Freight Forwarding as a Catalyst for Holistic Supply Chain Management

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A South African Retail Approach

Dissertation for the Young International Freight Forwarder of the Year Award Competition 2012

Acknowledgements

My current position within the freight forwarding industry has allowed me to combine my passion for the logistics industry with my academic background in retail management, especially from a *Supply Chain Management* perspective.

I am grateful that the FIATA topic for the competition year 2012 provided the opportunity to demonstrate how closely interlinked our freight forwarding industry is with the broader field of *Supply Chain Management*. I believe that if our industry fully understands the drivers behind a holistic management of supply chains, numerous opportunities emerge to develop and successfully deploy innovative freight forwarding products.

In order to exhibit the above in my dissertation, I would like to take this occasion to give my thanks to the following individuals.

Firstly, my thanks are directed to Rion Henning, my valued co-worker, who has constantly motivated me throughout the process of compiling this exposition.

Furthermore, I want to extent my thanks to my respected colleague Jean Pool, who has assisted with some of the aspects of customs procedures as outlined in Section 4 of my paper.

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Executive Summary

Retailers are faced with both market- and cost-related pressure in the chase for competitive advantage. As a result, customer value must be maximized and costs minimized at the same time. It is thus becoming ever more important for freight forwarding companies to understand their clients' market-related requirements. These determine the strategic direction of a supply chain and consequently should dictate the use of those freight forwarding products that support the supply chain strategy and, in turn, the goals to be attained in the marketplace.

My dissertation deals with the challenging fashion apparel environment which is characterized by rapid changes in demand patterns. Suppliers can only respond effectively to these changes, and deal with cost constraints, if they are supported by the supply chain and the transportation products deployed therein.

I have developed a multimodal product which I apply in such situations. The product meets the need for both rapid response to changes in the marketplace and cost containment. Besides the utilization of freight forwarding products, I advocate the understanding of trade agreements and customs legislation both of which in certain circumstances further reduce cost within the chain. My dissertation shows how South Africa's customs legislation, and the country's trade, development and cooperation agreement with Europe can bring about significant cost and liquidity improvements. Besides focusing on responsiveness and cost, I systematically introduce an additional dimension to the management of supply chains: that of environmental protection.

Finally, my exposition points out how growing opportunities for exports into African countries can be maximized in a South African retail context.

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List of Abbreviations

AMS	Amsterdam Airport Schiphol
AUH	Abu Dhabi International Airport
BAF	Bunker Adjustment Factor
BoE	Bill of Entry
BoL	Bill of Lading
CAF	Currency Adjustment Factor
CDD	Cargo Declaration Data Fee
CFS	Container Freight Station
CMB	Colombo
CO2	Carbon Dioxide
CPC	Customs Procedure Category Code
CPT	Carriage Paid To
CTO	Container Terminal Order
CV	Customs Value
DBN	Durban
DCT	Durban Container Terminal
DTD	Door-To-Door
DUS	Düsseldorf International Airport
EC	European Communities
E.g.	Exempli Gratia

ETS	Emission Trading Scheme
EU	European Union
EY	Etihad Airways
FAS	Free Alongside Ship
FCA	Free Carrier
FCL	Full Container Load
FOB	Free On Board
FRA	Frankfurt Am Main Airport
FSC	Fuel Surcharge
GGP	Greenhouse Gas Protocol
HAWB	House Air Waybill
HS	Harmonized System
I.a.	Inter Alia
ICC	International Chamber of Commerce
I.e.	It Est
ISO	International Organization for Standardization
ISPS	International Ship and Port Facility Security
ITAC	International Trade Administration Commission
JNB	Johannesburg
Kg	Kilogram
KL	Royal Dutch Airlines
Km	Kilometre

LCL	Less than Container Load
L/C	Letter of Credit
LH	Lufthansa
MAWB	Master Air Waybill
MBL	Master Bill of Lading
N.b.	Nota Bene
N.d.	No date
PTD	Port-To-Door
PTP	Port-To-Port
PVG	Pu Dong International Airport
R.O.E.	Rate of Exchange
RSA	The Republic of South Africa
RTM	Rotterdam
SARS	South African Revenue Service
SCM	Supply Chain Management
SHA	Shanghai
SOB	Shipped On Board
SSC	Security Surcharge
TDCA	Trade, Development and Cooperation Agreement
TEU	Twenty Foot Equivalent Unit
THC	Terminal Handling Charge
Tkm	Ton kilometre

UL	Sri Lankan Cargo
USD	United States Dollar
VAT	Value-Added Tax
Viz.	Videlicet
w/m	Weight / Measure
ZAR	South African Rand

1 Introduction and Structure of the Analysis

Businesses and retailers in particular are faced with a multitude of challenges in the quest for competitive advantage. Firstly, unpredictable consumers decrease the ability to forecast. Secondly, cost pressure forces retailers to source globally adding complexity to their supply chains (Christopher, 1998:23-28). Thus, I believe that the basis for competitive advantage is the consideration of the entire supply chain including all organizations involved in maximizing the value to the end consumer and in increasing the *Supply Chain Surplus*. This is the difference between the selling price and all costs associated with placing the final product onto the retail shelf (Chopra & Meindl, 2007:5). In this context, I think that the role of freight forwarding companies has changed. A thorough understanding of a client's supply chain drivers is critical in order to offer suitable forwarding products. Moreover, trade agreements impacting on retail supply chains must be understood and positioned correctly.

In addition to the above, I believe that limited growth prospects in the RSA create a *push* effect for local retailers to expand into new markets. In particular, certain African countries create a *pull* effect by offering growth opportunities for high-end merchandise. However, my experience shows that exportation is a new territory for RSA fashion retailers. Thus, I recommend the build-up of general export knowledge through initiatives with trading partners in established trading terrain before tackling the emerging opportunities in Africa.

In line with the above, the analysis focuses on a supply chain applicable to an RSA apparel retailer, who expands sales activities by exporting an established in-house brand for high-end women's wear to a department store network in Germany, where the RSA retailer intends to launch a *store-in-store* facility

(http://shopinshopconcept.com/). The fabric for the finished garments is sourced from a buying agent in Shanghai (SHA), China. It is then processed into the end product by a contracted manufacturer in Johannesburg (JNB), RSA. The final product is exported to the German department store network.

Based on this supply chain, my dissertation presents a multimodal model counterbalancing the strategic attributes of *Responsiveness* (Supply Chain Council, 2010:2.i.1) and *Cost Management* (Supply Chain Council, 2010: 2.4.1), which I believe to be crucial in keeping abreast of constant changes in demand patterns while focusing on profitability. Traditionally, these two attributes have been mutually exclusive for supply chains into the RSA. Reductions in responsiveness increase costs and vice versa.

This holistic model does not only aim to optimize and counterbalance two attributes, but moreover to integrate a third dimension into *Supply Chain Management* (SCM), videlicet (viz.) the *Supply Chain Environmental Impact*.

2 Legal Framework and Trade Agreements Pertinent to the Analysis

At first, I will introduce the legal framework that underpins my holistic model.

2.1 The South African Customs and Excise Act, 1964

Fabric is intended to be imported into the RSA for local processing and successive exportation. Rebate item 470.03 in *Schedule No. 4 / Part 3 - General Rebates of Customs Duties, Fuel Levy and Environmental Levy* – to the South African *Customs and Excise Act no. 91* (1964) makes provision for a full rebate of import duty and Value-Added Tax (VAT) applicable to goods cleared for use in manufacturing and processing solely for export. Appendix 1 provides further details on this rebate item.

2.2 The Protocol I to the Trade, Development and Cooperation Agreement

Annex II of *Protocol I* to the *Trade, Development and Cooperation Agreement* (TDCA) (1999) as incorporated in the present *South African Customs and Excise Act no. 91* (1964) rule 49(a) stipulates the processing to be carried out on non-originating material in order for the manufactured product to receive *originating* status. I identify this as necessary in order for the export goods to qualify for the preferential TDCA import tariff into the *European Communities* (EC) as explained in Subsection 2.4.

The finished export product is intended to be women's wear. Hence, *Harmonized System* (HS) headings 6204 – inter alia (i.a.) women's dresses and skirts – and 6206 – i.a. women's blouses and shirts – are envisaged for export purposes. *Protocol I* to the TDCA (1999) stipulates that the garment is either manufactured from yarn or from unembroidered fabric, under the condition that the value of the unembroidered fabric

is not higher than 40% of the ex-works price of the final garment as outlined in Appendix 2. I believe this is applicable to the analysis considering that the finished product is intended for the upper end of the market. Going forward, the dissertation refers to this stipulation as the *40% rule*.

Note 7 in *Section XI* of *Schedule No. 1 Part 1* to the *Customs and Excise Act no 91* (1964) excludes fabric from being classified under chapters 50 – 55 in case it has been cut to size prior to importation into the RSA. Hence, the imported fabric is required to be unprocessed.

2.3 The South African Value-Added Tax 404 – Guide for Vendors

An additional selling proposition of the RSA retailer to its buyer is the zero-rating of VAT on the tax invoice. Chapter 10 of the *VAT 404 – Guide for Vendors* stipulates the necessary requirements. The export from the RSA must be of *direct* nature, which means that the seller *consigns* or *delivers* the goods to an address in the country of destination provided by his buyer. The seller is in control of the export and can zero-rate the VAT provided all prerequisites in *Interpretation Note: No. 30 (Issue 2)* (2006) are met, which are listed in Appendix 3.

2.4 The Combined Nomenclature of the Customs Union of the European Communities

The Combined Nomenclature depicts the tariff of the Customs Union. A Common External Tariff is applicable to all goods imported into the *European Union* (EU), which is called *Taric* (http://europa.eu/legislation_summaries/customs/l11003_en.htm).

A preferential tariff is provided under the TDCA for products originating in the RSA. An example of a finished export product is a dress of subheading 6204.42, for which

the import duty is zero-rated (http://ec.europa.eu/taxation_customs/dds2/taric/measures.jsp?Lang=en&SimDate=20111123&Area=ZA&Taric=620442&LangDescr=en).

3 Multimodal Import Model for Fabric

The women's wear brand of the seller targets the high end of the market locally and will be integrated into a portfolio of fashionable international brands which will be made available in *store-in-store* facilities within the outlets of the buyer. The latter has adopted a *postponement* strategy with the rationale of bringing manufacturing and logistics decisions as close as possible to actual in-store demand. The objective is to reduce overall inventory and forecasting errors (Christopher, 2009:6).

In view of the above, I believe it is of paramount importance that the RSA retailer focuses on responsiveness and agility in order to react efficiently and effectively to changes in demand (Supply Chain Council, 2010:2.i.1). This will be achieved by importing the fabric into the RSA since the South African seller has the ability to manufacture what is required in the German market. The fabric is imported from a buying agent located in SHA, China. To facilitate responsiveness, the option of air freight could be considered. Clothing is among the top five air freight import commodities into Africa from the Asia Pacific region (Venter, 2011:14).

