



How does the Fruit and Vegetable Sector contribute to Food and Nutrition Security?

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The Dutch Food & Business Knowledge Platform (F&BKP) commissioned an explorative study regarding the existing knowledge base from development practice and research about the potential of the Fruit and Vegetables (F&V) sector to contribute to Food & Nutrition Security (FNS) in the context of (a) sustainable development (i.e. economic, social, ecological and gender equity) and (b) the Dutch international cooperation agenda (i.e. combining aid, trade and investments).

The outcome of this explorative study is reflected in this document. The findings and recommendations in this report are those of the authors and do not necessarily reflect those of the Food & Business Knowledge Platform.

Key words: Food & nutrition security, horticulture development, fruit and vegetable sector, gender

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Cover photo: F.J. Joosten (vegetable market in Lilongwe, Malawi)

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Summary

Contribution to Food and Nutrition Security

The development of the fruit and vegetable sector in developing countries has a positive impact on the Food and Nutrition Security (FNS) of the people engaged in the sector and for urban and rural consumers. This explorative study focused on the different FNS pillars for assessing the potential of horticultural sector:

- *Availability*: fruit and vegetable (F&V) production has increased over the past 10-15 years, also in food-insecure countries such as Ethiopia, Rwanda, Ghana, Uganda, Kenya, Indonesia and Vietnam. Different donor-funded projects have been implemented to increase production of fruit and vegetables. Some of these projects show positive impact in terms of increased production. However many other donor funded projects do not measure results in terms of FNS at outcome or impact level, resulting in limited empirical evidence on the impact of these projects.
- Income from land, labour and capital is an important determinant that influences *access* to fruit and vegetables.
 - Farmers: farmers that produce fruit and vegetables are increasing their income, especially compared to grains and other staple food crops.
 - Employment: the fruit and vegetable sector provides many job opportunities for male and female workers.
 - Consumers: increased levels of income have widely improved the access to fruit and vegetables for consumers. Female-headed households appear to spend more on fruit and particularly vegetables than male-headed households.
- Food *utilisation*: overall consumption levels of fresh fruit and vegetable are still below the daily intake levels recommended by FAO and WHO. In addition, (agricultural) economic growth contributes to a reduction of undernourishment. Households with fruit and vegetable cultivation appear to have less nutrition-related health problems such as vitamin and micro-nutrient deficiencies. The nutrition and health benefits were particularly noticeable also among women.
- *Stability* is an important pillar of Food Security. The production of fruit and vegetables requires access to appropriate inputs and technology. Necessary inputs and technology can bring the cultivation practices to a higher level whereby the (production and price) stability can be improved by reducing the risks of crop failure. There is evidence that vegetable producers are better integrated into markets contributing to a more stable market position.

Opportunities for creating impact

The traditional small-scale fruit and vegetable production and marketing sector is an important sector in terms of employment, income and scale of production. However, the informal and inefficient supply chain arrangements in the traditional F&V sub-sector provide low income and little incentives for growers and their families to improve their production and marketing activities.

More development opportunities are provided for F&V growers when they link up with upcoming small and medium-sized enterprises in the African agri-food sector that invest in logistics, wholesale, warehousing, cold storage, processing, local fast food and retail. An important trend is the upcoming supermarket sector in Asia and Sub-Saharan Africa. Surveys in Kenya and Indonesia show that F&V growers who participated in these higher value supply chain arrangements for the domestic and regional markets receive a higher income. Improving the level of organisation among F&V growers and creating economies of scale in the smallholder sector is a precondition for their inclusion in these emerging F&V supply chains.

In the high-value fruit and vegetables export sector in East Africa we observe a trend away from smallholder production as the main suppliers of fresh produce. However, alternative employment is created in the peri-urban packing houses. While the employment in the high-value export sector was initially focused on unskilled rural labour for F&V production, nowadays it requires a prepared labour force due to the complex demands of global buyers, the enforcement of new public and private standards, and the growing global competition among developing countries.

Comparing the fruit and vegetable sector with other sectors

The fruit and vegetable sector compares favourably with cereals and other food crop sectors in terms of employment and income generation. The production of vegetables has a comparative advantage particularly under conditions where arable land is scarce and labour is abundant. Vegetables have a lower comparative advantage when labour and access to inputs are the limiting factors.

We have not come across data and information that allows for a full fledged FNS impact comparison between the fruit and vegetables sector and other more intensive agri-food production sectors, such as poultry or dairy production or coffee or cocoa cultivation and processing activities. Based on several of the FNS indicators described in this study it should be possible to make such as a comparison.

Method

The Food & Business Knowledge Platform (F&BKP) requested for an explorative study centred on the question whether and to what extent investments and interventions in the development of the fruit and vegetable sector contribute to enhanced food and nutrition security. Although not exclusively, we concentrated the study on evidence derived from the F&V sector in the following countries: Ethiopia, Rwanda, Ghana, Uganda, Kenya, Indonesia and Viet Nam.

In the context of this explorative study we focussed on FNS indicators at household level when assessing the horticultural sector's potential to contribute to enhancing FNS. We looked at the F&V sector's potential in relation to:

- Food availability, with particular reference to F&V production and post-harvest losses, farm-gate price levels and cross border trade
- Food access, with particular reference to income levels and consumer food prices
- Food utilisation, in terms household diet and nutrition consumption patterns
- Stability; capacity to deal with cultivation and marketing risks and dependency on specific F&V products for income and FNS.

For the comparison between the fruit and vegetable sector and other agricultural sectors to assess their potential FNS impact, we have primarily focused on indicators such as labour opportunities and income from land or capital. In addition, we analysed the effectiveness of development strategies in different agrarian sectors in relation to the FNS impact achieved.

We combined a focused literature review (limited due to design and budget) with a series of semi-structured interviews amongst different growers, traders and workers in the Ethiopian fruit and vegetable sector.

The main findings and interim conclusions were discussed with a group of sector specialists organised and facilitated by F&BKP on 3 March 2015 in The Hague.

Abbreviations used

CFS	Committee on World Food Security
FAO	Food & Agriculture Organisation
F&BKP	Food & Business Knowledge Platform
FNS	Food & Nutrition Security
F&V	Fruit and Vegetable
IFPRI	International Food Policy Research Institute
kVND	1,000 Vietnamese Dong
LDC	Least Developed Country
ODA	Official Development Assistance
UNCTAD	United Nations Conference on Trade and Development
WHO	World Health Organisation



1 Introduction

1.1 Background

‘Horticulture comprises diverse cropping systems in all agro-climatic zones, provides healthy and nutritious food, and generates employment and income for smallholder farmers, including women who are often the main primary producers. Benefits from horticultural development include improved nutrition for children and families, increased income from sale of horticulture products, and improved status and confidence of women farmers. In many cases, horticulture can generate substantial income from smallholdings that would not be profitable if planted only to cereal crop staples. In addition, women typically use the income generated from horticulture to invest in family health and education, which multiplies the benefits by increasing social capital.’

This introductory statement is cited from an annual report of an international horticultural development programme (HortCRSP; Crump *et al.*, 2013) and is exemplary for the direct correlation often made between horticulture sector¹ development and food and nutrition security (FNS). The correlation seems highly plausible, but data on the impact potential of the fruit and vegetable sector (F&V) in terms of food and nutrition security is often missing or at least incomplete. Central to this study is the question whether and to what extent investments and interventions in the development of the fruit and vegetable sector contribute to enhanced food and nutrition security.

This study was conducted for the Dutch Food & Business Knowledge Platform (F&BKP) and the Topsector ‘Horticulture and Starting Material’. The role of the F&V sector is of increasing relevance in many developing countries, amongst others because of its economic potential and its relevance for nutrition security, also in the context of climate change, and trends such as urbanisation, and an aging farmers’ population. The sector shows potential for women’s and young people’s employment and empowerment; it is increasingly recognised that the participation of these two groups is key for effective (business) development.

The F&V sector is also of relevance as it is amongst the sectors which offer potential for private sector involvement, which fits well in the Dutch policy for international cooperation focusing on ‘aid, trade and investment’. As the Netherlands is the world market leader in protected horticulture production, supply, trade and logistics with a wealth of lessons on how to build a strong horticultural sector. It is worth further exploring the potential of this sector. Several of the Dutch embassies in developing countries support the development of the F&V sector under their bilateral food security and private sector support programmes. A number of Dutch development NGOs have a similar interest.

1.2 Scope of the study

Chapter 3 provides the main information and data on the potential of the F&V sector for Food and Nutrition Security. This overview explored whether and to what extent investments/interventions in this sector contribute to a higher income for farmers and farm workers in the F&V sector, an improved food and nutrition security status and the improved position of (smallholder) growers and farm workers (male and female, and youth in particular).

¹ Horticulture in the context of this paper includes fruits, vegetables and potatoes, not flowers.

Value chains provide critical linkages between - sometimes widely distant - producers, processors, retailers and consumers.

The following questions are explored:

- Whether and to what extent do investments and interventions in the development of the fruit and vegetable sector contribute to enhanced food and nutrition security? (Chapter 3)
- Which investments and interventions have a greater impact? (Chapter 4)
- Is the 'development return' on investments higher in the fruit and vegetable sector than in other agricultural sectors? (Chapter 5)

However, bottlenecks along the value chain may lead to inefficiencies. Currently, upstream post-harvest losses and downstream product waste receive a lot of attention from policy makers. Developing more efficient value chains can lead to improved market linkages between producers and consumers and can reduce transaction costs. Therefore, upgrading and improved governance of horticultural value chains plays an important role in developing conditions for increased food security and income of the rural population.

Following on from this, the explorative study also analyses which investments and interventions have a greater impact, given the fact that different horticultural production and marketing arrangements prevail in the developing countries. Here a direct link is made with a typology of prevailing fruit and vegetable value chain arrangements (based on Joosten, 2014): (a) production by smallholders who supply the low value domestic market through numerous informal and unintegrated stages in the supply chain; (b) more integrated production and supply arrangements with (groups of) smallholders and emerging commercial growers who supply the higher value domestic and regional markets; and (c) the high-value export production and supply by large scale commercial growers and a limited number of contracted growers supplementing the supply of fresh produce. In Chapter 4 we have tried to answer this question on the basis of different examples.

The third question that is covered by this explorative study is whether the 'development return' on investments (particularly in terms of positive effects related to food and nutrition security) is higher in the fruit and vegetable sector than in other agricultural sectors. This comparison between different sectors is covered in Chapter 5.

Cross-cutting with all three questions is the position and impact of different types of horticultural developments on women and youth. However, on the role of youth in the F&V sector we found scarce documentation.

1.3 Methodology

This explorative study was undertaken to broaden the knowledge base on the subject of food security improvement through F&V sector development. The study comprised a quick scan of the available literature (academic publications, grey literature and professional documentation). Due to design and budget constraints of the study it was impossible to review all relevant literature, therefore a consultation with a range of experts on food security, nutrition and horticulture was organised in the Netherlands.

In addition a series of interviews and site visits were conducted to collect case study material in the fruit and vegetable sector in Ethiopia. The main findings of these Ethiopian cases are presented as highlights (in text boxes) throughout the report. Appendix 1 gives a complete overview of the results.

We have approached also a number of F&V development projects and programmes in the selected focus countries. However, overall the feedback received from implementing partners was limited. We

found that some of these projects show positive impact in terms of increased F&V production, food safety and/or market access. However many of the projects appear not measure results (yet) in terms of FNS at outcome or impact level, resulting in limited empirical evidence on the impact of these projects for this explorative study.

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2 Assessing Food and Nutrition Security

2.1 Defining Food and Nutrition Security

Food and Nutrition Security (FNS) is a central concept that is explored in this paper in the context of horticultural sector development and its impact on growers, workers and other stakeholders in the developing world. The World Food Summit in 1996 defined food security as a situation 'when all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life'. At the World Summit of Food Security in 2009, this definition was reconfirmed, and the concept was extended and specified by adding that the 'four pillars of food security are availability, access, utilization, and stability' and stated that 'the nutritional dimension is integral to the concept' (Ecker and Breisinger, 2012).

The FAO Committee on World Food Security has combined these different elements and states

'Food and nutrition security exists when all people at all times have physical, social and economic access to food, which is safe and consumed in sufficient quantity and quality to meet their dietary needs and food preferences, and is supported by an environment of adequate sanitation, health services and care, allowing for a healthy and active life' (CFS, 2012).

2.2 Food and Nutrition Security at macro and household levels

This FNS definition is based on a comprehensive and integrated understanding of the issues at hand, but the concept of FNS becomes more meaningful by specifying also the level and scale at which the improved food and nutrition status is pursued and measured.

At the *macro level*, crucial factors of the FNS system include macro-economic stability, inclusive economic growth, public spending, and governance and quality of institutions. The state and related institutions play an important role in ensuring that public services are provided effectively and efficiently to citizens and that a good business climate attracts domestic and foreign private investments. Such investments, in addition to advances in productivity, are critical for accelerating economic growth and income generation. Whether economic growth improves FNS depends on a number of factors (Ecker and Breisinger, 2012). Research confirms that economic growth is good for improving food and nutrition security, especially at early stages of development. Economic growth and agricultural growth in particular are crucial for reducing undernourishment and thus for improving people's calorie sufficiency.

