014 [1]. Various types of vegetable crops are grown in Ethiopia under rain-fed and/or irrigation systems [2]. The major economically important vegetables include hot and sweet peppers (*Capsicum spp.*), Ethiopian mustard/kale (*Brassica carinata*), onion (*Allium cepa*), tomato (*Solanum lycopersicum*), chili (*C. chinense*), carrot (*Daucus carota*), garlic (*A. sativum*) and cabbage (*B. oleracea var. capitata*). According to the Ethiopian Investment Agency, green beans (*Phaseolus spp.*) and peas (*Pisum sativum*), okra (*Abelmoschus spp.*), asparagus (*Asparagus officinalis*), cauliflower (*B. oleracea var. botrytis*), broccoli (*B. oleracea var. italica*), celery (*Apium graveolens L.*), eggplant (*S. melongena*)

and cucumbers (*Cucumis sativus*) have also recently emerged as important export vegetables [3].

In 2013 for example, Ethiopia exported 220, 213 tons of vegetables and generated USD 438 million [4]. Ethiopia has favorable climate and edaphic conditions for the production of tropical, sub-tropical and temperate vegetables in the lowlands (<1500 meters above sea level), midlands (1500-2200) and highlands (>2200), respectively [5]. A serious challenge to human survival, particularly in the developing world, is the ever growing gap between human population and food supply. Growing and using wild vegetables is an opportunity that has never been adequately prospected to alleviate malnutrition and ameliorate food insecurity. Hundreds of edibles including many vegetables of wild/semi-wild origin are known to be sporadically

consumed by rural communities in Ethiopia [6]. Ethiopia is among the lowest income country in the world with an average per capita income of a merely USD 180. It is also much less than the average per capita income for Sub-Saharan Africa (i.e., USD 450). For decades both rural and urban poverty in Ethiopia has remained pervasive and ever deepening, despite of considerable macroeconomic stability achieved following the policy reforms of mid-1990s.

A vegetable is not a new sector in Ethiopia as the production of these crops has been undertaken for decades. The sector comprises large state farms supplying fruits and vegetables to the local market and for exports. There are few private companies involved in the production of vegetables mainly for the European market. In addition, there are numerous small producers growing a small range of vegetables for the local and regional export market. Apart from tropical fruits and few selected vegetables like onions, cabbage and tomatoes, local demand for horticultural produce is minimal [7]. The World Health Organization Estimate that low fruit and Vegetable intake contributes to approximately 2.7 million deaths a year from chronic disease and causes about 31% of ischemic heart diseases and 11% of strokes worldwide. It ranks low fruit and vegetable intake as the sixth main risk factor for mortality in the world [8]. The currently population of 80 million people in Ethiopia is expected to double within the next 30 years. Almost 80% of the population lives in the country side while the rest situated in urban area. An estimated five million people suffer from lack of vitamins and essential minerals, of which 80% are children [9]. With a population of over 70 million people, 44% of whom fall under the basic needs poverty line and a GDP which is 1/5 of the sub-Saharan African average, Ethiopia is one of the poorest countries in the world sited by Dereje, et al. [10].

In the overall, WHO places low vegetable consumption among its twenty risk factors in global mortality, just behind the better known killers such as tobacco use and high cholesterol level. Health workers often advise people to increase vegetable consumption, but many people cannot afford to buy vegetables or the inputs required to grow them. Whereas the role of wild leafy vegetables in food security is recognized in other African countries. However, rural Africans still hold indigenous knowledge about wild vegetables Modern agricultural systems have succeeded in providing calories, but in the process, they have increased 'hidden hunger' (micronutrient malnutrition) by displacing edible local plants. The economy of the country predominantly depends on agriculture, which contributes about 50% to the total GDP and 90% of export items of which horticultural crops are the leading component.

According to official statistics sited by EDRI, the proportion of the urban population under food poverty (those persons whose food expenditure per adult equivalent was less than the food poverty line) was estimated at 47% in 1999/00 compared to 41% in rural areas. Vegetable crops are valuable sources of vitamins, minerals and proteins especially to a country like Ethiopia where the people experience malnutrition due to heavy dependence on cereals such as tef (*Eragrostis tef*), maize (*Zeamais*), wheat and other cereals. The current investment policy in the country are favorable for expansion and diversification of vegetable crops both in the production and marketing sectors for export and foreign exchange earnings [9].

Several studies in the past and present have established that vitamin A deficiency is a major public health problem in Ethiopia, as elsewhere in developing countries. the fact that micronutrient status in general and vitamin A status in particular is strongly linked to vegetables/ fruits availability and consumption in developing countries. It is estimated that over 80% of vitamin A in developing countries is supplied by fruits and vegetables [11]. The objective of this paper is to Access the opportunity, problems and production status of vegetable in Ethiopia.

Definition and concept of vegetables

The term vegetable is used to describe the caring edible shoot, leaves, fruits and root of plants and spices that are consumed whole or in part, raw or cooked as a supplement to starchy foods and meats cited by Haile, 2014. Vegetables are also described as those plants, which are consumed in relatively small quantities as a side dish with the staple food. However, Vegetables are important food varieties within the human diet because they provide nutrients like vitamins and minerals and also the bulk of roughage the body desires and which are usually lacking in most traditional staple foods.

Classification of vegetables

Distinguishing vegetables in line with the part consumed is a method of classifying vegetables. According to the part consumed (character) vegetables can be described as follows as cited by leafy vegetables: the leaves and juicy young shoots are picked for consumption [1]. Examples are, lettuce, cabbage, bitter leaf, water leaf, jews mallow and fluted pumpkin, Fruit vegetables: This contains of young, immature unripe fruits or mature ripe fruits of plants grown as vegetables. Examples are tomato, pumpkin, watermelon and chilli pepper, Seed vegetables: This group is important for the seed produced. Examples are Egusi melon and Ito melon, Root vegetables: Such as sweet potato, carrot, and radish are grouped in this area and Spices: Important for their flavor and color in foods such as chilli pepper, onion, garlic, and basil. Principles and practice of vegetable productions.

According to Sacks and Silk, there are some principles needed in the production of vegetable crops, which are very important and well known to the producers. These principles are: Production of vegetables does not involve a long- time investment as does in the woods of citrus, mango or cashew, vegetable growers/farmers don't seem to be sure to produce the same crop every year like his counterparts, who grow fruit crops, vegetable growing lacks the stability which is systematically developed over a period of years like an orchard thus, getting into vegetable production is a fast process and getting out may even be faster, Vegetables can be grown by people with limited experience. Only skillful farmers keep going their vegetable production, the land for production of vegetable crops is flexible and adjustable. It is much easier for vegetable growers/farmers to vary production from one crop to another than for fruit crop grower, cooperative efforts and organizations are somewhat more difficult with vegetable crop producers than fruit growers are. Vegetable/grower/farmers have no long period for making plans. Vegetable production is seasonal and vegetable production requires more intensive production management per unit area and time.