However, transportation by air increases costs. An alternative is the combination of ocean with air freight in order to reduce air freight costs while simultaneously meeting lead time requirements (Al-Hajri, 1997:1). This type of multimodality is predominantly available on primary trade lanes connecting the Far East with Europe or North and South America (http://www.evergreen-logistics.com/STATIC/en/jsp/air/transportation jsp). My research shows that currently there is no viable option in operation for the Far East to RSA trade. I developed a solution combining ocean freight from SHA to Colombo (CMB), Sri Lanka, with air freight from CMB to JNB.

3.1 Multimodal Success Factors

I have identified the following requirements, which I deem necessary for a successful incorporation into the given context.

3.1.1 Cargo Matter and Term of Sale

The final product is classified under headings 6204 and 6206. *Schedule No. 1 Part 1 – Ordinary Customs Duty –* to the *Customs and Excise Act no. 91* (1964) categorizes *Articles of Apparel and Clothing, not Knitted or Crocheted* under chapter 62. Thus, it is a prerequisite that the imported fabric is of woven nature, which I classify under heading 5112. An average import shipment of uncut fabric has the following specifications:

No. of Pieces (bales):	66
Gross Weight in kg:	1, 670.00
Gross Volume in m^3:	7.23
Volumetric Weight in kg:	1, 205.00
Chargeable Weight in kg:	1, 670.00

Source: own illustration

Since the bales are round in shape, I obtain the gross volume by multiplying the length by the diameter for each bale, which I then use to calculate the volumetric weight based on the prevailing air freight weight to volume ratio of one metric ton being equal to six cubic meters (Reyd & Wouters 2005:6):

([7.23 m^3 / 6 m^3] * 1, 000 kg) = 1, 205 kg

Source: own illustration

I stipulate the term of sale between the RSA seller and the Chinese buying agent as *Free Carrier* (FCA) No. 1424, Tai He Road, Container Freight Station (CFS), Shanghai, China (Incoterms® 2010).This term places the South African retailer in full

control of the transportation of the goods between SHA and JNB, enabling the multimodal model, which combines sea with air freight movements, to be implemented. The retailer, or his nominated forwarding agent, can thus nominate the sea and air carrier. Had *C* and *D* terms (International Chamber of Commerce (ICC), Incoterms® 2010:33-75) been selected, this would not have been possible. The *Free On Board* (FOB) or *Free Alongside Ship* (FAS) terms are not applicable as they are to be used for cargo being transported by ocean or inland waterways only (ICC, Incoterms® 2010:77-93).

The selected term transfers the risk of loss of or damage to the cargo to the RSA retailer or buyer as soon as the cargo has been delivered to the carrier nominated by the buyer at the above named place, not offloaded from the delivery vehicle, but ready for unloading (ICC, Incoterms® 2010:24). As a result, appropriate marine insurance cover on the imported fabric must be procured by the importer from this risk transfer point onwards. I have provided further details on the current Incoterms® 2010 rules and marine insurance in Appendix 4.

3.1.2 Management of Cross Border Movements

I have identified the motivation behind the choice of multimodality to be the combination of the economy of ocean freight with the speed of air freight. Hence, stoppages at transhipment points should be kept to a minimum, which dictates the transhipment port to be a hub port specializing in fast turnaround operations. I have selected CMB as the hub as it is currently gearing up to compete with Singapore and Dubai (Ondaatjie, 2011). In Section 3.1.5, I demonstrate that the air freight market rates from CMB to JNB make this hub a viable option for multimodality on this route.

The following prerequisites must be in place for CMB to qualify for this type of operation:

- Sri Lankan customs legislation must make provision for an in-bond customs Bill of Entry (BoE).
- A *Less than Container Load* (LCL) cargo service must be available at the co-loader's CFS within two days of vessel berthing.
- The CFS' cargo services must include: the shrink wrapping of cartons to withstand the additional handling in order to mitigate the risk of damage / pilferage; and the pasting of Master Air Waybill (MAWB) labels on the cargo before it is handed over to the air carrier.

  Nota Bene (N.b.): the House Air Waybill (HAWB) labels will have been provided by the forwarding agent in SHA and have been pasted by the co-loader's CFS in China with the aim of reducing handling operations in CMB.
- The airport terminal must be situated close to the port terminal (both terminals in CMB are 41 kilometres (km) apart).
- Air cargo capacity must be sufficient as described in part 3.1.3.

To facilitate the flow of cargo through the various border crossing points, the subsequent documentary requirements must be met:

- The co-loader must issue the Master Bill of Lading (MBL) or Ocean Bill of Lading specifying the SHA forwarding agent as the consignor and the CMB agent as the consignee. The MBL must be endorsed with the following wording: *Sea to Air Transhipment Cargo.*
- The SHA forwarding agent must issue a HAWB stating *Pu Dong International Airport* (PVG) as the airport of departure and specifying the flight number

departing from CMB. Furthermore, the vessel name and voyage number in respect of the ocean leg must be inserted into the HAWB document. As a result, this contract of carriage between the shipper and the forwarding agent covers both sea and air sections of the supply chain.

I have provided examples of both documents in Appendices 5 and 6.

3.1.3 Management of Carrier Frequencies

In my opinion, the benefits of multimodality can only be drawn on, if both ocean and air carriers have frequent services on the given routes.

In this regard, co-loader *Globelink* offers a weekly LCL service departing SHA for CMB every Monday.

Air carrier *Etihad Airways* (EY) operates passenger flights every Monday, Tuesday, Thursday and Saturday from CMB to *Abu Dhabi* (AUH) *International Airport* on an A320 aircraft and daily passenger flights from AUH to JNB on an A330 aircraft. *Sri Lankan Cargo* (UL) operates a daily freighter service from CMB to AUH, which is also utilized by EY.

3.1.4 Management of Responsiveness

The term of sale is FCA (Incoterms® 2010) and it is known that the import leg of the supply chain ends at the processing facility in JNB. Hence, the focus is on the Port-To-Door (PTD) lead time when comparing the ocean only option with the multimodal option.

The ocean freight only transit time from *Yangshan, SGH Shengdong Terminal, Shanghai,* to *Durban Container Terminal* (DCT) can be estimated at 22 days (http://mysaf2.safmarine.com/wps/portal/Safmarine/schedulesByCorridor). A further 11 days are taken into account for the local Port of Arrival-To-Door section in JNB for

LCL cargo since the import shipments are sized for LCL movements so that the overall PTD lead time is 33 days for ocean freight only.

The following timelines have been established for the multimodal movements. Berthing takes place in CMB on Sundays, which is 13 days after the Monday departure from SHA. The cargo is available for collection at the CFS on the following Tuesday for the UL flight to AUH on Wednesday. The cargo then connects to flight *EY604* on Thursday morning for arrival in JNB at 15h55. Subsequent delivery to the final place of delivery can take place on Friday. I have provided the routing in Appendix 7.

The overall PTD lead time is thus set to be 18 days, which is a reduction of 45.46 % on the ocean only transit time.

3.1.5 Management of Costs

I recognize that the purpose of selecting multimodality over air freight is to reduce transport charges. In the tables below, the cost per kilogram (kg) of chargeable weight for air freight from *Pu Dong International Airport* to *OR Tambo International Airport* is compared to an all-in per kg freight rate for the multimodal model.

The air freight costs are based on current market-related rates for the weight category applicable to the afore-mentioned shipment.

Chargeable Weight in kg:	1, 670.00	
1. Origin Costs:	*Per Unit Costs:*	*Total Costs:*
Air Waybill Fee	$35.00 per Air Waybill	$35.00
Subtotal:		*$35.00*
2. Air Freight Costs:		
Freight:	$4.13 per kg	$6, 897.10
Fuel Surcharge (FSC):	$1.65 per kg	$2, 755.50

Security Surcharge (SSC):	$0.19 per kg	$317.30
Currency Adjustment Factor (CAF; 2.5% of $ Disbursements):		$250.12
Subtotal:		*$10, 220.02*
Total Air Freight Costs:		*$10, 255.02*
Total Rate per kg:		***$6.14***

Source: own illustration

My research identifies the following cost components for the sea-air model:

1. Ocean freight costs from SHA to CMB.

   Based on the FCA term (Incoterms® 2010), the cargo is handed over by the shipper to the CFS in SHA. The ocean freight cost component thus includes the pasting of air freight HAWB labels onto each piece (= bale) at the CFS.

2. Transhipment costs in CMB.

3. Air freight expenses from CMB to JNB.

I have highlighted each cost component as follows based on the aforesaid shipment details:

1. Ocean Freight Costs:	*Per Unit Costs:*	*Total Costs:*
HAWB Label Pasting at CFS:	$1.00 per piece	$66.00
Bill of Lading (BoL) Fee:	$55.00 per BoL	$55.00
Freight Management Fee:	$25.00 per BoL	$25.00
Ocean Freight Inclusive of Bunker Adjustment Factor (BAF):	$45.00 per weight/measure (w/m)	$325.35
Subtotal:		*$471.35*
2. Transhipment Costs:		
CFS Unpack Fee:	$15.00 per w/m	$108.45
Transhipment Handling Costs:	$50.00 per w/m	$361.50
Subtotal:		*$469.95*
3. Air Freight Costs:		

Freight:	$1.79 per kg	$2, 989.30
FSC:	$0.91 per kg	$1, 519.70
SSC:	$0.10 per kg	$167.00
CAF (2.5% of $ Disbursements):		$140.43
Subtotal:		*$4, 816.43*
Total Multimodal Costs:		*$5, 757.73*
Total Rate Per kg:		***$3.45***

Source: own illustration

The all-in multimodal rate per kg is 43.81 % lower compared to air freight only. I have excluded the import clearing and delivery charges on purpose as these are the same for both modes and only the true cost difference is of interest.

3.1.6 Management of the Environmental Impact

Traditionally, supply chains have been assessed on their performance and what it costs to operate them. However, I have found evidence that in the medium to long term future, a third dimension will become an integral part of supply chain decision-making, viz. the environmental impact of transportation. Currently, the inclusion of the aviation industry in the *Emission Trading Scheme* (ETS) of the EU is being debated by industry executives, who fear unintentional trade conflicts, exempli gratia (e.g.) the threat of castigatory action by China against Airbus for suspending deals totalling United States Dollar (USD) twelve billion (http://www.ftwonline.co.za/Default.aspx?NewsNo=15651). From 01 January 2012, EU and non-EU air carriers receive allowances from the EU authorities granting permission to emit a fixed amount of carbon dioxide (CO2) on any flight to and from the EU. For any surplus emissions, additional allowances must be purchased or traded with other carriers (http://www.pwc.com/gx/en/transportation-logistics/emissions-trading-aviation-frequently-asked-questions.jhtml). This is a measure affecting sources of CO2 owned by companies, it est (i.e.) caused by aircrafts owned by carriers. In future, I expect

the introduction of measures tackling CO2 emissions from sources not owned by companies, but caused instead by their business activities. It is thus my recommendation that companies start now to investigate the impact of their supply chains on the environment, especially in view of the fact that up to 75 % of a company's carbon footprint stems from transportation and logistics (Eyefortransport, 2008).

