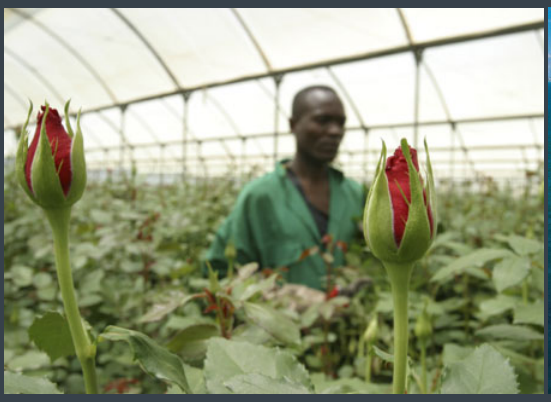
The Kenyan-Dutch Sea Freight Supply Chain for Roses



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Foreword

The international flower business has grown substantially in recent decades. International production has been combined with local production or has partly replaced the local supply of certain varieties.
This international growth has created many logistic challenges for supply chains.

The main issue facing the supply chains is how to respond to the comparative advantages held by the various production areas. Important factors in the competitive arena, in addition to production costs, are logistics costs, quality control and carbon and water footprints. A smart combination of especially selected varieties, post-harvest care, packaging, transport mode, quality control, ICT and supply chain management can contribute to the comparative advantages held by international production areas and give them stronger, more competitive position than local supply.

This GreenCHAINge study gives an excellent insight into some of the challenges facing the supply chain regarding roses produced in Kenya and shipped to the Netherlands (and the EU) by means of sea freight. It shows that the factors of costs and footprints can favour sea transport. Although the expertise and technology for realising sea transport is available or in the making, an excellent system of supply chain management is necessary to make this happen.

Herman de Boon
Chairman, VGB
Vice Chairman, Union Fleurs

Executive Summary

The cost of transport to Europe is the main expense faced by growers in Kenya. If successfully developed, sea transport can make the Kenyan-Dutch supply chain more competitive and can improve profitability. Attracted by the potential of low cost logistics, various parties all over the world have shown interest in sea transport of flowers and organised trial shipments. Over the past couple of years, much has been learned and while some trials failed others have developed into regular supply lines. The number of steady lines from Kenya and other African countries to the European market, however, is still modest.

To gain insight into the Kenyan-Dutch sea freight supply chain for roses, the Association of Wholesale Trade in Horticultural Products (VGB) has commissioned a study into the challenges and solutions for the further development of these sea freight chains. The study was carried out through a combination of desk research, interviews in the Netherlands and a fact finding mission to Kenya (Mombasa, Nairobi, Naivasha and Limuru).

During the study, we found that results of sea freight projects have been mixed. When problems occurred, it was often because of a combination of existing quality issues with roses (botrytis, downy mildew), deficient cold chain management and the unavailability of packaging specifically designed for sea freight. Projects also encountered problems due to poor shipping connections and frequent delays.

An important lesson learnt is that sea transport is only possible if the cold chain and other technical conditions are optimised and fully under control, starting at the nursery all along the supply chain until the roses reach their final customer. In our view, all required knowledge and technology is either available or can be acquired through additional research and testing.

Everything along the logistic chain is manageable and good results can be achieved, but it remains very dependent on the sailing schedule, the integrity of that schedule and how rigidly it is maintained.

As a result of piracy and low volumes, there is currently only one shipping line offering a direct connection to Europe without transhipping (taking container off the vessel to another vessel). This direct line with Linea Messina has a relatively short stop-over in Jeddah and arrives in ports in the Mediterranean area (Barcelona, Marseille, and Genoa) within about 20 days. Note that the Netherlands does not have a customs agreement with Spain for sealed transportation with T1 form and delayed checks in the Netherlands. As a consequence, containers, especially with roses, have to be opened for inspection in Barcelona, which goes at the expense of the cold chain.

For destinations in North-West Europe, all liners take alternative routes that involve a stop-over with transhipping. The transit time is typically 25+ days to Europe depending on the destination. See Table 'Best option sea freight routes'. Other connections either take too long (35+ days), or are according to experts not an option due to high risks of delays and quality issues, for instance connections via Jebel Ali, Dubai.

It is possible to combine different shipping lines to increase the frequency of shipments. The available forwarding companies in Kenya cover the following shipping lines:

- GMS: Linea Messina, Maersk and MSC
- Bolloré Africa: Maersk, MSC

Besides the transit time (planned vs. realistic vs. disaster schedule), the main criteria for selecting a shipping line and route are a combination of preferred arrival port, risk of delays (transhipment), quality of shipping line and, of course, the costs.

Best option sea freight routes

shipping line	destinations	trans shipping	travel days			remarks
			ideal schedule	realistic schedule	disaster schedule	
Messina	Barcelona	no	18	23	30+	• about five departures every two months • no transhipping
	Marseille	no	19	24	30+	
	Genoa	no	20	25	30+	
Maersk	Felixstowe	at Salalah	26	31	35+	• about weekly • 7 days to Salalah; 5-10 days waiting for connection in Salalah; 14-xx days to North Europe
	Zeebrugge	at Salalah	27	32	35+	
	Bremerhaven	at Salalah	29	34	35+	
	Rotterdam	at Salalah	31	36	40+	

Sources: Messina, Bolloré, Maersk

Total transit times from farm to Europe vary depending on location of consolidation point, shipping route and type of markets in Europe. To give an indication: Naivasha-Mombasa is one day driving. However, from stuffing the container in Naivasha until departure in Mombasa will take about 2 to 3 days. The sea transport itself can take anywhere between 20 and 30+ days. In the European port, the flowers have to be discharged and cleared before the receiving party can process and transport them to their customers, adding probably another two days before the flowers are in the shop. This way, the fastest route without any hiccups will still take at least 25 days door-to-door.

The following challenges were identified:

Available routes

- There is only one shipping line offering a direct connection to Europe without transhipping, arriving in ports in the Mediterranean area (Barcelona, Marseille, and Genoa) within about 20 days. For destinations in North-West Europe, all routes involve a stop-over with transhipping. The transit time is typically 25+ days to Europe depending on the destination, with high risk of delays.

Recommendation:

- Direct connections are preferred because of shorter transit times and less risk of delays (transhipment). Selection of route, however, also depends on the targeted market, costs of transport in Europe, etc.

Schedule integrity

- Reliability of the shipping lines is a major problem and *schedule integrity* is an important risk to flower shipments. Many vessels do not arrive at their scheduled arrival times. Arrivals can be delayed by a few days or even longer.
- Cut flowers are relatively new to most shipping companies and the limited volumes currently involved do not allow any demands to be put on the shippers with regards to shipping schedules or routes.

Recommendations:

- It is necessary to have a better feeling about actual *delay* rates and expected *waste percentages* to determine overall viability of a sea freight supply chain. *Risk management*: how often can we expect delays and what is the impact on the long run? This kind of information can be acquired through assessing historical shipping data and/or by recording current schedules to obtain insight into actual delays (schedule integrity) per shipping lines and routes.
- The *selection of forwarder* is an important determinant of the success of eventual trial shipments. There are really only two viable options: GMS and Bolloré Africa. The selection will depend on the preferred routes, innovation, tracking system, 'shut out' time (latest possible time to supply a ship), and costs.
- Assess if insuring shipments is possible and desired.

Volumes

- A major challenge is the amount of roses and the value it represents that has to be shipped at once. A 40ft container contains about 955 boxes. That's a lot of stems to be handled at one moment in time, not only for a grower, but also for an importer marketing-wise.
- Consolidating loads brings other logistic challenges.

Recommendation:

- For the initial trial shipment (proof of concept), ideally all products come from one farm. Alternatively, a farm can be used as a consolidation point for flowers from a small number of different farms. Locations for consolidating near the production areas or in Nairobi are available for in a later stage.

Varieties

- Earlier pilots and research projects have given us some insight into the characteristics of a number of varieties with respect to sea transport conditions. However, the possibilities and requirements of many Kenyan varieties are not yet known.

Recommendations:

- In order to qualify for long term sea shipment, relevant Kenyan varieties need to be researched. Which varieties can successfully cope with 25+ days of sea transport and how?
- A pre-selection of varieties for the initial trial shipment is needed.

Mombasa port

- Even though the situation is improving, incidences of delays persist due to *port congestion*.
- Cumbersome and time consuming *customs clearance procedures* still exist at the port. Although integrated computer systems are in operation, delays are still prevalent due to lack of complete integration between the systems and frequent system failures.

Recommendation:

- Liaise with relevant authorities and (stakeholder) organisations involved in improvement of port efficiency.

Arrival port

- There is a need to select a port of arrival close to the final destination that allows for swift clearance procedures and fast handling of containers. From experience, we know that this is a learning process.

Recommendation:

- To be determined by project partners (market).

Cold chain management

- As quality is a critical variable, it is necessary to tackle all factors that influence quality. Temperature is a primary factor here. It is crucial to ensure that the whole supply system, from grower to retailer, is designed to optimally preserve input quality.
- What additional techniques for *atmosphere management* to use? The impact of these extra services is not always entirely clear and will have to be determined by testing.

Recommendations:

- Develop, implement and strictly monitor protocols for sea transportation.
- Start initial trial shipments without additional techniques.
- Assess (and research) impact of additional techniques.

Packaging and box design

- Boxes will have to be optimised to fulfil reefer requirements, but also still need to comply with on-farm cold store requirements.

Recommendation:

- It is recommended to use boxes specifically designed for sea freight requirements.

Executive Summary in Dutch

Het vervoer van bloemen naar Europa vormt de belangrijkste kostenpost voor telers in Kenia. Indien succesvol ontwikkeld kan vervoer over zee de concurrentiepositie and winstgevendheid van de Keniaans-Nederlandse sierteeltketen versterken. Aangetrokken door de potentiële besparing op logistieke kosten hebben verschillende partijen over de wereld belangstelling getoond in vervoer van bloemen over zee. Er zijn verschillende projecten en proefzendingen opgezet, waardoor de afgelopen jaren veel kennis is opgedaan. Terwijl sommige projecten minder succesvol waren hebben andere geleidt tot de ontwikkeling van regelmatige aanvoerlijnen. Het aantal regelmatige lijnen vanuit Kenia en andere Afrikaanse landen naar de Europese markt is echter nog bescheiden.

Om inzicht te krijgen in de Keniaans-Nederlandse zeevrachtketen voor rozen, heeft de VGB opdracht gegeven voor een onderzoek naar de uitdagingen en oplossingen voor de verdere ontwikkeling van deze zeevrachtketens. De studie is uitgevoerd door een combinatie van deskresearch, interviews in Nederland en een fact-finding missie naar Kenia (Mombasa, Nairobi, Naivasha en Limuru).

Tijdens de studie vonden we dat de resultaten van eerdere zeevrachtprojecten uiteenlopen. Wanneer er zich problemen voordeden, was het vaak als gevolg van een combinatie van bestaande kwaliteitsproblemen met rozen (Botrytis, meeldauw), gebrekkig koelketenmanagement en het ontbreken van verpakking dat speciaal is afgestemd op zeevracht. De projecten ondervonden ook problemen als gevolg van de ongunstige scheepvaartverbindingen en frequente vertragingen.

Een belangrijke les die is geleerd is dat het vervoer over zee alleen mogelijk is als de koelketen en andere technische voorwaarden worden geoptimaliseerd en volledig onder controle zijn, te beginnen bij de kwekerij tot aan de uiteindelijke klant. Naar onze mening is alle benodigde kennis en technologie beschikbaar of kan worden verworven door middel van extra onderzoek en testen.

De gehele logistieke keten is in principe beheersbaar en goede resultaten liggen binnen handbereik. Het succes echter blijft erg afhankelijk van de vaarschema's en de integriteit van deze schema's met het oog op vertragingen.

Als gevolg van piraterij en beperkte volumes, is er momenteel slechts één rederij die een directe verbinding met Europa zonder overslag (van container naar een ander schip) aanbiedt. Deze directe lijn met Linea Messina heeft een relatief korte tussenstop (zonder overslag) in Jeddah en komt binnen ongeveer 20 dagen aan in havens in het Middellandse Zeegebied (Barcelona, Marseille, en Genua). Er dient opgemerkt te worden dat Nederland geen douaneovereenkomst heeft met Spanje voor gesloten transport met T1 formulier en vertraagde controles in Nederland. Bijgevolg moeten containers, vooral met rozen, worden geopend voor inspectie in Barcelona, wat ten koste gaat van de koelketen.

Voor bestemmingen in Noordwest Europa zijn er alleen routes mogelijk met een tussenstop waarbij overslag van de container naar een ander schip nodig is. De transittijd is gewoonlijk 25+ dagen afhankelijk van de bestemming (zie tabel 'Beste opties zeevrachtroutes'). Andere aansluitingen zijn ofwel te lang (35+ dagen), of zijn volgens deskundigen geen optie vanwege kwaliteitsproblemen en de hoge risico's van vertragingen, bijvoorbeeld verbindingen via Jebel Ali in Dubai.