Therefore, having those advantages vegetable growing makes more beneficiaries to the urban growers as well as urban economy.

Importance of vegetable

In fact, vegetables can generate high income for the farmers because of high market value and profitability. They also have high nutritive value compared to cereals as cited by kumilachew, et al. [12,13]. As urbanization increases, the need for sufficient food also increases. The opportunity to grow and/or acquire food produced locally, therefore, becomes a critical component in surviving in the city. It is well known that cultivating vegetable crops is the most common agricultural activity by the urban crop producers [1]. It is well known that cultivating vegetable crops is the most common agricultural activity by the urban crop producers.

Vegetables have lots of protective compounds like Cheratin in bitter gourd is effective against diabetes and most of the leafy vegetables and pumpkin are the rich source of beta carotene, They provide higher quantity of food per unit area, Vegetables gave more farm income than other crops, The cropping intensity in vegetable growing is very high as compared to others. Normally 3-4 vegetable crops can be raised in one year. Vegetables have high export potential. 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 [14,15].

Vegetables constitute also source of cash income for the households and an opportunity to increase smallholder farmers' participation in the market [2]. 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 [16]. The increasing development of the horticulture industry and the intensive production practices of horticultural crops are creating employment opportunity, especially for women and youth.

Vegetable Production and Its Status in Ethiopia

Cultivation zones

In a country like Ethiopia, where the amount, timing and distribution of rain fall is irregular, use of irrigation would significantly improved and raise the level of production [1]. Commercial horticultural crop production is carried out mainly in the central rift valley and eastern part of the country. Most of the vegetables and fruit produced in the eastern region are exported to Djibouti and small amounts of fruit and vegetables are also exported to Europe, Pakistan, Saudi Arabia and Yemen [17]. Vegetables are grown in different parts of the country both in commercial quantity as well as small volumes by private farmers and other operators engaged in the business. Small scale production is concentrated in Hararghe (eastern high land parts) and the central high lands, whilst large commercialized cultivations are widely spread in the low land zones, mainly following the Awash and Gibe/Omo rivers. As sited by Ethiopian-Netherlands Horticulture Partnership [7].

According to a recent study made by Ethiopian Export Promotion Agency, the major fruits and vegetables growing areas of the country are summarized as follows;- East Hararghe (eastern part of the country, i.e, Alemaya and Kombolcha districts in Oromia Regional State), with vegetables dominating, East Shewa (Central Ethiopia in Oromia Regional State) produces both fruits and vegetables including tomato, green beans, orange, mandarin, papaya, etc, Ethiopian-Netherlands Partnership: Agenda Fruits & Vegetables 10 West Shewa (Central Ethiopia in Oromia Regional State) which is good for producing tomato and mango fruits, among others. Arsi (central Ethiopia in Oromia Regional State), particularly in the Awash River basin which is known for its various types of fruits and vegetables, GamoGoffa (Southern Nations, Nationalities and Peoples Regional State), particularly Woliata and Sidama zones, are good producers of banana, avocado, pineapple, papaya and other types of fruits and vegetables in various districts. Dire Dawa and Harari (Eastern Ethiopia) are also well known production and supply areas of both fruits and vegetables. Tigary and Amhara regions.

Indigenous vegetables provide food security and sustainable food production

The status of vegetable production including indigenous one and consumption in the country yet need further improvement as cited by Dendana [9,18]. On the other hand, Ethiopia is well known for its diversity of indigenous food plants, including vegetables. The cultivated vegetables are mainly grown by traditional farmers in home gardens, although some are grown in fields and along field margins. About 27% of the crop species cultivated in home gardens in Ethiopia, many of them indigenous, are used as vegetables as cited by Dendana [18]. Traditional vegetables do not figure very prominently in modern crop research and conservation programmes rather marginalized in modern agriculture and receive no special attention. The vegetable resources of Ethiopia can be developed through a strategy of complementing and augmenting traditional practices with modern scientific approaches [18]. Ethiopia has vast genetic diversity of plant species including important Indigenous Vegetables (IVs) even though they are not consumed properly due to the reason that they are not exhaustively investigated so far. Ethiopia has vast genetic diversity of plant species including important Indigenous Vegetables (IVs) even though they are not consumed properly due to the reason that they are not exhaustively investigated so far. There has been no visible effort made to introduce/domesticate new food materials in our country. Potentially use of IVs by the community has been indicated among which *Corchorus olitorius* in Afar region, *Moringa oliferain* South Nation Nationality People Region (SNNPR) and *Coccinia abyssinica* in Wollega areas are a good examples. It has not planned to study the potential and possible opportunities of IVs as food source. Those IVs are usually referred to as "wild foods" or "famine foods".

International Development Enterprise (IDE) has recently introduced vegetable production in some parts of the Ethiopian highlands but these are on a small-scale mainly to promote increased household consumption due to the need for irrigation facilities as a pre-requisite for production in this agro-climatic zone. Similar to most other countries, two groups of vegetables could be distinguished

in Ethiopia: Globally important vegetables. The major ones identified from both farms and the markets and discussions with stakeholders are: Chili, head cabbage, garlic (in the Highlands), onions, tomatoes, carrots, beetroot, lettuce, sweet pepper, cucumber, celery etc. Indigenous vegetables: The main indigenous vegetable identified was the local kale. Others such as African eggplant, African nightshade and amaranth are not grown in the country and may be difficult to promote as per existing import permit restrictions. Historically, leafy indigenous vegetables in Ethiopia are by perception a poor man's food. This is however changing due to (i) increased awareness of the nutritional benefits of vegetables especially in urban areas, (ii) increased promotion of the health benefits of vegetables in controlling non-communicable diseases, and (iii) increased price of red meat which traditionally forms a major component of the Ethiopian diet [19]. Additional details of vegetable value chains in Ethiopia are available from value chain studies conducted by IDE and were shared with the team by the IDE Country Director for Ethiopia.

Share of vegetable production in Ethiopia

The agricultural sector accounts for 55% to the Gross Domestic Product and provides 85% of employment. Vegetable production and consumption is relatively limited. Vegetable small-scale farmers, who account for 90% of the agricultural output, cultivate an estimated 96% of total cropped land. In the country, vegetable crops are produced in different agro-ecological zones through commercial as well as small farmers both as a source of income as well as food. However, the type is limited to few crops and production is concentrated to some pocket areas [12]. As in alternative urban areas of the world happen, vegetable is produced in Ethiopian urban areas. In all cities of the nation, different types of vegetables for different purpose (either for commercial or direct consumption), are producing vegetable producers living near to urban centers largely practice vegetable farming. As most vegetables are not commonly practiced by the rural private peasant growers, the small volume of production recorded as well evidenced by the results of agricultural sample survey, 2012. vol. I. [1]. Ethiopia has a variety of vegetable crops grown in different agro ecological zones produced through commercial as well as small farmers each as a source of financial gain as well as food. However, the sort is restricted to few crops and production is concentrated to some pocket areas. In spite of this, the production of vegetables varies from cultivating a few plants in the backyards for home consumption up to a large-scale production for domestic and export markets as sited by Haile.