However, research also suggests that certain forms of malnutrition are less responsive to both agricultural and economy-wide growth. In addition to inclusive economic growth additional measures are required to tackle the underlying causes of malnutrition, which may be health or diet related, or to several other factors. The former calls for health interventions and the latter calls for actions that allow and encourage people to consume a more diversified diet. Beside policies that improve people's access to healthier foods and a more diversified diet, other measures have high potential to increase people's consumption of vegetables, fruits, and animal products directly and permanently, such as programmes that promote home, school, and community gardens and small-scale livestock husbandry and aquaculture. Of at least equal importance are nutrition and awareness and education campaigns that educate the malnourished population about the importance of good nutritional habits. Lack of this understanding will severely limit the potential impact of growth and policies aimed at improving people's economic access to improved sources of nutrition (Ecker *et al.*, 2011).

At the *micro or household level*, a major factor of food access is the household's (real) income and, in subsistence farm households, the assets necessary to produce enough food for own consumption. Poverty does not only limit the access to food of sufficient quantity and quality but also increases the vulnerability to sharp food price increases and other shocks and stresses entailing volatility in nutrient supply. Furthermore, individual food access and adequate food and nutrient intake is contingent upon intra-household food distribution and the care given to meet individual dietary needs, both of which in turn depend on a set of characteristics of the household decision maker and the person responsible for meal preparation and child feeding. Formal education and nutritional knowledge of parents, especially mothers, and gender equality in decision making on household resource allocation are crucial factors of the nutritional status of women and young children in particular (Ecker and Breisinger, 2012).

2.3 A framework to monitor Food and Nutrition Security

LEI Wageningen UR (Achterbosch *et al.*, 2014; Shutes *et al.*, 2014) has developed a comprehensive monitoring system (MAGNET) for household food and nutrition security based on a range of different indicators related to the four different FNS pillars:

1. *Food availability* - The availability of sufficient quantities of food of appropriate quality, supplied through domestic production or imports (including food aid). This also includes reductions in post-harvest losses.
2. *Food access* - Access by individuals to adequate resources for acquiring appropriate foods for a nutritious diet.
3. *Utilisation* – Use of food through adequate diet, clean water, sanitation and health care to reach a state of nutritional well-being where all physiological needs are met. This brings out the importance of non-food inputs in food security.
4. *Stability* – To be food secure, a population, household or individual must have access to adequate food at all times. They should not risk losing access to food as a consequence of sudden shocks (e.g. an economic or climatic crisis) or cyclical events (e.g. seasonal food insecurity). The concept of stability can therefore refer to both the availability and access dimensions of food security.

The four FNS dimensions are summarised in the diagram below (Figure 2.1), whereby the food and nutrition status of an individual, household or community is determined by the availability, access and patterns of use. The stability is related to external risks and fluctuations in income and can impact on the FNS status of the individual, household or community concerned. This is a generic FNS overview and we have highlighted a number of indicators and added a few which are particularly relevant for the fruit and vegetable sector and as such may be used also by development practitioners and policy makers with a direct interest and involvement in the F&V sector and FNS.

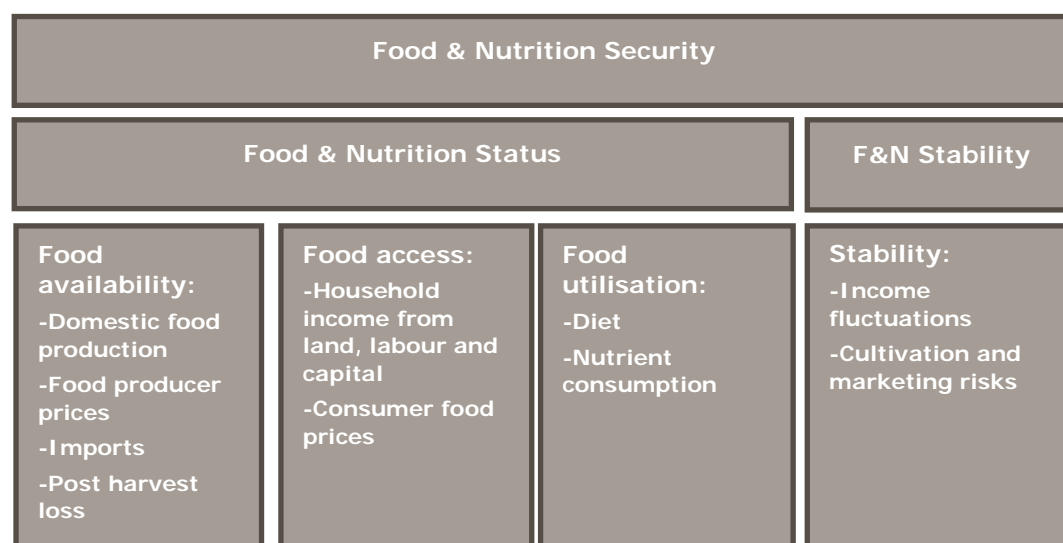


Figure 2.1 Indicators of FNS at household level

Source: Achterbosch *et al.* (2014); Shutes (2014).

2.4 Measuring Food and Nutrition Security in the context of this study

In the context of this explorative study we focus on the FNS indicators at household level when assessing the horticultural sector's potential to contribute to enhancing FNS (Chapter 3). We look at the Fruit and Vegetable (F&V) sector's potential in relation to:

- Food availability, with particular reference to F&V production and post-harvest losses, farm-gate price levels and cross border trade
- Food access, with particular reference to income levels and consumer food prices
- Food utilisation, in terms household diet and nutrition consumption patterns
- Stability; to deal with cultivation and marketing risks and dependency on specific F&V products for income and FNS.

One of the main assumptions is that the cultivation, handling and marketing of horticultural crops create employment and generate income for growers and workers in the sector, and therefore improve access to food, including fruit and vegetables. Another important assumption is that with increased production and availability of fresh horticultural produce, the health and nutrition status of growers and their families in the F&V sector improve, given the fact that the intake of fibre and important vitamins and other micro-nutrients increase. This assumes that there is a positive correlation between availability and access on the one hand and utilisation of the other. We are particularly interested in FNS impacts of developments in the F&V sector for particular vulnerable groups such as rural poor, women and youth. This applies to the different aspects of the food and nutrition status, but also the ability of these groups to improve their situation and deal with risks and fluctuations in production and income.

When we compare the different interventions and development options for the F&V sector (Chapter 4) we focus in particular on the average trends and developments of some of the key FNS indicators at a sector level. This comprises the sector's contribution to overall economic growth, job creation and income developments and the stability of different interventions on F&V development. Furthermore we assess in what way the F&V sector can contribute to healthier consumption practices and/or provide better health situation.

For the comparison between the fruit and vegetable sector and other agricultural sectors for their potential FNS impact (Chapter 5), we focus primarily on indicators such as labour opportunities and income from land or capital. In addition we look at the efficiency of development strategies (ODA funded) in different agrarian sectors in relation to the FNS impact achieved.

2.5 Methodology

The explorative study is undertaken on the basis of a desk-study in combination with interviews with F&V sector specialists. Examples of sector development initiatives, horticultural research projects and formal and informal data sources on horticultural production, poverty reduction and food security have been collected and analysed for the purpose of this study. The focus has been on the F&V sector in a number of countries which have been important for the Dutch bilateral programmes on food security and private sector development: Ghana, Kenya, Rwanda, Ethiopia, Uganda, Vietnam and Indonesia.

A local consultant conducted a series of semi-structured interviews in Ethiopia to develop a few case studies on FNS in the context of different forms of horticultural development in Ethiopia:

(a) commercial farm with wage labourers; (b) outgrowers supplying a processing plant or exporter; and (c) smallholders supplying the local or urban markets. Through these case studies we try to draw some lessons on how the different production and supply chain arrangements impact on the poverty and food security situation of the workers / smallholders concerned. The Ethiopian case-study material is presented in text-boxes in different chapters. Additional details can be found in the appendix to this report.

Interim results of the quick scan have been presented and discussed with a group of development practitioners, horticultural production specialists, policy makers, etc. from the profit and not-for-profit sector. Their feedback and suggestions collected during the half-day workshop on 3 March 2015 have been incorporated in the final version of the paper.



3 Contributions to Food and Nutrition Security

3.1 Food availability

3.1.1 Production

Global fruit and vegetable cultivation has experienced a remarkable increase in production. Output has been growing at an annual rate of about 3% over the last decade. In 2012, almost 637m tonnes of fruit and more than 1.1bn tonnes of vegetables were gathered throughout the world (Figure 3.1). World production growth has largely been driven by area expansion in Asia, especially China, which has emerged as the world's largest fruit and vegetable producer, with global output shares of about 20% for fruit, and more than 50% for vegetables.

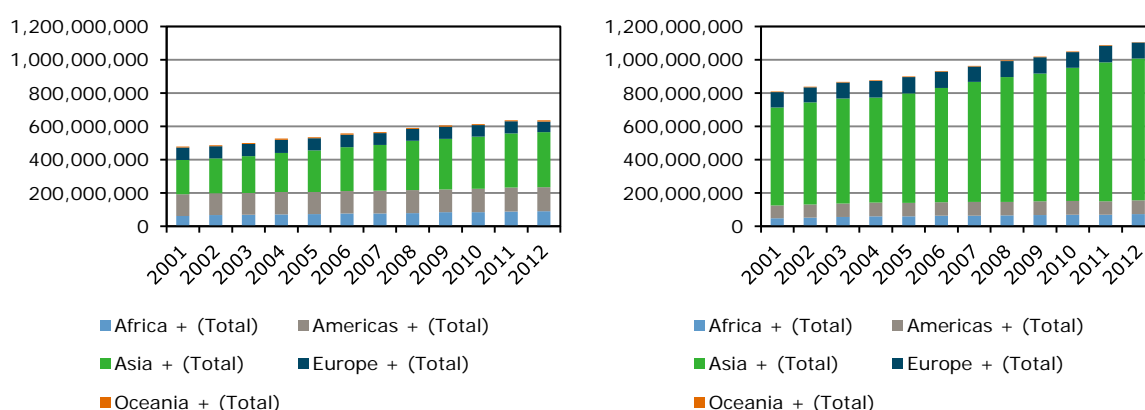


Figure 3.1 Fruit (left) and vegetable (right) production in tonnes, 2000-2012 (Source: FAOStat)

Strong growth rates in fruit and vegetable cultivation have also been recorded in food-insecure and low-income regions such as Sub-Saharan Africa and Southern Asia. Especially countries like Kenya, Ethiopia, Ghana, Rwanda, Uganda, Indonesia and Viet Nam have expansion of fruit and vegetable production (Figure 3.2). In particular high-value crops, like fruit and vegetables, have been identified as one of the fastest growing agricultural sub sectors in Sub-Saharan Africa in the past two decades (Afari-Sefa, 2007).

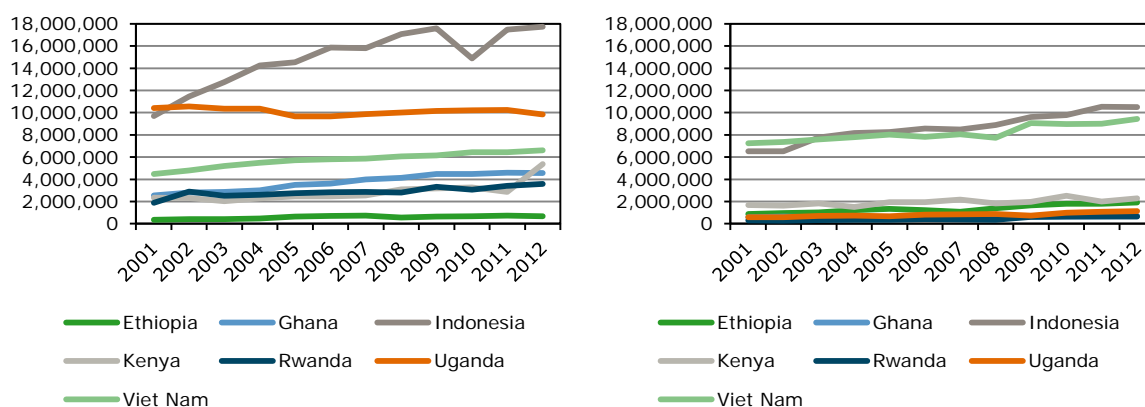


Figure 3.2 Fruit (left) and vegetable (right) production in tonnes in selected countries 2000-2012 (Source: FAOStat)

Various projects have been funded by the Dutch Government in order to increase the competitiveness of farmers in Africa and South East Asia. Recently projects were initiated in Ghana and Indonesia with the overarching aim to increase productivity of smallholder farmers. Since these project are still ongoing there is no impact data available. However USAID has financed a number of comparable projects in Sub-Saharan Africa. For example the Kenya Horticulture Development Program (KHDP) in which more than 58,000 farmers where trained to improve production and agro-processing practices and link them to markets, resulting in increased household income (Fintrac, 2009). In addition the USAID launched another programme, called the Kenya Business Development Services (KBDS) in the tree fruit sector. Both KBDS and KHDP undertook a wide range of interventions to broaden and deepen smallholders' commercial relationships in various chains. KHDP interventions aimed to expand the production and productivity of fruit and vegetable crops through research on new varieties, demonstration plots, training, extension services and market information. The KBDS project was reviewed by Snebstad and Snodgrass (2009). They found changes between the baseline and the end line related to an increase in production and welfare. However many other donor funded projects are not measuring results on an outcome or impact level.