Het is mogelijk om verschillende rederijen te combineren om zo de frequentie van zendingen verhogen. De beschikbare expediteurs ('forwarders') in Kenia werken met de volgende rederijen:

- GMS: Linea Messina, Maersk and MSC
- Bolloré Africa: Maersk, MSC

Naast de transittijd (geplande versus realistisch versus rampschema), zijn de belangrijkste criteria voor het selecteren van een route en rederij een combinatie van de gewenste aankomsthaven, het risico op vertragingen (o.a. door overslag), de kwaliteit van de rederij en natuurlijk de kosten.

Beste opties zeevrachtroutes

rederij	bestemming	overslag	reisdagen			opmerkingen
			ideale schema	realistisch schema	ramp schema	
Messina	Barcelona	nee	18	23	30+	• ongeveer 5 afvaarten per 2 maanden • geen tussenstop met overslag
	Marseille	nee	19	24	30+	
	Genua	nee	20	25	30+	
Maersk	Felixstowe	at Salalah	26	31	35+	• ongeveer wekelijkse afvaarten • 7 dagen naar Salalah; 5-10 dagen wachttijd voor verbinding in Salalah; 14-xx dagen naar NW Europa
	Zeebrugge	at Salalah	27	32	35+	
	Bremerhaven	at Salalah	29	34	35+	
	Rotterdam	at Salalah	31	36	40+	

Bronnen: Messina, Bolloré, Maersk

De totale reistijd van kwekerij naar klant in Europa zal variëren afhankelijk van het consolidatiepunt, de scheepvaartroute en de eindmarkten in Europa. Om een indicatie te geven: Naivasha-Mombasa is een dag rijden. In de praktijk duurt het toch ongeveer 2 tot 3 dagen van laden van de container in Naivasha tot aan het daadwerkelijke vertrek uit Mombasa. Het zeetransport zelf zal ergens tussen 20 en 30 dagen duren. In de Europese haven moeten de rozen uitgeladen en ingeklaard worden voordat de ontvangende partij deze kan verwerken en verder vervoeren naar hun klanten. Dit alles voegt waarschijnlijk nog twee dagen toe aan de totale reistijd. In het optimale geval zal de snelste route dus nog steeds 25 dagen duren (deur-tot-deur).

De volgende uitdagingen werden geïdentificeerd:

Beschikbare routes

o Er is slechts één rederij die een directe verbinding met Europa zonder overslag aanbiedt. Deze directe lijn komt binnen ongeveer 20 dagen aan in havens in het Middellandse Zeegebied. Voor bestemmingen in Noordwest Europa zijn er alleen routes mogelijk met een tussenstop waarbij overslag van de container naar een ander schip nodig is, met een hoog risico op vertragingen. De transittijd is gewoonlijk 25+ dagen.

Aanbeveling:

- Directe verbindingen hebben de voorkeur vanwege de kortere transittijden en lagere kans op vertragingen (o.a. door overslag). Selectie van route is echter ook afhankelijk van de beoogde markt, kosten van vervoer in Europa, etc.

Betrouwbaarheid van de dienstregeling

- De betrouwbaarheid van de rederijen en hun dienstregeling (*schema integriteit*) is een belangrijke risicofactor voor bloemenzendingen. Veel schepen komen niet aan op de geplande aankomsttijd. De vertraging kan een paar dagen zijn of nog langer.
- Snijbloemen zijn een relatief nieuw product voor de meeste rederijen. De beperkte volumes maakt het stellen van eisen ten aanzien van vaarschema's niet mogelijk.

Aanbevelingen:

- Het is noodzakelijk om een beter inzicht te krijgen in de werkelijke omvang van de *vertragingen* en daaruit voortvloeiende verwachte *productuitval* om de levensvatbaarheid van een zeevrachtketen te bepalen. *Risicomanagement*: hoe vaak kunnen we vertragingen verwachten en wat is de impact hiervan op de lange termijn? Dit soort informatie kan worden verkregen via het beoordelen van historische vaardata en/of door het volgen van de lopende dienstregelingen om inzicht te krijgen in de werkelijke vertragingen per rederij en route.
- De *selectie van expediteur* is een belangrijke bepalende factor van het succes van de uiteindelijke proefzendingen. De shortlist bestaat eigenlijk uit maar twee opties: GMS en Bolloré Afrika. De uiteindelijke selectie is afhankelijk van de gewenste routes, innovatie, tracking systeem, 'shut out time' (laatst mogelijke tijd om aan een schip te leveren), en de kosten.
- Het kan nuttig zijn om te beoordelen in hoeverre het verzekeren van zendingen mogelijk en gewenst is.

Volumes

- Een belangrijke uitdaging is de hoeveelheid rozen die moet worden verzonden in één keer en de waarde die deze vertegenwoordigt. Er gaan ongeveer 955 dozen in een 40 voet container. Dat zijn een boel stelen, niet alleen voor een teler, maar ook voor een importeur die deze zal moeten vermarkten.
- Consolidatie van ladingen brengt weer andere logistieke uitdagingen met zich mee.

Aanbeveling:

- Voor de eerste proefzendingen (t.b.v. proof of concept) zijn bij voorkeur alle producten afkomstig van één enkel bedrijf. Als alternatief kan een kwekerij worden gebruikt als consolidatiepunt voor bloemen van een klein aantal verschillende bedrijven. Locaties om te consolideren in de nabijheid van productiegebieden of in Nairobi zijn in principe voorhanden of the organiseren (voor in een later stadium van het vervolgproject).

Rassen

- Eerdere onderzoeksprojecten hebben ons enig inzicht gegeven in de kenmerken van een aantal rozenrassen met betrekking tot de omstandigheden tijdens het vervoer over zee. Echter, de mogelijkheden en eisen ten aanzien van een groot aantal Keniaanse soorten is nog niet bekend.

Aanbevelingen:

- Om in aanmerking te komen voor langdurige verzendingen over zee zullen relevante Keniaanse rassen moeten worden onderzocht. Welke rassen kunnen succesvol omgaan met 25+ dagen zeevervoer en op welke wijze?
- Een preselectie van rassen voor de eerste proefzending is nodig.

Haven van Mombasa

- Ook al is de situatie verbeterd en hebben verschillende vervoerders eigen oplossingen gevonden, het aantal gevallen van vertragingen als gevolg van *havencongestie* blijft aanzienlijk.

- Omslachtige en tijdrovende *douaneformaliteiten* bestaan nog steeds in de haven. Hoewel geïntegreerde systemen operationeel zijn, komen vertragingen nog steeds voor door een gebrek aan volledige integratie en frequente systeemstoringen.

Aanbeveling:

- Het aanhalen van contacten met relevante instanties en organisaties van belanghebbenden die betrokken zijn bij efficiëntieverbetering van de havenactiviteiten.

Aankomsthaven

- Er dient een haven van aankomst te worden geselecteerd die in de buurt van de eindbestemming ligt met vlotte inklaringsprocedures en snelle afhandeling van containers. Uit ervaring van projecten in Zuid-Amerika weten we dat dit voor een deel een leerproces is.

Aanbeveling:

- Te bepalen door de projectpartners (marktgerelateerd).

Koelketen

- Aangezien kwaliteit een kritieke variabele is zullen alle factoren die deze beïnvloeden optimaal moeten worden ingevuld. Temperatuur is hierbij een primaire factor. Het is cruciaal om ervoor te zorgen dat de gehele koelketen, van teler tot retailers, optimaal ontworpen is om inputkwaliteit te waarborgen.
- Welke extra technologieën voor *atmosfeerbeheer* te gebruiken (CA, MA, etc.)? Het effect van deze extra services is niet altijd duidelijk en moet worden bepaald door testen.

Aanbevelingen:

- Ontwikkelen, implementeren en strikt opvolgen van protocollen voor zeetransport.
- Start eerste proefzendingen zonder aanvullende technieken.
- Beoordelen (en onderzoeken) impact van extra technieken.

Verpakking

- Dozen moeten worden geoptimaliseerd om aan de eisen van zeevrachtcontainers te voldoen, maar daarnaast ook aan de kenmerken van een koelcel op de kwekerij.

Aanbeveling:

- Het wordt aanbevolen om dozen die specifiek voor de vereisten van zeetransport zijn ontwikkeld te gebruiken.

1 Introduction

1.1 Background

Traders and growers in the floricultural sector strive for recognition as sustainable and environmentally conscious partners. The project "Duurzame Sierteelt Ketens" (Sustainable Floriculture Chains) is the starting point to create sustainable transport flows for both imports and exports of ornamentals. The project focuses on increasing the use of more sustainable multimodal transport systems (sea freight, railway, inland waterway, and short sea shipping).

The VGB board has set the goal to have 40% of the imports and 20% of exports shipped by means of multimodal transport systems by 2020. This objective has been included in the PT programme Energy and CO2 2013-2016.

Efficient logistics chains, under Dutch coordination, will be able to define the starting quality at harvest, monitor and steer plant health during prolonged transport, and guarantee the quality that consumers demand.

In this project, VGB Trade Services and LTO Groeiservice have brought together wholesale companies and relevant producers to take initial steps towards realising the ambition 2020. Alliances are organised and pilot shipments conducted by the industry, while initially relying on the available knowledge. Simultaneously, the development and filling of a new quality management system is started; a system that both the import and export trade can use.

Consortium members: VGB Trade Services, Wageningen UR Food & Biobased Research (FBR), LTO Groeiservice, Productschap Tuinbouw, Flowerwatch, Hortiwise.

Importing wholesalers: Intergreen, Finlay Flowers, Bloom, OZ-import, Hilverda de Boer, Oudendijk, FleuraMetz, Ciccolella Group, Florimex Group.

1.2 Objectives

The aim of the study is to gain insight into the still to develop Kenyan-Dutch sea freight supply chain for roses, its bottlenecks and challenges. Lessons are learnt from experience in current and recent (pilot) projects. The study will provide insight into the main challenges (bottlenecks) and solutions for the further development of these sea freight chains, where relevant stakeholders are identified and involved. A first step will be made for a plan of required actions for subsequent pilot shipments.

1.3 Methodology

The study was carried out through a combination of desk research, interviews in the Netherlands and a fact finding mission to Kenya. The fact finding mission was used for visiting locations and interviewing parties in Mombasa, Nairobi, Naivasha and Limuru.

1.4 Team

The research team consisted of Milco Rikken (Hortiwise / ProVerde) and Jeroen van der Hulst (Hortiwise / FlowerWatch). Additionally, Arthur Kemp (PostHarvest Services) contributed his practical knowledge and experience in the Kenyan-Dutch sea freight chain.

Project manager was Robbert van Willegen (VGB), who also participated in the fact finding mission.

1.5 Abbreviations

CA	Controlled Atmosphere: An active process to regulate modified atmosphere composition, in which initial concentrations of gases are controlled and monitored throughout the transit by the addition or removal of quantities of gas as established by the TransFresh controller.
CFS	Container Freight Station
FEU	Forty Foot Equivalent Container
FPEAK	Fresh Produce Exporters Association of Kenya
Genset	Engine generator, a machine to generate electricity (for instance to cool a reefer)
ICD	Internal Container Depot
KFC	Kenya Flower Council
KMA	Kenya Maritime Authority
KPA	Kenya Ports Authority
KRA	Kenya Revenue Authority
KSC	Kenya Shippers Council
MA	Modified Atmosphere: A beneficial atmosphere mix established at the time of service based on respiration rate of the cargo. Used for shorter transits and specific commodities.
Reefer	Refrigerated container
TEU	Twenty Foot Equivalent Container

2 Development of the Kenyan-Dutch Flower Chain

Recent studies commissioned by the Dutch government, World Bank and others (Hortiwise 2012; Rikken 2011; CBI 2013; Advance Consulting 2011) describe a number of developments that are relevant for the Kenyan-Dutch flower chain:

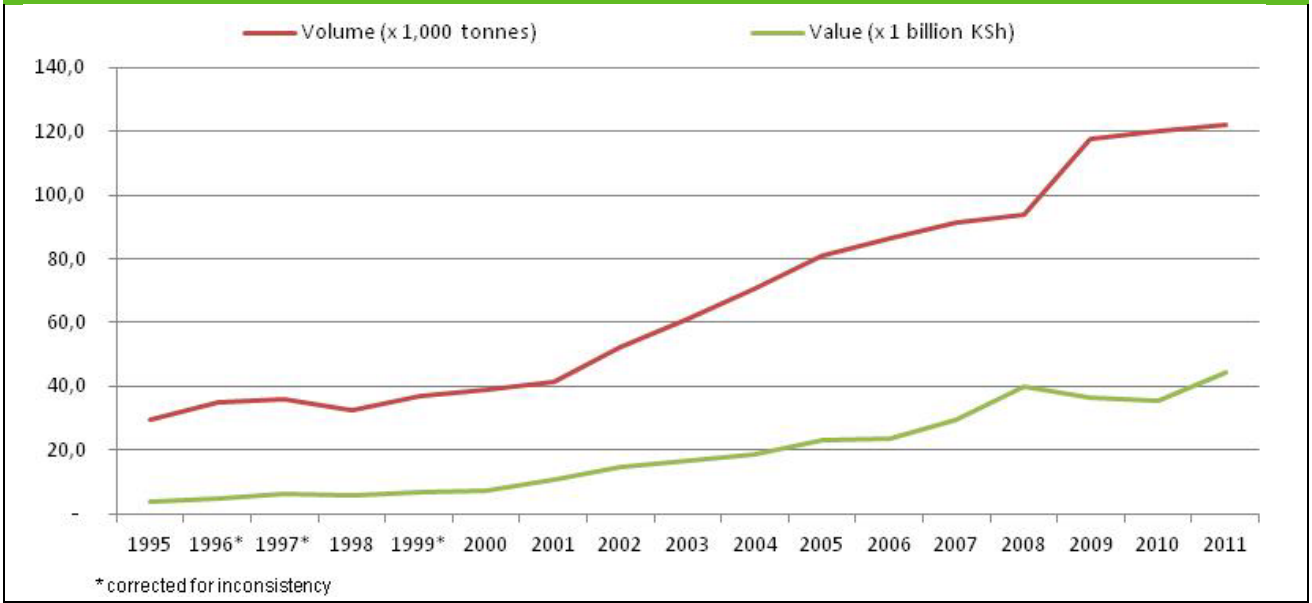
2.1 Strong growth in Kenyan horticultural exports to the EU

Kenyan horticultural exports have seen tremendous growth over the past two decades with the EU as the leading destination. Export volumes of fruits and vegetables such as green beans, avocados, and mangos are substantial, but cut flowers account for the lion's share of Kenyan horticultural exports.