For this reason, not only responsiveness and costs form part of my analysis, but also the carbon footprint, which is understood as the emissions of CO2 expressed in metric tons on a given trade lane for every 1, 000.00 kg of chargeable weight. For this purpose, I developed a measurement tool which quantifies the carbon footprint according to accounting standards as set out by the *Greenhouse Gas Protocol* (GGP). The tool defines the air and multimodal trade lanes based on the methodology explained in Appendix 8.

The inbound supply chain is defined as the distance travelled between the FCA point, referred to as the *Export Gateway*, and the final destination in JNB, i.e. the facility where the fabric will be processed. Each lane is given a name based on the air carrier, e.g. *03SHA-EY* for carrier EY.

1	Country of Origin	China - CN			
2	Export Gateway	Shanghai - SHA			
3	Lane Names	01SHA - EK	02SHA - QR	03SHA - EY	04SHA - SQ
4	Transport Mode from Export Gateway to Departure Airport	Road			
5	Vehicle Type from Export Gateway to Departure Airport	Heavy Goods Vehicle - Articulated - 5t			
6	Departure Airport & Code	Pu Dong Airport - PVG			
7	Intermediary Airport & Code	Dubai International Airport - DXB	Doha International Airport - DOH	Abu Dhabi International Airport - AUH	Singapore Changi Airport - SIN
8	Arrival Airport & Code	OR Tambo International Airport - JNB			
9	Transport Mode from Arrival Airport to Destination	Road			
10	Vehicle Type from Arrival Airport to Destination	Heavy Goods Vehicle - Articulated - 4t			
11					
12	Chargeable Cargo Weight (kg)	1,000.00	1,000.00	1,000.00	1,000.00
13					
14	Distance Export Gateway to Departure Airport (km)	4.56			
15	Distance Departure Airport to Intermediary Airport (km)	6,447.00	6,796.00	6,546.00	3,803.00
16	Distance Intermediary Airport to Arrival Airport (km)	6,407.00	6,235.00	6,294.00	8,650.00
17	Distance Arrival Airport to Destination (km)	6.78			
18					
19	Emission Factor Export Gateway to Departure Airport	0.00015262	0.00015262	0.00015262	0.00015262
20	Emission Factor Departure Airport to Intermediary Airport	0.00061324	0.00061324	0.00061324	0.00061324
21	Emission Factor Intermediary Airport to Arrival Airport	0.00061324	0.00061324	0.00061324	0.00061324
22	Emission Factor Arrival Airport to Destination	0.00015262	0.00015262	0.00015262	0.00015262
23					
24	Ton Kilometres Export Gateway to Destination Airport	4.56	4.56	4.56	4.56
25	Ton Kilometres Departure Airport to Intermediary Airport	7,027.23	7,407.64	7,135.14	4,145.27
26	Ton Kilometres Intermediary Airport to Arrival Airport	6,983.63	6,796.15	6,860.46	9,428.50
27	Ton Kilometres Arrival Airport to Destination	6.78	6.78	6.78	6.78
28					
29	Co2 Emissions (tons) Export Gateway to Departure Airport	0.0007	0.0007	0.0007	0.0007
30	Co2 Emissions (tons) Departure Airport to Intermediary Airport	4.3094	4.5427	4.3756	2.5420
31	Co2 Emissions (tons) Intermediary Airport to Arrival Airport	4.2826	4.1677	4.2071	5.7819
32	Co2 Emissions (tons) Arrival Airport to Destination	0.0010	0.0010	0.0010	0.0010
33					
34	Total Co2 Emissions (tons) for 1, 000 kg of Chargeable Weight	**8.5938**	**8.7121**	**8.5844**	**8.3257**

Source: own illustration

Since EY has been chosen as the carrier for the multimodal supply chain, this emission figure is considered when comparing emissions from the air only transport option with those generated by the multimodal option. EY emits a total of 8.5844 metric tons of CO2 for every metric ton of chargeable weight.

The multimodal model follows the identical methodology with the added complexity of additional transport nodes.

1	Country of Origin	China - CN		
2	Export Gateway	Shanghai - SHA		
3	Lane Names	01SHA - EK	02SHA - QR	03SHA - EY
4	Transport Mode from Export Gateway to Departure Port	Road		
5	Vehicle Type from Export Gateway to Departure Port	Heavy Goods Vehicle - Articulated - 5t		
6	Departure Port & Code	Shanghai - SHA		
7	Intermediary Port & Code	Colombo - CMB		
8	Transport Mode Intermediary Port to Unpack Depot	Road		
9	Vehicle Type Intermediary Port to Unpack Depot	Heavy Goods Vehicle - Articulated - 32t		
10	Transport Mode Unpack Depot to Departure Airport	Road		
11	Vehicle Type Unpack Depot to Departure Airport	Heavy Goods Vehicle - Articulated - 5t		
12	Departure Airport & Code	Bandaranaike International Airport - CMB		
13	Intermediary Airport & Code	Dubai International Airport - DXB	Doha International Airport - DOH	Abu Dhabi International Airport - AUH
14	Arrival Airport & Code	OR Tambo International Airport - JNB		
15	Transport Mode from Arrival Airport to Destination	Road		
16	Vehicle Type from Arrival Airport to Destination	Heavy Goods Vehicle - Articulated - 4t		
17				
18	Chargeable Cargo Weight (kg)	1,000.00	1,000.00	1,000.00
19				
20	Distance Export Gateway to Departure Port (km)	2.56		
21	Distance Departure Port to Intermediary Port (km)	6,863.51		
22	Distance Intermediary Port to Unpack Depot (km)	0.70		
23	Distance Unpack Depot to Departure Airport (km)	41.00		
24	Distance Departure Airport to Intermediary Airport (km)	3,288.00	3,613.00	3,298.00
25	Distance Intermediary Airport to Arrival Airport (km)	6,407.00	6,235.00	6,294.00
26	Distance Arrival Airport to Destination (km)	6.78		
27				

Source: own illustration

According to the calculation below, a total of 9.5991 metric tons of CO2 are emitted per 1, 000.00 kg of chargeable weight.

From my viewpoint, the route structure for sea-air suggests that CO2 emissions are lower since the air freight distance travelled is smaller, but the analysis below suggests the opposite. Row 32 of the table below indicates that the emission factor used for the distance between CMB and AUH is substantially higher than that used for the distance between AUH and JNB. This is because the latter distance is classified as *Long Haul* based on the assumption that the type of aircraft used is more economical than that used for *Short Haul* travel between CMB and AUH. I have provided insight into the differentiation as supported by the GGP in Appendix 8.

My analysis shows that this classification leads to distorted results. Accordingly, I suggest a more differentiated selection of emission factors by aircraft make and type for future development.

20	Distance Export Gateway to Departure Port (km)	2.56		
21	Distance Departure Port to Intermediary Port (km)	6,863.51		
22	Distance Intermediary Port to Unpack Depot (km)	0.70		
23	Distance Unpack Depot to Departure Airport (km)	41.00		
24	Distance Departure Airport to Intermediary Airport (km)	3,288.00	3,613.00	3,298.00
25	Distance Intermediary Airport to Arrival Airport (km)	6,407.00	6,235.00	6,294.00
26	Distance Arrival Airport to Destination (km)	6.78		
27				
28	Emission Factor Export Gateway to Departure Port	0.00015262		
29	Emission Factor Departure Port to Intermediary Port	0.00001250		
30	Emission Factor Intermediary Port to Unpack Depot	0.00015262		
31	Emission Factor Unpack Depot to Departure Airport	0.00015262		
32	Emission Factor Departure Airport to Intermediary Airport	0.00147389		
33	Emission Factor Intermediary Airport to Arrival Airport	0.00061324		
34	Emission Factor Arrival Airport to Destination	0.00015262		
35				
36	Ton Kilometres Export Gateway to Departure Port	2.56	2.56	2.56
37	Ton Kilometres Departure Port to Intermediary Port	6,863.51	6,863.51	6,863.51
38	Ton Kilometres Intermediary Port to Unpack Depot	0.70	0.70	0.70
39	Ton Kilometres Unpack Depot to Departure Airport	41.00	41.00	41.00
40	Ton Kilometres Departure Airport to Intermediary Airport	3,583.92	3,938.17	3,594.82
41	Ton Kilometres Intermediary Airport to Arrival Airport	6,983.63	6,796.15	6,860.46
42	Ton Kilometres Arrival Airport to Destination	6.78	6.78	6.78
43				
44	CO2 Emissions (tons) Export Gateway to Departure Port	0.0004	0.0004	0.0004
45	CO2 Emissions (tons) Departure Port to Intermediary Port	0.0858	0.0858	0.0858
46	CO2 Emissions (tons) Intermediary Port to Unpack Depot	0.0001	0.0001	0.0001
47	CO2 Emissions (tons) Unpack Depot to Departure Airport	0.0063	0.0063	0.0063
48	CO2 Emissions (tons) Departure Airport to Intermediary Airport	5.2823	5.8044	5.2984
49	CO2 Emissions (tons) Intermediary Airport to Arrival Airport	4.2826	4.1677	4.2071
50	CO2 Emissions (tons) Arival Airport to Destination	0.0010	0.0010	0.0010
51				
52	Total Co2 Emissions (tons) for 1, 000 kg of Chargeable Weight	**9.6585**	**10.0657**	**9.5991**

Source: own illustration

3.2 Supply Chain Assessment on Importation

The multimodal model combines the economy of ocean freight with the speed of air freight, which is reflected in my assessment of the three dimensions of SCM, namely:

1. *Supply Chain Performance*:

   The responsiveness of the inbound supply network is retained by a 45.46 % decrease in the PTD lead time of the ocean transport only option.

   Furthermore, multimodality avoids the routing via DCT used for the ocean

transport only LCL shipments which I consider to be a benefit in view of imminent port development projects (http://www.iol.co.za/dailynews/news/r400m-upgrade-for-durban-port-1.1265988).

2. *Supply Chain Cost*:

When both speed and cost containment are vital attributes, multimodality provides a valuable alternative to air freight only shipments. On the assumption that one shipment of fabric will take place per week an annual quantified value of USD233, 599.60 can be estimated.