Table 3.1

Description and impact of selected fruit and vegetable projects

	Country	Time frame	Estimated budget	Main output	Impact
Business Development Services (BDS) in avocado and passion fruit	Kenya	2002-2007	USD5m	<ul style="list-style-type: none"> linking 465 mango producer groups to buyers developing commercial spraying, grafting and pruning service 2,450 passion fruit producers signed contracts with buyers 	<ul style="list-style-type: none"> increased household income increased production (fruits per mature tree)
Kenya Horticulture Development Program (KHDP)	Kenya	2003-2010	USD10m	<ul style="list-style-type: none"> 58,000 farmers reached 300 demo plots 44% female farmers 	<ul style="list-style-type: none"> increase in production between 15 and 33% increased annual net earnings from growing horticultural crops by an average USD340
VegImpact	Indonesia	2013-2016	EUR5m	N.a.	N.a
GhanaVeg	Ghana	2014-2017	EUR4m	N.a.	N.a.

3.1.2 Food import

Food imports can supplement domestic production and enhance the overall availability. International trade statistics, however, show that F&V imports in the Sub-Sahara region are minimal. Here the consumers are more or less exclusively depending on domestic production for their availability of F&V. In the two Asian countries – Indonesia and Vietnam – however, the F&V imports are considerable.

Table 3.2

Value of F&V imports, selected countries 2012-14 (in million USD)²

Country	2012		2013		2014	
	Fruit imports	Veg. imports	Fruit imports	Veg. imports	Fruit imports	Veg. imports
Vietnam	516	277	823	323	n.a.	n.a.
Indonesia	849	504	667	641	789	644
Kenya	n.a.	n.a.	20	49	n.a.	n.a.
Rwanda	2	4	2	7	n.a.	n.a.
Uganda	3	3	4	3	5	9
Ethiopia	4	27	4	25	5	23
Ghana	13	21	13	19	n.a.	n.a.

For countries with substantial imports, import substitution policies can improve the trade balance and create jobs in the short run, as domestic producers replace foreign producers. However, import substitution denies the country the benefits to be gained from specialisation and foreign imports. The law of comparative advantage indicates that countries gain from international trade (Porter, 1990). Increasing fruit and vegetable production in developing countries and reducing imports is often mentioned as an objective of F&V development projects. In theory the food availability in a country can increase and import substitution might take place. However, strong empirical evidence that supports the claim that replacing imports with domestic production will lead to higher levels of food & nutrition security is missing for the fruit and vegetable sector.

3.1.3 Post-harvest losses

In theory the food availability can also be increased by reducing the fruit and vegetable losses along the value chain. In the end this can contribute to higher levels of food security (Tielens and Candel, 2014) and has the increasing attention from policy makers. As context matters, the importance of efficient value chains is stressed as a means to reducing post-harvest losses. Various projects have been implemented in the past to develop fruit and vegetable value chains in developing countries in order to reduce post-harvest losses and to develop linkages between value chain actors.

In spite of the popularity of food wastage interventions among policy makers, the number of studies on the correlation between food wastage interventions and food security is relatively limited. A study by the Food and Business Knowledge Platform (Tielens and Candel, 2014) identified 52 studies. They argue that the claim for food wastage interventions on food security is quite pervasive in both the academic and grey literature, but that in reality this relationship is rather implicit. According to this study there are only a few studies that show a positive correlation between reducing, reusing, or recycling food wastage on the one hand and food security on the other. Those studies that do, often lack sufficient empirical evidence or an ex ante evaluation. In spite of these limitations, the literature does provide some insights.

First, it is generally agreed in the literature, that some food wastage interventions can have a direct impact on short-term food security conditions. This is particularly true for pre- and post-harvest loss reduction actions in developing countries, particularly interventions at a local level in smallholder agriculture. Not only can these actions positively affect national food availability, they can also contribute to enhanced household food security, under specific circumstances, by increasing farmers' incomes and ensuring year-round food availability (Tielens and Candel, 2014).

Second, the favourable impacts of wastage interventions at the end of the value chains are less clear than those in the early stage of the value chain (e.g. production, storage).

² Source: ITC Trade Map on 21 May 2015

In addition, reduction on fruit and vegetable losses requires capital investments (e.g. cool chain interventions), which are only possible if operational profits for producers and traders are sufficient. Therefore it requires a certain level of value chain efficiency and transparency to justify these investments.

3.2 Food access

3.2.1 Household income from land, labour and capital

Fruit and vegetable crops generate more income for farmers compared to traditional staple crops. In addition they generate employment for the rural workers, and therefore improve access to food (Weinberger and Lumpkin, 2007). This positive correlation between vegetable commercialisation and household income is confirmed by various researchers. For example, Muriithi and Matz (2015) found a positive welfare effect for vegetable producers in Kenya. Afari-Sefa (2007) identified positive income effects for fruit producers in Ghana. Also English *et al.* (2004) indicate that vegetable production is more profitable for a smallholder than the traditional maize-bean intercropping system often found in Kenya. The gross margin (value of output minus all input costs) per hectare per season of maize and beans is about KES13,000. As a typical farmer would produce two such crops a year, with somewhat lower yields during the second short rainy season, total earnings would be on the order of KES 20,000–25,000. In contrast, the gross margin for French beans is about KES50,000–75,000 per harvest per hectare. Given the labour-intensive nature of French beans, smallholders normally dedicate no more than 0.5 ha to them, but it is possible to produce three crops a year under rain-fed conditions (and more with irrigation). Thus smallholders likely earn KES75,000–120,000 a year on a half-hectare plot, roughly four times the return from the traditional maize-bean combination. A farmer would normally engage in both cropping systems, with high-value crops providing an important source of cash income and maize and beans satisfying much of the household's staple food needs.

In Sub-Saharan Africa the share of the total budget allocated to fruit and vegetable consumption ranges from 3% to 13%, and the total food budget share ranges from 4.5% to 16% (Table 3.3). The demand and consumption for fruit and vegetables rises with increasing income levels. However, income elasticity for vegetables is higher than for fruits.³ Also a more recent study by Tschirley *et al.* (2014) analyses the food consumption patterns of the increasing middle class in East and Southern Africa. They analysed empirical data about perishable products like fruits, vegetables and meat. As the middle class grows, the share of these perishable products in the food economy, and their absolute level of consumption, will grow.

Table 3.3
Fruit and vegetable consumption patterns in Sub-Saharan Africa

	Ethiopia	Rwanda	Kenya	Uganda	Ghana
GDP (Current USD, 2005)	163	274	523	314	502
% of households consuming F&V	94%	94%	91%	89%	99%
Quantity (kg/person/yr)	26.7	62.8	114.0	64.2	73.7
Value (USD/person/yr)	3.8	15.3	27.7	10.6	36.3
% of household food budget	4.5%	15.6%	9.8%	9.2%	11.3%
% of total household budget	2.7%	12.6%	6.9%	5.1%	6.9%
Food as % of total household expenditure	56%	69%	58%	47%	56%
Price (USD/kg)	0.14	0.24	0.24	0.17	0.49

Source: Ruel *et al.* (2005).

³ Average income elasticity for fruits and vegetables range between 0.60 and 0.97; an income elasticity of 1.00 means that the consumption of a certain product changes at the same rate as the change in income.

Women tend to invest in their families by providing more food, preventative health care and education for their children (Hoddinott and Haddad, 1995). As a result female-headed households appear to spend more on fruit and particularly vegetables than male-headed households (Ruel *et al.*, 2005). They found that in Rwanda, female-headed households allocated a large share of their budget to fruit and vegetable consumption. Also in Kenya where more female-headed households were found in the highest fruit and vegetables expenditure quintile (Ayieko *et al.*, 2005).

The fruit and vegetables sector provides improved employment for many farm workers compared to other sectors. A Kenyan survey provides detailed information on the incomes of a sample of workers in the fruit and vegetable sector and comparative data for a control group of people not involved (McCulloch and Ota, 2002). Information was collected from packhouse workers and non-packhouse workers living in the same residential areas of Nairobi, workers on farms owned by exporters, workers on large commercial farms, smallholders engaged in fruit and vegetable production, and non-horticulture smallholders farming in the same region. The figures indicate that fruit and vegetable producers are much better off than non-horticulture smallholders, with a mean income that is four times larger. Also workers on exporter-owned farms and independent commercial farms do better than non-horticulture smallholders. As a result poverty rates are much lower among workers employed in the fruit and vegetable sector. Most of these workers are paid a wage that is above the government-mandated minimum agricultural wage.

Women in particular have been able to capitalise on these new labour market opportunities. In Africa, Asia, and Latin America, high-value crop exports are female intensive industries, with women dominating most aspects of production and processing. Evidence suggests that women occupy at least 50% or more of the employment in these industries (Dolan and Sorby, 2003). Often these farm workers are landless women who have few other opportunities for earning an income (McCulloch and Ota, 2002).

In Ethiopia we found that a medium-scale farm of about 10 ha can employ 38–50 women a day to weed, pick, and grade. In addition about 17 men are employed to spray and irrigate the fields, transporting and loading. Many farm labourers typically own little or no land of their own and tend to be poorer than most smallholders, especially those engaged in fruit and vegetable production. Consequently, their employment in the fruit and vegetable sector has a direct effect on poverty reduction.

Commercial F&V production development enhances access for rural consumers in Ethiopia:

In the case studies in rural Ethiopia (see Appendix 1) it was found that rural consumers in the production areas had better access to fresh vegetables and fruits than elsewhere in the country. F&V were generally more widely available and lower in price than elsewhere. Improved F&V access was particularly the case for growers and workers for commercial F&V farms. They were given (free) lunches with fresh produce and had easy access to surpluses or second grade vegetables and fruits at sharply reduced rates or free of charge.

It was also found that households of F&V growers are generally more food secure than other households, particularly because their extra income gives them the opportunity to buy food when necessary. agricultural sectors? (Chapter 5)

3.2.2 Consumer food prices

As land, labour and other resources are shifted towards non-staple-food production, the supply of high-value products such as fruit and vegetables expands, while that of staple foods contracts. Some observers have expressed concerns that this may result in an increase in staple food prices, with negative consequences for the urban poor and other poor net-buyers of food. However this substitution effect mainly concerns industrial commodities that require large production areas like soy. In many African countries land for the production of a wide variety of crops is still sufficiently available.

Table 3.3 (in Section 3.2.1) provided data on the average F&V prices and household expenditures in various countries in Africa. Average F&V prices may be low by international standards, but with an average of 10% of the food budget spent on fruits and vegetables, it becomes clear that the average prices of fresh fruit and vegetable produce are relatively high for the average African consumer.

A reduction of F&V waste along the value chain, including in OECD countries, would theoretically result in an increased overall availability and reduced prices of food. Empirical studies that examine these effects are lacking, with the exception of a study performed by Rutten (2013). She identified potential trade-offs from an economic perspective regarding the relationship between wastage interventions and food security and welfare, on both the supply and demand side. In a first analysis, Rutten modelled that a 40% reduction of waste during retail and consumption in the EU, would lead to a positive, but insignificant increase of food consumption (0.04%) and a very small decrease of food prices (0.2%) in Sub-Saharan Africa. This holds in particular for F&V since these products are highly perishable.

3.3 Food utilisation

3.3.1 Diet and nutrients

It is widely accepted that fruit and vegetables are important component of a healthy diet and that the consumption can help prevent a wide range of diseases. The WHO/FAO recommends a minimum of 400g of fruit and vegetables per day (excluding potatoes and other starchy tubers) for the prevention of chronic diseases such as heart disease, cancer, diabetes and obesity, as well as for the prevention and alleviation of several micronutrient deficiencies, especially in less developed countries.

Despite the growth recorded in the global F&V production and trade, the food consumption per capita in Africa is still well below the recommended 400 gram of fruits and vegetables per day (= 146 kg per person per year). Combined the annual fruit and vegetable consumption in Africa is less than 100 kg per person, which equals around 250 gram per capita per day (FAO, 2013). However in general, girls and women consume larger amounts of fruit and vegetables than do boys and men (Rasmussen *et al.*, 2006).

The substantial shortages in utilisation are confirmed by the levels of fruits and vegetable consumption in Sub-Saharan African countries. Detailed research by Ruel *et al.* (2005) in 10 different countries (including Ethiopia, Kenya, Ghana, Rwanda and Uganda) show that consumption ranges from 27 to 114 kg per person per year, which is far below the recommended amount. Except for Kenya, the majority of the households consume less than the minimum amount of fruits and vegetables recommended by the WHO and FAO (Table 3.4).

Table 3.4

Fruit and vegetable consumption patterns in Sub-Saharan Africa

	Ethiopia	Rwanda	Kenya	Uganda	Ghana
% of households consuming F&V	94%	94%	91%	89%	99%
Quantity (kg/person/yr)	26.7	62.8	114.0	64.2	73.7
% of households consuming less than 146 kg/person/yr	99%	90%	47%	88%	87%

Source: Ruel *et al.* (2005).

Results from a survey in Uganda (Kabunga *et al.*, 2014) show that fruit and vegetable production is beneficial for food security and ultimately anaemia status of individuals—in particular, women of childbearing age. These results are obtained from rural communities where no known interventions aimed at promoting F&V consumption or intensification of smallholder fruit and vegetable production systems existed. In a study in Uganda by Rubaihayo (2002) it was found that per capita F&V consumption falls short of daily recommended intake levels by 20 to 50%. It was found that F&V-rich

diets can potentially reduce childhood and maternal micronutrient deficiencies, which are reportedly high in Uganda. It was found that women caregivers aged 15-49 years and living in fruit and vegetable producing households consume more F&V than those living in non-producer households. In the Ugandan survey it appeared that F&V production increased fruit and vegetable intake of caregivers by 12%. It was also shown that the share of food-secure households was comparatively higher among fruit and vegetable producers than among non-producers.