In 2000, the total area under production of cut flowers was an estimated 750 to 1,000 hectares with about 38,000 tonnes of flowers being exported. In 2004, the sector had already grown to 2,000 hectares. Recently, HCDA estimated that there were about 4,039 hectares cultivated with flowers (greenhouse and outdoors) in 2012, of which 2,164 hectares of roses. Currently, flower exports have reached about 120,000 tonnes annually. In the period 2000-2010, the value of Kenyan flower exports has shown a spectacular six-fold increase (see figure below).

There are currently about 160 commercial flower growers in Kenya. They run mainly medium to large scale commercial operations, however, 20 to 25 of these growers are large to very large commercial enterprises, together accounting for roughly 75% of total flower exports. The leading flower growing counties are Nakuru (48%), Kiambu (39%), Machakos (5.4%), and Kajiado (2.4%).

Figure 1 Development of Kenyan cut flower exports



Source: Hortiwise from HCDA and KFC (2012)

The EU is the leading destination for cut flowers produced in Kenya. Sources report different figures, but most recent Eurostat show the Netherlands as main importer with almost € 250 million of flowers imported in 2011 (see Table 1). The UK and Germany are runner-up with respectively € 61.5 million and € 22.5 million.

HCDA reports a number of non-EU countries with considerable imports from Kenya in 2010: Russia (2,178 tonnes), Norway (1,174 tonnes), Switzerland (1,027 tonnes) and the United Arab Emirates (1,010 tonnes).

Table 1 The leading EU importing countries of Kenyan cut flowers

VALUE in € mln			
Fresh cut flowers			
	2011	**2010**	**2009**
Netherlands	248.9	231.4	220.9
United Kingdom	61.5	58.9	66.1
Germany	22.5	19.2	18.9
Sweden	7.6	5.1	6.8
France	3.7	4.1	3.8
Belgium	3.1	8.6	11.7
Cyprus	1.0	0.9	0.5
EU27	**348.7**	**328.7**	**329.3**

VALUE in € mln			
Roses			
	2011	**2010**	**2009**
Netherlands	209.2	199.8	188.6
United Kingdom	45.7	41.5	43.3
Germany	21.4	18.8	18.2
Sweden	7.6	5.1	6.8
France	3.1	3.4	3.0
Belgium	2.3	6.4	6.4
Cyprus	1.0	0.9	0.5
EU27	**290.8**	**276.4**	**267.2**

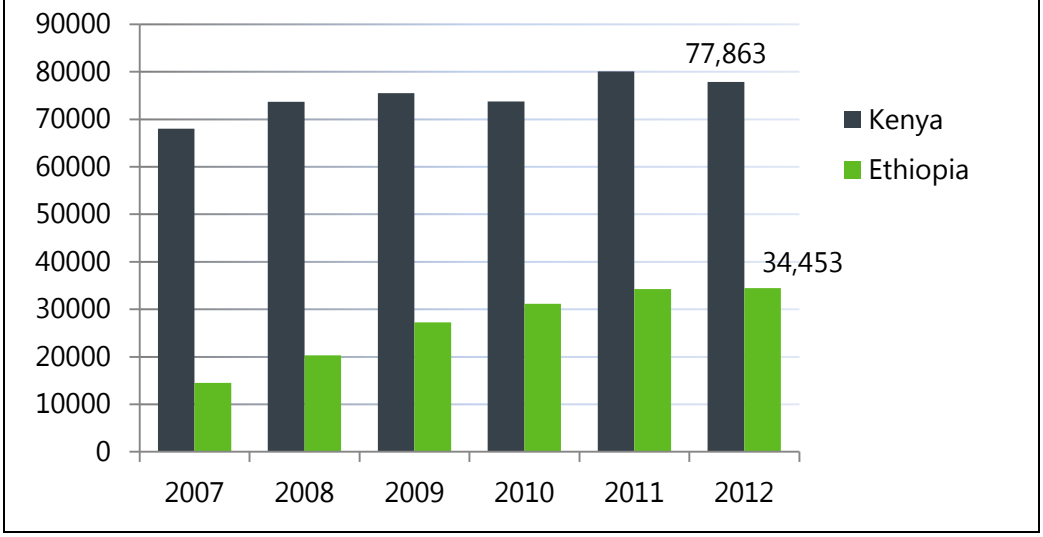
Source: Hortiwise from Eurostat (2013)

Since 2002, important supplying countries from the past, like Israel and Spain, have been losing ground fast. Among the top 10 of cut flower suppliers to the EU, they dropped, respectively, from rank 3 and 5 in 2002, to rank 6 and 12 in 2012. The main cause of the drop is the rise of Ethiopia and the increasing shares of Ecuador and Colombia.

Export volumes and potential for sea freight

Figure 2 shows that the volumes of roses exported by Kenya to the EU is currently about 80 thousand tonnes per year. As a reference, Ethiopia has been growing explosively and has reached about 35 thousand tonnes 2012. As we know, the lion's share of Kenyan rose exports is transported by air. Sea freight of roses is negligible.

Figure 2 Kenyan and Ethiopian rose exports in tonnes



Source: Hortiwise from Eurostat (2013)

As mentioned before, the VGB board has set the goal to have 40% of the rose imports shipped by means of multimodal transport systems by 2020. If translating these goals into numbers, this would mean that in 7 years time (with stable exports) no less than 32 thousand tonnes of roses will be transported over sea. This is the equivalent of about 3,000 containers per year or roughly 55 containers (40 foot) per week. In case of expected continued expansion of Kenyan export volumes, these numbers of course will be higher.

2.2 Changing market conditions

Stagnating market growth
The industry is facing a period of dramatic change. Market growth has stagnated in some markets, while the supply of flowers remains abundant. In the medium and long term, a moderate growth of only 2 to 4% annually is expected in Western Europe's cut flower markets.

Retail chains increasingly dominate
The cut flower value chain is increasingly dominated by large European mass-market retailers. Supermarkets tend towards single-sourcing based less on price (as the Dutch auction system) and more on quality, delivery reliability and traceability. The consequent concentration of importers is leading to a consolidation of producers.

Sustainability becomes mainstream
In the sector, quality standards and Corporate Social Responsibility (CSR) keep on gaining importance. Demand for sustainably produced flowers is rising, including a growing awareness of carbon footprint. Global trends such as global warming and depletion of natural resources have reinforced the perception that sustainable production and transport is necessary. In various covenants (directives and regulations), agreements are made to realise energy savings. Consumers regard sustainability to be increasingly important, or even self-evident.

Lean and transparent supply chains
The industry is evolving towards lean and transparent supply chains characterised by consolidation and vertical integration. The role of ICT in flower marketing increases. More than 60% of the roses traded at the FloraHolland auction are sold through the 'KOA' remote buying system. European wholesalers offer products in their own online web shops, where customers (wholesalers and retailers) can buy directly from stocks. Trade is becoming increasingly virtualised, making accurate exchange of information critical.

Improved varieties (for production in Africa)
East Africa is characterised by different cultivation conditions and a longer distance to market compared to traditional flower production areas in Europe. Breeders increasingly develop varieties specific for the East African growing and transport conditions.

Peak days
Flowers are often bought for special occasions like Valentine's Day or Mother's Day. Prices are often high during these peaks, but the range of flowers that match this specific demand during these peak days is limited (e.g. red roses during Valentine's Day). Importance of a number of other special days like Women's Day in Russia (March 8th) is increasing.

2.3 Specific developments with respect to sea freight of roses from Kenya

Preferential access uncertain

An old system of preferential access to European markets for developing countries finished in 2007, in which Kenya and other so-called ACP (African, Caribbean and Pacific) countries enjoyed duty and quota free access to the EU market. Since then, East African countries have been involved in a slow process of negotiating their own separate 'Economic Partnership Agreements' (EPAs) with the EU. Until the EC deadline of January 2014, Kenya still enjoys free entrance. However, the outcome of the negotiations is still uncertain, risking an import tariff ranging between 8 and 12% by next year.

Piracy

There is a risk of piracy in the Gulf of Aden and the East Coast of Somalia. This risk causes ship liners to take alternative routes which take 20-30 days to Europe depending on the destination (see Chapter 4), where 15-20 days through the Gulf of Aden could be possible. Piracy has also increased costs for sea transport (security measures, risk calculations).

Maersk price increase

Effective 1 January 2013, the shipping line Maersk has increased its base rates for reefer containers by US$ 1,500 per forty foot equivalent unit across the globe. The move by the world's biggest carrier provoked a storm of protest from shippers. The carrier said the sizable increase, which it announced in September, was necessary because rates have risen less than inflation for the past seven years and were not producing a return on the large capital investment in new equipment.

Development in air freight capacity

Since about 4 years, after a stable decade, outbound air freight capacity has developed strongly. New and more efficient cargo planes are introduced, creating price pressure. In Kenya, the difference between the costs of air freight and sea transport is decreasing (much smaller in comparison to the situation in Ecuador), making an introduction of sea transport in the sector more of a challenge.

3 Recent and Ongoing Sea Freight Projects

Attracted by the potential of low cost logistics, various parties worldwide have shown interest in sea transport of flowers and organised trial shipments. Over the past couple of years, much has been learned and some trials have developed into regular transport lines. Although industry professionals tend to be hesitant to share information on volumes and results, it is clear that, slowly but steadily, sea transport of flowers is on the rise:

- Hypericum, gypsophila and carnations are regularly exported out of Ecuador and Colombia to the EU by sea container. This is to a large extent possible because of the availability of regularly sailing ships used by banana exporters offering frequent shipping schedules. Furthermore, cut flowers are relatively light weight and can be easily added to the heavy loads of bananas.
- Israeli growers too, export their ornamentals by boat. Foliage accounts for about 85% of the sea freight, but solidago, waxflower, gypsophila and phlox can also be found on board.
- In recent years, Oudendijk has been shipping containers with proteas, leucadendron, foliage and hypericum from South Africa, Portugal and Ecuador.
- Since years, young plant material (rooted and unrooted cuttings, etc.) have been shipped from Central America.

The number of steady lines from Kenya and other African countries to the European market is still modest. On a regular basis, Finlays ships lilies and chrysanthemums from South Africa to the UK. Another relatively new sea connection, which can still be considered in development, is Finlays' carnation shipments from Kenya to the UK. Finlays is currently shipping about 40 containers of carnations per year, which represents about 20% of their production. Finlays also conducted trials with roses, but without success due to quality issues at arrival. Besides Finlays, Intergreen and Superflora of the Dutch Flower Group have conducted a number of trial shipments with different products from Kenya. Finlays and Intergreen both participate in the GreenCHAINge project.

An overview of other more or less recent projects with relevance for underlying report:

- Onderzoek Zeetransport (2003-2005)
- Flowers on Waves (2006)
- Star Flower project (2005-2007)
- Bloemen in containers beter bekeken (2005-2008)
- CoCos - Containerisatie en Conditionering in Sierteeltketens (2008-2010)
- Ketenregie en kwaliteitsborging zeetransport (2009-2010)
- CO2 reductie duurzame ketens bloemisterij (fase 1) (2012)
- Plantgezondheid in de multimodale keten (2012)
- Compact & Dry
- Fresh Flower Solutions (FFS) (2012-ongoing)

Lessons learnt, conclusions and recommendations of these projects have been incorporated in other parts of this study.