Moreover, a full rebate of duty and VAT applies on importation of the fabric as it will be used in the manufacture of apparel that will be exported. Sections 67(1)(e), 67(2)(a) and 67(4) of the *Customs and Excise Act no. 91* (1964) stipulate that the FOB value of the import cargo will be the Customs Value (CV) on which any import duties and taxes will be calculated. Each shipment in the example provided above has a total FOB value of USD24, 711.71, which results in a CV of ZAR196, 483.34 with a Rate of Exchange (R.O.E.) of ZAR1 = USD0.125770 (05 April 2012). Ad valorem customs duty for heading 5112 is 22 %. The rebate facility applicable to these shipments has thus enabled a total duty saving of ZAR43, 226.34 per shipment and an estimated annual saving of ZAR2, 247, 769.44.

A further liquidity improvement, equivalent to an amount of ZAR36, 310.12 per shipment and an estimated annualised amount of ZAR1, 888, 126.34, has resulted from the shipments' exemption from import VAT.

3. *Supply Chain Environmental Impact*:

   Currently, undifferentiated emission factors resulting in a warped measurement do not allow me to accurately quantify the saving in CO2 emissions.

4 Local Processing and Exportation of the Finished Apparel Merchandise

4.1 Cargo Matter and Customs Formalities in the Republic of South Africa

Under rebate item 470.03, the fabric is used for local manufacturing and processing activities for subsequent exportation.

The rebate user is required to register with the *South African Revenue Service* (SARS) as an importer and exporter on an *Application Form: Registration / Licensing of Customs and Excise Clients* (form DA185) together with the following supporting documentation:

- Importer – Annexure DA185.4A1.
- Exporter – Annexure DA185.4A2.
- Rebate User – Annexure DA185.4A3.

The purpose of rebate item 470.03, which is covered in Appendix 1, is the stimulation of economic growth through the provision of incentives for export manufacturers. The RSA textile manufacturing industry has gained international recognition for specialized garment processing (http://www.satiec.co.za/). Hence, I consider these kinds of stimulation to be crucial in order to increase international competitiveness. The *International Trade Administration Commission* (ITAC) plays a vital role in the implementation of item 470.03 since every rebate user registered with SARS is furthermore obliged to apply to ITAC for a rebate permit (SARS, 2009:10). Appendix 9 provides an overview of ITAC stipulations to be met by the rebate user.

In the scenario I have used, a South African retailer is selling to a German buyer. The seller, however, subcontracts a local manufacturer which specializes in the processing of apparel to make the finished garment.

In order for ITAC to issue a rebate permit, the imported goods must be the property of the registered importer (SARS, 2009:10). Based on this prerequisite and the circumstances, I will outline two scenarios for the import customs clearance of the fabric, the local manufacturing of the apparel and its exportation.

Firstly, the retailer is the registered importer and owner of the fabric whilst the manufacturer is a registered exporter and rebate user providing the rebate facility where the import cargo is utilized as a production input. Secondly, the manufacturer is the registered importer and exporter, the owner of the fabric and the rebate user. I will analyze both scenarios in terms of their viability.

The first possibility poses the challenge that the registered importer and owner of the import cargo is not the rebate user, which is one of the ITAC requirements. On importation, the cargo must be cleared into a bond facility on e.g. the clearing agent's premises under the *Customs Procedure Category Code* (CPC) E-40-00, from where a second BoE transfers the ownership from the importer to the rebate user under CPC E-41-40. A third entry then transfers the fabric from the bond store into general rebate for processing under CPC J-80-41 (www.sars.gov.za/Tools/Documents/ Document Download.asp?FileID...). Thus, three customs entries are required before the imported fabric can be utilized for manufacturing. A further requirement of ITAC is the possession of a firm export order by the applicant at the time of importation (SARS, 2009:11). In this scenario, the manufacturer, who must be in possession of a firm order from the retailer since the fabric is imported for the sole purpose of processing apparel for subsequent exportation, is required to be the applicant.

Furthermore, the manufacturer is simultaneously the exporter. The tax invoice for export is issued to the retailer who placed the order with the manufacturer. The price covers only the processing costs per unit and not the fabric, which was bought by the retailer. In this context, the 40% rule pertaining to the origin status of the exported goods must be carefully examined.

The *ship-to* address on the tax invoice is the place of delivery in Germany. Since the German buyer procures from the RSA retailer, a separate invoice must be raised by the retailer for the full cost price of the order.

The second of my two options requires the manufacturer to be the registered importer and owner of the fabric in addition to being the exporter of the finished garments. The retailer places the order to buy and import the fabric of HS heading 5112 with the manufacturer in addition to the export order. A separate agreement between the retailer and the manufacturer stipulates that the unit price on the tax invoice includes the fabric and the processing work. Thus, this option makes it easier to apply the *40% rule* of origin as the fabric costs are included in the ex works price.

Option two is my recommended approach because compliance with the EU's *40% rule* will be easier to attain, and because only one BoE is required on importation.

Protocol I to the TDCA (1999) requires the final product under headings 6204 and 6206 to be embroidered to receive *originating* status. Embroidery is understood as work carried out on e.g. woven fabric with embroidering threads, which can be of textiles, but furthermore can include other material such as glass, metal or raffia as laid down in the *Explanatory Notes* to *Chapter 58* in *Section XI* of *Schedule No. 1 Part 1* to the *Customs and Excise Act no 91* (1964).

4.2 Export Clearance and Term of Sale

I analyzed requirements pertinent to the case study only and not the general export process.

When the finished product is ready for exportation, the exporter or his nominated forwarding agent in JNB is required to produce an *EUR.1 movement certificate* as regulated by *Article 14* of *Protocol I* to the TDCA (1999), in order to qualify for the preferential import tariff into the EC. The certificate is issued on application to the customs authority of the exporting country. No *EUR.1 certificate* is required, if the exporter meets one of the following two prerequisites of *Article 19*. A tax invoice declaration is sufficient in these cases as stipulated in *Annex III* to *Protocol I*:

- The exporter enjoys the status of an *approved exporter*, as interpreted in *Article 20* of *Protocol I*.
- The total export value of a consignment containing packages with *originating* status does not exceed EUR6, 000.00.

I am assuming that that the total value of the initial export shipment exceeds the value threshold. In addition, the manufacturer, who is the exporter, does not enjoy the status of *approved exporter*. For these reasons, an *EUR.1 movement certificate* must be issued.

In Paragraph 2.3, I introduced the possibility of zero-rating the VAT on the tax invoice. The export must be of *direct* nature, which requires the seller to *consign* the goods to the German buyer on the tax invoice. Provision is made for *direct* exportation under those sales terms (Incoterms® 2010) which specify that the seller is responsible for paying the main carriage freight. The export process takes place under customs supervision as laid down in the Legal Notes to Item 470.00 in *Schedule No. 4* to the *Customs and Excise Act no. 91* (1964).

The German buyer, however, imports merchandise from various global sources and arranges all other import shipments – by ocean and air – on the term of FCA named place (Incoterms® 2010). This term transfers the risk from the seller to the buyer as soon as the cargo has been delivered to the carrier nominated by the buyer at the named place (ICC, Incoterms® 2010:27). Consequently, the German department store takes out marine insurance cover from the FCA point for all its import shipments originating outside the EC. Considering the above, the RSA retailer and the buyer agree on the term of *Carriage Paid To* (CPT) Compass Spedition GmbH, Im Freihafen 4, 47138 Duisburg, Germany (Incoterms® 2010). This is the location of the buyer's distribution centre. Firstly, the risk still transfers at the FCA point (ICC, Incoterms® 2010:37) enabling the buyer to purchase marine insurance cover as is its custom. Secondly, this term complies with the requirements for zero-rating the VAT on the tax invoice. The seller agrees to pay for the freight to the named place in order to zero-rate the VAT on the tax invoice with the overall goal not to pass on costs to the downstream partner in the supply chain, which would decrease the *Supply Chain Surplus*.

4.3 Export Model for Finished Apparel Merchandise

The holistic model seeks to deploy freight forwarding products in support of specific market requirements. All organizations within the supply chain work towards multiple annual launches of fashionable apparel with the ability to react to fluctuations in demand within each sales cycle with a simultaneous focus on cost containment.

I will introduce a product mix that aims at finding a deployment approach to match the above needs.

4.3.1 Management of Costs and Security

In store launch dates for each merchandise cycle are known in advance and hence the shipment cycle can be planned with a given lead time for the routing, which I clarify below.

The high-value apparel items necessitate a well-considered security solution. For this reason, I recommend the option of *Full Container Load* (FCL) shipments under a *carrier-haulage* movement from the manufacturer's premises in JNB, i.e. the FCA point, via the port of Durban (DBN), through the import gateway of Rotterdam (RTM) to the named place under the CPT term of sale (Incoterms® 2010), which is the distribution centre in Germany. The buyer imports all of its international ocean freight inbound shipments via RTM because of the proximity to the final place of delivery. I present a definition of the term *carrier-haulage* in Appendix 10. This type of multimodal move offers a security benefit for the buyer, who accepts the risk at the FCA point. The shipping line accepts liability for the cargo at this point, which terminates at the place of delivery (http://shippingandfreightresource.com/2011/03/01/what-is-the-difference-between-carrier-haulage-merchant-haulage-what-are-the implications/).

Both seller and buyer agree not to ship consignments in LCL movements because of the exposure to risk of pilferage or damage caused by multiple handling operations. FCL shipments provide the transportation in a sealed *International Organization for Standardization* (ISO) container from the FCA point until to the named place, which I will refer to as a Door-To-Door (DTD) section.

The focus on cost management necessitates the consideration of a break-even volume point in order to make FCL movements cost-efficient. To facilitate the calculation, I compared the total FCL and LCL costs incurred for a DTD shipment.

The USD cost factors are converted into ZAR at a R.O.E. of 1USD = ZAR8 and the EUR factors at 1EUR = ZAR10. This is required given that these charges are payable by the seller in the RSA under the agreed term of sale (Incoterms® 2010).