3.3.2 Nutrition

The impact of the fruit and vegetables consumption levels described above on people's nutritional status is influenced by multiple factors. An individual's health status is among the key factors of influence on the proper utilisation of the nutrients consumed. Individuals with a vulnerable health or at risk of health problems are those risking malnutrition too. Besides the references mentioned in paragraph 3.3.1, this study did not explore the nutrition effects of Fruit & Vegetables in detail, nor did it investigate the characteristics of different interventions aimed at improving food utilisation.

Some household-level studies have looked at the relationship between changes in household incomes and calorie and micronutrient deficiency (Abdulai and Aubert, 2004, Skoufias *et al.*, 2009). Other studies (e.g. Haddad *et al.*, 2003) have analysed the effects of changes in incomes on child nutrition. Results of these studies show a positive relationship between growing incomes and nutrition outcomes. Fewer studies exist on the relationship between (agriculture) economic growth and nutrition improvement. However a study by Ecker *et al.* (2011) indicate that economic growth can contribute to a reduction of undernourishment. They also indicate that agricultural growth reduces undernourishment, but at different growth rates. Unfortunately this study did not differentiate between different agricultural sub sector like fruit and vegetables.

3.4 Stability

3.4.1 Production fluctuations

Like any other agricultural activity the cultivation of fruits and vegetables is not without risks of crop failure. Drought and other adverse weather and pests and diseases are the most common production risks. Mitigation of these risks requires know how and access to improved inputs such as drought tolerant and resistant varieties. Also access to appropriate inputs and technology is often a precondition for cultivation success. Irrigation and greenhouses can bring the cultivation practices to an even higher level whereby the risks of crop failure are further reduced.

Some high-value agricultural produce requires investment. Fruit production involves planting trees and waiting 3-5 years for them to begin producing. In addition, most high-value commodities require the use of specialised and relatively expensive purchased inputs. Farmers in developing countries, particularly poor farmers, often do not have the savings or access to credit needed to make these investments and purchase the inputs. In other words, the opportunity cost of capital is very high for many smallholders.

Out of season fruit and vegetable production can be an important strategy to improve the availability of fresh produce during a longer time of the year. For example Minten *et al.* (2005) found that smallholders in Madagascar are able to reduce the length of the 'hungry season' by producing and selling vegetables to an exporter during the off-season. Also the introduction of protected cultivation of vegetables can increase the availability of produce. For example greenhouse tomato production is less susceptible to diseases and weather conditions and create a stable production system. Wachira (2007) used survey data from 216 tomato producers in the Nakuru-North district in Kenya, in the study he compared the profitability of greenhouse and open-field tomato production systems. The study used gross margin and net Profit to determine and compare the profitability levels for both greenhouse and open-field tomato production systems. The results indicate that the mean net profit/m² for greenhouse tomato was more than 10 times higher than that of open-field tomato production system. In combination with adequate irrigation it is possible to produce good quantities of

vegetables year-round and to provide a stable income for the farmer. However, the initial investments are high and various development projects have tried to provide solutions with grants or soft loans in order to create access to greenhouse technologies. For example, USAID has initiated various projects that support farmers in growing in greenhouses that show a positive impact on farmer income. USAID constructed 81 greenhouses in three districts of Herat Province in Afghanistan. Lead farmers were appointed to test greenhouses and train other farmers in their communities. Farmers participating in the greenhouse demonstration project nearly doubled their annual income (USAID, 2015⁴).

3.4.2 Income and marketing risks

The general assumption is that high-value agricultural commodities, most of which are perishable, are more risky than staple food crops. Farmers rarely switch completely from staples to high-value products; rather they combine staple food production and commercial production of high-value commodities. Therefore, although probably not common, it is possible that some farmers diversifying into high-value commodities face lower risks, particularly if the returns from staple foods and the high-value commodities are not correlated over time. Minten *et al.* (2009) found that smallholders in Madagascar are able to reduce the length of the 'hungry season' by producing and selling vegetables to an exporter during the off-season.

However vegetable producers are better integrated into markets. For instance in Bangladesh, farmers on average sell 96% of their vegetable products but only 19% of their cereal output (Weinberger and Genova, 2005). The same pattern is reported for other countries in Southeast Asia and East Africa. A study from Tanzania that analysed the significance of traditional African vegetables in agricultural production showed that the degree of commercialisation is high for fruits as well as traditional African vegetables (i.e. amaranth and African eggplant) and exotic vegetables (i.e. tomato and cabbage). In this study, 100% of farmers who grew fruits, 98% of farmers who grew exotic vegetables, and 88% of farmers who grew traditional African vegetables marketed their output. In comparison, only 49% of farmers who grew cereals marketed their output (Weinberger and Msuya, 2004).

This phenomenon is consistent across income groups, although wealthier farmers usually sell a larger share of their production. Minot (2002) found that both fruit and vegetable production in Viet Nam is highly commercialised, with about 70% of fruit and vegetable farmers selling their output. Minot compared the degree of commercialisation for wealthy and poor farmers. The market integration of the highest income quintile is higher at 75%, while in the poorest income quintile, 56% sell their output to the market.

⁴ <http://www.usaid.gov/results-data/success-stories/incomes-grow-farmers-warm-greenhouses>



4 Opportunities and interventions for increasing impact

4.1 Introduction

World trade in horticultural products has been growing steadily. The sector has become the single largest category in agricultural trade, accounting for more than 20% of world agricultural exports. In line with this overall trend, horticultural exports from Sub-Saharan Africa have also increased and now exceed USD2bn (UNCTAD, 2012).

Horticultural value chains in developing economies have many different configurations. Three value chain configurations exist in parallel in horticultural sectors in developing countries (see Figure 4.1). Each type has a different market orientation and is also distinctly different in terms of organisation, number and type of actors, value chain governance, level of transparency, etc. The different characteristics of the three value chain configurations are further described by Joosten (2014). In this chapter we wish to explore the potentials for FNS impact and possible intervention strategies to achieve FNS given the differences between these three value chain configurations.

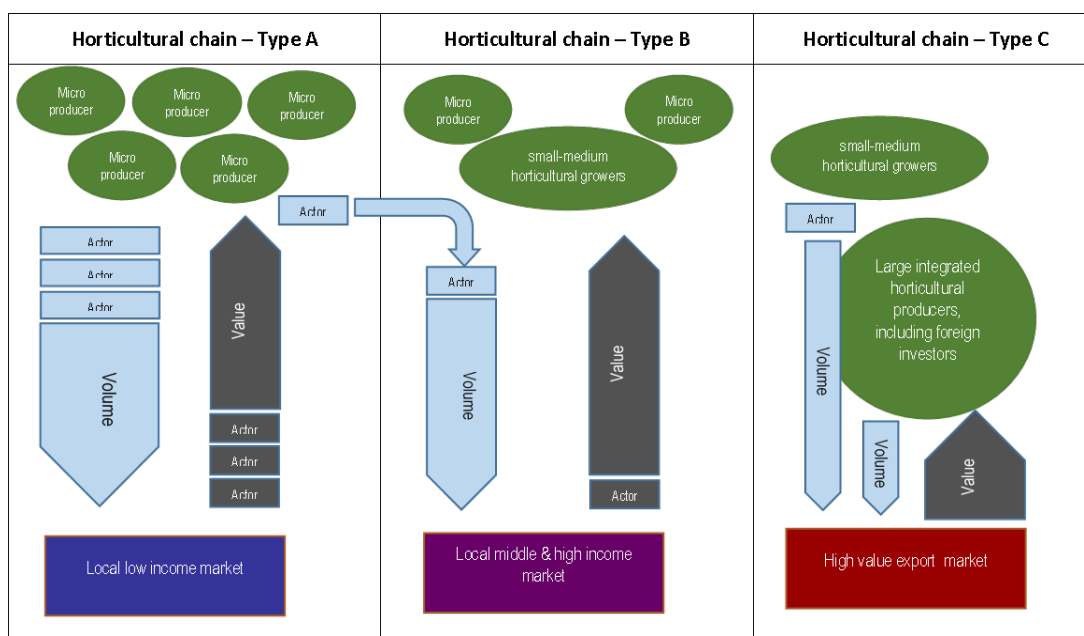


Figure 4.1 Horticultural value chain configurations
Based on Trienekens (2011); adapted by Joosten (2014).

4.2 Smallholders supplying local markets

In terms of volume of fresh produce the smallholder F&V production for the local markets is the most important value chain in the African and Asian markets covered in this explorative study. The fruits and vegetables that are sold to the consumer in local and urban wet markets are traded by small-scale traders or directly by the growers. Before the produce reaches the end markets the produce is often handled by different intermediate traders as many traders sell to or source from other traders. A horticultural value chain study in Rwanda (Verhofstadt and Maertens, 2013) shows that 62% of the fresh produce marketed by smallholder cooperatives and 83% from independent growers is supplied to the wet markets. Vertical coordination is relatively low in this value chain and is limited to some informal and flexible contracting arrangements between growers and traders.

The current supply arrangements in this sub-sector provide little incentives for fruit and vegetable growers to invest in production and quality improvements (Joosten, 2014). It is therefore important that smallholder growers will alter their market focus and target markets where more value is added and supply chain arrangements are more efficiently organised and implemented. However, Reardon *et al.* (2013) found that farmers growing for subsistence or for just local rural markets have much less capacity to make investments to increase productivity and add value to their produce. They also found that asset-poor farmers are less able to make essential investments needed to keep up for the high-value domestic market. The same study indicates that the post farm-gate segments of the value chain together form 50-70% of the food price for urban Africans, thus giving growers a relatively low farm gate price.

This value chain characteristic is described also by Gebreselassie (2012) in an Ethiopian case-study of smallholder horticultural producers in Lume district, near Addis Ababa. The growers in Lume received public support with irrigation infrastructure development and extension services. Combined with the growing market demand as a result of income increases and rapid urbanisation, this resulted in the development of market-oriented year-round vegetable production by the smallholders in Lume. Gebreselassie concludes that these developments have contributed to small but gradual changes in production objectives of the smallholders from 'sell what you have produced, to produce what you can sell'. He also concludes that the benefits for the growers of the commercial horticultural development are limited. On the basis of an analysis of the value chain of onion and tomato he found that their dependency on the spot markets implies that they are price-takers, even during the out-of-season periods and that brokers and wholesalers obtain the highest margins.

Data on income differences from semi-structured interviews in rural Ethiopia:

- income levels of workers for large scale commercial F&V farms are most constant (12 months per year) and highest.
- farm workers in the commercial sector also get additional benefits such as a free lunch, access to medical care and bonus payments
- income levels in the semi-commercial and smallholder sector are seasonal and on average lower than in the commercial sector
- independent F&V smallholders have the added risk of crop failure.

What this example demonstrates is that merely focussing on farm productivity improvements is not sufficient to significantly raise farm income levels and improve the food security situation of F&V growers. The way in which growers interact with other supply chain partners, have access to financing and other support services and the level of efficiency by which supply chain partners together meet the demands of the target market are other crucial factors. More information on these alternative supply chain arrangements is included in the following two sections.

4.3 Smallholders supplying high-value domestic and regional markets

Rapid urbanisation and rising living standards in the developing countries leads to an increased demand for high-value food products. The growing number of urban, middle class consumers has a preference for higher levels of food quality, food safety, diversity and convenience. To meet these new preferences, modern value chains in developing countries invest in logistics and value adding activities and adopt increased vertical supply chain coordination. Reardon *et al.* (2013) calls this the 'Quiet Revolution' in the African food supply chains. Similar to what has occurred one or two decades ago already in Asia, they observed and analysed the upcoming small and medium enterprises in the African agri-food sector that invests in trucking, wholesale, warehousing, cold storage, processing, local fast food and retail. An example is the sharp increase in fruit and vegetable processing and trade activities in Rwanda for the local and the regional market (Verhofstadt and Maertens, 2013).

Another important trend is the expansion of the supermarket sector in Sub-Saharan Africa. Although not yet as strong as in most parts of Asia and Latin America, the rise of the supermarkets will have system-wide effects on the fruit and vegetable sector. According to Tschirley *et al.* (2014) these effects include: (a) introduction of operational efficiencies in the value chain leading to lower consumer prices; (b) consolidation and increased scale of operation in processing and wholesale; (c) reduction of the number of small independent shops and wet market trade; (d) exclusion of the smallest growers from the supermarket procurement system; and (e) reduction of the food safety problems.

Data on employment differences from semi-structured interviews in rural Ethiopia:

- the smallholder F&V sector in Ethiopia accounts for 95% of the national production and provides work for 5 family members per ha for 120 days per year
- labour requirement in the other two sub-sectors is around 4 workers per ha.
- in all three sub-sectors more than half of the work on vegetable cultivation is done by women
- in the fruit sector more than 50% of the work is done by male workers (18-30 years old).

In Kenya supermarkets already account for 6% of the national food retail sector and 20% of the urban retail market. In Nairobi, supermarkets now account for 4% of fresh fruit and vegetable sales. It appears that the supermarket procurement strategies have started to influence the horticultural sector around the Kenyan capital and this phenomenon is spreading to other parts of the country. A survey undertaken among vegetable growers in Kiambu District in central Kenya shows that the growers' participation in supermarket channels has a positive impact on farm productivity and income. Higher farm-gate prices in the supermarket channels and a better market assurance leads to a higher ability and willingness to upgrade the production technologies, specialise and raise overall efficiency levels (Rao *et al.*, 2011).

