

ETHIOPIAN - NETHERLANDS HORTICULTURE PARTNERSHIP

Prospects and challenges for refrigerated container transport of fruits and vegetables from Ethiopia to the Middle East



Jason Hawkes/Tony Stone Images



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1 Introduction

Ethiopia has a big potential to grow more fruits and vegetables. Ethiopia's current fruit and vegetable export is very limited. Scope for expanding and diversifying its export markets is large. Demand for fruits and vegetables is growing in nearby international markets, like the Middle East. Although Ethiopia is land locked, it is geographically close to the Middle East. To reach the Middle East, and other international markets, produce has to be transported to Djibouti where it can be shipped. Roads to Djibouti are generally good, but transportation takes long due to long waiting times at the border, sometimes up to ten hours. Fresh produce is sensitive and needs to be refrigerated to remain fresh and of good quality during such long transportation time. To start exporting to the Middle East it is of paramount importance to build a good reputation and to deliver the fruit and vegetables in good condition. Refrigerated container transport offers possibilities to make use of the potential to export more fruit and vegetables which arrive the market in good quality.

Expanding fruit and vegetable production and trading at the international level will improve farmers' and traders' income and will result in a more positive trade balance. Currently entrepreneurs lack information about possibilities of refrigerated container transport and can not estimate whether it is practically possible and whether it is a worthwhile investment. Information on the feasibility and involved costs of refrigerated container transport strengthens the enabling environment and will possibly lead to a sustainable growth of the horticultural sector in Ethiopia.

Fresh fruit and vegetables (F&V) are perishable and have a relative short shelf life. Therefore, especially for F&V, costs of transportation are a crucial factor determining the competitive position in export markets. Several entrepreneurs have done trials with exporting common F&V by air to the Middle East, but not successfully. Airfreight is only an option for high-value products. The development of a refrigerated cool chain for relatively nearby markets such as the Middle-East could dramatically improve the competitive position of Ethiopia in the field of fruits and vegetables. Many private entrepreneurs have expressed interest in exploring this option during the WUR mission "Identification of opportunities in the Ethiopian Fruits and Vegetables Sector" in February 2007

This report offers an overview of the feasibility to use refrigerated container transport for Ethiopian fruit and vegetables export to the Middle East.

2 Research Approach

The feasibility study of setting up a refrigerated container transport from Ethiopia to the Middle East consists of information collection on the practical feasibility and on the economic feasibility. In order to do the calculations it was necessary to select a few fruits and vegetables due to time and cost limitations.

This feasibility study conducted the following steps to gather data:

- A. Interviews with Customs, Port authorities and the Ministry of Agriculture to get knowledge of the current rules, formalities, official requirements and overall view. Phytosanitary data has been gathered through desk research;
- B. Interviews with transporters (inland and sea), technicians (cooling facilities, materials handling, physical distribution), exporters and importers to indicate current and potential possibilities and a more detailed view;
- C. Data collection on production, current demand and market requirements to know the potential and the technical requirements;
- D. Data collection on costs involved throughout the whole chain;
- E. Monitor possible challenges and technical issues from previous and current experiences (also in other countries) and profound expertise and knowledge of logistics and cooled chains;
- F. Verify findings during the seminar on Ethiopian perspectives for and implementation of refrigerated container transport

The results of this research have been presented at a reefer business forum organised by the Dutch embassy, USAID/Fintrac, EHPEA and Maersk on the *Prospects and Challenges of fresh produce to the Middle East and Europe by reefer container*.

The following chapter will address the Middle East market, including the demand and the main requirements to enter this market. The market description is followed by a short chapter on the different transport possibilities to reach the Middle East market. Chapter 5 focuses on possible product market combinations. The complete supply chain is described in chapter 6 where the practical possibilities and challenges of reefer transportation are addressed. The costs of using reefer transportation are shown in chapter 7.

3. Middle East Market

In the Middle East it are mainly the United Arab Emirates (UAE) and Saudi Arabia who import fruits and vegetables. The UAE also re-exports a lot of products. The third biggest importer of fruit and vegetables is Kuwait, but importing only a third of what UAE or Saudi Arabia is importing (table 1). It is therefore concluded that UAE and Saudi Arabia are the most important markets for fruits and vegetables, verified by Ethiopian producers and exporters.

Table 1: Fruit and vegetable imports in Middle East countries

	F&V Imports in 2005 (in '000 US\$)		F&V Imports in 2005 (in '000 US\$)
United Arab Emirates*	690,955	Oman	89,768
Saudi Arabia	681,475	Qatar	76,352
Kuwait*	214,072	Syria	75,222
Iran	169,668	Bahrain	60,919
Israel	156,076	Yemen	34,526
Lebanon**	144,558	Iraq	na
Jordan	114,615	Palestina	na

* data from 2001; ** data from 2004

Source: UNSD-HS

Currently Saudi Arabia imports its fruits and vegetables mostly from Egypt, followed by imports from Asian and Middle East countries. UAE imports most from other Middle East countries and secondly from Asian countries. Both countries hardly import any fruits and vegetables from Ethiopia, although they both import substantial amounts from Egypt and South Africa (table 2).

Table 2: Saudi Arabia and UAE fruit and vegetable import sourcing countries

	F&V Import (in '000 US\$)	
	Saudi Arabia 2005	UAE 2001
Europe	46,717	38,136
Africa	234,153	60,278
Ethiopia	1,314	823
Kenya	902	6,320
Morocco	3,818	737
South Africa	51,087	27,044
Egypt	174,281	21,132
NAFTA	33,301	68,982
Middle East	127,781	286,462
Asia	145,729	195,040
Total World	681,475	690,955

Source: UNSD-HS

Both Saudi Arabia and UAE import much more fruits (and nuts) than vegetables (and roots/tubers) in terms of their value, see table 3. A huge import crop in Saudi Arabia are oranges from South Africa. Bananas are mainly imported from the Philippines and

apples from the USA, Chile and France. Fruits such as guava, mango and avocado are imported from different countries as Egypt, Pakistan, Iran and India. Grapes are imported from nearby countries as Iran, Lebanon and Turkey. Vegetables as tomatoes and onion are coming from nearby countries or from Egypt, China and India.

Table 3: Saudi Arabia and UAE fruit and vegetable import value

	Import (in '000 US\$)	
	Saudi Arabia 2005	UAE 2001
Vegetables, roots and tubers	161,360	270,817
Fruits and nuts	520,115	420,138
Tomatoes	27,899	39,501
Onions, shallots, garlic, leek	53,531	42,190
Banana	93,146	29,039
Dates, pineapple, avocado, guava, mango	33,314	67,367
Citrus	200,205	62,389
Grapes	17,882	31,254
Apples (& pears)	79,673	45,886

Source: UNSD-HS

3.1 United Arab Emirates

Market and Quality

Population

The UAE is a federation of seven autonomous Shaikhdoms with a total land area of 83,600 square kilometres. The seven emirates are Abu Dhabi, Dubai, Sharjah, Ras Al Khaimah, Fujairah, Umm al Qaiwan and Ajman. The UAE has around 4.9 Million inhabitants (2006) of which over 70% are male. This high number of male inhabitants is due to the high dependency on foreign employees. This is the same reason for the many young people in the country.

According to estimations only 20% of the inhabitants is Emirati (estimated is that 60% of the population is Asiatic and only 5% Western). Another remarkable population aspect is that over 50% of the population is 20 years of age or younger. Almost 80% of the population lives in urban areas. Of the total population, 96% is Islamic (EVD, 2007).

Market size/ Consumption

The agricultural production potential of the UAE has its limits because of its climate, water supply and soils. However the UAE try to be as self sufficient as possible. The government makes large investments in agriculture through subsidies, trainings and supply of materials. They currently manage to be self sufficient for 50% in the demand for fresh vegetables and fruit. Especially the date production is very large. Frequently produced fruits and vegetables are: tomatoes, cucumbers, various cabbages, zucchini, lemons, mangoes and melons.