According to the CSA 453,608.8 ha of land is under vegetable in Ethiopia, in general. Accordingly the study estimated that an annual production of 18,124,613.5 quintal was estimated from vegetable by the same year [1,20]. Vegetables took up about 1.43% of the area under all crops at national level (urban and rural). However, Of the total estimated area under vegetables, the lion share which is about 70.89% and 18.07% was under Red peppers and Ethiopian Cabbage, respectively (ibid). Production of vegetables contribute 2.95% of the total crops production, conversely, of the total production of vegetables, the above mentioned crops have the lions share, i.e. about 37.14% and 43.53%, in that order all over the country. However, the nation doesn't have policy regarding urban agriculture [1].

Small-scale and large scale vegetable producers

The number of small-scale producers involved in horticulture is estimated at 5.7 million farmers as sited by Ethiopian-Netherlands Horticulture Partnership [7,21]. Few smallholder farmers are engaged in out grower's arrangements. After the establishment of farmers association unions, like Mekibatu and Alemaya, in the rift valley and eastern part of the country respectively, approximately 600 farmers are supplying their products (tomato, onion, potatoes) to the unions under contractual agreements. The union supplies the out-growers with inputs like seed and fertilizer and sometimes pesticides.

Area under vegetables production and market availability

The area under vegetables increased from 350,600 ha with production of 2.36 million tons in 2010 to 396,510 ha with production of 4.48 million tons in 2013 for smallholder farmers as cited by Amsalu [20,22-24]. While the CSA, 2015 indicates that the production from area of 201,332.14 ha, produce 7,444,46.83 tones of vegetable. This implies that the area cultivated to vegetables increased by 13% while the production increased by 103%, between 2010 and 2013. The area under vegetable production and the quantity produced by medium and large scale commercial state and private farms also showed an increasing trend during the reference period. Similarly, export of vegetables increased from 37,210 tons valued at USD 163.86 million in 2003 to 220,210 tons valued at USD 437.5 million in 2013, representing 709% increase in export volume and 167% in revenue [4,22]. According to CSA, the area under all vegetables grown by smallholder farmers increased from 351,000 ha in 2010 to about 397,000 ha in 2013 in Ethiopia, representing an increase of about 16%. Total production also increased by 87.5%, from about 2.4 million tons in 2010 to about 4.5 million tons in 2013 (Figure 1) [25].

Region % age of cultivation and market availability of vegetable in Ethiopia: The proportion of households who did not produce/cultivate any vegetable was highest in Addis Ababa (99.7%), followed in Afar (94.9%), Dire Dawa (94.2%), Tigray (86.4%) and Harari (63.1%) regions (Table 1). In the overall, 41.5% did not produce any vegetable in nine regions studied. The proportion of households who did not produce any fruit over the year preceding the survey was highest in Addis Ababa (100%), followed in Dire Dawa (95.3%), Afar (92.9%), Tigray (92.2%), Harari (83.3%) and Oromiya (81.8%) regions. The weighted average for the nine regions was 75.5.

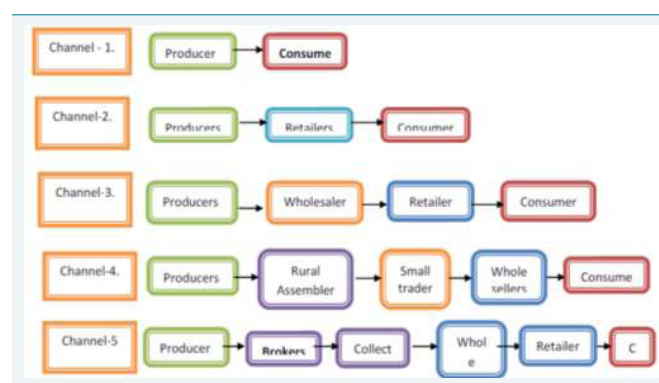


Figure 1: Market channel of vegetables (onion and tomato).

Table 1: Own production/cultivation and market availability situation of vegetables and fruits over the year preceding the survey by region, Ethiopia, 2006.

Region	N	Productive/Cultivation		Market availability	
		Not cultivated any vegetable	Not cultivated any fruit	Not seen any vegetable	Not seen any fruit
Afar	254	94.9	92.9	82.3	79.5
Tigray	295	86.4	92.2	15.6	67.0
Amhara	267	29.2	75.3	3.4	18.0
Addis Ababa	354	99.7	100	0.8	0.8
Oromia	136	50.0	81.8	2.1	14.8
SNNPR*	284	11.6	55.3	8.1	10.6
Benishangul Gumuz	300	25.3	55.0	1.7	7.3
Harari	287	63.1	83.3	20.9	13.9
Dire Dawa	275	94.2	95.3	11.3	11.3
Nine Reions	2552	41.5"	75.5"	15.3"	24.0"

Note: SNNPR = Southern Nations Nationalities and People's Region; **Nine regions proportions are weighed proportions source.

Vegetable Consumption Patterns in Ethiopia

Recently, despite of the ups and downs observed, the demand for vegetables especially for export is increasing as cited by Kumilachew, et al., [11,12]. In Ethiopia, there was no time when rural population has not been affected by drought, then food shortage which need alternative solution to overcome it [18]. Many at risk populations in developing countries are deficient in iodine, iron, and vitamin A making them more vulnerable to illness, fatigue, blindness, and memory loss and increasing the possibility of mental retardation among their children. This is true also in the case of Ethiopia mainly due to cereal based food habit is practicing and largely affect children's in most part of the country. Supplementation, food fortification, dietary diversification, nutrition education and food production are strategies that have been developed to reduce these micronutrient deficiencies and have, for the most part, demonstrated positive, though uneven, results. On the other hand, it has been reported that IVs are the cheapest source of vitamin A, C, minerals and fiber still people fail to consume enough to meet their nutrient requirement due to lack of knowledge in the nutritional value and production of those vegetables in the easiest way [18].

Traditional varieties of vegetables such as taro, yam and enchote are also grown but their production and consumption is declining. Among fruits, avocado, banana, orange, papaya and guava are common. Ethiopians consume on average 97 g of fruit and vegetables per day. Cereals contribute about 75% of the Ethiopian diet [17]. Fruit and vegetables are not common items in the Ethiopian diet. However the quantity consumed per person is still one of the lowest compared to the other countries even though price per kilogram in Ethiopia is the lowest of all countries [7]. The proportion of wild vegetables is known to be high and the degree of consumption varies from one socio-cultural setting to the other. Except in few cases of south Ethiopian communities and some others, consumption of underutilized edible plants, vegetables in particular, has often been looked upon as a sign of poverty; largely a reflection of lack of knowledge on their nutritional benefits. Fast regeneration of most vegetables under

limited soil moisture and availability of the perennial species all year round makes them capable of bridging the gap during food shortages and famine situations experienced by rural communities [6].