Onderzoek Zeetransport (2003-2005)
by Productschap Tuinbouw, WUR Food & Biobased Research, VGB, Pokon & Chrysal

The research project aimed at developing a distribution concept for cut flowers by sea container transport. To define the project, the focus was on the United States.

The outcome was positive, resulting in two pilot shipments of bulb flowers to New York, the first just before Valentine's Day 2005, the other just before Easter 2005. When opening the containers in New York, the flowers showed excellent quality and vase life was good. At arrival in the USA, the US Department of Homeland Security (Customs + phytosanitary inspection) turned out to be the most uncertain factor in the chain due to potentially long waiting times (up to almost a week).

In the end, the project has contributed to Holex exporting 40 to 50 containers per year to the USA.

Flowers on Waves (2006)
by Flower Transport Gel (FTG), Maersk, P&O

In January 2006, FTG Holland, in combination with a number of Kenyan flower growers, transported a reefer container with 190 boxes of fresh cut flowers from Nairobi to Aalsmeer (via route Mombasa to Salalah, Oman and then from Salalah to Rotterdam). The flowers were shipped from Nairobi on January 12th and arrived at their destination in Aalsmeer on February 3rd. All flowers were bunched, packed and sleeved with Flower Transport Gel to keep the flowers hydrated. Upon arrival in Aalsmeer, the container was unpacked and flowers were checked by independent VGB inspectors in accordance with VGB-criteria. Additional vase-life tests were conducted for a number of samples. The rest of the flowers were auctioned the following market day receiving good prices.

It was concluded that after the cut flowers had endured a containerised transit period of approximately three weeks, their arrival condition had been very satisfactory. Hence, most of the products had successfully sustained a vase-life period of 7-10 days. A few rose varieties ('Chelsea', 'Frisco', 'Sunbeam' and 'Gabriella') and most bouquet fillers even had an attractive appearance after a fortnight's vase-life at room temperatures. The vase-life test showed that there was no significant difference in comparison with the same types of flowers placed in water directly after harvesting.

Photo: Flowers on Waves, ready to ship.
Source: www.ftg.nl

Star Flower project (2005-2007)
by Maersk Line, World Flowers, Dole Fresh Flowers, FloraHolland, Green Wings, Intergreen, Smurfit Kappa Group, Pokon Chrysal International, WUR Agrotechnology & Food, UC Davis - University of California.

The project was initiated by Maersk Line, for the development of sea freight distribution protocols for large volume cut flower species using reefer containers in all relevant shipping corridors in the world. Products

under investigation were hypericum, carnations, gypsophila, roses, alstroemeria and chrysanthemum. Research approach: product treatments, handling, logistic procedures and packaging to ensure quality for transport times of up to 28 days.

Bloemen in containers beter bekeken (2005-2008)
by Productschap Tuinbouw, WUR Food & Biobased Research, VGB, Chrysal

The project was a continuation of the project 'Onderzoek Zeetransport'. The project aimed at determining the maximum container transport time of several types of (bulb) flowers. The optimal ways of loading containers and packaging that can be used were further studied.

It was concluded that suitability for long-term transportation is strongly cultivar dependent:

- Most tested lily and tulip cultivars were suitable, a minority of the cultivars not.
- Amaryllis, hyacinths and narcissus showed a mixed picture with suitable and not suitable cultivars, while also the origin played a role.
- Under strict conditions regarding harvest stage and treatments, the three tested freesia cultivars could stand a prolonged refrigerated transport.
- With respect to Anthurium and Zantedeschia little could be concluded about the transportability because the right treatments for a successful long-term transportation were not (yet) found.
- For allium, alstroemeria, eremurus and hydrangea long refrigerated transport is possible if certain quality limiting issues are accepted. Chrysanthemum and cymbidium seem to be suitable for long transport.

Prolonged transport means a transport of at least 7 days. The maximum transport duration is species and cultivar dependent. The project also produced protocols for the loading of containers.

CoCos - Containerisatie en Conditionering in Sierteeltketens (2008-2010)
by Productschap Tuinbouw, FloraHolland, VGB, WUR

The "CoCos" project aimed to further develop and target a wider application of specific innovative logistical processes for floriculture products, in particular container technology for flowers and plants (sea transport) and compact road transport. The CoCos project was to find the optimal transport conditions for long distance transport in containers. Emphasis was on roses and chrysanthemums, but also gypsophila, carnations, alstroemeria, leucodendron, solidago and lillies were covered.

An important task within the project was bundling and making accessible (new) knowledge about container and conditioning. The accumulated knowledge was assessed through practical pilots and demonstrations at company level. During the project, the optimal conditions throughout the logistics chain were examined, from farm to final destination.

Besides three export shipments to Finland, Turkey and Russia, a number of import pilot shipments were conducted:

1. Colombia - Netherlands (via Spain): two shipments (October 2008 and May 2009) with Wesseling Export. Various types of spray carnations. Good transfer time (14 days). Most varieties showed good vase life. Some varieties gave some problems with opening.
2. Ecuador - Netherlands: January 2010 and February 2010 with Oudendijk and MFI. Roses, alstroemeria, gypsophila and leucodendron. Good transfer time (17 days) and excellent vase life results.

3. Israel - Netherlands: May 2009 with Agrexco. Regular shipment of solidago. Transfer time of 7 days. Results were good.
4. Kenya - Netherlands: Research of the logistical corridor, but no actual shipment (Oserian/Bloom).

With respect to the planned Kenya shipping routes:

- The idea was to ship the products of the Oserian farms in Kenya to the Netherlands. Initially, Maersk seemed to have good lines. However, at the moment of the pilot it was found out that the journey in fact would take much longer. First, a ship would directly pass Somalia towards the Suez Canal. However, because of the drop in demand due to the crisis, they now go to a hub in Salalah, Oman. There, the containers would have to wait a week for a big liner to Rotterdam. In total, the containers would be 29 days on route.
- Also a corridor through Barcelona was examined. This route would take 22 days by sea, plus about an additional two days for road transport to and from the ports plus phytosanitary control. Containers, especially with roses, have to be opened for inspection in Barcelona, which goes at the expense of the cold chain. The Netherlands does not have a customs agreement with Spain for sealed transportation with T1 form and delayed checks in the Netherlands.

An important conclusion of the CoCos-project was that quality of flowers transported by sea can be better than when transported by air:

- Air transport: 3 days x 10 degrees Celsius average = 30 degree days
- Sea transport: 20 days x 1 degree Celsius average = 20 degree days

Another important conclusion was that the correlation between the temperature sum and the vase life is negative, very strong and largely linear (for roses without botrytis problems).

CO2 reductie duurzame ketens bloemisterij (phase 1) (2012)
by Productschap Tuinbouw

The overall objective of the project was to seek to reduce the CO2 footprint for floriculture products by 30% in 5 years. This primarily concerned the emissions in the transport chain. Within the project, the aim was to show how much energy use reduction can be achieved on the main import routes and two important European export corridors.

By calculating the carbon footprint for different transport scenarios, insight was acquired into the possibilities to organise the transport of imports and exports of flowers in a more sustainable way.

A substantial reduction in greenhouse gas emissions would be achieved by using alternative modes of transport on routes that are now covered by transport by truck or plane. It was concluded that, depending on the final destination, rail or sea can offer a sustainable alternative through its lower energy consumption per tonne-kilometre.

Plantgezondheid in de multimodale keten (2012)
by Productschap Tuinbouw, LTO Groeiservice, VGB

This project investigated the requirements and effects regarding plant health, choice of varieties and postharvest treatment with respect to the transition to a multimodal chain. It included work on obtaining

insight into problem crops, the simulation of two multimodal transports and communication on plant health best practice in transport in the chain.

Compact & Dry (2009-2012)
by Productschap Tuinbouw, WUR Food & Biobased Research, FleuraMetz

Compact & Dry research by Food & Biobased Research was preceded by CoCoS and was the predecessor of Q-cotrans. In Compact & Dry, the different methods for transporting flowers dry (and thus in a compact manner) were investigated. Quality, costs and CO2 emissions were researched. The objective: expansion of knowledge and with that creating the needed argumentation to make informed choices.

Compact & Dry was a project that ran in four phases. In the first phase, the research question was determined on the basis of queries and requests from businesses in the industry. Phase two consisted of examining the economical and sustainable aspects of different modes of transportation and destinations. Next phase consisted of experiments with different types of flowers. Focus was on answering the following questions: can they be dry, can they be compact, can the entire chain be dry, what problems can be expected, and are there problems when the flowers are in a consumer's vase? Finally, five intensive pilots were completed.

FleuraMetz that was responsible for the pilots: "Following a certain schedule, we transported some of the flowers dry and the others not, through the entire chain from the grower in Ecuador to both a Cash & Carry in Germany and a florist in France (as we deliver directly and via distributors)."

Fresh Flower Solutions (FFS) (2012-ongoing)
by FloraHolland, TransFresh

FloraHolland and TransFresh have joined in Fresh Flower Solutions (FFS) to offer growers the opportunity to store and transport their products using TransFresh technology. FFS is an end-to-end flower logistics service that includes an optimal container environment during marine transport to growers all over the world.

As a project under the umbrella of FFS, a series of shipments have been carried out from Kenya to the Netherlands in 2012. A total of 15 Kenyan rose growers were involved in the first trial shipments as FloraHolland wanted a representative sample of growers from the different regions of Kenya.

Several interviewed parties indicated that the trial shipments encountered some problems. FloraHolland used TransFresh controlled atmosphere. However, TransFresh was not effective because of only 8 tonnes of flowers in the container (fruit 20 tonnes). Volumes appear not enough to maintain required atmosphere.

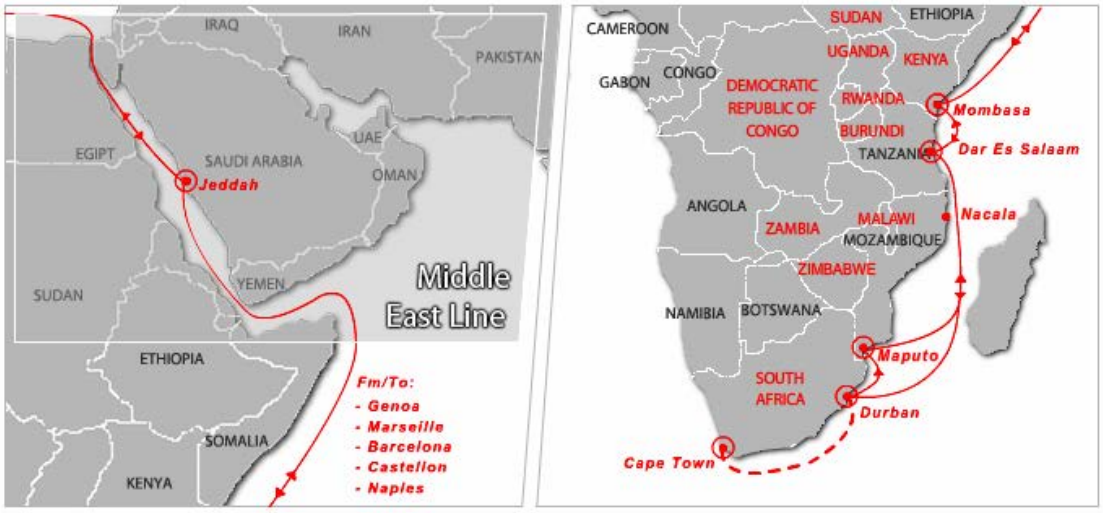
4 Sea freight routes Kenya-Europe

There are regular feeder services between Mombasa and Dar-Es-Salaam, Durban, Mogadishu, Djibouti, Salalah and Dubai. Direct services from Kenya to European destinations, however, are scarce.

Due to the risk of piracy in the Gulf of Aden and the East Coast of Somalia, many ship liners take alternative routes which take 25+ days to Europe depending on the destination, where 14-16 days through the Gulf of Aden could be possible.

As a result, there is currently only one line offering a connection without transhipping (taking container off the vessel to another vessel). This direct line with Linea Messina has a relatively short stop-over in Jeddah (see map) and arrives in ports in the Mediterranean area (Genoa, Marseille, and Barcelona).

Figure 3 Messina connections to Europe



Source: www.messinaline.it

For destinations in the North-West of Europe, transhipping is necessary. Shipping lines, such as Maersk/Safmarine, MSC, CMA CGM, Delmas, and Messina offer connections to all major ports in Europe, however, with transhipping in the Middle East. Containers are shipped by a feeder connection to for instance Salalah in Oman where they are unloaded and have to wait for a connection on a larger vessel to their European destination. Transhipping makes the transit time more prone to delays and less predictable.

Figure 4 Maersk connections to Europe

Source: Bolloré Africa

The most viable options currently available are:

Table 2 Best option sea freight routes

shipping line	destinations	trans shipping	travel days			remarks
			ideal schedule	realistic schedule	disaster schedule	
Messina	Barcelona	no	18	23	30+	• about five departures every two months • no transhipping
	Marseille	no	19	24	30+	
	Genoa	no	20	25	30+	
Maersk	Felixstowe	at Salalah	26	31	35+	• about weekly • 7 days to Salalah; 5-10 days waiting for connection in Salalah; 14-xx days to North Europe
	Zeebrugge	at Salalah	27	32	35+	
	Bremerhaven	at Salalah	29	34	35+	
	Rotterdam	at Salalah	31	36	40+	

Sources: Messina, Bolloré, Maersk

Other connections either take too long (35+ days), or are according to experts not an option due to high risks of delays and quality issues, for instance connections via Jebel Ali, Dubai.