A survey of 600 chili farmers in the highlands of central Java, Indonesia indicated that their participation in supermarket supply channels is linked to proximity to road, more education, and younger farmers. Their participation is not related to farm size, irrigated area, or ownership of assets (other than storage facility). Farmers who participate in these modern channels have 75% higher incomes. The modern retail sector in Indonesia represented only 11% of food retail sales in 2009, but growth of the number of supermarkets and hypermarkets has been 12% per year. It is projected that the share of urban food spending at modern retailers will grow in Indonesia to 25% during the coming 10 years (Minot *et al.*, 2013).

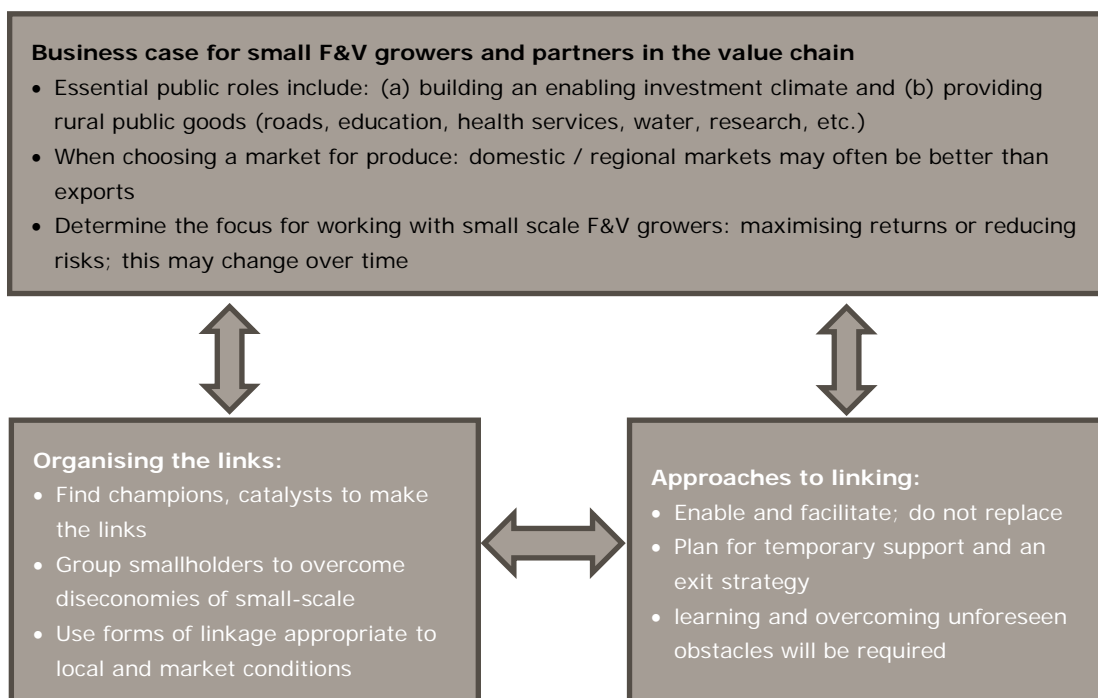


Figure 4.2 Three dimensions in linking smallholders to markets

In order to promote the inclusion of smallholder F&V growers in these emerging high-value supply chains the diagram above provides a generic approach (Wiggins & Keats, 2013). Most small scale F&V growers are not linked to the emerging higher value markets for a variety of reasons: remoteness, low production, low product quality, and lack of information, to name a few. To overcome these constraints Wiggins & Keats (2013) indicate that a level of organisation and economies of scale in the smallholder sector are important preconditions for inclusion.

4.4 High-value export markets

Since the 1980s, international trade of fruit and vegetables has been characterised by tremendous growth, driven by rising incomes and the expansion of the middle class worldwide. Motivated by this growing global demand, several developing countries have actively pursued the production and export of this high-value agricultural subsector and have successfully captured a portion of the horticultural market. This export industry offers an important source of employment for these developing countries (Fernandez-Stark *et al.*, 2011).

Kenya has been the largest exporter of high-value horticultural produce to the European markets. The Kenyan fruit and vegetable industry's growth was based on a high involvement of smallholder producers, which in 2004, accounted for approximately 60% of the export production of fruit and vegetables; however, this share has declined considerably since the implementation of private standards. Although they have become more organised through farmers' groups to increase their bargaining power with exporters and reduce individual risk in face of changing demand for products, smallholders now account for just 30% of production. At the higher end of the chain are a small group of approximately 12 Kenyan producer-exporters with their own production farms and extensive packing installations. These exporters are well organised, with advanced technologies in cold chains and logistics, and their final products include fully packaged 'ready to eat' convenience fruit and vegetables.

An important aspect of high-value export markets is contract farming or out-grower schemes for produce through which nucleus farms or processing firms seek to ensure a steady supply of produce. Evidence show that female farmers are largely excluded from modern contract-farming arrangements

(FAO, 2011). Often since female farmers lack secure control over land, family labour and other resources required to guarantee delivery of a reliable flow of produce. For example, women comprise fewer than 10% of the farmers involved in smallholder contract-farming schemes in the Kenyan fresh fruit and vegetable export sector (Dolan, 2001), and only 1 of a sample of 59 farmers contracted in Senegal to produce French beans for the export sector was female (Maertens and Swinnen, 2009).

In addition the evidence is mixed regarding whether contract farming increases overall household incomes or creates conflicts between the production of cash crops and food crops. For example, Dolan (2001) argues that the growth of high-value F&V supply chains has been detrimental for rural women in Kenya because land and labour resources that were traditionally used by women to cultivate vegetables for home consumption and sale in local markets have been appropriated by men for export vegetable production under contract. On the other hand, although their results are not gender-specific, Minten *et al.* (2009), found that high-value vegetable contract-farming in Madagascar leads to improved productivity for food (rice) production through technology spill overs, thereby improving the availability of food in the household and shortening the 'hunger season'. Maertens and Swinnen (2009) do not find evidence of gender conflict over resources in the French bean export sector in Senegal because households only allocate part of their land and labour resources to bean production, which occurs during the off-season and does not coincide with the main rainy season when staple food crops are being produced.

Today the export orientated F&V sector provides considerable employment in both rural and urban Kenya. This growing workforce can be divided between two key segments: (1) farm workers, and (2) pack house labour. Farm labour is typically rural, while employees in pack houses are based in urban centres close to Kenya's international airport. Employment in these segments is gender-based, with women playing an important role in pack houses, in particular. While this employment was initially focused on unskilled labour, nowadays it requires a prepared labour force due to the complex demands of global buyers, the enforcement of new public and private standards, and the growing global competition among developing countries (Fernandez-Stark et al, 2011).

In Ghana households cultivating horticultural export crops like pineapple are on the average better off than those that do not (Afari-Sefa, 2007). Despite the enormous contribution of horticultural exports to foreign exchange earnings, the micro level distributional effects has not favoured the chronically poor households who are structurally impeded from seizing the existing opportunities of the export boom by virtue of their poor resource endowment and liquidity constraints (Afari-Sefa, 2007).

In terms of employment conditions it is important also to review the position of different workers involved in export-oriented F&V chains. A literature study of horticultural and other commodity value chains implemented by Chan (2013) reveals that informal employment conditions are the norm in the export sector. All types of informal workers were found to be vulnerable to changes in market conditions, and overall, women informal workers tend to experience worse conditions than their male counterparts. While these cross-cutting patterns were observed across all worker categories, most constraints were found to be quite specific to each type of informal worker. Thus, for workers in formal enterprises, the main concern is the disparity between the conditions of informal as compared to formal workers and the weaker legal protection afforded to the former group. In the case of smallholders who supply export traders or pack houses, the key issue was found to be the limited returns experienced by many of those. In contrast, hired workers on smallholder farms faced a different range of issues including poor wages, poor health and safety standards, inadequate leave entitlements, and gender discrimination. For contributing family labour, the key concern was the fact that they were providing much of the labour on smallholder export farms, yet receiving little of the rewards.

The main commercial growers and importing companies in Europe are increasingly aware of the importance of the better terms and conditions for workers, both in the formal and informal sectors. GlobalGAP is the most common sustainability and traceability standard in the international F&V sector.

Workers' safety and health are part of this standard, but for example gender equality, the right for collective bargaining and non-discrimination are not covered. Initiatives such as the Global Social Alliance Programme⁵, the Business Social Compliance Initiative⁶ and the Ethical Trade Initiative⁷ are becoming increasingly important. In the Netherlands IDH the Sustainable Trade Initiative has launched the Sustainable Initiative Fruit and Vegetables (SIFAV⁸), which tries to harmonise the different sustainability standards and place more emphasis also on social inclusiveness and workers' conditions in addition to environmental sustainability and food safety and quality.

⁵ www.gscpnet.com

⁶ www.bsci-intl.org

⁷ www.ethicaltrade.org

⁸ www.sifav.com



5 Comparing fruits and vegetables with other agricultural sectors

5.1 Income

Farmers engaged in the production of fruits and vegetables often earn higher net farm incomes than farmers who are engaged in the production of cereal crops alone (Table 5.1). Studies from developing countries frequently show higher average net farm incomes per household member among producers. A study in Kenya that sampled smallholder farmers who produced for export found that net farm incomes were five times higher per family member compared to smallholder farmers who did not grow horticultural products.

Table 5.1

Difference in net farm income per family member of fruit and vegetable production versus cereals smallholder farms

Country	Share (%)
Kenya	497
Northern Viet Nam	20
Southern Viet Nam	189
Cambodia	117

Sources: Kenya: McCulloch and Ota (2002); Cambodia: Abedullah *et al.* (2002); Viet Nam (northern): Thuy *et al.* (2002); and Viet Nam (southern): Hau *et al.* (2002).

5.2 Profitability

The profitability of fruit and vegetable crops compared to cereals has been shown to be a determining factor for crop diversification into horticultural production in Asia. Table 5.2 gives the results of several studies in Asia and Africa. Profitability of vegetables and cereals is expressed as the net return on different input measures (area, labour, and days field is occupied). In these studies total labour cost is included, while land costs are excluded. Profitability of vegetables (as a group) compared to cereals (rice) is expressed as the ratio of vegetables to cereals. Thus, an index of 1 would indicate that the profitability for the specific measure is the same for vegetables and cereals, whereas an index greater than 1 indicates a greater profitability of vegetables, and an index smaller than 1 indicates a greater profitability for cereals. While the absolute value of the index varies greatly, certain trends can be observed. Apparently, vegetable production is more profitable than rice production in terms of cropping days—since the growing period of vegetables is usually less than rice—and in terms of cropped area.

Thus, the production of vegetables has a comparative advantage particularly under conditions where arable land is scarce and labour abundant. Vegetables have a lower comparative advantage when labour and access to inputs are the limiting factors.

Table 5.2

Profitability indicators of vegetable production as a ratio to rice

	Ha	Labour day	Cropping day
Niger	3.3	1.6	n.a.
Northern Viet Nam	14.2	2.3	16.7
Southern Viet Nam	9.6	1.9	10.6
Cambodia	9.4	1.9	13.8

Sources: Niger: Chohin-Kupera *et al.* (1999); Viet Nam (northern): Thuy *et al.* (2002); and Viet Nam (southern): Hau *et al.* (2002); Cambodia: Abedullah *et al.* (2002).

5.3 Employment

Production of fruit and vegetable products offers opportunities for poverty alleviation, because it is usually more labour intensive than the production of staple crops (see Table 5.3). Often, fruit and vegetable production requires twice as much, sometimes up to four times as much labour than the production of cereal crops. Research of Huong *et al.* (2013) in the Red River Delta⁹ shows that permanent vegetable cultivation requires more labour than the traditional cropping systems with rice followed by seasonal vegetables. Profit, labour requirement and costs of pesticides used were calculated as variables characterising the vegetable production systems expressed in kVND per hectare per growing day. The data showed that permanent vegetable production has the potential to contribute to poverty alleviation in rural areas by substantially increasing household income. However, the presence of some crops with negative profit also illustrates the risks associated with vegetable cultivation and marketing. Furthermore, very small landholdings and small production plots appear to form a barrier to development of commercial vegetable cultivation as these hamper effective marketing.

In Kenya, the production of snow peas and French beans, the two most important vegetable export crops, require 600 and 500 labour days per ha, respectively (Dolan, 2002). See Table 5.3, which compares average labour use in vegetable production with average labour use in cereal production for several Asian countries and an African country.

Table 5.3

Average number of labour days per ha for production of cereals and vegetables in Asia

Country	Cereals	Vegetables
Kenya	n.a.	500-600
Northern Viet Nam	216	468
Southern Viet Nam	111	297
Cambodia	81	437

Sources: Kenya: Dolan (2002); Viet Nam (northern): Thuy *et al.* (2002); and Viet Nam (southern): Hau *et al.* (2002); Cambodia: Abedullah *et al.* (2002).

In addition, the export industry offers an important source of employment for developing countries. Cultivation of fruit and vegetables is substantially more labour-intensive than growing traditional export crops and offers more post-harvest opportunities to add value. Today, packing and processing services—such as washing, chopping, and mixing, as well as bagging, branding, and applying bar codes—are often carried out at the source rather than at the end-market destination. These processes, which were previously based in the developed world, have created considerable new employment opportunities in developing countries (Fernandez-Stark *et al.*, 2011). However if labour is scarce, the availability of hired labourers may actually be a limiting factor to vegetable production as a study of determinants of horticultural production in Kenya has shown (McCulloch and Ota, 2002).