Based on the survey per capital consumption of the annual fresh production assorted vegetables is about 2.86 million tons. From the total volume of horticultural products 95% is fresh vegetable production. Overall, among all the index children studied in nine regions Ethiopia, 38.1% did not eat any of the common vegetables (kale, spinach, cabbage, carrot, tomato and pumpkin) over the week preceding the survey. The proportion of index children who did not eat any vegetable was high in Afar (85.0%), Tigray (77.6%), Amhara (61.8%) and Addis Ababa (59.3%) and relatively low in SNNPR 2 (7.0%), Dire Dawa (15.6%) and Oromiya (18.6%). Among all the children studied in nine regions, 36.5% did not eat any of the common fruits (mango, papaya, oranges, avocado and banana) over the week preceding the survey. The proportion of index children who did not eat fruits was high in Tigray (88.1%) and Afar (83.5%) and was relatively low in Harari (23.3%).

Opportunities for Vegetable Production in Ethiopia

The Government of Ethiopia, in recognition of the role of the private sector in the economy, has revised the investment law over three times for the last twenty years to make it more transparent, attractive and competitive. Major positive changes regarding foreign investments have been introduced through investment Proclamation No.280/2002 and Regulations No.84/2003. As a result of the implementation of the above mentioned policies and strategies, agricultural and industrial production, investment and export trade are growing steadily from year to year both in terms of variety and volume [26].

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 use.

Increasing registration of commercial vegetable varieties in Ethiopia

As it is 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.

Cost of Land and Utilities

According to EIA, in Ethiopia, land is public property [3].

Both urban and rural land is available for investment on leasehold basis. Lease right over land can be transferred, mortgaged or sub-leased together with on-build facilities. The period of lease may also be renewed. The rental value and the lease period of rural land are determined and fixed by land use regulations of each regional state. The costs of rural land in four regional states and in Dire Dawa are shown below:

- Oromia.....US\$ 4.02 - 7.71 per hectare per year
- Amhara.....US\$ 6.34 - 28.45 per hectare per year
- Southern Nation, Nationalities and People Region.....US\$ 2.17 - 6.68 per hectare per year.

Transport

Road plays a vital role in transporting people and goods in Ethiopia. Cognizant of its cardinal role, the Government has identified the road sector as top priority for public investment and remarkable progress has been made in the expansion of the road network in the country [3].

Road transport

Addis Ababa, the capital city, is an important regional and international transport hub. The road network radiates from Addis Ababa to regions linking it with important cities, towns and other economically active centers of the country. International highways also link Addis Ababa and other cities and towns with neighboring countries such as Kenya, Djibouti, Eritrea, Somalia, the Sudan and South Sudan. In 2008/09, the total road network, excluding community roads, reached 46,812 km, out of which 45% are Federal roads and the remaining 55% are rural roads with annual growth rate of 5.5%. Based on the classification of the road network, about 21,172 km are in the Federal network, asphalt road constituted 33% and gravel road 67%. All-weather rural road grew by 7.1% per annum constituting 25,640 km of the total road network in 2008/09. In the same year, the community road, non-engineered road, was 85,767 km [27]. About 71,000 km of new roads, including all-weather roads to virtually all kebele administrations and an expressway linking Addis Ababa to Adama (a key route to facilitate export and import trade) are constructed. Constructing 2,395 km of new railways linking Addis Ababa with Djibouti, linking selected domestic cities and within Addis Ababa [3].

Road transport is by far the most dominant means of transport in Ethiopia providing for over 90% passenger and freight carriage. Both asphalt and gravel roads radiate from Addis Ababa to main cities, towns and centers of commercial, industrial and agricultural activities. International highways also link Addis Ababa to neighboring countries like Djibouti, Kenya and the Sudan [28].

Air transport

Air transport is an important part of Ethiopia's transport network. Ethiopian Airline, Africa's World Class Airline, which has gained a very good reputation internationally in its 68 years of active services, provides both domestic and international air transport

services. It has an outstanding safety records and is one of the few profitable African airlines. Ethiopian services include both passenger and cargo transport in its international flights and domestic routes. It also provides training and maintenance services to more than a dozen other African and Middle Eastern airlines. Domestic flight services are provided through 17 destinations across the country. Ethiopian links the country with over 63 destinations worldwide including Brussels, Frankfurt, London, Paris, Rome, Stockholm, Washington DC, Bahrain, Bangkok, Beijing, Beirut, Dubai, Guangzhou, Hong Kong, Jeddah, Kuwait, Mumbai, Delhi, Riyadh, Sana'a, Tel Aviv, Johannesburg, Nairobi, Lagos, Lusaka, Accra, Dakar and many more big cities in Africa. It is also expanding its international services. Regarding Ethiopian cargo services, it operates over 40 cargo destinations spread across Africa, Europe, Asia and the Middle East via its hub - Addis Ababa and another cargo hub at Liege [27].

In addition to Ethiopian, other airlines have flight schedules from and to Addis Ababa and these include such airlines as Emirates, KLM, Lufthansa, Kenyan and others. The passenger terminal at Bole International Airport in Addis Ababa has new and modern facilities providing efficient services to passengers. Ultra-modern cargo terminal catering to fresh products and a maintenance hangar have also become operational since 2006. This new and modern terminal has the capacity to handle 350,000 tons of cargo per annum. Anticipating the future growth of perishable cargo, Ethiopian has proactively launched an expansion project to construct a new perishable cargo terminal that will be operational within the foreseeable future [27].

The Ethiopian Government has taken the policy initiatives for the development of the aviation sector in the country. The most significant initiative undertaken by the government is the opening up of air cargo service to foreign investors without any capacity limit and allowing Ethiopian nationals to provide chartered services using aircrafts with a seating capacity of up to 20 passengers [27].

Markets

Fresh and processed Fruits and vegetables have a large domestic market in Ethiopia, significantly higher than the exported volumes. The size of the Ethiopian population is currently estimated at about 80 million. This is a strong indication of the existence of large potential demand for fresh fruit and vegetable crops in the country. The other customer of Ethiopian fresh fruits and vegetables is processing plants, i.e., wineries, tomato processing plants and vegetable canning factories which require grapevine, tomato and various types of vegetables for processing. Processing of fruit juice into concentrate near the source of the fruit either for export markets or to the local manufacturers is also an area of investment available in the country [27].