Table 4: UAE import of fruit and vegetables from Ethiopia

Product	Total import from Ethiopia (in '000 USD)	Main exporting countries to UAE
Apple, pear	45,886	USA, Chili, France
Melon, papaya	11,978	Iran
Grapes	31,254	Iran
Citrus	62,389	S-Africa, Egypt, Lebanon
Dates, figs, pineapple, avocado, guava	67,367	Iran, Pakistan, India
Banana	29,039	Bangladesh, Philippines
Nuts	102,596	Iran, USA
Coconut	23,892	India, Sri Lanka
Vegetables leguminous dried, shelled	48,347	Iran, Australia, Canada
Vegetables fresh, nes, chilled	47,628	India, Netherlands, Tunis
Onions	42,190	China, India

Source: UNSD-HS year 2001

“Business Seasonality”

Although there are no clearly defined buying seasons, it is advisable not to conduct business in general during the two main Islamic religious holidays, the Eid al-Fitr holiday which occurs at the end of the holy month of Ramadan (month of fasting), and the Eid al-Adha which celebrates the time of year when pilgrims arrive from around the world to perform the Hajj. During these periods the majority of businesses are closed for approximately three working days (all government offices close for a longer period). Demand for fruits and vegetables is increasing enormously during the Hajj because of the huge increase of consumers.

Regulations

Labelling and packaging regulations

Labelling in Arabic is required on all consumer products. Labels need to provide information that includes placement of identification data, identification of the manufacturer, product information, and standard quality disclosures. Additionally, many food products may also have to comply with hygiene and ingredients regulations. Food labels must have information on product and brand names, production and expiry dates, country of origin, name of the manufacturer as well as a comprehensive list of ingredients and additives.

Health certificates

Requirements for food and agrarian products are formulated by the General Secretariat of Municipalities (GSM) and the Emirates Standardization and Metrology Authority (ESMA). Samples for analysis on hygiene and soundness are taken at random at supermarkets. Possibly an importer can demand a Radiation Certificate. This should guarantee that the product is free of radioactive radiation. The authorities do except all certificates from acknowledged laboratorial in the country of origin. It is advisable to have the certificate in Arab or English.

Phytosanitary certificate

A Phytosanitary certificate from the country of origin is required for all fruit and vegetables that are imported into the UAE. This certificate should state that the product is free of insects and diseases. Without such a certificate the products can not enter the country. Specific products might require specific demands.

Import licensing

Imports into the UAE can only be undertaken by those importers who have the appropriate trade license. All imported beef and poultry products require a health certificate from the country of origin and a halal slaughter certificate issued by an approved Islamic centre in the country of origin. Imports by the public sector should be guaranteed by the government in Abu Dhabi, although this is rarely needed for the private sector.

Customs duties

The UAE's customs tariffs are based on the Customs Co-operation Council's nomenclature system. Duties may be levied ad valorem or specific to the goods concerned. Foodstuff, medicines, government and oil company-destined goods are generally exempt from duty. Customs duties are levied on the CIF value at the rate of 5% on goods that are not exempted. All transit cargo are exempt from duty. However, the customs authorities may call for a cash or bank guarantee as security, refundable to the owner of the goods, on their re-export outside the UAE (Abu Dhabi Customs Department, 2007).

Anti Dumping/countervailing

As a signatory to the World Trade Organisation (WTO) the UAE can apply anti-dumping or countervailing duties to products which are sold in the UAE for less than they sell in the country of origin in order to gain market share or undermine an existing or emerging industry in the UAE. These additional duties are imposed on a temporary basis to counteract the effects of an unfairly low price or an unfair subsidy to the producer. An example of an unfair subsidy would be government grants, capital loans, favourable loan guarantees, export rebates, and tax incentives. These duties can only be imposed if the imported goods have caused, or are likely to cause, material harm to the UAE domestic market.

3.2 Saudi Arabia

Market and Quality

Principal commercial centres and towns

Riyadh is the capital, with an estimated population of over 5 million. All the main Saudi government offices are here. Jeddah (population approx 1.6 million) is the other main business centre, with the largest harbour on the Red Sea. Dammam, Al Khobar and Dhahran on the Gulf coast, are the three main towns in the Eastern Province. The Province has a population of 2.9 million. Mecca (Makkah) has around 1.5 million inhabitants. Every year, over 2 million Muslims make the Hajj (major pilgrimage) for 3-4 weeks to the city. Hundreds of thousands more make Umra (minor pilgrimage). Medina (Madinah) has a population of 1.1 million and is Islam's second holiest city. The oasis city of Al Kharij, which is located about 70 kms to the south east of Riyadh, is home to

large-scale agricultural projects producing vegetables, grains, dairy products, poultry and animal fodder.

Population

According to the latest Central Department of Statistics, the Kingdom's total population reached 23.86 million in 2006, reflecting an annual growth rate of 2.6%. Approximately 27% of the population are foreign nationals, mostly from the Asian sub-continent. About 100,000 Westerners live in Saudi Arabia. Some 60% of the Saudi population are aged below 20, and only 2% aged over 60. Saudi Arabia is an Islamic country.

Market size/ consumption

The aim of Saudi-Arabia is to be as self-sufficient as possible. For vegetables they manage for 84 percent, for fruit 62 percent, for red meat 52 percent, for fish 52 percent, and for fresh dairy products, eggs for consumption, dates, they manage for 100%. The major challenge in being self sufficient is the access to water to irrigate the fields.

Saudi-Arabia imported agrarian products for 4,3 billion US dollar of which 1.8 billion dollars for vegetable products in 2002 (GCC-SG, 2006). Since January 1, 2003 0-5 % import tax needs to be paid for agrarian imports from countries other than the GCC (Gulf Co-operation Council: Saudi-Arabia, Bahrain, Kuwait, Oman, Qatar en de UAE). Saudi Arabia imports from all over the world.

Saudi Arabian Import of Fruit and Vegetables per country

Product	Total import from Ethiopia (in '000 USD)	Main exporting countries to UAE
Bananas	93,146	Philippines, Ecuador
Tomatoes	27,899	Syria
Apple	79,673	USA, Chile, China, France
Grapes	17,882	Lebanon
Onion	43,495	Egypt
Guava, Mango	29,015	Egypt, Yemen, Pakistan
Mandarin	20,034	S-Africa, Lebanon, Pakistan, Turkey
Oranges	157,293	S-Africa, Egypt

Source: UNSD-HS year 2001

Market development

Since self-sufficiency is considered to be important, the government stimulates the agrarian sector by giving subsidies and loans. For example the Saudi Arabian Agricultural Bank can give loans free of interest up to 80% of the project costs. In the sector of fresh fruit and vegetables chain-initiatives have started to improve logistics and reduce losses but also to improve the position of the farmer. The developing agro-sector contributes 10 % to the BNP and employs around 6% of the working population (mostly non-Arabs).

The population is growing fast (3,5% per year) which increases the demand for food. Saudi Arabia's ongoing economic development has resulted in a major shift in consumer eating habits. One trend is the increasing popularity of fast food and non-alcoholic

beverages (juice, pop, and water). The market of the latter is expected to continuously grow with 4% the coming years (EVD, 2007).

Another trend is growing consumer interest in healthy eating. The minister of agriculture announced plans to introduce organic crops to the country, to protect both the environment and public health (BMI, 2007). Quality control is mostly visual; the products should look good and fresh. Although currently there are barely inspections on residues, the government aims to have a law and inspection system installed within a few years to guarantee food safety (Wijnands and Maaswinkel, 2007).

The number of supermarkets is increasing alike the variety of food offered in the supermarkets. Currently modern supermarkets are around 40% of the retail market (Wijnands and Maaswinkel, 2007). The wholesale market is still an important marketing channel, for both retailers as farmers. The fruit and vegetable wholesale market in Riyadh moved in 2004 to a location of 30 ha. The prices are set at the auction during storage.

“Business Seasonality”

It is generally best to avoid visiting Saudi Arabia in July and August (when many Saudi businessmen are out of the Kingdom) and during the two Eid Festivals. Visitors during Ramadan need to be prepared to do business outside western hours. The period just before and during the pilgrimage (Hajj) season is the peak-buying season for merchants in Jeddah, Makkah and Medina.