1. South African Landside Charges:	*Original Currency Amount:*	*ZAR Equivalent:*
Courier Documentation:	R420.00 per Shipment	R420.00
Cargo Dues:	R1, 081.60 per Twenty Foot Equivalent Unit (TEU)	R1, 081.60
NAVIS Release / Container Terminal Order (CTO):	R175.00 per TEU	R175.00
EUR.1 Movement Certificate Fee:	R150.00 per Shipment	R150.00
Terminal Handling Charge (THC):	R1, 159.00 per TEU	R1,159.00
Agency Fee (3.85% of Disbursements or a Minimum of R1, 195.00):		R1, 387.47
EDI Fee:	R50.00 per Shipment	R50.00
Documents And Processing:	R420.00 per Shipment	R420.00
Subtotal:		*R4, 843.07*
2. Ocean Freight Costs:		
Freight, i.e. inclusive of pre- and on-carriage charges:	$3, 418.81 per TEU	R27, 350.48
BAF:	$660.00 per TEU	R5, 280.00
International Ship and Port Facility Security (ISPS):	$9.00 per TEU	R72.00
Cargo Declaration Data Fee (CDD; for Exports to the EU):	$35.00 per Shipment	R280.00
BoL Fee:	R220.00 per Shipment	R220.00

Subtotal:		*R33, 202.48*
3. European Landside Charges:		
Customs Clearance (Duty Free with EUR.1 Certificate)	€50.00 per Shipment	R500.00
Compliance Fee Risk Management	€8.35 per Shipment	R83.50
THC	€215.00 per TEU	R2, 150.00
Handling Charge / Release Agents Fee	€40.00 per Shipment	R400.00
ISPS	€16.00 per TEU	R160.00
Destination Delivery Note	€45.00 per Shipment	R450.00
Inbond Documentation Fee	€85.00 per Shipment	R850.00
Forex Fee (2% of Disbursements)	€9.19	R91.90
Subtotal:		*R4, 685.40*
Total DTD Costs per TEU:		***R42, 730.95***

Source: own illustration

The total LCL costs for the DTD section contain the below items.

1. South African Landside Charges:	*Original Currency Amount:*	*ZAR Equivalent:*
Courier Documentation:	R420.00 per Shipment	R420.00
Cargo Dues:	R76 per w/m	R76.00
Groupage FOB:	R 360.00 per w/m	R360.00
EUR.1 Movement Certificate Fee:	R150.00 per Shipment	R150.00
Agency Fee (3.85% of Disbursements or a Minimum of R1, 195.00):		R1, 195.00
EDI Fee:	R50.00 per Shipment	R50.00
Documents And Processing:	R420.00 per Shipment	R420.00
Subtotal:		*R2, 671.00*

2. Ocean Freight Costs:		
Freight, i.e. inclusive of pre- and on-carriage charges:	$112.09 per w/m	R896.72
BAF:	$28.00 per w/m	R224.00
ISPS:	$6.50 per Shipment	R52.00
CDD (for Exports to the EU):	$8.00 per Shipment	R64.00
BoL Fee:	R180.00 per BoL	R180.00
Subtotal:		*R1, 416.72*
3. European Landside Charges:		
Customs Clearance (Duty Free with EUR.1 Certificate)	€50.00 per Shipment	R500.00
Compliance Fee Risk Management	€8.35 per Shipment	R83.50
Quay Charges	€45.00 per w/m	R450.00
Handling Charge / Release Agents Fee	€40.00 per Shipment	R400.00
ISPS	€2.50 per Shipment	R25.00
Destination Delivery Note	€25.00 per Shipment	R250.00
LCL Charges	€30.00 per w/m	R300.00
Forex Fee (2% of Disbursements)	€4.02	R40.20
Subtotal:		*R2, 048.70*
Total DTD Costs per w/m:		***R6, 136.42***

Source: own illustration

I have calculated the break-even point by equating the total charges applicable to the DTD movement of one TEU with the total amount payable for the DTD movement of one w/m.

ZAR37, 428.08 = x * ZAR2, 306.72

x = 16.23 m^3

My analysis reveals a break-even volume of 16.23 m^3. Thus, each TEU shipped for the launch of a new style should be equal to or exceed this volume point in order to maximize cost-efficiency.

The above solution is designed on a *carrier-haulage* movement via road to DBN port on grounds of increased responsiveness compared to the movement via rail. In Paragraph 3.2, I have made reference to imminent port construction projects in DBN likely to cause disruptions in port operations in the medium-term future. As a result, I propose the consideration of an alternative option of routing the cargo in *carrier-rail* via the port of Cape Town with the following evaluation.

	Transit Times via Durban:	*Transit Times via Cape Town:*
FCA point to Port:	1 day (via Road)	7 days (via Rail)
Loading in the Port:	3 days	1 day
Port-To-Port (PTP):	25 days	19 days
Total:	***29 days***	***27 days***
Difference:	***2 days***	
Carrier-Haulage Cost per TEU	R12, 500.00 (via Road)	R9, 375.00 (via Rail)
Difference:	***R3, 125.00***	

Source: own illustration

The planned lead time for store launches can be reduced by 2 days with a cost reduction of R3, 125.00 per TEU, which reduces the total DTD costs for one TEU to R34, 303.08. This in turn decreases the break-even volume point to 14.87 m³ increasing the cost-efficiency of shipments.

4.3.2 Management of Responsiveness

Air freight consignments are required in order to respond quickly to changes within the sales cycles, when demand for a certain style can fluctuate.

Responsiveness expressed in lead time outweighs cost considerations in this context as the directive is to reconcile actual in-store demand with the required merchandise so that items can be sold at full price, which increases revenue and hence absorbs the higher air freight costs.

I identify eleven carrier options for airings into the German *Düsseldorf* (DUS) *International Airport*. The above directive dictates that I deem those carriers preferred, which offer superior connectivity to DUS, e.g. *Lufthansa* (LH) via the German *Frankfurt* (FRA) *Am Main Airport*. In view of my prediction that the environmental impact will play a key role in the future supply chain decision-making process, I discovered the option of *Royal Dutch Airlines* (KL) airing to *Amsterdam* (AMS) *Airport Schiphol* with a connecting road-haulage service to DUS under one contract of carriage. This option eliminates the transfer to a domestic aircraft. The following Section 4.3.3 will provide insight into the CO2 footprints of both options.

4.3.3 Management of the Environmental Impact

The below table reveals a decrease of 2.53 % in CO2 emissions, if the cargo is routed to AMS in *carrier-haulage* via road to DUS. However, I am cautious with regards to the interpretation of this result caused by my findings in Section 3.1.6. The distance on LH between FRA and DUS is classified as *Domestic* with a substantially higher emission factor compared to the distance between JNB and FRA.

2	Point of Collection	Manufacturer's Premises - JNB	Manufacturer's Premises - JNB
3	Lane Names	01JNB - LH	02JNB - KL
4	Transport Mode from Point of Collection to Departure Airport	Road	Road
5	Type of Vehicle from Point of Collection to Departure Airport	Heavy Goods Vehicle > 3.5 - 33t	Heavy Goods Vehicle > 3.5 - 33t
6	Departure Airport & Code	OR Tambo International Airport - JNB	OR Tambo International Airport - JNB
7	Intermediary Airport & Code	Frankfurt Am Main Airport - FRA	N/A
8	Arrival Airport & Code	Dusseldorf International Airport - DUS	Amsterdam Airport Schiphol - AMS
9	Transport Mode from Arrival Arport to Destination	Road	Road
10	Type of Vehicle from Arrival Airport to Destination	Heavy Goods Vehicle > 3.5 - 33t	Heavy Goods Vehicle > 3.5 - 33t
12	Chargeable Cargo Weight (kg)	1,000.00	1,000.00
14	Distance Point of Collection to Departure Airport (km)	6.78	6.78
15	Distance Departure Airport to Intermediary Airport (km)	8,684.00	9,011.00
16	Distance Intermediary Airport to Arrival Airport (km)	188.00	
17	Distance Arrival Airport to Destination (km)	27.80	204.00
19	Emission Factor Point of Collection to Departure Airport	0.00015262	0.00015262
20	Emission Factor Departure Airport to Intermediary Airport	0.00061324	0.00061324
21	Emission Factor Intermediary Airport to Arrival Airport	0.00196073	
22	Emission Factor Arrival Airport to Destination	0.00015262	0.00015262
24	Ton Kilometres Point of Collection to Departure Airport	6.78	6.78
25	Ton Kilometres Departure Airport to Intermediary Airport	9,465.56	9,821.99
26	Ton Kilometres Intermediary Airport to Arrival Airport	204.92	
27	Ton Kilometres Arrival Airport to Destination	27.80	204.00
29	Co2 Emissions (tons) Point of Collection to Departure Airport	0.001	0.001
30	Co2 Emissions (tons) Departure Airport to Intermediary Airport	5.805	6.023
31	Co2 Emissions (tons) Intermediary Airport to Arrival Airport	0.402	
32	CO2 Emissions (tons) Arrival Airport to Destination	0.004	0.031
33			
34		**6.212**	**6.055**

Source: own illustration

The below examination of the environmental impact for ocean freight discloses that the rail solution via Cape Town emits 24.16 % less CO2 than the road solution via DBN.

1	Country of Origin	South Africa - ZA	
2	Point of Collection	Manufacturer's Premises - JNB	Manufacturer's Premises - JNB
3	Lane Names	01DBN - SAF	02CPT - SAF
4	Transport Mode from Point of Collection to Departure Port	Road	Rail
5	Veicle Type from Point of Collection to Departure Port	Heavy Goods Vehicle > 3.5 - 33t	Freight Train
6	Departure Port & Code	Durban - DBN	Cape Town - CPT
7	Arrival Port & Code	Rotterdam - RTM	Rotterdam - RTM
8	Transport Mode from Arrival Port to Destination	Road	Road
9	Vehicle Type from Arrival Port to Destination	Heavy Goods Vehicle > 3.5 - 33t	Heavy Goods Vehicle > 3.5 - 33t
10			
11	Chargeable Cargo Weight (kg)	1,000.00	1,000.00
12			
13	Distance Point of Collection to Departure Port (km)	566.00	1,393.00
14	Distance Departure Port to Arrival Port (km)	12,860.29	11,413.88
15	Distance Arrival Port to Destination (km)	142.60	142.60
16			
17	Emission Factor Point of Collection to Departure Port	0.00015262	0.00002850
18	Emission Factor Departure Port to Arrival Port	0.00001250	0.00001250
19	Emission Factor Arrival Port to Destination	0.00015262	0.00015262
20			
21	Ton Kilometres Point of Collection to Departure Port	566.00	1,393.00
22	Ton Kilometres Departure Port to Arrival Port	12,860.29	11,413.88
23	Ton Kilometres Arrival Port to Destination	142.60	142.60
24			
25	CO2 Emissions Point of Collection to Departure Port	0.0863829200	0.0397005000
26	CO2 Emissions Departure Port to Arrival Port	0.1607536000	0.1426735000
27	CO2 Emissions Arrival Port to Destination	0.0217642225	0.0217642225
28			
29		**0.269**	**0.204**

Source: own illustration

4.4 Supply Chain Assessment on Exportation

The local manufacturing and subsequent exportation lead to the following benefits.

1. *Supply Chain Performance:*

   The uncut fabric allows for mid-cycle style changes. This reduces forecasting errors and the air freight mode ensures that this merchandise meets actual demand allowing a sale at full price.

   The *carrier-rail* option reduces the planned lead time for store openings.