Ethiopia exports fresh fruits and vegetables to the international markets. The major markets for Ethiopian fresh fruits and vegetables are the European Union, the Arab countries and the regional markets. Ethiopia is very well known in some parts of Europe especially for her green beans, climbing beans, cut flowers, okra, melon and passion fruits. Thus, there is a reliable demand for these Ethiopian products during a particular period and a great volume is re-exported. Therefore there is strong business image for Ethiopian vegetables and flowers in the European markets. The demand for Ethiopian wine is also high

both in domestic and export markets. Currently, the winery receives fresh grapes from Guder, Nura Era, Merti and Zewai Vineyard. Grape production in a great volume for the domestic winemaking plant is, therefore, an attractive area of investment in the country. Ethiopia is exporting the majority of its horticultural products to EU. However, it is exporting it high quality flowers, fruits vegetables to more than 100 market destinations throughout the world among which Netherland, Germany, Saudia Arabia, Norway etc [5].

Labour

Horticultural farming is high labour-intensive, requiring 32 to 34 laborers per hectare per day. Since Ethiopia has abundant supply of unskilled labor at Birr 20-30 (US 1.17- 1.76) per day.

The investment policy

To encourage private investment, the Ethiopian Government has developed a package of incentives under Regulations No.84/2003 for investors engaged in new enterprises and expansions, across a range of sectors. Foreign investors can invest alone or in partnership with domestic investors: No restrictions on equity ownership in Joint Venture (JV) Investment, Required to have investment permit from Ethiopian Investment Agency (EIA), Required to allocate minimum capital, USD 200, 000 for a single investment project USD 150, 000 for joint with a domestic investor USD and 100, 000 for technical consultancy if wholly owned or USD 50, 000 jointly with a domestic investor.

Investment incentives

According to, special loan is provided through the Development Bank of Ethiopia (DBE) and the bank has the following credit policy: Interest rate is fixed at 7.5% per annum. However, this could vary from time to time. The Bank shall give its clients maximum grace period that involves the period up to the commencement of operation. Maximum allowable grace period is fixed at three years. All fixed asset of the project shall be held as collateral or loan security of the project. The debt/equity ratio requirement shall be 70/30 for newly starting projects. However, for ongoing projects which include expansion of existing projects, ratio shall be 60/40. Loan repayment period is determined taking into account the profitability and debt servicing capacity of the borrowing concern as well as the economic life of major investment items, with the maximum repayment period of 10 years. Full repatriation of profits, dividends, principal and interest payments on external loan etc. out of Ethiopia in convertible currency [29].

The right to employ expatriate experts and management staff, bilateral investment promotion & Protection treaties with 30 countries, Double taxation avoidance treaties with 18 countries Customs duty exemption on imported capital goods, construction materials and spare parts worth up to 15% of the value of imported capital goods., Income tax exemption (2 to 9 years), Loss carry forward (for half of income tax exemption period), The incentive policy does not discriminate between domestic & foreign investors [26].

Climate

Ethiopia's agro-Climatic conditions make it suitable for the production of a broad range of fruits, vegetables as well as cut flowers.

The range of altitude, temperature and soil variability of the country has created an enormous ecological diversity and a huge wealth of biological resources. In other words the wide range of ecological conditions that prevail in the country have created a favorable habitat for diversified forms of life including plants, animals and microorganisms [28].

Water supply

Ethiopia has huge run-off and ground water potential. However, it utilizes a small portion of these resources [27]. Ethiopia is endowed with abundant water resources. A large number of rivers flowing on either side of the rift valley form a drainage network that covers most of the country. Most of the rivers that carry the water resources, however, end up in neighboring countries hence making them international or Trans boundary Rivers. The total surface water resources of Ethiopia, coming from the country's twelve river basins, are estimated to be in the order of 122 billion cubic meters per year [28]. The overall goal of the Water Resources Policy (WRP) is to enhance and promote all national efforts towards the efficient, equitable and optimum utilization of the available water resources for significant socio-economic development on a sustainable basis [30].

Considering water as a social and economic good, the principle of cost recovery, acceptance of the basin as a unit of planning, decentralized management, equitable and reasonable water allocation, capacity building and research and development are the most important concepts incorporated in the policy [30]. Overview of Ethiopian investment policy, 2013 aimed to expand the water supply infrastructure to cover 99% of the population and the drilling of some 3,000 water wells per year. Ethiopia has abundant annual rainfall and other significant water sources that with careful planning, infrastructure development and resources could be developed for irrigation and other development needs [31].

Rainfall

Rainfall is the ultimate source of water in Ethiopia, with surface water, ground water and other water sources fed by rain. To understand the country's irrigation potential, it is important to understand these water sources. Ethiopia has significant rainfall [31].

Surface water

Ethiopia has 12 river basins that provide an estimated annual run-off of ~125 billion m³, with the Abbay basins (in central and northwest Ethiopia) accounting for ~45 % of this amount. While much of this run-off could be used for irrigation or other purposes, Ethiopia has limited water infrastructure to use this surface water [31].

Ground water

Given the hydro-geological complexity and costs, Ethiopia has barely exploited its groundwater resources, especially for agriculture. Research in this area is relatively new and initial estimates of groundwater potential vary from 2.6 to 13.5 billion m³ per year. Local experts' advice and test drillings for pioneering projects suggest that the potential could be much higher. The preliminary ground water potential of Ethiopia based off of elevation, aquifer productivity and moisture availability.

Gains of Vegetable Production in Ethiopia

Eradicate extreme hunger and poverty

Fruits and vegetables generate more jobs per hectare, on-farm and off-farm, than staple based agricultural enterprises [32]. This benefits farmers and landless laborers in both rural and urban areas. Value addition to fruits and vegetables generates further employment in the associated agri-businesses and further down the commodity chain from the producer to the consumer. Vegetables can generate higher profits than staple crops, especially when land is relatively scarce and labor is abundant [33-36].

The value of vegetables per unit area is significantly higher than the value of the cereal crops. Although the costs of inputs such as labor can be higher, the profits are higher and the income thus generated can be used for many different purposes in terms of eradication of hunger and affording access to education and health care. Over two billion people suffer from micronutrient deficiencies through poor diets [37]. Fruits and vegetables are the most appealing and affordable sources of these micronutrients. Diet improvement increases a person's productivity, reduces health care related costs and therefore raises the productivity and incomes of the poor.

Supply vitamins and micronutrient to the consumer

Even though the farmers did not know the scientific justification regarding for eating Indigenous Vegetable (IVs), they related with health problems they face and relief they will get after consuming those vegetables. Among the micronutrient problem Ethiopia is facing now a day is vitamin A deficiency which can be related with poor nutrition problems as cited by Dendana [18]. Many research reports indicated that an estimated five million people are suffering from lack of vitamins and essential minerals. Rich foods to the most vulnerable groups which is a good opportunity to tack the problem and increase the production and consumption of potential Indigenous Vegetable. Lasting long solution to vitamin A deficiency problems in Ethiopia especially for children's rest on increasing the availability of vitamin A rich foods to the most vulnerable groups which is a good opportunity to tack the problem and increase the production and consumption of potential Indigenous Vegetable. In line with this, Indigenous Vegetable has the potential nutritional value and cheap source of vitamins like A, C and minerals such as iron, calcium and phosphorous [18]. Over the week preceding the survey by region, Ethiopia, 2006 (Table 2).