Regulations

Labelling and Packaging Regulations

Arabic labelling is required on all consumer products. Labelling is particularly important for companies marketing food products, personal care products, healthcare products, and pharmaceuticals. Products that do not conform may be rejected at the port of entry by the quality control laboratories. In addition to this, products which arrive in the country with short periods before expiration will generally be rejected and prohibited from being sold on the market. Companies can obtain copies of Saudi Arabian Standards relevant to their products and to discuss labelling requirements with their representative or distributor.

Import controls

Inspection rules change frequently so exporters should check the requirements either with their customer or with the relevant pre-shipment company. Custom duties for fruit and vegetables are lower than 5%.

Phytosanitary certificate

A Phytosanitary certificate from the country of origin is required for all fruit and vegetables that is imported into Saudi Arabia. This certificate should state that the product is free of insects en diseases. Without such a certificate the products can not enter the country. Specific products might require specific demands.

Export Documentation Requirements

The documents required for all commercial shipments to the Kingdom of Saudi Arabia must be presented to any of the Saudi Arabian Consulates in the following manner or they will be rejected: Commercial Invoice, Certificate of Origin, Insurance Certificate, Bill

of Lading (or airway bill), Steamship (or airline company certificate), Packing List and any of the special documents, all stapled together.

Anti Dumping and Countervailing

Dumping occurs when a non-Saudi Arabian firm sells its product in Saudi Arabia for less than it sells it in its own country in order to gain market share or undermine an existing or emerging industry in Saudi Arabia. Saudi Arabia can apply anti-dumping or countervailing duties to these products. These additional duties are imposed on a temporary basis to counteract the effects of an unfairly low price or an unfair subsidy to the producer. An example of an unfair subsidy would be government grants, capital loans, favourable loan guarantees, export rebates, and tax incentives. These duties can only be imposed if the imported goods have caused, or are likely to cause, material harm to the Saudi Arabian domestic market.

3.3 Market prospects and challenges

Saudi Arabia and the United Arab Emirates are the major fruit and vegetable import countries in the Middle East. Both import fruit and vegetables almost up to 700 million US\$, which mostly consist of fruits. Main sourcing countries are Egypt, South Africa and Asian countries, besides neighbouring countries. The UAE with a population of about 5 million people is also an important trade transit country. Saudi Arabia has a population of 24 million with an additional 2 million visitors during the Hajj. Both the UAE and Saudi Arabia want to be self sufficient in agricultural production and produce their own fruits and vegetables. During their summer season when temperatures are very high, production will be low. The demanded quality for fruits and vegetables is in general not particularly high. However, the large population of expatriates and the growing middle and upper class population demand high quality fruits and vegetables. Consumers are becoming more and more health concerned and also worry about the food safety of fruits and vegetables. In both countries the food safety controls are currently minimal but will change in the near future as attention for food safety is increasing rapidly, particularly in Saudi Arabia. Current regulations for exporting fruits and vegetables to Saudi Arabia and the UAE are easy to follow.

Not much market information about these countries is available, resulting in non-transparent markets. The Saudi Arabian Ministry of Agriculture has realised this lack of information and has started to elaborate its website with more market information, unfortunately in Arabic. Experience of traders trying to access the Middle East markets also show the cultural differences and the importance to have good relationships with local people. An often heard complaint is that payments are late.

For Ethiopia to be able to compete with Egypt and other Arabian countries, it is important to build a good reputation. Competition is tough and Ethiopia needs to prove it can also supply good quality fruits and vegetables.

4. Transportation to the Middle East

For international transportation there are four modalities one can choose:

- air
- sea
- rail
- road

The choice of which modality to use is both based on the interest of the exporter and his client and the following criteria:

- travelling speed
- accessibility
- type of products
- cost
- availability
- probability of delays or variability
- frequency

Besides these criteria also the impact of transport on the environment (CO₂ footprint) is playing a growing role when deciding which modality to use for transportation. The report (in Dutch) '*Energiebesparing zeetransport tomaten*' shows that the potential amount one can save per year by a complete modal shift from air to sea is 1.58 PJ. The savings for 1 kilogram tomato's on a vein are 56,4 MJ per kilogram¹. So, not only logistical and product specific criteria and costs are determinative, also social issues are relevant.

In the case of Ethiopian export to the Middle East the '*accessibility*' criterion is leading. Only two modalities are available i.e. transportation by sea and air. Transportation of fresh produce by rail, road of goods to the Middle East is not possible because the sea is in between.

By choosing between one of the two modalities, in this project, the criterion '*availability*' plays a crucial role. In the current situation transportation by sea is developed, but because we are talking about perishables items (i.e. these products must be transported under conditioned circumstances with more precise temperature settings) it is absolutely necessary that regardless of the modality, cooling is available. In the case of sea transport this means that instead of using normal containers, you have to make use of so-called reefers. These are special containers in which the temperature can be set in such a way that it complies with 'the requirements of the product'.

You can see that nowadays all export of perishables is done by air transport. However, in this project we want to find out if a modal shift is possible, i.e. a modal shift from air to sea.

¹ Growing one kilogram of vegetables in the Netherlands uses on average 1-4 MJ/kg, whereas by cultivation under glass uses 40 MJ/kg extra. Cultivating tomato's on a vein a use of 1 m³ gas per kilogram of product is the amount used. A cubic meter has a 35.3 MJ of energy. In this respect the potential savings of 56.4 MJ per kilogram during transportation to the United States of America are considerable.

As mentioned earlier within this research we are referring to perishable products which when transported under optimal conditions need to have a certain shelf life that allows time for all activities necessary between harvesting and displaying it in the Middle East supermarkets which still want to have up to 7 days in which the product can be sold to the consumers.

The decay of the product quality will start immediately after harvesting. This deterioration can be slow down by using the right set of conditioning. Therefore it is necessary to

- a. minimize transportation time and / or
- b. setting the set of conditions in such a way that a longer transit time is possible taking product quality and shelf life into account.

The combination of the transportation speed, type of product and probability of delays or variability are playing an important role. In general a combination of these criteria is in favour of air transport, specially when the possibilities of conditioning the product are limited. However, when the right facilities are available the products we look at in this research can be transported by sea by using reefers (in section 6.2 we mention that the total transportation time in the worst case scenario can go up to 21 days. For tomato's this will be tight, but for grapes this is no problem).

The lower speed by sea transportation and the bigger change of delays in comparison with air transport must be compensated by an excellent initial product quality, perfect post harvest treatments (including pre cooling) and perfect conditioning during transportation, handling when arriving at the importer and during storage at the retailer.

Air transport

Advantages of air transport are:

- speed
- high frequency and absence of physical obstacles on the transportation routes
- high level of reliability and the ability of shipping high value, perishable and season sensitive products.

However, disadvantages are:

- lost of time during handling at the airport
- high prices through which it is only feasible for high value crops or crops of low volume and weight

In Ethiopia the prices of air freight are relative low because of overcapacity, especially on the corridors to the Middle East. Not only for Ethiopian Airlines, bus also for the other carriers. Even in comparison to the cost involved shipping by reefers, air freight is relatively cheap (more about the costs of sea transport later in this report. But the mean reasons way reefer transport is costly can be found in the facts that transport to the port by road and the fact that reefers are almost not available). In Europe or the United States of America this is not the case.

Sea and road transport

For export from Ethiopia only the port of Djibouti is a real option. Distance from Addis Ababa to Djibouti is more than 900 kilometre. Inland transport can be done by road or rail.

Maersk opened an office in Addis Ababa in March 2007. This is a regional office covering Ethiopia, Sudan, Eritrea and Djibouti. Maersk provides a weekly feeder service at Djibouti, transporting cargo to Salalah in Oman, from where cargo is transported to any destination in the world through main line vessels calling Salalah port. Maersk is able to offer reefers and gensets which are necessary to transport the container over land to and from Addis, see chapter six.