2. *Supply Chain Cost:*

   The reduced freight charges of the *carrier-rail* option, the maximization of cost efficiency, the omission of VAT on the tax invoice and the absence of import duties into the EU increase the *Supply Chain Surplus*.

   Air freight costs are offset by revenue growth.

3. *Supply Chain Environmental Impact:*

   The *carrier-rail* option offers a reduction in CO2 emissions. However, the result for the air freight option must be viewed cautiously as I have outlined in Section 4.3.3.

5 Conclusion

In Section 1, I refer to market challenges necessitating the collaboration of all organizations within the supply network with a view to maximizing customer value and increasing profitability. The fashion garments in my dissertation appeal to a dynamic group of end consumers, which means that a quick response to changes in demand patterns within sales cycles drives the supply chain, which simultaneously must focus on cost control. The freight forwarding company serving the supply chain partners understands these needs and positions a multimodal product, which counterbalances responsiveness and cost. At the same time, the correct application of trade agreements and customs legislation leads to further cost reductions within the entire chain. I have thus shown that the forwarding industry is pivotal in creating for its clients competitive advantage that accrues from both value and productivity enhancements.

In addition, my model provides a learning curve for exportation which will enable local retailers to capitalize on imminent growth opportunities in Africa.

Furthermore, I advocate the commencement of an understanding of the impact of supply chains on the environment. In my opinion, early adopters of this approach will reap the benefit of being able to incorporate this third dimension of SCM into the decision-making process when environmental legislation has an impact on the bottom line.

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7 Appendices

7.1 Appendix 1 to Section 2.1

Rebate item 470.03 in *Schedule No. 4 / Part 3 - General Rebates of Customs Duties, Fuel Levy and Environmental Levy* – to the South African *Customs and Excise Act no. 91* (1964):

Data as on : 2011-11-16 SCHEDULE 4 / PART 3 CUSTOMS & EXCISE TARIFF

Rebate Item	Tariff Heading	Rebate Code	C D	Description	Extent of Rebate	Ref. No.
470.01						
	00 00	01.00	03	Goods for processing, provided such goods do not become the property of the importer	Full duty	1,285
470.02						
	00 00	01 00	01	Goods (including parts therefor) for repair, cleaning or reconditioning	Full duty	1,285
	00 00	02 00	05	Parts for goods temporarily imported for repair, cleaning or reconditioning	Full duty	1,285
470.03						
	00 00	01 00	03	Goods (excluding goods free of duty as contemplated in section 75A) cleared in terms of a permit issued by the International Trade Administration Commission, for use in the manufacture, processing, finishing, equipping or packing of goods exclusively for export	Full duty	1,312
	00 00	02 00	08	Goods free of duty, for use in the manufacture, processing, finishing, equipping or packing of goods exclusively for export	Full duty	1,312

The rebate item was first introduced in 1984 by the Board on Tariffs and Trade with the purpose of encouraging economic growth by exonerating export manufacturers from the financial strain enforced on their liquidity (SARS, 2009:3).

7.2 Appendix 2 to Section 2.2

Annex II of *Protocol I* to the *Trade, Development and Cooperation Agreement* (TDCA) (1999) as incorporated in the present *South African Customs and Excise Act no. 91* (1964) detailing required work to be carried out on non-originating material in order for the manufactured product to receive *originating* status:

ex Chapter 62	Articles of apparel and clothing accessories, not knitted or crocheted; except for:	Manufacture from yarn (1) (2)	
ex 6202, ex 6204, ex 6206, ex 6209 and ex 6211	Women's, girls' and babies' clothing and clothing accessories for babies, embroidered	Manufacture from yarn (1) or Manufacture from unembroidered fabric provided the value of the unembroidered fabric used does not exceed 40 % of the ex-works price of the product (3)	
ex 6210 and ex 6216	Fire-resistant equipment of fabric covered with foil of aluminised polyester	Manufacture from yarn (1) or Manufacture from uncoated fabric provided the value of the uncoated fabric used does not exceed 40% of the ex-works price of the product (3)	

7.3 Appendix 3 to Section 2.3

My exposition focuses on the seller *consigning* the goods to the department store network in Germany. In this case, relevant transport documents and proof of payment of the transport charges by the seller are required. Other required documents include the following as stipulated in the *VAT 404 – Guide for Vendors*:

- A copy of the seller's zero-rated tax invoice.
- A copy of the buyer's order or an equivalent contract between the parties.
- The export documentation as prescribed in the Customs & Excise Act, i.a. the SAD500.
- The proof of payment.

Furthermore, the exportation must take place from one of 42 listed commercial ports. DBN and Cape Town are included in this list.

7.4 Appendix 4 to Section 3.1.1

The current Incoterms® 2010, which I used in my dissertation.

Incoterms® 2010. Source: http://logisticscommercialcareer.files.wordpress.com/2011/07/incoterms-2010.jpg

For the reason, which I explained in the main body under Section 3.1.1, it is up to the buyer to take out marine insurance cover on the imported fabric under the FCA sales term (Incoterms® 2010) as soon as the cargo has been delivered to the carrier nominated by the buyer at the named place. I recommend Institute Marine Cargo Clauses A for the import consignments, which is the most comprehensive cover available and thus appropriate for the movement of new goods. This clause covers all risks of loss of or damage to the subject-matter insured with the exception of the below-mentioned exclusion clauses (http://www.charlestayloradj.com/pdfs/Cargo Clauses09.pdf).

This insurance covers general average and salvage charges, adjusted or determined according to the contract of affreightment and / or the governing law and practice.

Exclusions:

General Exclusion Clause

In no case shall this insurance cover:

- *Loss, damage or expense attributable to willful misconduct of the assured.*
- *Ordinary leakage, ordinary loss in weight or volume, or ordinary wear and tear of the subject-matter insured.*
- *Loss, damage or expense caused by insufficiency or unsuitability of packing or preparation of the subject-matter insured.*
- *Loss, damage or expense caused by inherent vice or nature of the subject-matter insured.*
- *Loss, damage or expense proximately caused by delay, even though the delay be caused by a risk insured against.*
- *Loss, damage or expense arising from insolvency or financial default of the owners managers charterers or operators of the vessel.*
- *Loss, damage or expense arising from the use of any weapon of war employing atomic or nuclear fission and / or fusion or other like reaction or radioactive force or matter.*

Unseaworthiness and Unfitness Exclusion Clause.

- *In no case shall this insurance cover loss damage or expense arising from unseaworthiness of vessel or craft, unfitness of vessel or craft for the safe carriage of the subject-matter insured, where the Assured are privy to such unseaworthiness or unfitness, at the time the subject-matter insured is loaded therein.*

- *The insurers waive any breach of the implied warranties of seaworthiness of the ship and fitness of the ship to carry the subject-matter insured to destination.*

War Exclusion Clause.

In no case shall this insurance cover loss damage or expense caused by:

- *War, civil war, revolution, rebellion, insurrection or civil strife arising there from, or any hostile act by or against a belligerent power.*
- *Capture, seizure, arrest, restraint or detainment (piracy excepted), and the consequences thereof or any attempt thereat.*
- *Derelict mines, torpedoes, bombs or other derelict weapons of war.*

Strikes Exclusion Clause

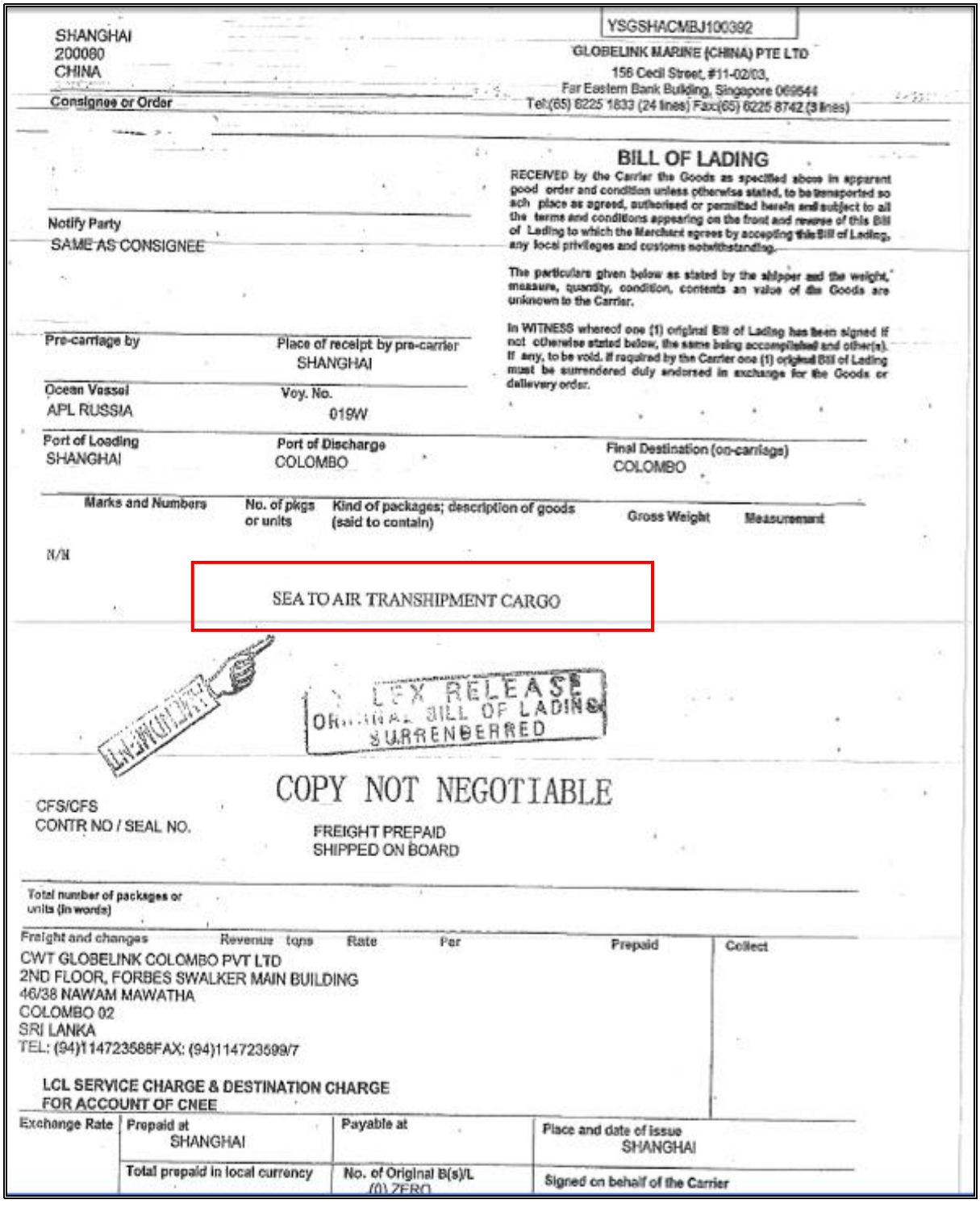
In no case shall this insurance cover loss damage or expense:

- *Caused by strikers, locked-out workmen, or persons taking part in labor disturbances, riots or civil commotions.*
- *Resulting from strikes, lock-outs, labor disturbances, riots or civil commotions.*
- *Caused by any person acting from a political, ideological or religious motive.*

(http://www.charlestayloradj.com/pdfs/CargoClauses09.pdf)

7.5 Appendix 5 to Section 3.1.2

MBL with requirements for multimodal transportation:



SHANGHAI
200080
CHINA

Consignee or Order

YSGSHACMBJ100392

GLOBELINK MARINE (CHINA) PTE LTD
156 Cecil Street, #11-02/03,
Far Eastern Bank Building, Singapore 069544
Tel:(65) 6225 1833 (24 lines) Fax:(65) 6225 8742 (3 lines)

BILL OF LADING

RECEIVED by the Carrier the Goods as specified above in apparent good order and condition unless otherwise stated, to be transported so ach place as agreed, authorised or permitted herein and subject to all the terms and conditions appearing on the front and reverse of this Bill of Lading to which the Merchant agrees by accepting this Bill of Lading, any local privileges and customs notwithstanding.