Comparative analysis of the situation regarding production, market availability and consumption of fruits and vegetables between predominantly urban areas (Dire Dawa, Addis Ababa and Harari) and predominantly rural areas (Amhara, SNNPR, Benishangul-Gumuz, Tigray, Oromiya and Afar) showed that significantly more rural households have produced/cultivated vegetables compared to urban households.

Contribution of vegetable production to sustainable livelihoods and Ethiopia economy

Vegetable production is an important economic activity in Ethiopia. The development of the vegetable sub-sector is one of the priority areas in the agricultural development strategy of Ethiopia

Table 2: Proportion of children who did not eat any of the common vegetables and fruits over the week preceding the survey by region, Ethiopia, 2006.

Region	N	Vegetable	Fruit
Afar	254	85.0	83.5
Tigray	295	77.6	88.1
Amhara	267	61.8	30.3
Addis Ababa	354	59.3	33.9
Oromia	136	18.6	28.0
SNNPR*	284	7.0	35.2
Benishangul Gumuz	300	38.3	41.3
Harari	287	35.5	23.3
Dire Dawa	275	15.6	31.6
Nine Reions	2552	38.1%*	36.5*

Note: *SNNPR = Southern Nations Nationalities and Peoples' Region; **Nine regions proportions are weighted proportions.

as cited by Amsalu et al., [22]. The agricultural productivity is low due to use of low level of improved agricultural technologies, risks associated with weather conditions, diseases and pests, etc. Moreover, due to the ever increasing population pressure, the landholding per household is declining leading to low level of production to meet the consumption requirement of the households [12].

With regard to horticultural production, 46% of the vegetable producing area is planted with potato followed by pepper and sweet potato vegetables can make a significant difference to smallholder livelihoods [17]. Vegetable production needs only a small area of land, with minimal capital outlay and can provide access to a valuable food under subsistence conditions, but also has the potential to provide an initial step towards establishing an income base for poorer households. Vegetables form a large and diverse commodity group: although they do not have botanical features in common, they generally share similarities in cultivation methods. Usually smallholders intensively cultivate vegetables in gardens, and promoting vegetables in gardens can help smallholders in a number of ways: It provides vegetables at a low cost; It provides a regular supply of vegetables; It's a more varied diet for the farm family; it can teach smallholders how to grow vegetables: test cultivation Practices carried out in a garden are less risky and less costly, than if vegetables were planted on a larger scale [38].

It allows for testing out vegetables that were never planted before; it can provide income from the sale of vegetables; It can provide gender employment and gender participation in economic activities; It can provide employment for the disabled and the elderly. However, even though home gardens provide advantages for smallholders, often they are seen as small and complicated for inclusion in development programmes. This requires appraising diverse and often location-specific economic, cultural and environmental conditions in traditional farming systems. However, policy-makers and advisors need to integrate vegetable gardens into development programmes and provide training and promotion for such initiatives [38]. Specifically speaking, the vegetable sector has become crucial source of employment and specialization because the cultivation and gardening to a large extent is labor intensive than the cereal crops and gives more post-harvest chances to add value [39].

Vegetables for both fresh and processed have a huge domestic market in Ethiopia which is by far significant than that of the export volume. The major export markets for fruits and vegetables for Ethiopia are the surrounding countries Djibouti, Sudan and Somalia and the main products exported to these countries is non-graded fresh fruits and vegetables [39]. Vegetable crops make significant contributions to the Ethiopian household and national economy. Potato and sweet potato are valuable food security crops for densely populated highland regions and drought prone areas respectively. Vegetables like hot pepper and onion are also used for flavoring local dishes and as well important as sources of vitamins and mineral. Root and tuber crops can yield as much as 40-60 tons per hectare and can provide food security especially in times of drought, famine and food shortages. Commonly the highest yield of commonly grown tef, the staple food of the country, is on average 1 tons per hectare which is sixty times less yield per hectare of potato (60 ton ha⁻¹). At present, different vegetable crops are produced in many home gardens and also commercially in different parts of the country [9].

Contributing factors for investment expansion of vegetable crops of the country

Ethiopia has got an immense potential to develop intensive vegetable production especially at commercial scale. Some of the favorable factors that contribute to an overall investment include proximity to profitable markets, agro-climatic suitability and rich water resources for irrigated vegetables, rise of demand for vegetable crops particularly in the urban areas, diversity of agro-climatic conditions that facilitate the diversification of the crops and the current malnutrition problem in the country that calls for an increased need for vegetables [9]. Further, the high productivity of vegetable crops (root and tubers) compared to cereals can be the viable alternatives to supplement the good supply of farmers living at subsistence level. On the other hand, export possibilities for these crops are very encouraging and if fully exploited [9].

Promote gender equality and empower women

Vegetables production in particular, provides women with economic opportunities. Women are the principal producers of most horticultural crops in developing countries and are predominantly involved in the value-addition activities from production to marketing. Targeting women in agricultural technology dissemination can have a greater impact on poverty than targeting men. The enhanced social and economic status of women, for example achieved through horticultural activities, leads to greater household food and nutrition security [40]. In addition to the financial benefits of horticultural production, increasing women's access to vegetables for themselves and their families, will improve their health and work performance, thereby contributing to higher incomes. The sale of garden surplus is often a major source of income for rural women, and largely used for crucial family needs.

Health benefits

Reduce child mortality: Malnutrition is one of the major causes of, or is a significant contributing factor to, child mortality in developing countries. The link between horticulture and child mortality is indirect, but important. The absence of essential

micronutrients exacerbates poor children's vulnerability to disease. Improving access to vegetables and fruits in their diets reduces mortality and morbidity of infants and children under five years old, particularly in rural areas. Improving diets of women of child-bearing age and specifically pregnant women, reduces infant mortality and may reduce maternal transmission of HIV/AIDS to infants.

Improve maternal health, malaria and other chronic diseases:

Maternal health depends on having achieved food security during girlhood as well as a diet rich in micronutrients during conception, pregnancy and the first few months after childbirth. The health of women before conception directly impacts their health during pregnancy and child birth. The majority of pregnant women in developing countries suffer from anemia and other micronutrient deficiencies. This affects both their productivity during pregnancy and can lead to complications for the fetus during and after childbirth. Horticulture can benefit maternal health directly by improving the quality of women's diets. Vegetables are the most appropriate sources of micronutrients in the diets of these women, and are critical in regions where vegetarian diets predominate.

A balanced diet, rich in micronutrients, is likely to reduce the number of chronic infections, prevent some infections and help the body to combat the severe infectious diseases which are common in developing countries and which are the leading causes of adult and childhood mortality. Fruits and vegetables are also considered by FAO and WHO as the primary nutritional tools to prevent non-communicable and micronutrient deficiency related diseases [41]. Diabetes type 2, obesity and certain cardiovascular diseases and cancers can be significantly reduced via increased consumption of fruits and vegetables [42].