Advantages of road transport:

- flexibility
- no handling from one truck to another
- costs of packaging are relatively low
- total costs are in general reasonable
- almost all products can be transported

Disadvantages of road transport:

- obstacle sensitive, especially in Ethiopia
- the cooling trucks that are available are outdated and in Ethiopia where temperatures can go up to 40 degrees Celsius during 2 or 3 days of the transportation time combined with poor roads and fluctuating initial product quality, this is very challenging

Transportation by road is in Ethiopia a common and relatively good way of transportation. However, for transporting perishables under the right conditions, even in reefers, Ethiopia lacks the right facilities.

Sea and rail transport

Advantages of rail transport:

- not much physical obstacles
- advantages on longer routes
- environment friendly and energy economical
- in general short border transit times
- par excellence suitable for mass products
- high variety of types of coaches available

When reefers are put on a train they must have some kind of power supply. You can make use of so-called gensets of the train when it has its own power supply (generator).

Disadvantages rail transport:

- not flexible
- lower average speed in comparison with road transport
- less destinations in comparison with road transport
- goods must cope with hammering
- different width of the spurs in different countries

In Ethiopia the railroads are out of date and for a great part it exists of narrow-gage railroad. Narrow-gage railroad has the disadvantage that the train can not transport as much coaches as it could when using normal railroad. This is enough reason why rail transport is not a serious option.

The Ethiopian government is researching, together with South African investors, how to modernize the railroad system. Goal is to restore the railroad system by the end of 2010. When the railroads are restored they could build so-called 'block trains'. This type of train (or charter) is a freight train that transport goods specifically for one customer. This kind of transportation is suitable for clients that can put together a complete train (for example a train that could be loaded by Maersk). Mostly the shipper and receiving party have their own loading docks. The advantage for the customer is that he can count on a fixed schedule time. Furthermore a 'block train' is much faster than a regular train because of the absence of shunting.

Disadvantage is however the big altitude difference that has to be bridged during transportation from Addis Ababa to Djibouti. The consequence is that the trains can not be as long as in Europe or America (maximum 600 meter en tot 5400 ton).

In conclusion:

- a. At the moment air freight is the only alternative for transporting perishables;
- b. The air tariffs are relatively low, but when export raises the air tariffs will also raise and transport by sea will become more and more an alternative;
- c. When transporting by sea all perishables must be transported by reefers, not only on the ships but also on the road;
- d. Inland transport can be done only by road were it is absolutely necessary to invest in reefers, gensets and / or trucks with their own power supply for the reefers.

5. Ethiopian Fruit and Vegetable Export

The current and potential supply of Ethiopian fruit and vegetables should fit to the demand in the Middle East for imported fresh products. Chapter three has described the demand in Saudi Arabia and the UAE, this chapter focuses on the potential in Ethiopia to fulfil this demand. To become a trading partner with the Middle East in fruits and vegetables it is necessary to have produce in bulk and of continuous supply and of good quality.

5.1 Production and export potential

The agricultural sector accounts for 55% to the Gross Domestic Product and provides 85% of employment. Ethiopia produces mainly variety of cereals, pulses, oilseeds, and coffee. Grains are the most important field crops. Vegetable and fruit production and consumption is very limited. Small-scale farmers, who account for 90% of output, farm an estimated 96% of total cropped land (Greenhalgh and Havis, 2005). Number of small scale producers involved in horticulture is estimated at 5.7 million farmers (MoARD, 2007). In the fruits and vegetable sector, exports are still dominated by the two state farm operations, namely Upper Awash Agro-Industry Enterprise (UAAIE) and Horticulture Development Enterprise (HDE), both established in 1979/80 and both currently in the process of being privatized. Alongside the state companies a number of private sector companies and cooperatives are involved in relatively small-scale production, processing and export of vegetable products.

The past five years have seen a major change in Government policies towards the horticultural sector, reflecting efforts to redirect the economy away from centralized planning to a more liberalized economy. The Government increasingly considers the private sector as the engine of economic growth and the catalyst for employment creation and export expansion (Greenhalgh and Havis, 2005). As a result private companies were allowed and facilitated with an array of incentives to engage in the sector.

Due to Ethiopia's very good agro climatic circumstances it is able to produce fruits and vegetables throughout the year. Both the low- and highland areas offer good opportunities. Table 1 shows the production trend of fruit and vegetables. Beans (Faba and Haricot) is the main vegetable being produced mostly by private companies and state farms. Other vegetables are mainly produced by smallholder farmers and the state farms. Fruit production in terms of acreage and volume but also in terms of value has always been substantially lower than vegetables (Kubsa et al., 2006). Within the group of fruits, banana is clearly the most common fruit being produced.

Table 1: Fruit and Vegetable production trend

Fruit and vegetables	Quantity produced (1000 tonnes)				
	2000	2001	2002	2003	2004
Avocados	78	79	80	81	82
Bananas	82	82	82	84	84
Beans (incl. cow peas), dry	147	211	101	118	175
Beans (incl. string beans), green	4	3	3	3	3

Cabbages and other brassicas	120	130	150	152	152
Carrots and turnips	1	1	1	1	1
Cauliflowers and broccoli	0	0	0	0	0
Chick peas	165	176	187	114	136
Citrus fruit, nec	2	2	2	2	2
Cucumbers and gherkins	1	1	1	1	1
Other Fruits	137	143	145	160	160
Garlic	40	50	70	71	71
Ginger	1	1	2	2	2
Grapes	6	7	7	7	7
Guavas, mangoes and mangosteens	153	157	160	163	135
Leeks and other alliaceous vegetables	1	1	2	2	2
Other Leguminous vegetables	2	2	3	3	3
Lemons and limes	7	7	7	7	7
Lentils	59	65	38	36	35
Lettuce and chicory	6	6	6	6	6
Onions (incl. shallots), green and ripe	93	120	140	142	162
Oranges	14	15	15	16	16
Papayas	197	223	226	231	230
Peas, dry	118	147	200	140	170
Peas, green	1	1	1	1	1
Other Pulses	118	107	108	100	100
Rapeseed and Mustard seed	15	16	18	21	31
Tomatoes	54	55	55	60	55
Other Vegetables (incl. Okra)	420	420	420	430	430

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The supply of vegetables for the European market comprises predominantly green “bobby” beans. The export to Europe used to be somewhat more diversified, including peas, mangetouts and asparagus. However, the share of these latter crops has declined over the past years, whereas the export of green beans has been growing again. The supply is limited to a relatively short export season from December through April or May. Europe does not produce fresh beans in winter season and production in countries like Egypt and Morocco in January and February can be unreliable.

Whereas the state farms used to grow and export a wide variety of crops including asparagus, peas, leeks, paprika, chilli peppers and tomatoes, the present trend in production for export to the EU market is away from a wide range towards exports of green “bobby” beans in bulk. The Horticulture Development Enterprise has reduced its produce range significantly over the past years and big chunks of its land near Ziway have been leased out for floriculture. Also the UAAIE has been for sale for several years without a buyer coming forward. On the other hand, some experiments and trials are undertaken (by private companies) of production of peas, mangetouts, cherry tomatoes and asparagus for export to the EU and Middle East market.

The main fruits produced and exported are bananas, citrus, grapes, mangoes, papaya and avocados. The main export markets for these Ethiopian fruits are Djibouti, Saudi Arabia and Sudan. The majority of citrus production is still largely confined to state farms, but the productivity of their orchards is on the decline. The production of mangoes is to a large extent scattered and unprofessional; the varieties and quality tend to be not as good in quality as those produce in competing countries and are usually unfit for

further processing. In the Chenchha highland apples have been grown for decades by small farmers. Apple production is expected to go up as the State of Oromia ordered 70,000 apple tree seedlings from Spain. Pineapple production is also scattered and has been unstable over the past years, which caused a pineapple drying plant near Nazareth to function below its production capacity for years in a row.

In addition to the export of relatively low value fruits, nowadays there are a number of trials undertaken to produce more high value crops for export and to access new or more attractive fruits markets (i.e. grapes, avocado, passion fruit).

5.2 Selection of Fruit and Vegetables

To do the economic calculation of the feasibility of refrigerated container transport it is necessary to select a few crops. Selection has been done based on:

1. Middle East market potential through its current imports and import trends. Ethiopia needs to be able to supply bulk volume and of continuous supply to be able to enter the market on a sustainable basis;
2. Competing production countries; and
3. Stakeholder's wishes.