It is possible to combine different shipping lines to increase the frequency of shipments. The available forwarding companies in Kenya cover the following shipping lines:

- GMS: Linea Messina, Maersk and MSC
- Bolloré Africa: Maersk, MSC

More about forwarders in Section 5.1.2 and shipping lines in Section 5.1.4.

Criteria for selecting shipping line and route

The main criteria for selecting a shipping line and route are a combination of:

- preferred arrival port (market)
- transit time (planned / realistic / disaster schedule)
- risk of delays (transhipment)
- quality of shipping line (material, tracking system)
- costs

Other important criteria include the shipping schedule and frequency of departures, preference for a forwarder, quality and availability of reefer containers, etc.

Schedule integrity and delays

Typically, schedule integrity depends on weather conditions (winds) and volumes (need for full ships). For shipping lines, reefer cargo on a vessel is the "cream" on top, while dry cargo provides the base on which the service is built. As dry cargo is not time or transit sensitive, it dictates how the schedule works.

Delays occur due to late arrival at the departure port (Mombasa), on route, at the port of transhipment (Salalah for instance), or at the port of arrival (Customs clearance).

Long handling times at sea ports: on average, logistics for air freight in Kenya are concluded within 24 hours, whereas sea freight logistics are completed within 96 to 120 hours.

Usually, the dates of arrival, berthing and departure are only mere estimates given without guarantee and subject to change without prior notice. Claims are not possible in case of delays.

It is recommended to carry out an analysis of historic schedules and/or record current schedules to obtain insight into actual delays (schedule integrity) per shipping line and route.

Other observations

- Export volumes dictate the sailing frequency and intervals. If a country is a large exporter of goods then more shipping lines and more capacity is offered with better sailing frequencies. Sadly, Europe is in financial turmoil and cannot absorb all the goods Africa would like to export and pay the price expected. So, a depressed market comes with lower volumes, less vessels and extended sailing schedules.
- The frequency of departures tends to be stable throughout the year.
- Export acceptance cut-off time is usually about 24 hours in Mombasa and 48 hours in Nairobi.
- Shipping lines between South American rose producer countries and Europe are far more frequent and predictable thanks to the banana vessels and the volume of fresh products heading for Europe.
- Chartering a vessel is not an option. As at least 200 containers are needed to fill a small vessel, which would still result in high costs (the bigger the better).
- In their 2012 trials, Intergreen/Superflora used both Maersk and Messina. Experiences with the Maersk shipment was ok, with Messina the shipment encountered problems as the container arrived in Barcelona where the products were kept for a week by the local Customs.
- Finlays, who regularly sends carnation to the UK, works with Bolloré as forwarder and Maersk as shipping company to transport their carnations to Felixstowe (UK) via transhipment in Salalah, Oman.

There are talks about potential developments that can positively influence the availability of routes and schedules on the longer term. As the risk of piracy is slowly fading, Maersk and other shipping lines might consider direct connections from East Africa to Europe. Also, with the broadening of the Panama Canal in 2014, more volume will be transported with big container liners that circle the globe. Salalah is an important hub for these ships, which can result in better connections with feeders from Mombasa.

5 The Sea Freight Supply Chain

5.1 Links in the chain

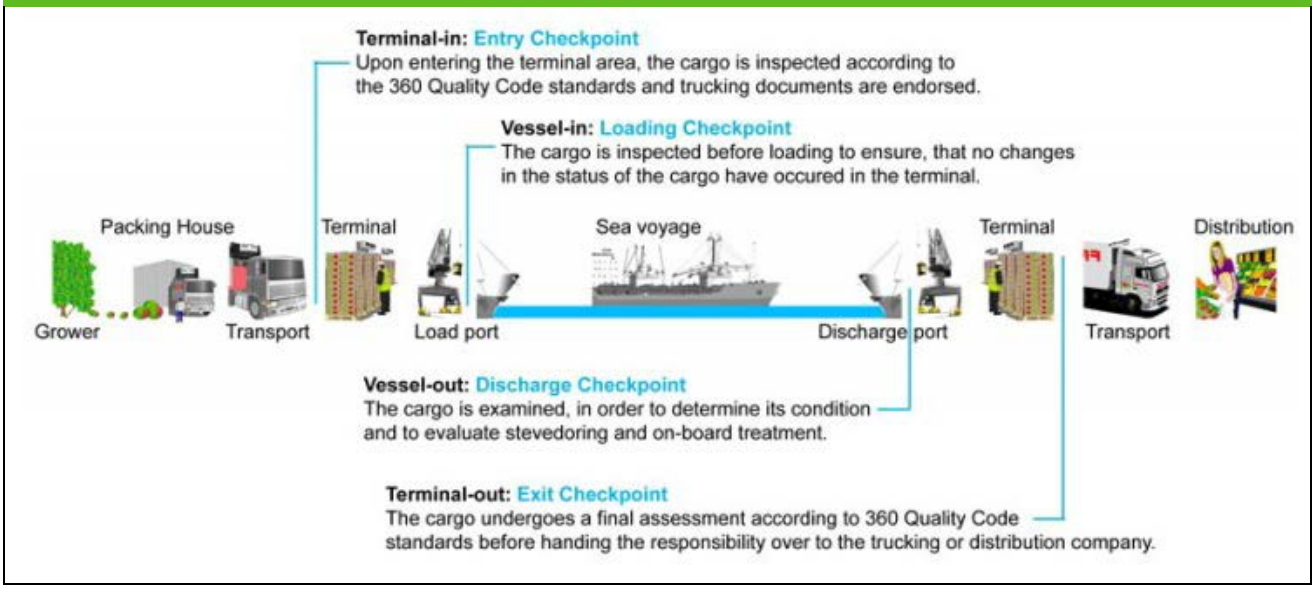
In case of sea freight, the supply chain can take different shapes and involve a variety of players in handling the products.

Ideally, a reefer container is stuffed at the farm. If more than one farm is supplying, the flowers can also be collected at a consolidation point (in the area, in Nairobi or near the port). Flowers are then transported by truck to a depot near the port where the reefer containers are unloaded from the trucks and plugged in. When the vessel has arrived in Mombasa and the departure time is known, the container is transported from the depot to the birth and loaded onto the vessel either by the forwarder, port authority or shipping line. The forwarder specialised in sea freight can assist in the whole process.

At the destination port in Europe, the flowers are typically received by the importing company or a service provider who delivers to the importer (handling agent or other). The container is either unloaded/stripped in the port or it continues as one sealed unit (in case of CA or MA, products will need to remain in the container until their final destination).

From there onwards, the flowers are usually trucked to the importers premises for further processing before being supplied to their (retail) customers. Alternatively, the imported flowers are prepared for auctioning, but that route will take the flowers a few days extra to reach the consumer.

Figure 5 The sea freight supply chain from grower to end consumer



Source: www.360quality.org

Transit times

Total transit times vary depending on location of consolidation point, shipping route and type of markets in Europe. To give an indication: Naivasha - Mombasa is one day driving. However, from stuffing the container in Naivasha until departure in Mombasa will take about 2 to 3 days. Note that paperwork has to be completed four days before departure of the vessel. As we have seen in Chapter 4, the sea transport itself can

take anywhere between 20 and 30+ days. In the European port, the flowers have to be discharged and cleared before the receiving party can process and transport them to their customers, adding probably another two days before the flowers are in the shop. This way, the fastest route without any hiccups will still take at least 25 days.

5.1.1 Growers, including transport from farm to port

Observations

On the farm

- Errors in the crop protection system at the farm can lead to a higher incidence of botrytis in roses. In this case, sea transport should not be considered. CoCos recommends to select varieties with little sensitivity to Botrytis and prevent contamination during cultivation and post-harvest.
- CoCos about roses: Dipping the flower buds in Switch, Medallion or chlorine reduces the risk of Botrytis infection. Test the dip: Switch and chlorine can damage some cultivars. Pre-treatment with Chrysal RVB and AVB may give a better flower opening, but this is cultivar specific.
- Oserian has a cold store with an air-tight seal to the reefer container. The only other location we have seen with these specs was at Finlays' Kingfisher farm.
- Finlays loads cooled carnations into a cooled reefer. This is possible because they have the airlock. Hamburg Süd advices that if no airlock is available, pre-cooling of the reefer container should generally not take place.
- Most growers/importers consider one shipment per week ideal on the longer run.

Collection point

A major challenge is finding an appropriate collection point for the roses that are to be shipped. Best practice is to fill a reefer container as close as possible to the farm. Any transportation by truck goes at the expense of maintaining an optimal cold chain. The following options are possible:

1. Best practice is to fill a reefer container at the farm, straight from the farm's own cold store. Ideally, all products come from that one farm. Alternatively, a farm can be used as a consolidation point for flowers from a small number of different farms. A problem, however, is that most growers are not willing to bring their products to another farm.
2. Collection in a central location, i.e. a regional consolidation point close to production locations. Farmers transport their products in refrigerated/insulated trucks to the regional collection point where the boxes are stored and cooled back to appropriate temperatures. Of course this location should have all the necessary facilities such as appropriate space and cold store capacity.

   ⇨ Option: HCDA and FPEAK jointly manage a loading facility in Limuru (near Naivasha), which was intended as a consolidation point for flowers. The facility with four cold stores and 15 tonnes capacity is currently in use by Sunripe as a collection point for avocados and other fruit and vegetables. The facility has been visited and assessed. FPEAK has indicated that the facility can be used for the planned trial shipments.

⇨ Jane Ngige (KFC) mentions KFC's Mount Kenya Regional Group, which is quite a cohesive group of farm owners that have been discussing sea freight in the past.

3. Another option is to collect the boxes at a facility in Nairobi. Cold store facilities are readily available with various forwarding companies near the airport. In the past, several trials have opted for this solution. The phytosanitary checks by KEPHIS takes place at the place of stuffing. In case of collecting at JKIA airport, the experience and network there can be an advantage.
4. Stuffing the container in Mombasa, for instance at depot facilities provided by the forwarders. This is not a desired option because of the long transport by truck to Mombasa and sub-optimal handling facilities in Mombasa.

Photo: HCDA/FPEAK Depot in Limuru in use by Sunripe
Source: VGB

Other observations

- Although under pressure, Nairobi continues to be the primary communication and financial hub of East Africa. It has the region's best transportation links, communications infrastructure, and trained personnel. The road network in Kenya is well developed compared to other countries in the region. The system is fairly extensive and consists mainly of unpaved roads. The road linking Nairobi and Mombasa is in good condition. To maintain its leading position, Kenya has been investing significantly in the country's infrastructure over the last couple of years. Several major national highways are currently under construction. (Advance Consulting 2011)
- Distance Nairobi-Mombasa 430km. The transport from Nairobi to Mombasa of a 40 foot container typically costs about US$ 800.
- A truck can handle 85 to 89m3 of cargo, but a reefer only 65 to 69m3. To save on expensive domestic transportation, it is therefore most efficient to have two trucks driving and fill up three containers.
- The railway system links the nation's ports and major cities. A railway line also connects Kenya with neighbouring Uganda. For perishable goods, the railway system is not an option as it does not provide refrigerated/reefer transportation (Kenya Port Authority in interview).

Challenges

o Required volumes: A major challenge is the amount of roses and the value it represents that has to be shipped at once. A 40ft container contains about 955 boxes. That's a lot of stems to be handled at one moment in time, not only for a grower, but also for an importer. In case of consolidated loads, this brings new logistic challenges.

o Selection of varieties: Earlier pilots and research projects have given us some insight into the characteristics of a number of varieties with respect to sea transport conditions. However, the possibilities and requirements of many Kenyan varieties are not yet known. In order to qualify for long term sea

shipment, relevant Kenyan varieties need to be researched. Which varieties can successfully cope with 25+ days of sea transport and how?

5.1.2 Forwarders/handling agents

Observations

There are roughly two types of forwarders involved in offering assistance to sea shipments:

1. Carrier haulage, offering all-inclusive door2door service.
2. Merchant haulage, offering port2port and service provider.

In the case of Kenya, the second type tends to be more familiar with specific requirements of flowers. The two best examples are GMS and Bolloré Africa (SDV Transami).

Typical scope of work of the forwarders includes, amongst others:

- Planning of the shipment
- Collection and delivering of reefers
- Pre-trip-inspections
- Depot management services
- Transport of loaded container from Nairobi/elsewhere to Mombasa port
- Lift Off Lift On
- Plugging in depot while awaiting vessel
- Temperature monitoring at depot and port
- Shunting to port
- Handover at the port or loading vessel with own equipment

All in all, the forwarder takes care of all the micro-management involving the shipment and the activities in the port.