⁹ Region in northern Viet Nam supplying fresh produce for the urban consumers in Hanoi.

6 Conclusions and discussion

6.1 Conclusions

The development of the fruit and vegetable sector in developing countries has a positive impact on the FNS situation of the people in the sector and consumers in more than one way. The scale of fruit and vegetable production has increased over the past 10-15 years also in food insecure countries such as Ethiopia, Rwanda, Ghana, Uganda, Kenya, Indonesia and Viet Nam. The overall fruit and vegetable availability has improved in these countries.

Access to food has improved simultaneously. F&V producers become more food secure as a result of increased levels of income. This particularly applies to emerging commercial growers and male and female workers in the commercial F&V sector. The production of fruits and vegetables by smallholder growers for the low-value domestic markets appears to be less attractive for increasing farm income levels.

There is a direct correlation between increasing levels of income and the demand and consumption of vegetables. Female-headed households appear to spend more on fruit and particularly vegetables than male-headed households. Fruit and vegetable consumption among urban households is higher than in rural areas. This is attributed to the higher income levels in urban areas. Overall consumption levels of fresh horticultural produce in most parts of Sub-Saharan Africa are rising, but are still far below the daily intake levels recommended by FAO and WHO. In Asia and some of the Francophone parts of Africa the low F&V consumption levels are less of a problem.

Households with fruit and vegetable cultivation appear to have less nutrition related health problems such as vitamin and micro-nutrient deficiencies. The nutrition and health benefits were particularly noticeable also among women of childbearing ages. Furthermore, when women are assisted to earn more money, they tend to invest in their families by providing more food, preventative health care and education for their children. In terms of FNS improvement the vegetable sector in particular provides many jobs for female workers, with good employment conditions.

When comparing to other crop production sectors, the F&V sector is far more labour intensive. The traditional small-scale fruit and vegetable production and marketing sector is still the most important sector in terms of employment, income and scale of production. However, informal and inefficient supply chain arrangements provide low income and offer little incentives for growers and their families to improve their production and marketing activities. Smallholders could alter their market focus and target markets where more value is added and supply chain arrangements are more efficiently organised and implemented.

More opportunities are provided for F&V growers to link with upcoming small and medium-sized enterprises in the African agri-food sector that invests in logistics, wholesale, warehousing, cold storage, processing, local fast food and retail. Another important trend is the upcoming supermarket sector in Asia and Sub-Saharan Africa. Surveys in Kenya and Indonesia show that F&V growers who participate in these higher value supply chain arrangements for the domestic and regional markets (preferred suppliers) receive a higher income. Improving the level of organisation among F&V growers and creating economies of scale in the smallholder sector is a precondition for their inclusion in these emerging F&V supply chains.

In the high-value fruit and vegetables export sector in East Africa we observe a trend away from smallholder production as the main suppliers of fresh produce. However, alternative employment is created in the urban packing houses. While the employment in the high-value export sector was initially focused on unskilled rural labour for F&V production, nowadays it requires a prepared labour

force due to the complex demands of global buyers, the enforcement of new public and private standards, and the growing global competition among developing countries.

The fruit and vegetable sector compares favourably with cereals and other food crop sectors in terms of employment and income generation. The production of vegetables has a comparative advantage particularly under conditions where arable land is scarce and labour is abundant. Vegetables have a somewhat lower comparative advantage when labour and access to inputs are the limiting factors.

We have not come across sufficient data and information that allows for a FNS impact comparison between the fruit and vegetables sector and other more intensive agri-food production sectors, such as poultry or dairy production or coffee or cocoa cultivation and processing activities. Based on several of the FNS indicators described in this paper it should be possible to make such a comparison. This would enable Governments, donors, CSR managers and development agencies to weigh up the alternative development investments in terms of the expected FNS impact potentials.

6.2 Final remarks

On the basis of this explorative study it is not possible to formulate a comprehensive set of guidelines for policy makers and practitioners on how to pursue FNS objectives in the F&V sector. Additional research and analysis is required in relation to a number of areas, including:

- The comparison of the F&V sector with other productive sectors with high levels of smallholder involvement such as poultry farming, dairy farming and agro-commodity production (e.g. cocoa and coffee) for its FNS impact potential;
- The income and employment effects of the recent changes in the high-value commercial F&V sectors, particularly also related to the shift from rural to urban-based employment;
- The most effective strategies for including increasing numbers of smallholder producers in supplying the growing high-value domestic F&V markets in developing economies, with due attention also to the opportunities for female growers and farm workers and youth;
- Evaluation of the effectiveness and viability of existing strategies aimed at creating added value for smallholder producers in supplying domestic BoP F&V markets, including individuals at risk of malnutrition.

On the basis of the data and information gathered it can be concluded that F&V sector development will not provide FNS for all growers and workers involved in the sector. Whether investments in the development of the F&V sector will provide the highest development dividend is also not certain. However, there appears to be considerable evidence that by supporting the growth and development of F&V supply chains aimed at the high-end domestic and export markets, positive effects can be expected in terms of:

- Increasing income levels and additional employment generation for growers and workers, both male and female;
- Improved access to food and a more balanced diet for those growers and workers active in these F&V sub-sectors.

The Dutch F&V sector, with its broad know-how and experience related to intensive cultivation, safe and efficient production and handling of fresh produce and interests in the supply of modern inputs and trade of produce, can be a valuable partner for the growers and other supply chain partners in the F&V sector in Africa and Asia. By working with leading commercial farms, wholesale traders in quality inputs and fresh produce and emerging supermarket chains the Dutch F&V sector can facilitate the inclusion of increasing numbers of emerging small-scale commercial growers. The main focus should be on the sustainable and safe intensification of the cultivation and handling of F&V by commercial growers, both small and large scale. The Dutch F&V sector should also assist with efficient solutions to organising economies of scale in supplies from emerging commercial growers.

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Appendix 1 Case studies from Ethiopia

Introduction

The main data included in this case study report on FNS in the horticulture sector was collected during a series of interviews with different stakeholders in the production and supply of fruit and vegetables in the Ziway and Koka regions. These are important vegetable production areas from where the export and urban markets in Addis Ababa are supplied.

In total 10 smallholders, five medium scale and four large scale commercial growers were interviewed by Mr Yared Sertse and his colleagues of Shayashone Consult on the basis of a semi-structured interview schedule. In addition they talked to 10 farm workers in the F&V sector and five intermediate traders.

The number of people interviewed and the method of selection make the sample population not fully representative for the F&V sector in Ethiopia. However, in terms of anecdotal evidence and case study material, the outcome of the interviews as summarised in the pages below provide a rich and relevant background picture for this explorative study on food & nutrition security in the F&V sector.

Horticulture sector in Ethiopia

Fruit and vegetable production is an important component of Ethiopian agricultural production system. Annual fresh vegetables & fruits production in 2013 was estimated to be 4.9m tonnes. Because of the unique climatic and natural resources, almost all types of fruits and vegetables can potentially be grown in Ethiopia. The country has more than 137bn m3 of ground and surface water per annum; close to 70m hectares of arable land, over 10m hectares of irrigable land. The Government of Ethiopia sees the horticulture sector as one of high priorities for export as well as domestic market. A separate government organisation, Ethiopian Horticultural Development Agency has been established to speed-up investment and intensification of the sector. A total of over 1m hectares of land has been identified for investment in horticulture of which less than 10% is developed.

There are two categories of horticulture producers in Ethiopia: smallholder and commercial/investors. Smallholder farmers are the principal suppliers of fruits & vegetables; accounting for over 95% of the national production but the commercial horticultural production is increasing fast. These farmers own an average of 0.03 ha per household. Production is mostly rain fed but there is increasing trend of using irrigation particularly in Zeway, Lake Tana and Awash belts. Onion/Shallot, garlic, potatoes and chillies as well as perennial tropical fruits such as mango, avocado, papaya and banana are mainly produced under rain fed conditions. Tomatoes, carrots, lettuce, beetroot, cabbage are usually restricted to areas where irrigation water is available. Fruit and vegetable production in the smallholders sector is mainly rain fed while most commercial farmers use irrigation.

The commercial producers are mostly found in the Rift Valley region along Awash River Basin and Lake Ziway. They use irrigation and grow during the dry season between October and April where smallholder farmers are not active. Commercial producers can further be categorised as small scale farmers supplying to low value local market and larger/international investors targeting export market or supply to high end local market. The small scale commercial farmers are mostly local people working in short term lease arrangement with the local farmers. They usually run 5-50 ha of land. This group of producers usually grow short term horticultural products such as onion, tomato, lettuce, cabbage, and pepper. The larger scale commercial farmers or investors are specialised producers granted land from government. There are over 20 large scale horticulture producing farms in Ethiopia- both fruit and vegetables. Large scale commercial farms run 200-300 ha land on average but few such

as upper Awash and Africa Juice have over 3,000 ha. The principal products of large scale horticulture producers are export products such as beans and peas, egg plan, tomato, cherry, cucumber, strawberry and table grapes.

Marketing and distribution

Fruit and vegetable products are important cash crops though there is also significant household utilisation. Evidence from farmers during the field mission indicated that the proportion between marketed and consumed volumes per household production is 85:15. Farmers sell their fruit and vegetable to local trader either harvested or on the field. In some cases the farmers are organised into trading cooperatives. Both local traders and cooperative unions sort and move the product to regional or central market. About 94% of fruit and vegetable production in Ethiopia is consumed fresh within the domestic market. Usually products of high quality are supplied to supermarkets for international and high income class consumers. Since there are no cooling systems only fresh products are transported and traded. Smallholders bear regular production and market risks that often lead to losses. The loss of vegetables between production and consumption is estimated to be 25-35%. The fact that these products are highly perishable hinders the possibility to store and sell when prices improve.

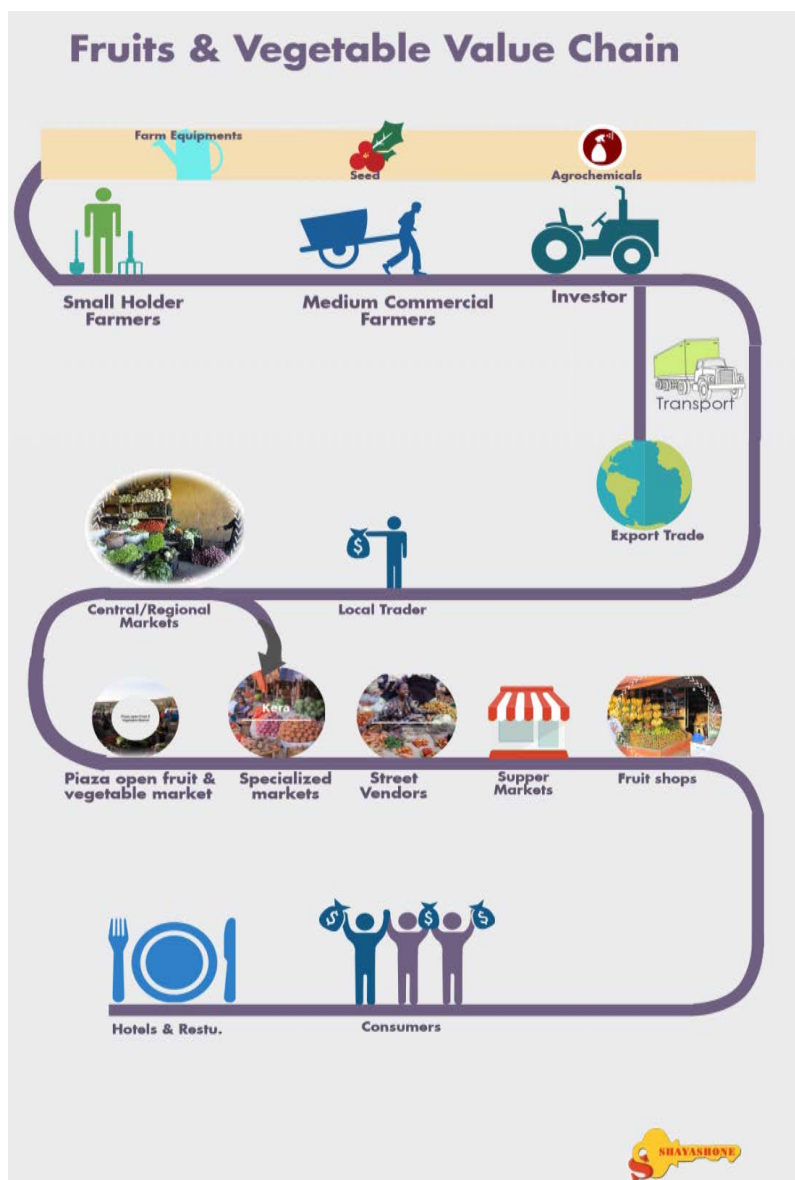
‘Success in vegetable production largely depends on your luck. You lose one year and compensate next. Our major problem is the market, which is highly unpredictable. Today a kilo of onion is sold at 10 Birr but tomorrow it can go to 2 Birr. There were even times when we couldn’t sell our product at all and the whole thing rotted on the farm. Onion is particularly risky as the whole product ripens at once but products such as pepper and tomato have different maturity window where you can at least compensate from early or late harvests. Personally, I would still love to work on my own farm despite the risk.’