Other criteria which are important as well are the ability to produce the required production quality, to have a favourable crop calendar compared to the Middle East and/or other producing countries and to have a domestic market for the produce during off-season in the export market and for non exportable quality.

The UAE and Saudi Arabia mainly import apples, bananas, grapes, onions, tomatoes, citrus fruit, guava, mango and little avocado. For vegetables in general there is a relatively small market.

Grapes are imported from Lebanon, Turkey and Iran, and compete with South Africa from December to July. It will probably be difficult for Ethiopia to intervene. Citrus are coming from South Africa, Egypt and Lebanon; bananas from the Philippines. Grapes are produced and exported by countries with tight relationships with ME. Avocado and mango seem to be sourced from different countries as Pakistan and India and Egypt and might therefore offer potential for Ethiopia to penetrate this market. If Ethiopia is able to compete with Egypt and South Africa in oranges this could be a huge market.

In the selection of crops we further want to take into account the preferences of the different stakeholders as MoARD, ongoing governmental and non-governmental programmes and current producers and traders. MoARD have as target crops mango, avocado, pineapple, apple, okra, grape vine, strawberry, squash, bobby beans and garlic. SNV has ongoing projects mostly aimed at the domestic market, for pineapple, mango and apple. CFC and EHPEA have plans to link smallholders to exporters for green beans, okra and hot pepper. Current producers and traders are often interested in avocado, grapes and vegetables as sugar snaps, hot pepper and capsicum.

Avocado, mango, grapes and tomatoes have been selected as crops to include in the feasibility study. Avocado (harvested from May to August) and mango (January to August) have been selected as they are target crops of MoARD, have hopeful potential

to compete with other countries and have interest from investors. There are some Indian investors trying to establish fresh mango exports from existing plantations, particularly around Wolega in western Ethiopia. Grape is also a governmental target crop and has investors' interest but might face difficulties in the market from strong competitors. There is a small group of investors currently developing new plantings of Table Grapes for export. The first 75 hectares are planted this season, with plans to expand over the next few years. Although the market size for greenhouse vegetables is not very large, the market is large enough for smallscale exports. Investors in production and export are very much interested in these vegetable and therefore tomatoes have been included as well. This is one of the heavier and higher added value vegetable (cherry tomato), important when comparing the sea transportation costs with airfreight costs. Currently some vegetables are already exported to the Middle East through air transportation.

5.3 Potential product market combinations

Current production of fruits and vegetables in Ethiopia is limited. Of the little production it is mostly vegetables and less fruits which are being produced. The Middle East offers however a larger market for fruits than for vegetables. At the other hand, Ethiopia has a very high potential to produce much more fruits and vegetables. Avocado, mango and grape are target crops of the Ministry of Agriculture and Rural Development. Avocado and mango are both in demand in the Middle East and are crops for which it will be possible to start the competition with other exporting countries. The current quality (as variety) might not be fully suitable yet, potential to export these crops is high. Grapes are also in demand in the Middle East but faces strong completion. Green house vegetables receive a lot of interest from current producers and investors and trade with the Middle East has started which is hopeful.

To have a guaranteed and large supply of good quality fruits and vegetables it is important to pay attention to the production methodologies, available varieties and future standards setting in the Middle East.

6. Reefer Chain

6.1 Chain organisation & configuration

The chain from 'field to fork' consists of the following activities:

- a. growing
- b. harvest
- c. post harvest activities
 - i. cleaning
 - ii. sorting and grading
 - iii. packing and pre cooling
 - iv. preparing for shipping (palletize)
 - v. cooled storage
 - vi. loading reefer or cooling truck
- d. transport (inland)
 - i. road transport (cooled, especially when transporting to the port of Djibouti, even when there are no reefers used)
- e. handling at the port (with the exception of custom formalities, et cetera)
 - i. transporting to the port and transportation by sea needs reefers. As an alternative you could make use of cooling trucks and stuff the products in reefers in the port (this is not optimal because you interrupt the cooled chain and cooling trucks are less efficient in cooling product).
- f. transport (international)
- g. handling at the port
 - i. unloading the ship and possibly putting the goods in another means of transport, for example from reefer to cooling truck. In practice this will not be done a lot.
- h. inland transport in the importing country to distribution centre of the importer / retailer
- i. handling importer/retailer
 - i. in general it are quality checks after unloading the reefers. Sometimes they repack products.
- j. distribution to the stores
- k. sales / storing at the stores

Activities a, b en c will be carried out in Ethiopia by the exporter.

Activity d will be carried out by a transporter. In Ethiopia it is compelled that an Ethiopian company organizes and carries out the transportation of the goods. For example, Maersk is not obliged to carry out the transportation, they have to contact it out to a third party.

Activity e is done by a specialized company at the port.

Activity f is officially done by Ethiopian Shipping Lines (ESL). Because ESL does not have reefers they contract this transport out to Maersk (or other shipping lines).

The activities g through k will be carried out partly by exporting companies and partly by importing companies or the final customer.

Ownership of the products will change when the product arrives at the distribution centre of the retailer.

6.2 Activity based lead times

- after harvesting, cleaning, sorting and grading the product will be packed (including Phytosanitary inspection). Then it will be palletized and placed in the cold stores. The temperature will be lowered from 20 °C to just about 8 °C. The whole process will take between a half and one day (**0,5 – 1 day**)

- loading of one container (reefer) 40 feet with more or less 22 pallets takes due to the infrastructure and hardware half a day (**0,5 days**)

- road transport will take up to 2 and 3 days (**3 days**)

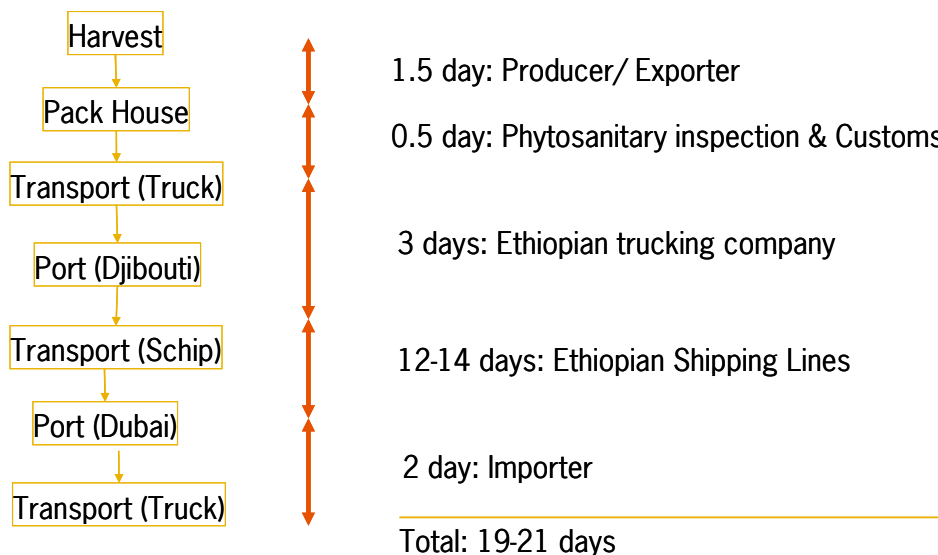
- handling at the port of Djibouti can change a lot. It will take more or less one day (**1 day**)

- sea transport to Dubai takes 12 to 14 days From Djibouti the shipping takes place using feeders to Salalah at Oman. After Salalah the ship to Jebel Ali at the UAE this is more or less 35 kilometres from Dubai. (the feeder will go after Jebel Ali to Port Rashid at the UAE) (**12 – 14 days**). Shipping to Jeddah in Saudi Arabia is also via Salalah in Oman. The shipping time is 10 days.

- handling at the port of Dubai and transport to the warehouse is 0,5 to 1 day (**0,5 – 1 day**)

- distribution to the stores will be a maximum of 1 day (**1 day**)

Total transshipment time: 18,5 – 21,5 days, let's say between 18 and 22 days. This is the maximum and average will be more likely to be at the lower end of the range. For fresh products an additional shelf life of 7 days (in the shop and at home) is desirable, the total required shelf life will be 25 to 29 days.