According to nearly all interviewed parties, the two best options with respect to logistics freight forwarders are GMS and Bolloré Africa:

Gateway Marine Services (GMS):

- GMS works with the following relevant shipping lines for flowers to Europe: Messina, Maersk and MSC.
- GMS is a so-called "NVOCC", a non-vessel operating container carrier, meaning they have (lease) their own containers which can be used on both MSC and Messina vessels. GMS is officially accredited to maintain and repair reefer containers with carrier cooling units.
- GMS enjoys a special deal between MSC and Messina (Vessel Sharing & Slot Agreement): In case of a MSC bill of lading, it is still possible to ship on a Messina vessel. This makes planning of shipments more flexible. This way, GMS can roughly offer five shipments per month.
- GMS offers additional techniques/services like ethylene blocking, ethylene scrubbing, CA, ozone sanitation for botrytis and humidity systems, amongst others.

Photo: Reefer with extra backup genset
Source: Hortiwise

- GMS has an own depot in Mombasa and uses facilities of 'From Eden Ltd' at the Nairobi airport.

- There is a distance of 1.3 km between the ship and the GMS depot in Mombasa. It will take about two hours to transport the reefer from the depot to the ship and load it on the vessel. These two hours the reefer is without power. GMS indicates that they get priority from the KPA when loading the ship.
- CACP certified (Certified Accredited Customs Programme). Customs formalities are carried out in the GMS depot. They have their own scanner.
- GMS focus lies in the reefer business (fish, avocado), but also work with regular containers. They are currently building a new depot so they can separate the two types. GMS is said to handle about 40 reefer containers per week.
- GMS co-ower Paul Bletterman also represents the shipping line MSC, via his company Kenfreight.
- FloraHolland and DFG worked with GMS. Both consider GMS a good partner with good material and reefer containers in stock.

Bolloré Africa (SDV Transami):

- Last year, SDV Transami was renamed to Bolloré Africa. Bolloré Africa Logistics is a specialist in multimodal logistics and major industrial projects. It is the largest private operator of port concessions in Africa, operating 13 container terminals and 11 dry ports in public-private sector partnerships.
- Bolloré works with the following relevant shipping lines for flowers to Europe: Maersk and MSC.
- In Kenya, they are known to have big contracts with UN organisations.
- Bolloré is CACP certified (Certified Accredited Customs Programme). For shipments they closely interface with KPA and Shipping Lines.
- Finlays works with Bolloré for their regular carnation shipments. Bolloré also has experience in shipping flower bulbs. They also indicate to have organised trial shipments for FloraHolland.
- Depending on the shipping line, the availability of reefer containers can be problematic. Some like MSC and Maersk will have lots of available equipment, smaller operators less. During a meeting, Bolloré mentioned that a trial shipment should be planned at least two months in advance because of the scarcity of reefer containers.

Other observations

- The Kenya Shippers' Council (KSC) is a private sector organisation that provides a platform for articulating shippers' concerns and demands to service providers and government institutions. It offers a cross-sector liaison forum for discussions with a wide variety of logistics and service providers. The improvement of logistics performance is an important policy objective.

Challenges

- The selection of forwarder is an important determinant of the success of eventual trial shipments. Important criteria for selecting a freight forwarder are:
  - available shipping routes
  - integrity
  - innovation
  - tracking system
  - 'shut out' time (latest possible time to supply a ship)
  - costs
- What additional techniques for atmosphere management to use? Forwarders appear very keen to offer extra services such as CA and MA. From interviews and reviewing results of previous pilots, the impact of these extra services is not always completely clear and will have to be determined by testing. Experts indicate that developing a chain where the temperature chain is held constant is all important and more significant than any technology. CA has been extensively tested and whilst it is possibly to run

atmospheres with elevated CO2, the level of CO2 which would control Botrytis, is also likely to be phytotoxic to roses (above 10%). So, possibly this should be extensively researched to see if this works as it is a relatively simple technology to employ if required and tested to be of use. More information about this topic can be found in Hamburg Süd's Reefer Guide.

5.1.3 Mombasa port

Observations

Kenya Port Authority (KPA) and the Mombasa port

- KPA maintains, operates and regulates all scheduled sea ports situated along Kenya's coastline. Activities include safe navigation, pilotage, berthing, mooring, pollution control, stevedoring, shore handling and storage services. Mombasa port holds 16 deep water berths and 5 container berths.
- The port also runs Inland Container Depots (ICDs) in Nairobi, Kisumu and Eldoret which are underutilised due to the failure of the rail system.
- The Port of Mombasa plays a strategic role in the regional economy as a gateway to the international markets and suppliers. This not only applies to Kenya's economy but also to the economies of the landlocked Northern Corridor countries of Uganda, Rwanda, Burundi, DRC and Southern Sudan. The current port infrastructure is complemented by the presence of CFS stations within the port run by private sector investors. (KSC 2009)
- A new port north of Mombasa is under construction, intended for the shipment of oil from Sudan and imports into Ethiopia.

Congestion and delays

- The Port of Mombasa is one of the biggest potential bottlenecks or threat to an efficient supply chain. All other parties in the chain are able and will plan to suit the best possible situation for the flowers. However, due to operational inefficiencies and difficulties in the coordination of export procedures, it is hardly possible to favourably influence the port in order to improve its operation. Their main export cargo leaves in dry containers with no threat of spoilage due to delays. The shipping lines are affected by the port inefficiencies, so they suffer the same consequences as exporters and large costs due to extended times on the berth.

Photo: Mombasa Port Container Terminal
Source: twa.co.za

- Kenya Shippers Council indicates that the lead time at the Mombasa port is currently about 7 to 8 days (for comparison: Djibouti takes only 1 day). Messina states that the congestion for outgoing shipments was about 10 days in the past. Nowadays, it is improving, currently taking up to 7 days.

Clearance procedures: CACP and Kentrade

- Standard clearance procedures at ports are organised but do not always run as smoothly as at the airports. The procedures surrounding phytosanitary inspections can be a lengthy process, delaying the release of the containers on arrival.
- There is a Certified Accredited Customs Programme (CACP). The leading forwarders (including GMS and Bolloré) are CACP certified. Nevertheless, Customs still inspects many shipments. Revenue targets at the end of the quarter makes Customs keen on checking. (Kenya Shippers Council)

- Nowadays, there is Kentrade, a single window application that has markedly sped up the process. Different export procedure systems are channelled through the electronic Kentrade system, such as SIMBA (Customs), CLIENT (KEPHIS). Currently, Kentrade is for about 60% complete and expected to be up and running by September 2013.

Challenges

- Port congestion: Although the situation is improving, persistent incidence of port congestion and the rising number of long stay containers at the port of Mombasa.
- Cumbersome and time consuming customs clearance procedures still exist at the port. Although computerised systems are in operation, delays are still prevalent due to lack of complete integration between the systems and frequent system failures. (KSC 2012, CPCS 2010)

5.1.4 Shipping lines

There are two major types of vessels in use for the perishable shipping industry: conventional reefer vessels and container reefer vessels. Within perishable seaborne trade, a clear trend is emerging since the 1990s that the market share of conventional reefer vessels is declining, while the container fleet has shown a continuous growth. (Chen 2012)

Shipping lines currently active in the Mombasa port with container reefer vessels are:

- Maersk (Safmarine)
- Linea Messina
- Mediterranean Shipping Company (MSC)
- CMA CGM / Delmas

Maersk and Messina have dedicated births in Mombasa.

Observations

Maersk (Safmarine)

- About 60% market share in containers leaving Mombasa.
- Indirect connection to Europe through Salalah in Oman. Weekly feeder service from Dar Es Salaam and Mombasa to Salalah.
- Possible destinations are, amongst others, Felixstowe, Antwerp, and Rotterdam.
- The shipping line Safmarine is widely known as a north/south trade and Africa specialist. Safmarine was bought by Maersk in 1999 who retained the brand name. Damco is the combined brand of the Maersk Group's logistics activities previously known as Maersk Logistics and Damco.

Photo: Maersk vessel with "on-ship gear" in Mombasa port
Source: Hortiwise

- Due to the congestion in the port and the associated delays, Maersk has started using a different type of vessel. That type of ship has its own cranes on board, so that they can lift the containers on board

themselves, making them less dependent on the port's authority. The term used for this is "on-ship gear". This probably makes Maersk a bit more expensive.

Linea Messina

- Linea Messina offers fastest (direct) connections to Europe (Genoa, Marseille and Barcelona).
- Messina has 4 vessels that rotate in 10-14 day intervals. That way they can offer 5 departures in two months.
- With transhipment in Salalah, Messina can also transport to Felixstowe (UK).
- They work in collaboration with Thermocar (www.thermocar.com). Thermocar offers a complete service with reefer containers (maintenance, service, cleaning, stuffing and monitoring of all containers).
- Sunripe uses Messina for avocado and mango, sailing twice per month with about 10-20 containers in high season.
- To cope with port congestion, Messina uses Roll-on/Roll-of service to load ships. It is the second world largest ro-ro container operator.

Photo: Linea Messina Jolly Diamante
Source: Marinetraffic.com

Mediterranean Shipping Company (MSC)

- World's second-largest shipping line in terms of container vessel capacity. MSC's most important port is Antwerp in Belgium.
- One of the forwarders mentioned that MSC suffers a lot delays compared to the other lines. And advices against using this line.

CMA CGM / Delmas

- CMA CGM S.A. is a French container transportation and shipping company. It is the third largest container company in the world.
- Seems to offer an optional route to Europe with transhipment in Khor Fakkan (Oman). Transit time as indicated was 22-23 days. However, in reality probably much longer and high risk of delays. It was advised against by several parties.

Challenges

- Reliability of the shipping lines is a major problem. Schedule integrity is an important risk to flower shipments.
- Need for a base cargo. Cut flowers are relatively new to most shipping companies and the limited volumes currently involved do not allow any demands to be put on the shippers with regards to shipping schedules, transport times and whether there is a direct route or a transhipment involved. One needs a large base cargo, like bananas from South America where the banana shippers dictate the schedule.

5.1.5 Ports in Europe

On the one hand, the preferred port of arrival depends on the intended final destination of the roses, i.e. the main market of the importer. For instance, the UK is the main market for both Finlays and Intergreen/Superflora. Both companies indicated that the preferred arrival port would be in the UK.

On the other hand, in selecting the port of arrival also the services and facilities at that port should be taken into consideration. In one of their recent trials, Intergreen used Linea Messina (with transhipment in Jeddah) and arrival in Barcelona. The shipment encountered major problems as it took the local Customs in Barcelona a week to process the container.

Photo: Port of Barcelona
Source: wikimedia

Observations

- EU Custom's requirements are often forgotten. A reefer container needs to be reported to the EU Customs authority 24 hours in advance of loading the container onto the vessel.
- In their 2012 trials, Intergreen/Superflora used both Maersk and Messina. Experiences with the Maersk shipment was ok, but with Messina the shipment encountered problems as the container arrived in Barcelona where the products were kept for a week by the local Customs.
- Lesson learnt from CoCos: Containers, especially with roses, have to be opened for inspection in Barcelona, which goes at the expense of the cold chain. The Netherlands does not have a customs agreement with Spain for sealed transportation with T1 form and delayed checks in the Netherlands.
- Cross docking means that a container is unloaded in the arrival port where the flowers are loaded onto a truck. For controlled atmosphere, this is not an option.

Challenges

- There is a need to select a port of arrival that allows for swift clearance procedures and fast handling of the containers. Not in every port, authorities are experienced or fully up to speed with requirements of clearing flowers. From experience with South American shipments, we know that this can improve over time (learning process).

5.2 Cold chain, reefers and packaging

5.2.1 Cold chain

A high value product such as Kenyan roses represents a potential value of € 0.10 – 0.35 per stem in the European market. However, such prices are received only if the product makes it to the markets with minimal loss of quality and value. An optimal cold chain from farm to export market is an essential part of the flower business.

The integration of the cold chain must be preserved from the point of origin, through each supply chain phase, including loading, unloading, handling, and storage, and extends to storage at the final customers. The supply chain integrity includes the additional requirement of proper packaging, temperature protection, and monitoring, which is fuelling the growth of demand for in-transit temperature monitoring. (Chen 2012)

The cold chain starts at the farm. If the quality (incl. temperature) of cut flowers that feed into the supply chain is compromised, the supply chain can at best only maintain this input quality. Adequate storage facilities and handling procedures are of the greatest importance to ensure that flowers start their journey at the right temperature (for roses this means departure temperatures close to 0ºC). Ideally, from the farm's facilities, the flowers are directly stuffed into a reefer container where it is maintained at the ideal temperature all along its travel to the European customer.