Women and youth are the principal groups engaged in the local trading business. They get products from the local farmers but few have own/family farms. The local trading of fruits and vegetable is mostly along the main routes to Addis Ababa and Hawassa under tree shades. The primary buyers from the local traders are travelling passengers but as the product shelf life shrink youth and people in the community buy at a low price. The average daily sales by these group ranges from Birr 500 to 1000. There is tangible evidence on the change in living standard of those traders. As shown in the box below, traders are happy with the growth and prospect they see for the future. Some of these traders have previously employed at commercial horticultural farms but they see their current job generates more income. In the smaller towns such as Koka and Zeway there are fruit and vegetable shops that also sell fresh juice and salads.

Over 60% of the fruit and vegetable collected by local traders and cooperatives is transported to Addis Ababa. Generally products brought to Addis have no significant quality difference with those traded at local level. However, the products shipped to the central or Addis Ababa market are at early maturity stage with better shelf life. The transportation between farm gate and Addis is usually done with medium-sized trucks during night time so that products become ready for the next morning market. The Addis Ababa Fruit and Vegetable market can be categorised into: distributor/wholesalers, specialised fruit and vegetable open/shade markets, supermarkets and shops.

The popular Piazza fruit and vegetable market is the distribution hub and gate way to over 60% of products transported to the capital. From this hub, products are shipped to the other three market categories. The Piazza distribution hub has strong impact on the market price of fruits and vegetables nationwide. There are 10 specialised fruit and vegetable markets in Addis Ababa that get most of their products from Piazza. These markets sell to consumers and businesses-hotels, restaurants and juice houses.

The supermarkets in Addis get products mostly from the Piazza market but they increasingly source directly from regional suppliers and commercial producers. In the former case, they have informally accredited or dedicated suppliers who can serve higher quality products. The commercial farmers deliver high-value products such as table grapes, strawberries, chili pepper and cherries and special types of tomatoes. Few supermarket chains such as Fresh Corner have their own fruit and vegetable farm and out grower schemes. The principal buyers of the supermarkets are foreigners and high income consumers mostly in premier areas such as Bole, CMC and Sar Bet. However, there are also few B2B buyers such as Ethiopian Airlines and big hotels-Sheraton and Hilton.



The fruit and vegetable shops and street vendors serve about 80% of the end consumers in Addis. They often are multipurpose shops with dual business of selling fruits and vegetable plus fresh juices and salads on the spot users. They get their products from the Piazza distribution centre.

In the urban areas, in particular in Addis Ababa, fruit and vegetable can be observed in sufficient quantities at markets, but demand for fresh fruits and vegetables is constrained by the fact that most consumers cannot afford them. The most prominent vegetable products in the Addis Ababa Market are-onion, potato, tomato, cabbage and pepper while banana, mango, avocado, and citrus are most popular fruits. Except for bananas, fruit is mostly consumed by middle and higher income classes, which represent not more that 20% of the overall population. Per-capita fresh fruit and fruit juice consumption in the country is 5kg/year and 0.02kg/year respectively. Due to absence of market,

postharvest handling facilities, and processing industries, a large part of the fruit is left untouched, with estimated 20% product damage.

Employment creation

The fruit and vegetable sector created partial employment opportunity for over 9m smallholder farmers. Apart from contributing to the overall economic development of the country, the horticultural export industry has created job opportunities for about 133,000 people (excluding the flower farms), of whom the 70% are women. In addition, the number of people engaged in trading, transporting and processing could be over 100,000. Fresh juice and fruit and vegetable business is common in major cities and highly preferred by consumers.

Looking at the local imperatives the horticultural sector is playing a pivotal role in creating job opportunities at two levels: production and trading. Horticulture is more labour intensive compared to crop production or livestock. Labour requirements per hectare vary between smallholder farmers and commercial investors as well as from product to product.

Interview of smallholder farmers during the field mission indicated that they needed a total of 400 man days of labour or equivalent of five fulltime family or hired labour for one hectare land of onion continuously working for three months. The labour requirement for tomato is 300 man days, slightly less because of the less labour intensive weeding and planting processes. The major fruit grown by smallholder in the study area is papaya, requiring about 120 man days per year. Most of the smallholder farmers use family or neighbours' labour.

The medium commercial farmers use tractors for land preparation but other production steps of planting, weeding, watering, harvesting are labour based. According to the information from the interviews, a full time equivalent of approximately 4 people per ha is needed for three months production cycle. The large scale investors noted average fulltime equivalent of 3.7 people per ha. During the peak seasons of planting, weeding and harvesting labour demands are as high as 40 people per ha per day.

The employment composition at the horticultural farms varies on the type of crop and nature of work. Over 80% of the labour force for onion production is women while the reverse is true for tomato. This difference in distribution of labour by gender is related to the fact that plant population per square area for onion is large and hence demands a more precision during planting, weeding and cultivating. Women are active in activities that demand precision and attention to details and less physical strength. The male workforce is mostly youth between 15-30 years of age. This group is responsible for activities that demand physical strength such as land preparation, spraying agro-chemicals, cultivating and loading harvest. The table below represents the data of 10 smallholder farmers, 5 medium commercial farms and 4 large scale farms.

Production	Process	Smallholder farm (days/ha)	Medium Commercial (days/ha)	Large scale farm (days/ha)
Onion	Land preparation	72	80	16
	Seedling	64	72	64
	Cultivating	88	80	80
	Weeding	88	88	56
	Collecting	80	72	64
Tomato	Land preparation	64	64	16
	Seedling	64	64	64
	Cultivating	88	88	56
	Weeding	40	40	40
	Collecting	48	48	52

Income generation

Fruits and vegetables are strategic export commodities for Ethiopia. Over the last five years export has shown steady growth of nearly 80% per year. Important export markets for fruits and vegetables are the surrounding countries (Djibouti, Somalia, and Sudan). The main products to these countries were non-graded fresh fruit and vegetables such onion, tomato, potato, banana, mango and avocado. High-value graded pre-packed vegetables and fresh herbs account for only 11% of the total export. Most of these products are exported to the United Kingdom (UK), United Arab Emirates (UAE) and The Netherlands. On the other hand, Ethiopia imported over 60.000MT juice during the same year; import has been increasing by 1,900MT per annum since 2009. Tomato Juice (35%), mixed Juice (18%) and pineapple juice (18%) are the top three imported juices to Ethiopia.

Fruits and vegetables are important cash crops or means of earning for many households. There are three categories of people engaged in production of horticulture: self-employed, permanent employees and daily labourers. The self-employed are mostly smallholder farmers growing vegetables and fruits on their own land; they account for not more than 10% of the community. These are households who have land closer to the lakeside whereby pumping water is not costly. Farmers cultivating vegetables on their own land can get a net annual income of up to USD 4,000 per year in two production cycle at the time of good harvesting and market season. Average farm size is close to 0.25 but less than 10% of the people have land suitable for horticulture production. This group of producers heavily depend on family labour that occasionally resulted in large number of children dropping out of school. Besides the pre-investment finance is a major constraint for smallholders to grow horticulture and usually end-up leasing their land or working in partnership modality with people bringing in finance.

'I work on a land my brother and I own, 0.5ha. Including us we support 12 family members. We spend around ETB 24,000 (USD1,200) for one production period and sell it for about ETB 120,000 (USD6,000). It is always nice to work on your own land even if there is a risk of losing when vegetable prices fall. It is also very time consuming and tiring. We mostly have to hire daily labourers for ETB 80-100/day per one labour. We grow maize and chickpea in the rainy season but our economic improvement came from onion. Our kids can now go to better school and we have tin roofs for our houses.'

During the rainy season, when horticultural products are not grown, smallholder farmers switch to crop production which is the main source of household food security. Crop production takes place in different plots from those used for vegetables. In the area where this study is conducted the vegetable field is usually water logged and hence, the land is mostly idle during rainy season-June to September. Self-employed farmers mentioned increased asset base; example building better house and buying animals as major success over the years. The daily labourers on the other hand noted saving cash and starting their own farm. The table below for the average of the five medium commercial farms shows the average return per hectare. However it is important to note that the farmers mentioned this return can be recouped during a good harvest and marketing seasons. The return per hectare for smallholder farmers is generally low because of the limited use of high yielding varieties, poor management and lack of proper market information and forecasting.

	Onion	Tomato
Productivity (MT/Hectare)	24	50
Total income from sales (ETB/Ha)	264,000	300,000
Costs		
Seed (ETB/Ha)	9,600	9,000
Labour (ETB/Ha)	46,800	36,000
Land (ETB/Ha)	8,000	8,000
Fertiliser (ETB/Ha)	3,700	2,300
Agro-Chemicals (ETB/Ha)	1,000	1,000
Other costs (trellis) (ETB/Ha)		2,000
Total cost (ETB/Ha)	69,100	58,300
Profit before tax (ETB/Ha)	194,900	241,700

'I work on my brother's farm with my other brother. We were street venders wasting our money on food and wasting our time going to school. Then we saw how our brother worked on other people's farm and learned the ins and outs of growing vegetables. Then he rented land, grew tomato and onion and got very rich. He currently has bigger plot of land, his own loading truck and a nice house in the city. So now we manage his land well and he pays us good- 120br/day. We save what we get and plan to have our own land soon. During the rainy season I polish shoes and engage in some daily activities in Ziway town.'

'I have worked for several years as an employee. I have gained a lot of knowledge on how to grow vegetables and even fruits. My brother has quarter of a hectare of land and I am giving him advisory service. Sometimes you don't value the intangible gains you have here but when you leave one day, you see that your time was well spent.'

'I am 17 years old and a 7th grader. I buy tomato and onion from farmers and sell on the street for travellers passing by. I mostly buy about 50kg of onion and a box of tomato at a time and make about 100br profit from each. It is me, my sister and my mom at home. We have a piece of land- 0.25ha, where we grow teff and maize. We consume all that is grown on that land. The vegetable retail business is mostly profitable; I don't want to be hired in a farm. I plan to quite school and work on it full time. I feel sorry that you are employees doing field work in such dry weather.'

The daily labourers work at medium and large commercial farms. The payment in this case is task based in which labourers agree to accomplish a defined task (example planting or preparing X hectare of land) for a given amount of money. On average a person can earn USD3 for a day's work plus lunch. Of the medium and large scale commercial farms, the former pays about 20% high but they often have limited amount of work that leads to regularly switching between farms. A major advantage of daily labour is its flexibility. If the labourer is able to complete the task ahead of time then he/she can go and work on another land or work further than the agreement and earn accordingly. However, jobs of this kind are for limited number of days in a year. On average a temporary labourer can work up to 200 days per year in horticulture fields. There is clear division of labour between men and women based on the nature of the job. Evidence from large scale commercial horticulture producers indicated that most people in the community incline to this modality.

Permanent employment is a common practice at large scale commercial farmers. They earn a stable income ranging from USD50 to USD100 per month. Those with limited experience in working at horticultural field get entry level salaries while the more experienced employees get higher compensation. Generally, there is no gender discrimination in terms of benefit and compensation. There are also other benefits such as social security, medical, food and Personal Protective Equipment, and performance based incentives such as bonuses and pay rise. In addition companies invest in training, coaching and at times sponsorship for formal education. Over 70% of the people in this category are women. The major advantage of permanent employment is income security and intangible gains in the form of self-development. Evidences suggest that many people who work at the horticultural companies on a permanent basis have acquired knowledge and exposure that helped them to start their own farm or support their family members to invest in the sector.

Outside of production, local people engaged in the wholesaling of fruits and vegetables earn USD5-8 per day while those retailing generate around USD4 per day. However, as stated above, the production of fruits and vegetables is seasonal so these individuals work part time and the rest of the time they either help on the family farm growing maize, teff and the like or look for temporary jobs.

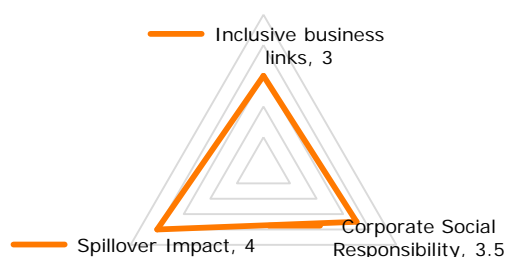
Groups	Pros	Cons
Own land	<ul style="list-style-type: none"> • High return • Flexibility • Household use 	<ul style="list-style-type: none"> • High risk venture • High capital requirement • Intensive and complex management
Permanent employment	<ul style="list-style-type: none"> • Guaranteed monthly income • Medical and pension, free lunch • Personal development-Trainings, coaching and exposure. 	<ul style="list-style-type: none"> • Lower tangible income • Less flexible-fixed working hours.
Daily Laborer	<ul style="list-style-type: none"> • Flexibility • Higher daily rate • Minimal personal risk 	<ul style="list-style-type: none"> • Less man days per year • Unstable and insecure job. • Switching cost

Inclusiveness

Three types of inclusiveness are observed in the horticultural sector at the study area: inclusive business links (out growers), positive spill over impact (knowledge and technology transfer) and Corporate Social Responsibility (CSR). The out grower scheme is limited to fruit production (e.g. Africa Juice in passion fruit) and some bulk vegetables for local market (e.g. Luna, EthioVegFru). Out growers scheme provides better quality seed, agronomic coaching and backstopping, and guaranteed market. However, the fact that most of the commercial farms are supplying to a high-value market means that quality is extremely important. Achieving a uniform and high quality fruits and vegetables particularly for fresh export or local supply is often difficult in an out grower business model.