6.3 Post harvest handling

If Ethiopia wants to enter the Middle East market with fruits and vegetables the country will face competition with other countries. Some other countries have already longstanding trade relationships with the Middle East. Therefore Ethiopia has to make sure it has good quality products in order to start competition at all. The quality of fresh fruits and vegetables depends on the variety, care during production and post harvest handling. Currently the Middle East is mostly focussed on shape and colour of the fresh products, but is paying more and more importance to residue levels and certificates as EurepGAP.

The post-harvest losses of fruits and vegetables in Ethiopia (at state farms) are estimated to be between 25 and 35% (Tadesse, 1991). Post harvest loss reduction starts at selecting the right time of harvesting, indicated by the harvest index. The harvest index for mature fruit vegetables depends on several characteristics, and proper harvest maturity is the key to adequate shelf life and good quality of the ripened fruit. The harvest index for most fruit and vegetables is based principally on size and colour (UCDAVIS, 2007).

Immature fruit vegetables generally have very tender skins that are easily damaged in harvest and handling. Special care must be taken in all handling operations to prevent product damage and subsequent decay. Loaded field vehicles should be parked in shade to prevent product warming and sun burning. Considerable mechanical damage occurs when replacing the harvested fruits and vegetables: bruising, scratching and splitting are common examples. Once the harvest has reached the packing house the following activities should take place in order to send the proper quality to the customer:

- *Post harvest treatment*, mostly to control pest and diseases, examples are hot water treatment or fungicides spraying
- *Presizing*, fruit and vegetables below a certain size are eliminated.
- *Sorting or selection*, the sorting process eliminates overripe, misshapen, and otherwise defective fruit or vegetables and separates products by colour, maturity, and ripeness classes.
- *Grading*, fruit and vegetables are sorted by quality into two or more grades according to certain standards.
- *Sizing*, after sorting for defects and colour differences, the fruit or vegetables are segregated into several size categories.
- *Packing*, depending on the type of fruit and vegetables and on the customers demand.
- *Palletizing*, packed shipping containers of most fruit and vegetables in large-volume operations are palletized for shipment.

Transporting vegetables by sea using reefers demands that the product temperature (in the core) is at the right stage before entering the container. A reefer is a very good 'box' in which you can keep the temperature of the product at the temperature it entered the container, but it has not enough cooling capacity and it is not build to cool products down. This means that it demands certain requirements from the pack house, cooling facilities, warehouse and so on. Sorting and grading of the product can be done in areas where the surrounding temperature can (and even should because of the working circumstances of the people working there) be ambient. Cooling the product down must be done in especially for this purpose built cold storages rooms.

Packaging

The Middle East market for vegetables demands high quality products at the same level as they know from the Dutch products. But not only the quality of the products must be at a relatively high level, also the packaging materials must have the same appearance as the packaging in which Dutch products are sold. Until now packaging materials are shipped from the Netherlands to Ethiopia. They import plane cardboard boxes which are fold en glued by hand on site. The materials and the printing techniques available in Ethiopia are not yet on such a (high) level. Especially the printing techniques are a bit out of date. However, the expectation is that within a relatively short term high quality printing can also be done in Ethiopia as the required investments for the up to date hardware and software are little. Packaging requirements concerning ventilation, strength, moist absorption and so on can easily be copied to other countries like Ethiopia. Starting-point however must be that the machinery and the right materials are present in the country.

Cold storage

As mentioned earlier cooling facilities are essential when you want to ship perishables by reefer. The cooling facilities must be put in place to make it possible to pre cool the product before entering the container. The core of the product must be at the right temperature before entering. The cooling facilities will at first not be used for long-term storage. So, the rooms must be designed for this purpose and must hold a minimum of 22 pallets (the average amount of pallets that fit into a 40 feet reefer) that can be cooled down and stored up to 3 days.

The necessary technology to build these cold storages or cold rooms is currently not available in Ethiopia. All the cooling facilities are therefore build by foreign companies from Israel or the Netherlands. These companies have an office (consulting) in Ethiopia, but they did not import the technology production yet. The hardware like panels, compressors, cooling devices, et cetera are being imported. Even for building the facilities they sometimes hire foreign companies and people.

The mayor advantage is that importing technology which will be used for promoting export of Ethiopian fruits of vegetables is free from taxes. So, importing technology is in no way limited by the government of Ethiopia.

Fresh Consolidation Centers

Different organizations or institutions in Ethiopia consider to found big(ger) central placed facilities where activities as sorting, grading, packaging, pre cooling, storage, palletizing and loading of the reefer can be organized by combining different flows of products form different origin, growers, parts of the country. Even logistic organizations like Ethiopian Shipping Lines or Maersk are considering this option. But also organizations like OASIS or a Group of local investors called Ethiopian Perishable Logistics are playing with this thought. Locations that are mentioned are Debre Zeit, Mojo or an other location close to Addis Ababa.

The advantage of building such a central placed facilities is that it will be possible to combine relatively small flows of products form different origins or growers. Combining all activities in one central place, will make the process more efficiently. Also it is more easily to fill a complete reefer with only one type of product. Small growers will not be able to fill such a reefer. And by consolidating these different flows it is also possible to check the entire product on product quality and rate them at the same level. So the

product quality that will be shipped abroad is more uniform than when all the growers do it by themselves.

Furthermore from these fresh consolidation centres you can ship the products that are not suitable for export to the home market after a short or longer period of storage. This is also an advantage of these facilities. You can balance demand and supply by storing the product under the right conditions so when there is a shortage of one type of product it can be put on the market at the right quality after storage.

At the short term mainly the big exporters that produce the right initial product quality, have cooling facilities, packaging, knowledge of the export market, knowledge of the products and the consumers and enough product to fill one container at a time will export fruits and vegetables. Facilities like fresh consolidations centres will be built at a later stadium when the right basis of exporting Ethiopian fruits and vegetables is set.

6.4 Phytosanitary inspection & Customs control

Until 1993, quarantine stations were established at Bole International Airport (near Addis Ababa), Dire Dawa, Moyale and Nazaret. After 1993 the regional stations were placed under the responsibility of the regional governments as part of the decentralisation of government services. In September 2005 the regional stations were placed under direct responsibility of the national plant quarantine services. A fifth plant quarantine station has been established in Metema, on the border with Sudan in the North-western part of the country. Ethiopian phytosanitary services are understaffed and lack essential equipment and facilities. This particularly applies also to the team responsible for most of the phytosanitary export inspections on horticultural exports that are based at Addis Ababa / Bole Airport (Joosten and Meggelen, 2007).

The quarantine regulation in Ethiopia states that plants and plant products exported from the country have to be inspected and accompanied by a phytosanitary certificate. The Ethiopian phytosanitary services follow a so-called 'system inspection approach' for the plants and plant products that are intended for export. This means that the production of horticultural products are inspected during the growing stage rather than the actual export consignments themselves. Visiting all export growers on a regular basis to ensure compliance with international phytosanitary standards and regulations is too time consuming for the CPD's Plant Quarantine Team (Joosten and Meggelen, 2007). Checks are done at random at the farms. The farmer is doing the inspection himself, based on information received from the Ministry of Agriculture.

Each inspection visit is concluded with an inspection report. The reports are filed at the inspector's office and all these reports are later used for the compilation of the annual reporting of the Crop Protection Department. It is not customary to provide the export grower with a copy of the inspection report; any recommended phytosanitary measure is thus only communicated verbally and is issued without any sanctions. Most exporters employ handling officers who ensures that the export consignments are sent with the proper documentation, airway bill and phytosanitary certificate. The phytosanitary certificate is attached to the consignment together with the other paperwork; earlier in the day the exporter's handling officer has collected the certificate prepared by an inspector in a separate office in Addis Ababa outside the airport. The phytosanitary

certificate is prepared on the basis of specifications of the consignment phoned to the handling officer from the grower's production place (Joosten and Meggelen, 2007).