Observations

- In case collection from different farms at a central consolidation point is necessary, the roses have to be transported there by truck. While many farms have their own truck(s), others use the truck services of the forwarding companies. Trucks transporting flowers from farm to consolidation point are not always refrigerated. Consequently, many flowers undergo temperature increases on their way to the reefer container.
- Current facilities at most farms and forwarders are not capable of cooling and loading large volumes of flowers (a reefer can transport 8-10 tonnes of flowers) at temperatures close to 0°C.
- Christo van der Meer, FloraHolland (Vakblad No. 21, 2012): Temperature determines for 70% if a sea shipment of flowers is successful. A deviation of one degree during transport may result in a difference of two days in vase life. According to Van der Meer, it is quite possible to keep the temperature of the flowers on an average of one degree all the way from the nursery to the Netherlands. It does require total control of the supply chain from grower to end customer.

Experiences from CoCos project - General:

- General: cool rapidly and keep product cold.
  - A low sum of degree days results in improved durability of flowers.
  - Prioritising: 1. temperature, 2. dehydration, 3. condensation.
  - After harvest, cool rapidly (rule of thumb: 30-60 min) back to or close to the transport temperature. Use vacuum or forced air cooling.
- Sum of degree days ('temperatuurdagsom') = product temperature during transport x number of days on route
  - Both transport time and transport temperature affect quality.
  - The sum of degree days gives good insight of the impact of transport on the quality.

Experiences from CoCos project - Rosa specific:

- Precooling: cool the product before transport to the correct temperature (0.5-2°C)
- Transport
  - Use a set-point of 0.5°C (no frost damage occurs). The set-point is the temperature at which the controller of the reefer is set.
  - Temperatures up to 2°C are suitable for transportation. Temperature ranges of 1.5°C are normal in a container or truck.
  - For selected varieties, a transport time of at least 14 days is possible.
- Hydrate after dry transport: within hours recovery above starting weight.
- Vase life: keep sum of degree days as low as possible. The sum of degree days between harvest and sales is a direct measure for the remaining vase life (in case of roses without botrytis problems).

Challenges

o As quality is a critical variable for Kenyan flowers, it is obviously necessary to tackle all factors that influence quality. Temperature is a primary factor here. It is crucial to ensure that the whole supply system, from grower to retailer, is designed to optimally preserve input quality.

5.2.2 Reefer containers

Observations

- In Kenya, there is an imbalance in reefer demand and supply due to relatively little imports of perishable products. Reefer business is less attractive for shipping lines. As a result, the availability and costs of good reefer containers can be a problem in Kenya.
- 40 foot containers are standard in Kenya. Other sizes such as 20 foot containers are hardly in use (about 5%). It is anyway estimated that using a 20 foot container instead of a 40 foot adds about 10-15% extra costs to the shipment.
- Globally, 45 foot containers are more and more in use. These containers are not (yet) available in Kenya.
- Shipping lines use their own containers and have arrangements with certain parties. It is, therefore not possible to use any container at a shipping line.

Photo: Rough life of a reefer
Source: Hortiwise

- From experience, experts indicate that the actual temperatures of reefer containers are mostly not stable, but tend to fluctuate between 2 and 5 (or even 8) degrees Celsius. Instances of a broken genset are sometimes reported. Some freight forwarders offer double gensets on a reefer as backup.
- There are two standard loading patterns for perishable products in reefer containers: loose cartons or cartons on pallets. In case of flowers, most experts in the field advise not to palletise the boxes.
- Load capacity of a 40 foot container is 955 standard (airfreight) boxes.

Figure 6 Average Reefer Container Specifications

Size	20' x 8' x 8'6"	20' x 8' x 8'6"	40' x 8' x 9'6"
ISO Code	22R1	22R1	45R1*
Equipment Type	Integrated Reefer Container	Integrated Reefer Hanging Cargo	Integrated Reefer High Cube Container
Interior Dimensions (Length, Width, Height)	5,470 – 5,560 mm (L) 2,290 – 2,304 mm (W) 2,290 – 2,345 mm (H)	5,458 mm (L) 2,294 mm (W) 2,291 mm (H)	11,582 – 11,651 mm (L) 2,290 – 2,310 mm (W) 2,544 – 2,607 mm (H)
Door Opening (Width, Height)	2,290 – 2,300 mm (W) 2,271 – 2,344 mm (H)	2,296 mm (W) 2,290 mm (H)	2,288 – 2,310 mm (W) 2,490 – 2,576 mm (H)
Weights Gross	30,480 kg	30,480 kg	34,800 kg
Tare	2,500 kg – 3,160 kg	3,920 kg	4,260 kg – 4,900 kg
Payload	27,320 kg – 27,980 kg	26,530 kg	29,900 kg – 30,540 kg
Volume	29.20 – 30.00 cbm	28.70 cbm	67.50 – 70.00 cbm

Source: Hamburg Süd

The 360Quality Code about reefer equipment:
Prime condition of refrigerating equipment is paramount for successful results of transporting cargo under refrigeration. The refrigeration machinery including devices and instruments for control and monitoring must be capable of maintaining the conditions required during the transport of refrigerated cargo.

Air flow
Most reefer containers are equipped with bottom air delivery. This means that the air is supplied from the bottom of the container through the floor. The air is forced down the bulkhead and through the floor, under and up the load. The air returns to the evaporator over the top of the load and through the top of the bulkhead.

This air flow is distinct from the way boxes are cooled in cold stores, by vacuum coolers or forced air coolers. As a result, boxes ideally need to be adapted accordingly.

Figure 7 Standard 40 foot reefer with bottom air delivery

Source: Hamburg Süd

Challenges

o Design packaging suitable for airflow requirements in reefer containers.

5.2.3 Packaging

Packaging is another essential quality factor, both in terms of presentation, protection and the facilitation of an optimal temperature during transport. Packaging can be divided into sleeves and wraps in paper or plastic materials, and external packaging in boxes, up to the sealed pallet in case of airfreight.

Flower packaging has to satisfy a number of conditions, mainly in the field of handling and quality protection. The transport volume must be as efficient as possible, and a high level of uniformity is desirable.

Observations

- In Kenya, most flowers shipped in reefer containers are still packed in standard airfreight boxes, which are actually unsuitable for sea freight because they lack air circulation and strength.
- In Colombia, Ecuador and Chile, flowers transported by sea are packed in boxes that have been developed specifically for that purpose.
- There is a capacity of 955 standard boxes in a 40-foot container.
- How the cut flowers are packaged and stacked in the reefer containers impacts the quality of the flowers on delivery.
- Dry packing is the most common.
- In case of heavy loads and humidity within the boxes, the lower placed boxes on each pallet might collapse due to the large weight on top of each box.

Experience from CoCos (Floriculture International 2010-05):

- With reference to the type of packaging used for cut flowers, three designs were compared in the CoCos pilot project: the maritime shipping crate; the standard air freight box; a modified air freight box, where more openings were introduced for a higher level of ventilation. The quality of the flowers was also judged depending on whether they were shipped with or without bouquet sleeves in these boxes. The conclusion of the researchers was that, with correct stowage, sleeving and start quality, the packaging has no significant effect on the end product's quality. More important are the dimensions of the boxes to

ensure correct stacking on the pallets, which are then placed inside the container, this provides the optimum solution in both use of space, ventilation and prevention of bruising.

Experiences from CoCos project - Rosa specific:

- Best packaging: dry in sleeve and box.
- For long-keeping, dry conditions result in better quality (less Botrytis during vase life) than storage on water.
- Sleeves protect against dehydration.
- Packaging of the roses in liners showed no added value compared to using the standard sleeves.
- There is no significant difference in vase life and flower opening between horizontally and vertically transported roses (dry in sleeve and box).

Challenges

- Optimisation of box design: Boxes will have to be optimised to fulfil reefer requirements, but also still need to comply with on-farm cold store requirements. In order to optimise transportation, it is recommended to use boxes with, amongst others:
  - Dimensions matching the size of a sea freight container (efficiency and ease of loading a reefer).
  - Thicker carton: very best option would be to use 5 layer cardboard boxes with extra protection for the corners.
  - Better and more ventilation holes

5.3 Carbon footprint & energy output

5.3.1 Results 'Duurzame Sierteelt Ketens'

As part of the project Sustainable Chains and GreenRail III, the potential for energy savings in the major import and export flows (> 800 km) within the horticultural sector were researched in 2012.

The research investigated the potential for energy saving in the transition from 'traditional' transport to intermodal transport. Not only the *theoretical maximum* energy savings were determined, but also an estimate was made of the *achievable* energy savings given the economic and logistical constraints.

As part of the research study, which was conducted by Wageningen UR Food & Biobased Research, a model ('Broeikasgasemissiemodel') was developed to calculate the CO2 emissions in the transport chain for cut flowers imported into the EU. The calculations included all direct emissions caused by the use of fuels and electricity, plus the indirect emissions caused by the production of fuels and electricity.

These were the main results and conclusions with respect to the research on import routes:

Import route Kenya

Analysis of the flow of goods from Kenya shows that CO2 emissions per air cargo container (similar to a full truck) amount to 43,498 kg, while the same transport with refrigerated sea transport would result in 5,653 kg of CO2 emissions. Thus, per shipment, there is a saving of 87% achievable.

Import routes Ethiopia and Ecuador
Similar reductions were calculated for the other import routes, i.e. 90% in case of Ethiopia and 95% for shipments from Ecuador.

If a full transition from air to intermodal transport would take place, the study estimates an overall savings of 312 million kg of CO2 emissions. A target of 40% by 2020 would mean a saving of about 125 million kg.

Table 3 Savings potential total import flows

	Imports	Number of containers[1)]	CO2 emissions/ container			Total CO2 baseline scenario	Prognoses multimodal transport	Savings[2)]	
			air	deep sea	savings			(CO2 equivalent)	
	tonnes	pieces	kg	kg	kg	tonnes	container	ton	%
Kenya	55,556	4,938	43,498	5,653	37,845	214,805	4,938	186,891	87%
Ethiopia	24,444	2,173	36,868	3,851	33,018	80,109	2,173	71,742	90%
Ecuador	9,778	869	65,284	3,564	61,719	56,740	869	53,643	95%

[1)] 11.25MT Container (FloraUnit) [2)] In case of 100% shift to deep sea

Source: Report 'Duurzame Ketens (versie 1.4 3 september 2012)'

5.3.2 Other issues with impact on the carbon footprint

Results from the 'Broeikasgasemissie' model are generally in line with statements from the experts who were interviewed in the past months.

During the study, however, we also came across a number of issues with a potentially strong effect on the carbon footprint of roses shipped by sea.

As we do not have sufficient insight into all parameters used in the model, the question raises to what extent the model takes into account the observed issues. The issues with potentially strong impact on the carbon footprint of sea freight are:

1. Type of reefer container used (20, 40 and 45 foot containers)
The research model is based on the use of 45 foot reefer containers of the type FloraUnit with a loading capacity of 12.5 tonnes of flowers. In reality, 40 foot containers are prevailing in Kenya. These 40 foot containers have a loading capacity of about 10 tonnes in case of roses.

Shipping lines (and some forwarders) have their own reefer containers. They differentiate between each other by who has containers with the largest interior volume. This raises transport performance per container and improves the CO2 balance of container shipments.

Various types of gensets are in use with different levels of energy consumption. Are environment-friendly refrigerants used? Is energy-efficient scroll compressor technology employed?

Lack of uniformity and standards in packaging causes inefficient transport. A lower carbon footprint can be achieved through more efficient loading of the cargo space.

2. Waste and rejects

Ideally, optimal conditions exist and no roses are rejected after arrival in Europe. However, in the case of sea freight from Kenya, unavoidable risks remain, particularly due to the unpredictable nature and frequency of shipping delays.

Growers with experience in sea transport of carnations from Kenya indicated that waste rates (rejects) of about 5-8% are common for shipments without any major problems. In case of small logistical hiccups, waste rates can rise to 30-50%. Incidentally, an entire container is lost.

These potentially high waste rates, which will have to be compared to airfreight practices, will have a significant impact on the calculations of any carbon footprint model.

5.4 Costs

The total costs of getting a container to Europe is estimated at about US$ 10,000 to US$15,000. This would include forwarding charges (reefer container, genset, transport from Nairobi to Mombasa, handling, port charges, etc.) and shipping to the destination port in Europe. Of course, the actual costs depend on several factors, including the chosen forwarder, shipping line and route.

When flying 11 tonnes (average content of container) to Europe, the total airfreight costs would be about US$ 20,000 to US$ 25,000.

Calculating with known values, we find that the estimated cost savings of shipping flowers from Kenya by sea as compared to flying is in the 30-40% range.

Note that the total costs of getting the product to market also depend on the final destination of the products. Inland transport in Europe can raise the total logistics costs considerably. The costs of moving a container form Genoa to Aalsmeer costs about € 4,500.

All in all, because of higher shipping rates and increased risks of delays, the advantage of a flower shipment from Kenya to the Netherlands is considerably smaller than a shipment from Colombia to the Netherlands.

Some relevant cost items and variables that have to be kept in mind:

Shipping rates

There are considerable price differences between the shipping lines. Experts indicated that costs of shipping a container from Kenya to the Europe are roughly (according to one of the interviewed importers) US$ 9,000 for MSC, US$ 10,000 for Maersk and about US$ 12,000 for have a container shipped by Messina.