‘In recent years we have seen good progress in terms of changing our livelihood through horticulture. Here we have several farms around us from whom we learn and get the inspiration to work by our own. We wanted our government to promote companies that bring new things that we don’t do before [...] this will give us an opportunity to learn and adapt. It doesn’t make sense if those investors are producing onion and tomato using furrow irrigation which we have been doing long before...we need the ones with new products [...] companies who could supply vegetable seed for us are highly valuable.’

The technology and knowledge transfer is the most interesting with high impact as noted by the local farmers. A typical example of this is the current practice of exported orientated farms like Florensis distributing high yielding and value tomato and onion seedling and SolAgro distributing improved varieties of potato seed. In the case of Florensis, the company couldn’t serve the seedling demand with its current available land and farmers have to wait one season to get seedling. In addition to the direct distribution of seedling, the horticulture sector has significantly contributed in brining know-how and sensitising the local farmers that has led to an increasing production at farmers’ level. Several self-growing farmers mentioned the positive spill over impact of the different horticultural companies in their localities that resulted in an increasing trend of production in horticulture.



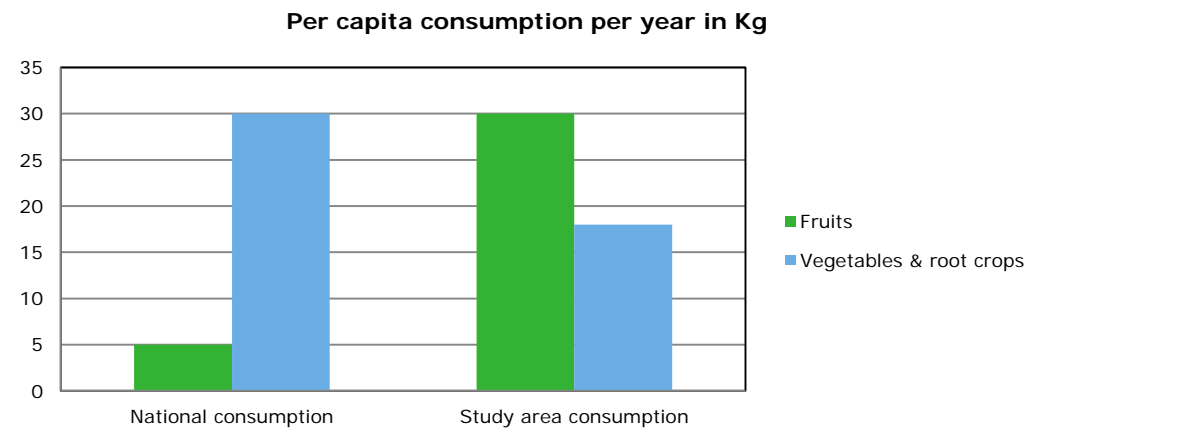
The corporate social responsibilities are related to sponsorship of community projects such as potable water, building health centres and schools. A good example of this is joint community investment in building such facilities by different horticultural companies in Koka belt. A similar case but in floricultural sector is the case of Sher Ethiopia flower farm that has built school, hospital, potable water and sport fields to the community. In terms of gender inclusiveness most of the horticultural companies give priority to women in their employment offerings. At the major horticultural farms there is no wage discrimination between gender and age groups. However these groups of people are occasionally challenged by the physical nature of horticulture endeavours. The bigger farms are strict in terms of child labour but in the smaller local farms it is common to see children working in the field. Though this is a common practice in Ethiopia it sometimes brings the risk of school drop outs.

Nutritional status of vulnerable groups

Fruit and vegetable crops are rich in vitamins, carbohydrates and other nutrients that contribute a major portion to an Ethiopian daily dish mix. Some nutritional deficiencies like vitamin A and C, and iron can be corrected by use of selected vegetable and root crops as well as fruits. Fruits and vegetables are usually used as cash crop however; there is also large consumption at household level. Vegetables such as onion, potato, cabbage, pepper and fruits such as banana, papaya and avocado are well integrated in Ethiopia's feeding practices. In some areas of the country, root crops particularly potatoes and sweet potatoes are used as staple food for considerable portion of the population. Root crops in general and sweet potato in particular are drought resistant and serve as security food crops in drought prone areas.

'I mostly take home tomatoes when they start bearing fruit. I take about 0.5kg on a daily basis. Onions are kept home after the whole production has been collected. We keep 50-60kg at home for consumption. We use this for about 6 months.'

Producers in the study area mentioned annual average consumption of vegetables and fruits of 18 kg and 30 kg per person respectively. This is against the respective national annual per capita consumption of 8kg and 5kg respectively for vegetables and fruits. The primary reasons for high consumption in the study area are availability and affordability. Local people get access to horticultural produces from smallholder farmers. However, at times the large scale commercial farms also sell low graded vegetables and fruits at lower value. Priority is given to people working on those farms sometime free of charge. Horticultural products particularly vegetables are widely served during lunch service at the commercial farms. The regular price of a kg of vegetables and fruits in the study area is 30-40% less than that in the central market. But prices decline sharply up to 100% when the product is about to lose its shelf life.



In terms of food mix, the major combinations are cereals, pulses and vegetables. Fruits are consumed solely during harvesting season. Consumption of animal products as well as quantity of other high-value food except home grown fruits and vegetables is not that different from other parts of the country. Generally farmers who are producing fruit and vegetables are more food secure mainly because income generated from sales of fruits and vegetables gives them leverage to purchase food during losses due to drought. The fact that they have access to water means that they can also grow in dry season which significantly reduces their risk.

Stability of systems

Three key success factors are frequently mentioned by all producer groups: market, disease and climate. The large scale commercial farmers engaged in export and delivering to a high end market are less vulnerable. However, they noted that horticultural products from Ethiopia are less competitive in the EU market with products from Latin America and North Africa for cost and quality reasons. The Middle East countries provide great opportunity with less quality requirement. Even in the EU, Ethiopia has a special window during off season in other countries. This group still have strong market linkage to the local high end market where by they can easily overcome when their products fail international grades or fluctuations. Most sell to the super markets and bigger hotels in Addis Ababa but few have their own distribution channels. A good example is Luna and Jittu horticulture that have set-up their own extensive vegetable and fruit chain in Addis Ababa. Upper Awash Agro Industry (ETFRUIT) has long been a brand name for its popular fruits distribution channels in Addis reaching the lower income group in different corners of the city.

Market problems are severe for smallholder farmers and medium commercial farmers who are supplying to the local mass market. This group noted that market is highly unpredictable and many producers have abandoned horticulture after big losses. When the Addis Ababa market is stocked up with products from other parts of the region, farm gate prices fall by three or four times and at times there might even be no buyer coming. This is particularly critical for tomato which cannot be dried or stored in different forms.

In the years where there is excessive rain fall farmers are affected by water logging while when there is drought the lake water sizes drops and becomes expensive to pump to the fields. Now a day's siltation due to flood from nearby mountains and high pump out of water from the lakes is posing an increasing risk of lake drainage. This issue is particularly eminent in lake Ziway area where in flow of water is far below out flow. Most of the smallholder and medium scale farmers are using furrow irrigation which has large water wastage. The other important risk in the system in increasing use of fertiliser leading to water contamination in the area.

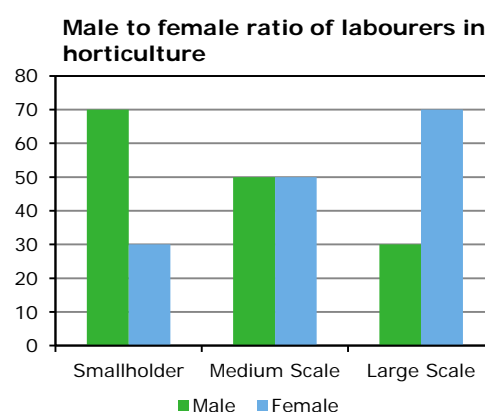
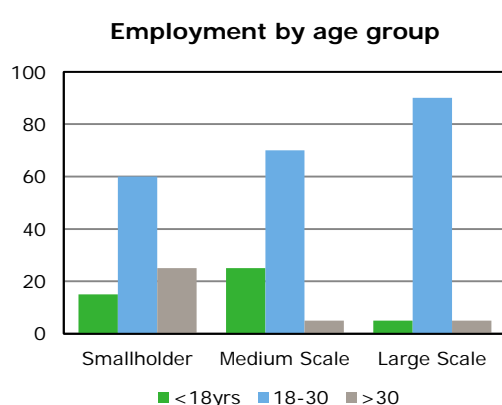
Vegetable diseases are other major challenges that result in high pre-harvest loss. Onion is commonly affected by rust particularly when there is sequential mono-cropping and soil moisture at maturity period. Tuta-Absoluta (tomato leaf miner) and late blight bacteria are the main diseases noted for tomato. In addition tomato is affected by broom-rap weed that stifles the vegetative growth of the crop. The severity of product loss due to disease in tomato is very high sometimes resulting up to 50% product loss.

	Market	Disease	Climate
Onion	Highly Volatile	Rust	Water Logging
Tomato	Volatile	<ul style="list-style-type: none"> • Broom-rap weed • Tuta-Absoluta 	
Pepper	Stable		
Papaya	Stable	Red spider mite	Siltation
Citrus		Red scale	38 degree
Mango	Stable		
Banana	Stable		

Different interventions are in place to manage these adverse impacts. The natural resource conservation and rehabilitation programme is one of the priority areas in the Growth and Transformation Plan of the Government of Ethiopia and significant steps have been taken and sound achievements have been obtained during the last five years. If the existing effort and focus continues the foregoing challenges will be minimal and Ethiopia in general and the area in particular will remain climate resilient. Parallel to the mainstream strategic intervention pursued by the government, the Royal Netherlands Embassy is tapping resources to manage siltation in Lake Zeway area.

Can you draw a conclusion or make a summary table how the different factors impact in the stability of the three different vegetable and fruit production systems?

	Disease	Climate	Market
Smallholder farmers	High: Smallholders have limited access to good quality agro-chemicals (pesticides, insecticide etc) partly due to lack of accessibility but importantly due to lack of finance. There is also problem of proper land preparation and mono-cropping.	Very High: Production and productivity of smallholder land as the water used for irrigation is not regulated but highly dependent on nearby river flow. When the water level drops they have to pump more distance leading to high fuel cost.	High: Due to lack of market information, transportation facility and perishable nature of produce, smallholder farmers have low bargaining power and are usually price takers. When production is small quantity farmers consume it at household.
Medium Scale Commercial Farmers	Medium: Medium Commercial farmers are cost conscious to use high quality expensive agro-chemicals. Access to the chemicals is also limited but much better than smallholder farmers.	High: Irrigation system is not regulated but still they have to pump long distance during dry season and when there is flooding the field is not protected.	High: Production is solely for market. Farmers noted a loss once in every three years and the loss that goes up to full harvest. They have better market information and planning compared to smallholders but still no reliable market chain that can absorb their products at acceptable price reduction-operate via brokers.
Large Scale Commercial Farms	Low: They have access to high quality agro-chemicals and they afford to invest on that. However; newly merging diseases and those adapting to the chemicals remains challenges.	Low: Some produce in green house and drip irrigation system. The land is level to reduce the risk of flooding. They often have their own underground water.	Low: Mostly supply to international market and focus on high-value fruits and vegetables where market fluctuation is not as severe as the conventional ones. At domestic level they supply to the high end supermarkets and some such as fresh corner have their own distribution outlets.



Gender and youth

The total man days needed per hectare for the different crops under different farming systems have been highlighted in the previous sections. Generally one can conclude cultivation of fruit is highly labour intensive and most of the individuals working in this sector are men and women ages 18-30. Due to the presence of several horticultural farms, young women and men migrate to the Koka-Zeway belt in search of a job. There is occasional shortage of labour particularly in the peak production seasons of November-April. During this season average daily wage increase up to 50%. There are division of labour based on farm activities and crop types. Women mostly involve in activities that require detail focus and patience; namely planting, weeding, harvesting. On the other hand the men are active in land preparation, earthling, loading and unloading. Evidence showed that some horticultural crops such as onion are more women friendly whereby over 80% of women labour is utilised at different levels.

The gender mix varies in the different farm types (i.e. smallholder, medium scale and large scale). The smallholder farmers system is more male dominated because traditional labour division puts men working in the field while women take care of the house and the children. The field work is perceived as more physical compared to activities at the house. Three reasons explain the large proportion of women at large scale commercial farm levels (1) women are seen as more accountable in taking responsibilities seriously and they are reliable in terms of attention to details (2) the production system at the large scale farms is semi-mechanised where difficult tasks such as land preparation, internal transport and loading and unloading are handled by machineries (3) women labour is readily available than men since the latter usually prefer to work on their own or on rented fields. In terms of impact women working on commercial farms complement the family with additional income and provide the woman with income independence from the man. This is also evident among the petty horticulture traders in the areas where most are women and who seem to enjoy the income they generate the freedom they have both in terms of income as well as being their own boss. The labourers in commercial farms are mostly young and high proportions of them don't see the value in having job security and a sustainable source of income. They prefer to have the flexibility to work in different farms taking advantage of the comparative payment.

Off farm activities-such as trading, are predominantly run by women but there are youth groups often below 18 who are helping the women in packing and loading products. The trading activity has become a very popular means of earning for the women and youth to the extent that most youth don't want to go to school but rather focus on the quick cash. Alike the trading the fresh juice processing activities in towns are solely run by women but the ownership of the business in few cases can still be men.

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