Ensure environmental sustainability

Legume vegetable crops increase soil fertility through atmospheric nitrogen fixation. Leguminous vegetables integrated into cereal-based cropping systems in rotation or as part of a mixed-cropping system enrich the soil and can break plant disease life cycles. Perennial tree crops can conserve and protect the soil in hilly and high rainfall regions. Disease-resistant varieties, mixed cropping and the use of Integrated Pest Management (IPM) technologies reduce pesticide use. Understanding the concepts of low-input agriculture allows maximum outputs with minimum inputs [43]. This can even include promotion of 'organic' practices for niche market trade. Micro-irrigation technology permits efficient use of water, allowing the water to be delivered to the point it is required with minimal evaporative losses. This is particularly important where water supplies are scarce. Through fertigation, plant nutrients can be safely and economically delivered through irrigation systems. High value horticultural crops produce more profit per unit of water used, compared to most traditional crops and cropping systems.

New jobs and economic opportunities

Horticultural crop production creates jobs. On average it provides twice the amount of employment per hectare of production compared to cereal crop production [32]. The move from cereal production towards high-value horticulture crops is an important contributor to employment opportunities in developing countries. The horticultural

commodity chain is also longer and more complex than the cereal crop one and as a result job opportunities are more abundant [44]. Women have the most to benefit from the increasing importance of horticulture in rural economies.

Women, in general, play a much more significant role in horticultural crop production compared to starchy staple crops. Throughout the developing countries of Africa, women play a dominant role in the production of horticultural crops and cultivate more than half of the total smallholdings. Besides creating jobs on the farm, the horticultural sector also generates off-farm employment, especially for women. This is the case for export and value-added processing industries, which are important sectors of the economy of Ethiopia. Since horticultural production is very labor-intensive, landless laborers also benefit from the new employment opportunities created by horticultural crop production. These jobs usually provide more income than jobs obtained by the laborers in most other sectors [45,46].

Higher incomes and stronger rural economies

Horticultural crop production provides new and profitable sources of income for farmers. The production of horticultural crops can be especially important for small-scale farmers since these crops are well suited to smallholdings and family enterprises and are often adaptable to urban areas and small plot gardens [47,48]. Horticultural crops have a comparative advantage over cereal crops when land is scarce and labor is abundant, which is often the case in developing countries. Studies from the developing countries of Asia and Africa consistently show that farmers engaged in the production of fruits and vegetables earn higher net farm incomes than farmers engaged in cereal production alone [33].

Horticultural production contributes to the overall growth of markets and agri-businesses in rural economies. Studies show that the agro-industrialization process has been faster for nontraditional products such as fruits and vegetables [49,50]. In many African countries, export horticulture is providing opportunities in an otherwise poor agriculture sector [51].

Improved food security and nutrition value

All of the hungry and many of the overweight are afflicted with micronutrient deficiency (lack of vitamins and minerals). Over two billion people, the vast majority of whom are women and children, suffer from micronutrient deficiencies [53,54]. Horticultural crops can play a vital role in solving this global micronutrient crisis. Vegetables and fruits are the most sustainable and affordable sources of micronutrients in diets [53]. Healthy diets improve the learning capacity of children and the productivity of workers [45].

In contrast, micronutrient-deficient diets lead to reduced mental and physical development, poor performance in school, loss of productivity in the workplace, and the likelihood of poverty in future generations; Vitamin A deficiency alone weakens the immune system of 40% of children in developing countries [53]. This deficiency increases a child's risk of severe illness and death from infectious diseases, which are the leading causes of death in developing countries. Vitamin A deficiency contributes to higher rates of anemia as well as

morbidity from common childhood infections such as respiratory and diarrheal diseases, measles and malaria [56-58]. Deficiencies of vitamin A and other micronutrients may increase the likelihood of HIV/AIDS transmission from mother to child and hasten the progression of the disease in infected persons [59,60].

Iron deficiency affects at least 2 billion, and perhaps up to 3.5 billion people. Shortage of iron in the diet causes reduced productivity, which results in economic losses of billions of dollars globally [45,53]. These losses are so substantial that economists at the Copenhagen Consensus in 2004 agreed that relieving iron and other micronutrient deficiencies should be the second highest priority in world development initiatives, second only to relieving the HIV/AIDS crisis. Although essential in diets, not enough vegetables are available, especially to poor families in developing countries. Rates of production of vegetables and fruits cannot satisfy consumer demand and these micronutrient rich food sources are often too expensive for the poor.

Constraints in Vegetables Crops' Production System in Ethiopia

In Ethiopia, vegetable crops are produced in different agro-ecological zones through commercial as well as smallholder farmers both as a source of income and food. However, due to perishable nature and biological nature of production process, vegetables production process, vegetables productions are risky investment activities. In this context, risk perceptions play a key role in the production and investment behavior of farmers in vegetable production decisions [12]. Vegetables are highly perishable, they start to lose their quality right after harvest and continued throughout the process until it is consumed [61].

In general, the drawback to this sector include social and cultural habits of the population like dietary preferences for meat and other animal products and distaste for vegetable crops, lack of consumer awareness, economic reasons of the local consumers, absence of nutrition intervention programme using vegetables and their processed products and certain environmental limitations. Heavy losses that are caused mainly due to price fluctuations, lack of guaranteed prices and unplanned planting patterns, This causes heavy post-harvest losses most vegetables are sold in unprocessed form [9]. Lack of storage facilities, poor traditional storage system, which are prone to storage pests and diseases, lack of on-farm storage system and absence of cool storage facilities are among the important limitation to the vegetable production sector of the country [9].

According to Bezabih Emana and Hadera Gebremedhin, 2007 & Adugna Gessesse, 2008, the constraints of horticultural production including vegetables production could be Categorized in to Farmer related, institutional, natural and infrastructure related factors [22].

Farmer related constraints

Vegetables production system in Ethiopia is based on tradition, which is poorly supported by scientific recommendations. It is apparent that inadequate farmer skills, knowledge of production, product management, attempt to select varieties, uses of fertilizers and traditional crop management practices affects the supply of

vegetables produces. Farmers' know-how of product sorting, grading, packing and transporting is traditional, which severely affects the quality of vegetables products supplied to the market. Because all of vegetables products are easily perishable within short time until it reach to consumers. Due to these reasons the availability of crops to the consumers is low compared to the potential yield obtained in the research centers and on farmers' field technology verification studies. For instance, the productivity of onion was about 90 quintals per hectare compared to the potential yield of 400 quintal per hectare in research centers.