The particulars given below as stated by the shipper and the weight, measure, quantity, condition, contents an value of the Goods are unknown to the Carrier.

In WITNESS whereof one (1) original Bill of Lading has been signed if not otherwise stated below, the same being accomplished and other(s), if any, to be void. If required by the Carrier one (1) original Bill of Lading must be surrendered duly endorsed in exchange for the Goods or delivery order.

Notify Party
SAME AS CONSIGNEE

Pre-carriage by

Place of receipt by pre-carrier
SHANGHAI

Ocean Vessel
APL RUSSIA

Voy. No.
019W

Port of Loading
SHANGHAI

Port of Discharge
COLOMBO

Final Destination (on-carriage)
COLOMBO

Marks and Numbers	No. of pkgs or units	Kind of packages; description of goods (said to contain)	Gross Weight	Measurement
N/M		SEA TO AIR TRANSHIPMENT CARGO		

TELEX RELEASE
ORIGINAL BILL OF LADING
SURRENDERED

COPY NOT NEGOTIABLE

CFS/CFS
CONTR NO / SEAL NO.

FREIGHT PREPAID
SHIPPED ON BOARD

Total number of packages or units (in words)

Freight and charges	Revenue tons	Rate	Per	Prepaid	Collect
CWT GLOBELINK COLOMBO PVT LTD 2ND FLOOR, FORBES SWALKER MAIN BUILDING 46/38 NAWAM MAWATHA COLOMBO 02 SRI LANKA TEL: (94)114723588FAX: (94)114723599/7 LCL SERVICE CHARGE & DESTINATION CHARGE FOR ACCOUNT OF CNEE					

Exchange Rate	Prepaid at	Payable at	Place and date of issue
	SHANGHAI		SHANGHAI
	Total prepaid in local currency	No. of Original B(s)/L	Signed on behalf of the Carrier
		(0) ZERO	

The MBL serves as a receipt for the goods and as evidence of the contract of carriage between the carrier and the forwarding agent. The carrier issues the MBL

according to the information in a dock receipt, or in some cases according to a completed working copy of the MBL supplied by the customs broker.

The MBL must indicate that the goods have been loaded on board or shipped on a named vessel, and it must be signed or authenticated by the carrier, or the agent on behalf of the carrier. The signature or authentication must be identified as being that of a representative of the carrier, and in the case of an agent signing or authenticating the MBL, the name and capacity of the carrier on whose behalf such agent signs or authenticates must be indicated (http://www.export911.com/e911/ship/docBL.htm).

7.6 Appendix 6 to Section 3.1.2

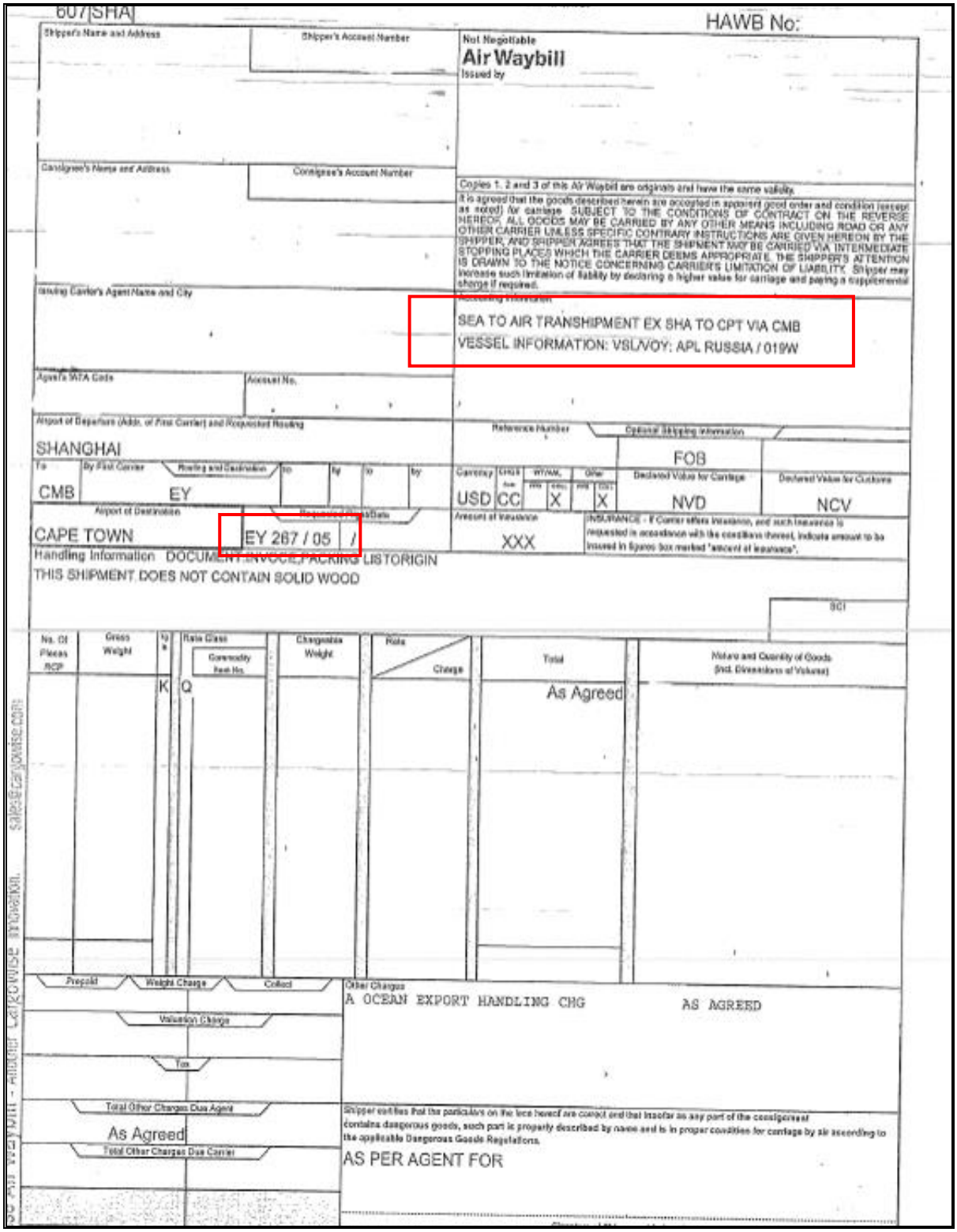
The HAWB serves as a receipt for goods and as evidence of the contract of carriage between the forwarding agent and the shipper, but it is not a document of title to the goods. Hence, the HAWB is non-negotiable.

The goods in the air consignment are consigned directly to the party named in the Letter of Credit (L/C). Unless the goods are consigned to a third party like the issuing bank, the importer can obtain the goods from the carrier at destination without paying the issuing bank or the consignor. Therefore, unless a cash payment has been received by the exporter or the buyer's integrity is unquestionable, consigning goods directly to the importer is risky.

The Air Waybill must indicate that the goods have been accepted for carriage, and it must be signed or authenticated by the carrier or the named agent for or on behalf of the carrier. The signature or authentication of the carrier must be identified as carrier, and in the case of an agent signing or authenticating, the name and the capacity of

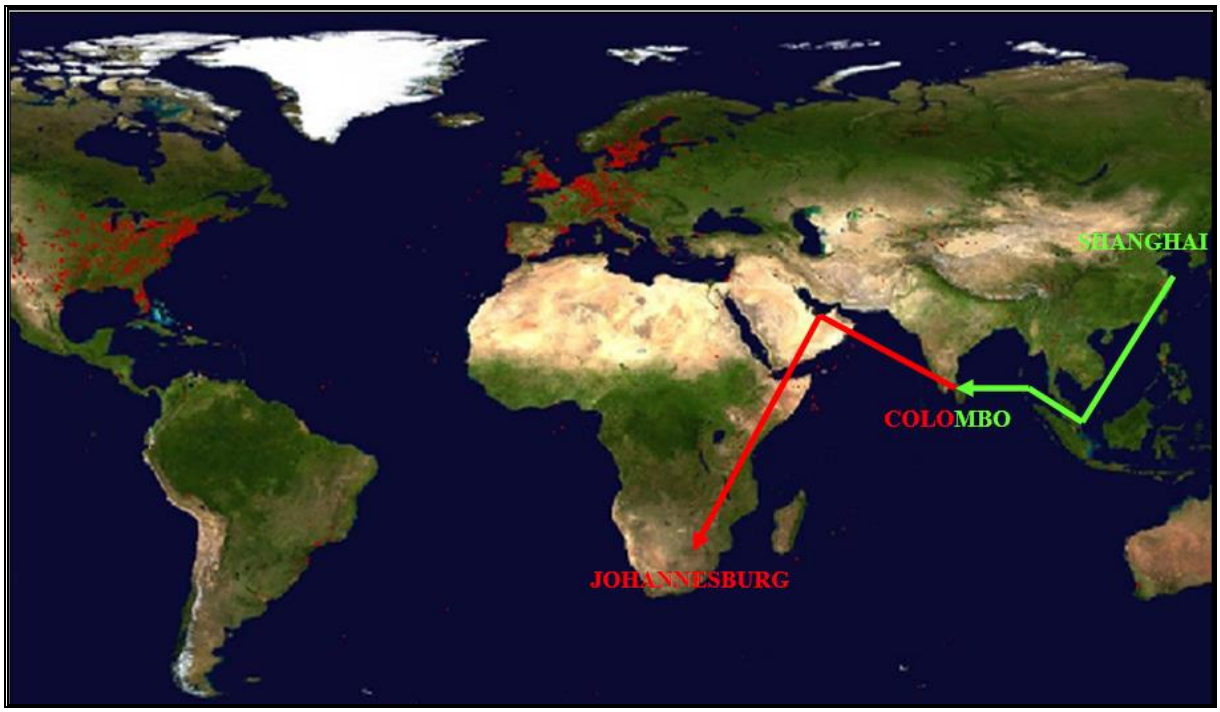
the carrier on whose behalf the agent signs or authenticates must be indicated (http://www.export911.com/e911/ship/docAWB.htm).