Consultancy and guidance

Sea transport is not a 'done deal'. It needs guidance and coordination to make it successful. You have to calculate the consultancy and guidance costs which you will need to make this work.

Value at risk

The total value represented by a container full of roses can vary anywhere between € 20,000 and € 80,000 (955 boxes x 250 to 400 stems per box x € 0.10 to € 0.20 per stem).

Waste

Again (see Section 5.3.2), with the long transit times and potential delays, the potentially waste rates and rejects can have a significant impact on the costs of sea freight.

Inland transport

Costs of inland transport in Kenya depend on the location of the consolidation point. As an indication, trucking a 40 foot container from Nairobi to Mombasa will set you back about US$ 600 to US$ 800.

Atmosphere control and other additional services

Additional services like modified and controlled atmosphere can add extra costs to the bill (about US$ 1,500 for controlled atmosphere).

Challenges

- Risk management: it is necessary to have a better feeling about actual delay rates and expected waste percentages to determine overall viability of a sea freight supply chain. How often can we expect delays and what is the impact on the long run? This kind of information can be acquired through assessing historical shipping data or by virtually following a number of shipping schedules to assess schedule integrity.

6 Conclusions & Recommendations

6.1 Conclusions

We have seen that, attracted by the potential of low cost logistics, various parties all over the world have enrolled in organising trial sea shipments. Over the past couple of years, much has been learned and while some trials failed others have developed into regular supply lines. The number of steady lines from Kenya and other African countries to the European market, however, is still modest.

So far, the results of sea freight projects with Kenyan roses have been mixed. When problems occurred, it was often because of a combination of existing quality issues with roses (botrytis, downy mildew), deficient cold chain management and the unavailability of packaging specifically designed for sea freight. Projects also encountered problems due to challenges related to poor shipping connections and frequently occurring delays in the supply chain.

An important lesson learnt is that sea transport is only possible if the cold chain and other technical conditions are optimised and fully under control, starting at the nursery all along the supply chain until the roses reach their final customer. In our view, all required knowledge about these topics is either available or can be acquired through additional research and testing.

Everything along the logistic chain is manageable and good results can be achieved, but it remains very dependent on the sailing schedule, the integrity of that schedule and how rigidly it is maintained.

As a result of piracy and low volumes, there is currently only one shipping line offering a direct connection to Europe without transhipping (taking container off the vessel to another vessel). This direct line with Linea Messina has a relatively short stop-over in Jeddah and arrives in ports in the Mediterranean area (Barcelona, Marseille, and Genoa) within about 20 days. Note that the Netherlands does not have a customs agreement with Spain for sealed transportation with T1 form and delayed checks in the Netherlands. As a consequence, containers, especially with roses, have to be opened for inspection in Barcelona, which goes at the expense of the cold chain.

For destinations in North-West Europe, all liners take alternative routes that involve a stop-over with transhipping. The transit time is typically 25+ days to Europe depending on the destination. See Table 2 ‘Best option sea freight routes’.

It is possible to combine different shipping lines to increase the frequency of shipments. The available forwarding companies in Kenya cover the following shipping lines:

- GMS: Linea Messina, Maersk and MSC
- Bolloré Africa: Maersk, MSC

Total transit times from farm to Europe vary depending on location of consolidation point, shipping route and type of markets in Europe. To give an indication: Naivasha-Mombasa is one day driving. However, from stuffing the container in Naivasha until departure in Mombasa will take about 2 to 3 days. As we have seen in Chapter 4, the sea transport itself can take anywhere between 20 and 30+ days. In the European port, the flowers have to be discharged and cleared before the receiving party can process and transport them to their

customers, adding probably another two days before the flowers are in the shop. This way, the fastest route without any hiccups will still take at least 25 days door-to-door.

Looking at the identified challenges, it is clear that organising a commercially successful sea transport supply chain is all about:

Optimisation	Monitoring & Controlling	Managing Risk
Varieties Quality Cold chain Packaging Protocols Market	Post-harvest Cold chain Procedures Planning	Transit times Schedule integrity Delays Waste rates Liaising

As mentioned before, the VGB board has set the goal to have 40% of the rose imports shipped by means of multimodal transport systems by 2020. If translating these goals into numbers, this would mean that in 7 years time (with stable exports) no less than 32 thousand tonnes of roses will be transported over sea. This is the equivalent of about 3,000 containers per year or roughly 55 containers (40 foot) per week. In case of expected continued expansion of Kenyan export volumes, these numbers of course will be higher.

6.2 Challenges

The following challenges were identified:

Available routes

- Only one shipping line offering a direct connection to Europe without transhipping, arriving in ports in the Mediterranean area (Barcelona, Marseille, and Genoa) within about 20 days. For destinations in North-West Europe, all routes involve a stop-over with transhipping. The transit time is typically 25+ days to Europe depending on the destination, with high risk of delays.

Recommendation:

- Direct connections are preferred, not only because of shorter transit times, but also because of high potential delays in case of transhipment. Selection of route, however, also depends on the targeted market, subsequent costs of transport in Europe, etc.

Schedule integrity

- Reliability of the shipping lines is a major problem and *schedule integrity* is an important risk to flower shipments. Many vessels do not arrive at their scheduled arrival times. Arrivals can be delayed by a few days or even longer.
- Need for a base cargo: Cut flowers are relatively new to most shipping companies and the limited volumes currently involved do not allow any demands to be put on the shippers with regards to shipping schedules, transport times and whether there is a direct route or a transhipment involved.

Recommendations:

- It is necessary to have a better feeling about actual *delay* rates and expected *waste percentages* to determine overall viability of a sea freight supply chain. *Risk management*: how often can we expect delays and what is the impact on the long run? This kind of information can be acquired through assessing historical shipping data and/or by recording current schedules to obtain insight into actual delays (schedule integrity) per shipping lines and routes.
- The *selection of forwarder* is an important determinant of the success of eventual trial shipments. There are really only two viable options: GMS and Bolloré Africa. The selection will depend on the preferred shipping routes, innovation, tracking system, 'shut out' time (latest possible time to supply a ship), and costs.
- Assess if insuring shipments is possible and desired?

Volumes

- A major challenge is the amount of roses and the value it represents that has to be shipped at once. A 40ft container contains about 955 boxes. That's a lot of stems to be handled at one moment in time, not only for a grower, but also for an importer marketing-wise. In case of consolidated loads, this brings new logistic challenges.

Recommendation:

- For the initial trial shipment (proof of concept), ideally all products come from one farm. Alternatively, a farm can be used as a consolidation point for flowers from a small number of different farms. Locations for consolidating near the production areas or in Nairobi are available for in a later stage.

Varieties

- Earlier pilots and research projects have given us some insight into the characteristics of a number of varieties with respect to sea transport conditions. However, the possibilities and requirements of many Kenyan varieties are not yet known.

Recommendations:

- In order to qualify for long term sea shipment, relevant Kenyan varieties need to be researched. Which varieties can successfully cope with 25+ days of sea transport and how?
- A pre-selection of varieties for the initial trial shipment is needed.

Mombasa port

- *Port congestion*: although the situation is improving, there are persistent incidences of delays due to port congestion and the rising number of long stay containers at the port of Mombasa.
- Cumbersome and time consuming *customs clearance procedures* still exist at the port. Although integrated computer systems are in operation, delays are still prevalent due to lack of complete integration between the systems and frequent system failures.

Recommendation:

- Liaise with relevant local authorities and (stakeholder) organisations involved in improvement of port efficiency.

Arrival port

- There is a need to select a port of arrival close to the final destination that allows for swift clearance procedures and fast handling of containers. From experience with South American shipments, we know that this is partly a learning process.

Recommendation:

- To be determined by project partners (market).

Cold chain management

- As quality is a critical variable, it is obviously necessary to tackle all factors that influence quality. Temperature is a primary factor here. It is crucial to ensure that the whole supply system, from grower to retailer, is designed to optimally preserve input quality.
- What additional techniques for atmosphere management to use? From interviews and reviewing results of previous pilots, the impact of these extra services is not always entirely clear and will have to be determined by testing.

Recommendations:

- Develop, implement and strictly monitor protocols for sea transportation.
- Start initial trial shipments without additional techniques.
- Assess (and research) impact of additional techniques.

Packaging and box design

- Boxes will have to be optimised to fulfill reefer requirements, but also still need to comply with on-farm cold store requirements.

Recommendation:

In order to optimise transportation, it is recommended to use boxes with, amongst others:

- Dimensions matching the size of a sea freight container (efficiency and ease of loading a reefer).
- Thicker carton: very best option would be to use 5 layer cardboard boxes with extra protection for the corners.
- More and better-positioned ventilation holes, allowing ventilation between boxes.

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www.wikipedia.org

Appendix 1 Interviewees

Growers

1 Finlays Horticulture Ltd.
- Mr. Maarten Piet (Company Commercial Manager)

2 Vegpro
- Mr. Peter de Jong (Commercial Manager Flowers)

Freight Forwarders

3 Gateway Marine Services (GMS)
- Mr. Bob Weyn (Managing Director)

4 Kuehne + Nagel Nairobi Ltd.
- Mr. David Evans (National Airfreight & General Manager)
- Mr. Steve Mclean (Contract Logistics Manager)

5 Kenfreight EA Ltd
- Mr. Paul Bletterman (Group Managing Director)

6 Bolloré Africa Logistics
- Mr. Auni Bhaiji (Managing Director Kenya)
- Ms. Ann Mukalani (Sea Freight Exports Sales Executive)
- Mr. Haim Konforti (Logistic Manager Kenya)

Ports

7 Kenia Ports Authority (KPA)
- Mr. Symon K. Wahome (Head of Inland Container Depots)
- Mr. Josphat K. Thiongo (Principal Operations Officer ICDN)
- Ms. Jane M. Kivaa (Marketing & Customer Care Officer ICD)

Shipping Lines

8 Maersk / Safmarine
- Ms. Joyce Maina (Sales)

9 Ignazio Messina & C. S.p.A.
- Mr. Cyprian Khamala (Branch Manager Nairobi)

Government, Organizations, others

10 Centre for the Development of Enterprise (CDE)
- Mr. Rooben Mooteeveeren (Operations Officer)
- Mr. Farai Douglas Majuru (Head of Regional Office for Eastern Africa)

11 Depot Limuru (HCDA/FPEAK/Sunripe)
- Ms. Sarah Ndegwa (FPEAK/HCDA Depot Manager)

12 Fresh Produce Exporters Association of Kenya (FPEAK)
- Dr. Stephen Mbithi (Chief Executive)

13 Horticultural Crops Development Authority (HCDA)
- Mrs. Florence Masia (Horticulturist)

14 Kenya Flower Council (KFC)
- Mrs. Jane Ngige (CEO)
- Mr. John Njenga (Auditor)

15 Kenya Shippers Council (KSC)
- Dr. Humphrey Kisembe (Economist)

16 Netherlands Embassy in Nairobi Kenya
- Mr. Melle Leenstra (Ambassadesecretaris Voedselzekerheid en Handel)

17 Trademark East Africa
- Mr. George G. Wolf (Infrastructure Director)

Appendix 2 List of Relevant Contacts

Note: personal e-mail addresses of contacts are not included in this publication will become publically available.

Government and Private Organisations

Fresh Produce Exporters Association of Kenya (FPEAK)
Contact: Dr. Stephen Mbithi (Chief Executive)
www.fpeak.org

Kenya Flower Council (KFC)
Contact: Ms. Jane Ngige (CEO)
www.kenyaflowercouncil.org

Kenya Ports Authority (KPA)
Contact: Mr. Symon K. Wahome (Head of Inland Container Depots)
www.kpa.co.ke

Kenya Shippers' Council (KSC)
Contact: Mr. Humphrey Kisembe
info@kenyashippers.org

Netherlands Embassy in Nairobi Kenya
Contact: Melle Leenstra (Ambassadesecretaris Voedselzekerheid en Handel)
http://kenia.nlembassy.org

TradeMark East Africa
Contact: Mr. George Wolf (Infrastructure Director)
www.trademarkea.com

Forwarders/handling agents

Bolloré Africa Logistics / SDV Transami
Contact: Mr. Auni Bhaiji (Managing Director Kenya)
www.bollore-africa-logistics.com

Gateway Marine Services (GMS)
Contact: Mr. Bob Weyn (Managing Director)
www.gmsreefer.com

Kenfreight
Contact: Mr. Paul Blettermann (Managing Director)
www.kenfreightgroup.com

Kuehne + Nagel Nairobi Ltd.
Contact: Mr. David Evans (National Airfreight & General Manager)
www.kuehne-nagel.com

Shipping Lines

Ignazio Messina & C. S.p.A.
Contact: Mr. Cyprian Khamala (Branch Manager Nairobi)
www.messinaline.it

Maersk Kenya Ltd
Contact: Ms. Joyce Maina (Sales Nairobi office)
www.maersksealand.com

Mediterranean Shipping Company S.A. (MSC)
MSC Agency Head Office in Kenya / Oceanfreight (EA) Ltd
www.mscgva.ch