Customs control can be done at the farm by customs officers. The container can therefore be sealed at the farm. Because the container is sealed it does not to be reopened at the border. This is very important as it will create a closed cold chain. If a cooled container needs to be opened during transportation it will deteriorate the quality as the temperature will not be optimal any more. Once in Djibouti the container if sealed by Ethiopian customs does not to be checked again. At random controls are however performed once in a while to check the papers with the actual content.

To have the container checked at the farm does not require any extra papers or costs. Ethiopia doesn't levy export tax for horticultural products.

6.5 Logistics

The available cooling trucks in Ethiopia are out of date. Furthermore, transporting highly sensitive products like perishable by cooling trucks in countries like Ethiopia where temperatures can rise extremely high during a long time of transport is not very suitable. Cooling trucks use an air flow that is blown in the overhead space above the pallets whereas reefers make us of so-called T-bars that 'push' the air flow from underneath through the pallets and products. In short, for transporting fruits and vegetables even by road reefers are far more efficient than cooling trucks. This applies even more for countries as Ethiopia where temperatures and transportation times are relatively high and long.

This argues for reefers. Looking at the export chain, it is even more efficient to stuff reefers at the farm so the cold chain will not be interrupted because of loading and unloading, stuffing and unstuffing. The reefer can go from the truck, in stack at the port and on the ship. When making use of cooling trucks the product must be stuffed in a reefer at the port of Djibouti. If the cold chain will be broken, there will be a change of damage, there will be loss of time, et cetera. In short, when using sea transport it is absolutely necessary to make use of reefers even for the inland transportation.

Advantages of (reefer) container transportation:

- shipping times are shorter because of less ports the ships have to visit to pick up cargo
- suitable for almost al products
- decreasing required time for loading and unloading
- after arriving at the port the reefers can go straight on the truck to be driven to a warehouse or distribution centre

The first advantage however is a disadvantage when looking at Ethiopia. Due to a lack of supply and demand of reefers, Ethiopian companies did not invest in the right infrastructure. As a result there is not a good corridor for reefer transport to and from Addis Ababa.

Currently in Ethiopia there are no reefers available. It is compulsory to export through Ethiopian Shipping Lines, but they don't have reefers. They will ask Maersk who do have reefers available in Djibouti. Supplying the reefers with energy during transportation is

another problem. You can use a genset or a power supply on the modality (truck, train) to supply the reefer with energy.

The supply and demand of gensets is even harder to manage than that of reefers. At the moment Maersk has two gensets available at the port of Djibouti. Besides the availability of the genset, also the age of the genset plays a crucial role. The genset must not be too old because in situations like in Ethiopia you can not afford to break down during transportation. Otherwise there must be a highly advanced backup plan that makes it possible to deliver or repair the genset within 1 hour. This will be hard to manage in Ethiopia. A better alternative is making use of trucks with their own power supply. However these trucks are yet not available anywhere in Ethiopia. Maersk is willing to invest in these trucks. They would like to buy up to 30 trucks. This means an investment of on average 80.000,- US \$ per truck.

In short, gensets and trucks with their own power supply are currently not easily available.

Djibouti port is no transshipment port. This means that all reefers to the Middle East are picked up by a so-called feeder. This feeder goes to different ports before arriving at a transshipment port. In this port all the reefers are put on a big container vessel and are shipped to, in our case, Dubai or Jeddah. The consequence is that the transshipment times are very long in comparison to the distance between Djibouti and Dubai and especially Jeddah.

Also the frequency of departures is at the moment very low. Now there are 3 departures in 1 month. At high season when big growers could fill one container every day and their customers want to receive one container every day this is a major problem. Reefer transport has not started yet in Ethiopia and only one company is investing in this idea (Maersk / Safmarine). Because there is no second or third company the amount of departures will not increase on the short term.

Known is that the port of Djibouti is made ready for receiving the biggest container vessels available. Djibouti is willing to become a transshipment harbour. When Maersk /Safmarine would use Djibouti as their transshipment port it is very likely that the transshipment times to Dubai will shorten. However, it is not known how long it will take to be at this stage and if a shipping company like Maersk is willing to make use of Djibouti port as their transshipment port.

Until that moment it is relatively expensive to make use of reefers. Because there are not enough companies in Ethiopia that make use of imported products by reefer and therefore exporting company must bring in the reefers themselves. So they do not only have to pay for sending the container, but also for getting it (in normal circumstances the importing company pays for getting the reefer in. So in Ethiopia an exporter has to pay at least twice as much).

It is possible to lower these costs for example by bringing in dry cargo in reefers. This is more expensive for the importing company so he would not be willing to pay for the whole amount but only the costs that are the same as bringing in a normal container. In this case the exporter has to pay the additional cost. Overall it will be less expensive for the exporting company, but still he has to pay let's say 1,5 times the cost in comparison to other countries just because the balance between incoming and outgoing reefers is disturbed.

Furthermore ESL gets a fee just for every container that is brought into the country by an other company than ESL. Because ESL does not have reefers, all the reefers will be brought into the country by other companies (now it is Maersk / Safmarine). So, the additional costs of bringing in a reefer must always be taken into account.

Djibouti port has enough plugs to feed the reefer containers with electricity.

6.6 Practical feasibility

The use of reefers will provide the possibility to supply the fruits and vegetables in the right conditions to the client in the Middle East. But to ensure a good quality the inherent product quality needs to be high already. This will depend on the production methodology but also on post-harvest handling, storage and packaging.

The reefer chain is currently non-existing. To build a reefer chain for fruit and vegetable export will not face major physical problems. Phytosanitary and customs control will not create additional problems. The transportation time is slightly long due to the fact that feeder ships will need to go to Salalah first to transfer to another ship that will continue to Jebel Ali or Jeddah. Maximum transportation time from harvest to sales point is around 20 days.

Major bottleneck is the availability of reefers. At the moment only Maersk offers the possibility to transport reefers. Reefers need special trucks for supplying electricity or trucks need to have an additional genset. These are also not easily available but possible to be supplied by Maersk. The low availability of the required technology will be reflected in high prices as shown in the following chapter.

7. Chain activity based costing

The activities involved in using reefers to export fruits and vegetables have been described in previous chapters. This chapter will provide costs of reefer transport. As the reefers are not yet being used to export products from Ethiopia it is not easy to provide costs as some have to be established yet. Therefore provided costs are rough estimates and are from different sources which we will keep anonymous.

The phytosanitary and customs certificate costs are very minimal. The phytosanitary certificate will on average cost 4 US \$ and the customs certificate between 6 and 10 US\$.

The reefer transport chain starts with the cold storage. Required investments in cooling technology will be different for each farm. The investment depends on:

- cooling for short periods to reduce temperature of the produce or for longer storage periods
- other functions in the storage (for example functions that can use the produced heat of the cooling system)
- harvested amount of produce per day or per week
- number of batches in which the produce will come in the cold storage per day
- required cooling rate (a few hours or days available to reduce temperature of the crop)
- required system demand (forced cooling, vacuum, type of walls)
- availability of land, this will determine the height of cooling cells. In Ethiopia this will not likely to be an issue.

The temperature at which the produce will come into the cold storage will roughly be in between 20 and 25 degrees Celsius. The temperature for grapes has to be reduced to zero degrees, this will require a forced cooling system. The temperature for mango has to be 13 degrees for partly ripe (green) and 10 degrees when it is a bit riper. Avocado need to be at 2 to 4 degrees when ripe and between 5 to 13 degrees for partly ripe. Temperature of tomatoes needs to be reduced to an average of 8 degrees. Table below shows an overview of the required temperature, relative humidity and the resulting shelf life in such a conditioned atmosphere (CA) compare to a regular shelf life.

Cold storage requirements and shelf life for selected fruits and vegetables

	Temperature (oC)	Relative Humidity (%)	Shelf life regular (weeks)	Shelf life CA (weeks)
Mango	10 – 13	90 – 95	2 – 4	3 – 6
Avocado	5 – 13	90 – 95	3 – 4	9
Grape	-1 – 0	90 – 95	2 – 4	na
Tomato	12.5 – 15	90 – 95	2	6

A reefer can be filled by 28 European pallets. A cold store for 28 pallets needs to have around 40 square meters. In Ethiopia a relative simple small cold room is estimated to cost around 20.000 US\$.