Institutional factors

Are related to lack of provision of improved production technologies including supply of relevant varieties, agronomic practices, improved product management techniques, market outlets linkage, storage and processing facilities, marketing information, credit facilities and strengthen farmers cooperatives. In addition to this lack of standardization, large number of middlemen in the marketing system, lack of coordination among producers to increase their bargaining power, price fluctuations and others are institutional factors that affect production and productivity of vegetable crops these should be addressed. For example the farmers are not access to the different vegetable seed varieties they wish in type and quantity to cultivate due to these institutional factors. Institutions failed to bring up farmers' capacity to the expected dry lands coordination group level. Research based practical recommendations on agronomic practices and pre and postharvest management are lacking at farmers level. Moreover, inputs such as fertilizer and pesticides should be available through known and accountable sources. Conducive policies and enforcement mechanisms should be put them in place. Quarantine of exotic pests through the enforcement of laws by exercising Python sanitary inspection at points of their entry is essential. Institutions like the marketing agency should also make available the market information needed for production planning.

Natural factors

These including inadequate rainfall, shortage of water supply, drought, flood, frost, diseases and pests, location and season specific production are often beyond the control of farmers and institutions that is the main reasons for low productivity. There is a shortage of irrigation water mainly in the low land areas. Yet, contingency planning and forecasting of the events which may help to minimize the effect is not available perhaps due to traditional ways of production. Moreover, an appropriate management system including variety selection and diversification would reduce the effect of natural factors. Improving the institutional constraints discussed above will be instrumental for improving the management system.

Infrastructure factors

Such as rural roads inaccessibility, high transportation cost and lack of means of information communication for efficient flow of goods unsuitable transportation facilities and market information are limiting factors. Most of the rural area is not accessible by vehicle. The products are transported to the road side by donkeys or by people. This requires longer time to reach the market and affects the quality of the products. Moreover, there are no communication systems

to access market information that would assist the producers to decision making. Hence, vegetables productions are risky investment activities. Riskiness of vegetable production may be attributed to several factors that are beyond the control of producers [12]. The main constraint with regard to vegetable production is that, because of market and food security concerns, rural farmers prefer to produce cereals and pulses. Other constraining factors include low production and productivity, lack of adequate pest control, poor soil fertility management practices, lack of attention to product quality and prevention of physical damage, as well as the lack of storage and packaging facilities [17].

Major sources of vegetable production risks

Generally speaking, agricultural risk is associated with negative outcomes stemming from imperfectly predictable biological, climatic, and price variables. These variables include natural adversities (for example, pests and diseases), climatic factors not within the control of agricultural producers, adverse changes in both input and output prices and financial losses. To set the stage for dealing with risks in vegetable production, the risk sources were classified into different groups. These sources of risks were categorized into technical, market, social, institutional and financial risk sources and analyzed to find out their order of importance in decision making. To determine their importance the mean scores and Standard Deviations (SD) in farmers' responses towards various drivers of risks in production of vegetables were analyzed. The perception of farmers on vegetable production risks was assessed using the five point Likert scale; 1 meaning no risk and 5 meaning very high risk. This method of analysis is consistent with other studies [32].

The results of the study are presented in Table 3 below. Farmers' perceptions about the technical/production sources of risks in vegetables production are presented in Table 3. An important characteristic of yield/production risk is that its level can be influenced by the level of input use: while some inputs increase the level of yield risk, others will reduce it [62]. It is quite clear that farmers are vulnerable to natural conditions such as drought and high rainfall. Risks due to pests and diseases in vegetables have also emerged as an important concern in farmers' responses.

Summary and Conclusion

All living creatures, including humans, depend on nature for production of food. Vegetables are source of energy, body-building nutrients, vitamins and minerals. Vegetable production plays crucial role in the Ethiopia economy. Although factors such as malnutrition, illnesses and unavailability of fat in the diet, contribute towards vitamin A deficiency, inadequate intake of foods containing vitamin A appears to constitute the single most important risk factor in developing countries. Ethiopia has a comparative advantage in a number of Vegetable commodities due to its favorable climate, proximity to European and Middle Eastern markets and the regional markets, cheap labor, Government policies and strategies of Ethiopia are good for investment having its own proclamations. In general, the drawback to the sector include social and cultural habits of the population like dietary preferences for meat and other animal products, and distaste for vegetable crops, lack of consumer awareness,

Table 3: Mean scores and rank of major vegetable production risk sources.

Source of risks	Percentage response					Mean	SD	Rank
	1 ^R	2 ^R	3 ^R	4 ^R	5 ^R			
Technical production								
Drought	10.8	20.8	21.5	41.5	5.4	3.1	1.126	2
Pests/disease	19.2	10.8	50.0	16.9	3.1	2.74	1.053	3
Termites/insect attack	26.9	18.5	37.7	15.4	1.5	2.46	1.094	4
Flood/high rainfall	34.6	30.8	22.3	7.7	4.6	2.17	1.128	6
Market/Price								
Output price fluctuation	10.0	21.5	23.1	36.2	19.2	3.23	1.267	1
High costs of input	30	22.3	31.5	13.1	3.1	2.37	1.135	5
Human/Causal/Social								
Illness/Injury/death of operator/member	50.0	30.8	13.1	5.4	0.8	1.76	0.93	7
Changes in family relation	43.8	44.6	6.2	3.1	2.3	1.75	0.881	8
Theft	53.8	29.2	10.8	3.8	2.3	1.72	0.996	9
Conflict and violence	63.8	21.5	6.2	6.2	2.3	1.62	1.007	10
Institutional								
Changes in policy & rules	80.8	5.4	7.7	3.8	2.3	1.42	0.955	11
Financial								
High costs of credits	89.2	4.6	4.6	1.5	0	1.18	0.581	12

economic reasons of the local consumers, absence of nutrition intervention programme using vegetables and their processed products and certain environmental limitations, heavy losses that are caused mainly due to price fluctuations, lack of guaranteed prices and unplanned planting patterns, This causes heavy post-harvest losses Most vegetables are sold in unprocessed form, Lack of storage facilities, poor traditional storage system, which are prone to storage pests and diseases, lack of on-farm storage system and absence of cool storage facilities are among the important limitation to the vegetable production sector of the country.

Improvements to be done

- Improve the technical knowledge and skill of farmers and development agents in vegetable production and crop protection measures by providing training in improved production and crop husbandry practices and use of quality inputs so has to provide effective extension service to increase vegetable yield.
- Strength research-farmer-extension linkages to develop improved varieties adapted to diverse biotic and a biotic stresses and improved management practices so as to overcome the current production pitfalls to address the wider observed yield gaps.
- Develop improved and affordable postharvest handling and storage structures to prolong shelf life and minimize postharvest losses.
- Build the capacity of farmer's cooperatives/unions so as to provide cooperatives with much better opportunities for integrating smallholders into vegetable value chains so that the profit margins of the farmers could be improve.
- Engage government and policy makers in frequent dialogues to increase their awareness so as to enhance widespread implementation of vegetable seed certification policy/

regulations to support vegetable value chain development so that farmers get sustainable incentive to increase production.

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