To make an estimation of the cooling and storage costs (per kg), five indicators are crucial. These are:

1. costs per kg cooling technique
2. costs per kg isolation
3. costs of the doors
4. costs for the CA installation (when necessary, this will not be the case for the products we are looking at)
5. local warehouse costs per m2

To translate these prices into costs per kg product you have to make some assumptions. The assumptions we made are in terms of the amount of products that will be harvested per day, the square meters that are needed to cool and store the products, the costs of building the facilities, storage time, the timeframes between the incoming products et cetera. These assumptions in combination with expert opinions give a very rough estimation as mentioned below. Unfortunately it is not possible to get these numbers more accurate because the factors that influence these costs are very specific to the type of machinery, type of product, type of harvesting methods, type of country, type of service level agreements with your clients, et cetera.

Furthermore, these rough estimates show that when you have products that need a proper cooling like grapes (to zero degrees Celsius) the costs per kilogram rise enormously in comparison to products that do not need such cooling systems, like tomatoes. So, these estimates are realistic for an average situation in a country like Ethiopia and the difference between the cost per kilogram of grapes and tomatoes is a realistic comparison between 'hard cooling' and 'soft cooling'. To get these numbers realistic, you have to know the realistic situation.

With assumptions of a cold room for cooling fresh produce for short periods to reduce the temperature of the produce, have regular batches coming in, require an average cooling rate and a simple system, a very rough estimate of 0.03 US\$/kg produce for cooling can be an average. In case of forced cooling system the costs increase a lot and we take 0.10 US\$/kg as a rough average.

Reefers are currently not available in Ethiopia and need to be imported. Import costs are based on the possible loading of the container. Importing an empty container will therefore be very expensive and are estimated at around 500 US\$ for a 40' container. Costs of importing the container will be calculated in the price of using reefers from Ethiopia to the export markets. To truck the produce from Addis to Djibouti in a 40' reefer will cost around 3000 US\$, including the reefer import costs and some basic activities in Djibouti Port like plugging the container to electricity. The port in Djibouti might request some other payments, which we have not been able to retrieve.

Transporting a 40' reefer from Djibouti to Jebel Ali or to Jeddah is estimated to cost around 3500 US\$. This includes also some minor costs in the destination port. Additional administration cost of the reefer transport is roughly 500 US\$. The port costs in Jebel Ali such as inbound handling and container grounding are relatively high. Provided inbound

handling costs of 105 US\$ per cubic meter with a minimum chargeable for 40 ft container of 44 Cubic Meters seems not to be realistic. The Port & Custom Authorities of Dubai levy a 5% duty on commercial goods based on Cost, Insurance, and Freight value declared (C.I.F.).

Finally some minor costs have to be paid for trucking the reefer to the distribution centre in the city (Dubai vs. Jeddah).

To be able to know whether the use of reefer transport is economically feasible you can compare the transportation costs with the production cost and selling price. Therefore you need to calculate the transportation cost on a kilogram basis. A 40' container can hold around 20 ton mangos or avocados, 11-12 ton (cherry) tomatoes and 15 ton grapes. The exact tonnage depends very much on the type of packaging and can therefore vary substantially. In the case of grapes it differs from 11 to 18.5 ton per 40' container.

Some costs depend very much on the producer and the arranged selling price. For example the avocado prices in Saudi Arabia vary between 0.52 to 2.27 US \$/kg. It will therefore be impossible to even provide an average value of a container.

Costs based on a 40' container					
		40'container costs (in US \$)	Crop based costs (in US \$ per kg)		
			Cherry tomato	Grape	Avocado/mango
Cold storage			0.03	0.10	0.03
Transport to Djibouti	trucking + electricity	3000	0.25	0.20	0.15
	administration	500	0.04	0.03	0.03
Port Djibouti		port & authority levy container lifting			
Sea transport	to Jeddah/ Jebel Ali	3500	0.29	0.23	0.18
Port Jeddah/ Jebel Ali	port & authority levy		5% of CIF value		
	inbound handling		105/m3 or 1000 kg, min of 44 m3		
	container grounding		350		
	import tax		5% of CIF value		
Trucking to city			0.02	0.02	0.01
Total			0.63	0.58	0.40

The provided total costs are not the final total yet as some port costs are not included. However this total cost does provide an idea of what the minimum selling price should be when you add the production cost. Also the comparison with air transportation is possible. The air transportation is roughly 0.65 \$/kg. It therefore seems that sea transportation is especially interesting for heavy fruits and vegetables which can be loaded efficiently in a container like avocado and mango.

In conclusion,

- The cost of using reefers to export F&V includes costs of cold storage rooms, trucking to Djibouti, sea transportation and trucking to distribution centre.
- Cold storage costs depend very much on the type of fruit or vegetables. Produce that requires to be stored at low temperature as grapes need to be cooled down very quickly by forced cooling systems which are much more expensive than regular cooling systems.
- Reefers need to be imported into Ethiopia. An import fee needs to be paid to Ethiopian Shipping Line on the basis of a fully loaded container. As the demand for imported products that need reefers is low it will be difficult to have a fully loaded container. This will increase the costs to the exporter as he needs to pay for importing the container. This is a major bottleneck for fruit and vegetable exporters to use sea transportation.
- The total costs of using reefers and sea transportation differs for each fruit and vegetable, depending on the type of required cooling system but importantly on the weight of the product and the efficiency of packing the container. The more fruits and vegetables will be able to put into a container, the more economically the costs will become. Sea transportation is therefore more beneficial for avocados and mangos than for grapes or tomatoes.
- The other option of exporting fruits and vegetables from Ethiopia to the Middle East is by air. The air transportation costs are only a bit higher than the sea transportation costs but require much less time. Furthermore the air transportation costs in Egypt, a major competing country, are also low.

Conclusion & Recommendations

The Middle East is an interesting market for Ethiopian fruit and vegetables with some possibilities to enter. Sea transportation is becoming more and more interesting due to the decreasing capacity in air transportation and much lower environmental impact (and possibly costs). Ethiopia's current fruit and vegetable production is low, but the country has potential to increase a wide range of products throughout the year. It is required to have good quality to be able to enter the export market and to compete with other exporting countries. Reefers will ensure maintenance of quality during transportation. The quality of the produce should be high from the very start. It is therefore recommended to carefully select the seed or seedlings and have proper production and post-harvest technologies.

Exporting fruits and vegetables from Ethiopia to the Middle East and in particular to Saudi Arabia and the UAE over sea by using reefers is practically feasible. For sea transportation it is important that the produce is continuously in the optimal environment. The fact that a closed cold chain is feasible – the container does not to be reopened during transportation- is therefore positive. The reefers are currently not available in the country but can be imported, including the required gensets. However, the costs of importing the reefers are high, resulting in relatively high costs to get the fruits and vegetables cool in the port in Djibouti. In order to make full (economic) use of a container you need to be able to load it completely. Therefore the reefers are yet a feasible option for largescale producers but not yet for smallscale producers who would need a fresh consolidation centre. It is recommended to organise such centres who can receive fruits and vegetables from different farmers, offer cold storage possibilities and fill a container efficiently.

The economic feasibility of using reefers for exporting fruits and vegetables depends very much on the type of produce and the negotiated market price. In any case it will be more positive for fruits and vegetables which can be packed efficiently and therefore fill a container with a higher tonnage. The market price is always based on a weight basis and as most container transportation costs are based on a volume basis it is profitable to have a high weight in one container.

The activity lead time is a maximum of 18 to 22 days, excluding the desired shelf life of 7 days in the shop and/or at consumers' home. This slightly long transportation time is a bottleneck for reefer transport to the Middle East. This is due to the fact that ships from Djibouti will first have to go to Salalah before continuing. Djibouti is enlarging its port and if sea transporters are willing to change their routes, transportation times will be shorter.

Using reefers will be expensive as long as it required paying reefer import costs to ESL. The import and export demand for reefers is not in balance which causes the costs for the exporter to be even higher. During the Reefer Business Forum, Maersk has stated to be willing to go into discussion with the interested exporters to negotiate a price that will enable the use of reefers.

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