HAWB with requirements for multimodal transportation:



7.7 Appendix 7 to Section 3.1.4

The sea-air import routing can be displayed as follows with the green section depicting the sea portion and the red segment illustrating the movement via air:



Source: own illustration

7.8 Appendix 8 to Section 3.1.6

At first, I intend to make a distinction between direct and indirect emissions as defined by the GGP.

What is the difference between direct and indirect emissions?

The GHG Protocol defines direct and indirect emissions as follows:

- Direct GHG emissions are emissions from sources that are owned or controlled by the reporting entity.
- Indirect GHG emissions are emissions that are a consequence of the activities of the reporting entity, but occur at sources owned or controlled by another entity.

The GHG Protocol further categorizes these direct and indirect emissions into three broad scopes:

- Scope 1: All direct GHG emissions.
- Scope 2: Indirect GHG emissions from consumption of purchased electricity, heat or steam.
- Scope 3: Other indirect emissions, such as the extraction and production of purchased materials and fuels, transport-related activities in vehicles not owned or controlled by the reporting entity, electricity-related activities (e.g. T&D losses) not covered in Scope 2, outsourced activities, waste disposal, etc.

Source: http://www.ghgprotocol.org/calculation-tools/faq.

The analysis in my dissertation concentrates on *Scope 3* emissions only, which are caused by an organization's business activities, but stem from sources not owned by the organization. This is the case in the transportation of freight by a carrier on behalf of e.g. an importer or exporter, where the carrying vehicle is not owned by the importing or exporting company.

Furthermore, the analysis focuses on the calculation of CO2 emissions only. CO2 represents more than 95 % of total greenhouse gas emissions (http://www.GGPprotocol.org/calculation-tools/all-tools).

The calculation tool, which I display in Section 3.1.6, is structured according to the methodology laid down below.

Rows one to ten define the transport nodes along the supply chain under review. I define the *Export Gateway* as the FCA point in the country of origin, which is the same across all carrier options. The mode of transport from the *Export Gateway* to the *Departure Airport* is by road. The vehicle used is a Heavy Goods Vehicle – Articulated – 5t and falls into the classification category *Road Vehicle - HGV - Articulated - Engine Size 3.5 - 33 tonnes* according to the classification of the GGP.

CO2 Emission Factors by Weight Distance (i.e. Freight Transport)		
Vehicle and Size	***Region***	***CO2***
Air - Domestic	UK	1.96073
Air - Short Haul	UK	1.47389
Air - Long Haul	UK	0.61324
Rail	UK	0.0285
Road Vehicle - HGV - Rigid - Engine Size 3.5 - 7.5 tonnes	UK	0.65946
Road Vehicle - HGV - Rigid - Engine Size 7.5 - 17 tonnes	UK	0.41243
Road Vehicle - HGV - Rigid - Engine Size >17 tonnes	UK	0.20027
Road Vehicle - HGV - Rigid - Engine Size Unknown	UK	0.25115
Road Vehicle - HGV - Articulated - Engine Size 3.5 - 33 tonnes	UK	0.15262
Road Vehicle - HGV - Articulated - Engine Size >33 tonnes	UK	0.08678
Road Vehicle - HGV - Articulated - Engine Size Unknown	UK	0.08869
Road Vehicle - HGV - Type Unknown	UK	0.12427
Road Vehicle - Light Goods Vehicle - Petrol - Engine Size < 1.305 tonnes	UK	1.1735141234856
Road Vehicle - Light Goods Vehicle - Petrol - Engine Size 1.305 - 1.74 ton	UK	0.820633385902712
Road Vehicle - Light Goods Vehicle - Petrol - Engine Size 1.74 - 3.5 tonne	UK	0.496006632491552
Road Vehicle - Light Goods Vehicle - Diesel - Engine Size < 1.305 tonnes	UK	0.94952
Road Vehicle - Light Goods Vehicle - Diesel - Engine Size 1.305 - 1.74 tor	UK	0.87386
Road Vehicle - Light Goods Vehicle - Diesel - Engine Size 1.74 - 3.5 tonn	UK	0.52197
Road Vehicle - Light Goods Vehicle - LPG or CNG - Engine Size ≤3.5 tonr	UK	0.61742
Road Vehicle - Light Goods Vehicle - Fuel and Engine Size Unknown	UK	0.58651
Watercraft - Large RoPax Ferry	UK	0.0495
Watercraft - Shipping - Small Tanker (844 tonnes deadweight)	UK	0.0333
Watercraft - Shipping - Large Tanker (18371 tonnes deadweight)	UK	0.0091
Watercraft - Shipping - Very Large Tanker (100000 tonnes deadweight)	UK	0.0059
Watercraft - Shipping - Small Bulk Carrier (1720 tonnes deadweight)	UK	0.0292
Watercraft - Shipping - Large Bulk Carrier (14201 tonnes deadweight)	UK	0.0079
Watercraft - Shipping - Very Large Bulk Carrier (70000 tonnes deadweigh	UK	0.0041
Watercraft - Shipping - Small Container Vessel (2500 tonnes deadweight	UK	0.02
Watercraft - Shipping - Large Container Vessel (20000 tonnes deadweigh	UK	0.0125

Source: (http://www.ghgprotocol.org/calculation-tools/all-tools).

The *Departure Airport* and *Arrival Airport* are consistent across all carrier options, whereas the *Intermediary Airport* varies by carrier. The transport mode is road from the *Arrival Airport* to the *Destination* with a Heavy Goods Vehicle – Articulated – 4t, which is classified in the same category as highlighted in the GGP illustration above.

I stipulate the chargeable weight as 1, 000.00 kg across all carrier options in row twelve.

The above lane structure determines the calculation of CO2 emissions expressed in metric ton equivalents. The *2011 Guidelines to Defra / DECC's GGP Conversion Factors for Company Reporting* serve as a guideline on how to calculate these equivalents. Table *7f* in *Annex 7* deals with the conversion of freight transport by air. Firstly, total ton kilometres (tkm) travelled are multiplied by a *km uplift factor,* which is set at 9 % taking into consideration non-direct routes and delays or circling at the *Arrival Airport.* Thereafter, the tkm inclusive of the *km uplift factor* is multiplied by the emission factor, which is stipulated as kg CO2 per tkm (DECC & Defra, 2011:30). I transfer this methodology into the calculation tool as follows.

In lines 14 to 17 of the tool, I calculate the distances between the transport nodes. Distances between airports are obtained from www.world-airport-codes.com. Latitudes and longitudes for the calculation of distances between two locations are found on www.gpsvisualizer.com, which I then insert into the *great circle formula* in order to compute the distances between two locations on land (http://people.hofstra.edu/ geotrans/ eng /ch1en/conc1en/greatcircle.html).

In rows 19 to 22, I determine the emission factors for each transportation leg according to the factors published in version 2.3 of the GGP (http://www.ghgprotocol.org/calculation-tools/all-tools).

For road transportation, the vehicle classification has been explained above. For air transportation, three types of air services exist, viz. *Domestic*, *Short Haul* and *Long Haul* with their pertinent emission factors. *Note 14* in *Annex 6* to the *2011 Guidelines to Defra / DECC's GGP Conversion Factors for Company Reporting* illustrates the distinction between these three types of service. A distance is classified as *Domestic*, if less than 463 km are travelled. *Short Haul* international journeys may not exceed 3,700 km and *Long Haul* international flights exceed 3,700 km (DECC & Defra, 2011:24).

CO2 Emission Factors by Weight Distance (i.e. Freight Transport)		
Vehicle and Size	*Region*	*CO2*
Air - Domestic	UK	1.96073
Air - Short Haul	UK	1.47389
Air - Long Haul	UK	0.61324
Rail	UK	0.0285
Road Vehicle - HGV - Rigid - Engine Size 3.5 - 7.5 tonnes	UK	0.65946
Road Vehicle - HGV - Rigid - Engine Size 7.5 - 17 tonnes	UK	0.41243
Road Vehicle - HGV - Rigid - Engine Size >17 tonnes	UK	0.20027
Road Vehicle - HGV - Rigid - Engine Size Unknown	UK	0.25115
Road Vehicle - HGV - Articulated - Engine Size 3.5 - 33 tonnes	UK	0.15262
Road Vehicle - HGV - Articulated - Engine Size >33 tonnes	UK	0.08678
Road Vehicle - HGV - Articulated - Engine Size Unknown	UK	0.08869
Road Vehicle - HGV - Type Unknown	UK	0.12427
Road Vehicle - Light Goods Vehicle - Petrol - Engine Size < 1.305 tonnes	UK	1.1735141234856
Road Vehicle - Light Goods Vehicle - Petrol - Engine Size 1.305 - 1.74 ton	UK	0.820633385902712
Road Vehicle - Light Goods Vehicle - Petrol - Engine Size 1.74 - 3.5 tonne	UK	0.496006632491552
Road Vehicle - Light Goods Vehicle - Diesel - Engine Size < 1.305 tonnes	UK	0.94952
Road Vehicle - Light Goods Vehicle - Diesel - Engine Size 1.305 - 1.74 tor	UK	0.87386
Road Vehicle - Light Goods Vehicle - Diesel - Engine Size 1.74 - 3.5 tonn	UK	0.52197
Road Vehicle - Light Goods Vehicle - LPG or CNG - Engine Size ≤3.5 tonr	UK	0.61742
Road Vehicle - Light Goods Vehicle - Fuel and Engine Size Unknown	UK	0.58651
Watercraft - Large RoPax Ferry	UK	0.0495
Watercraft - Shipping - Small Tanker (844 tonnes deadweight)	UK	0.0333
Watercraft - Shipping - Large Tanker (18371 tonnes deadweight)	UK	0.0091
Watercraft - Shipping - Very Large Tanker (100000 tonnes deadweight)	UK	0.0059
Watercraft - Shipping - Small Bulk Carrier (1720 tonnes deadweight)	UK	0.0292
Watercraft - Shipping - Large Bulk Carrier (14201 tonnes deadweight)	UK	0.0079
Watercraft - Shipping - Very Large Bulk Carrier (70000 tonnes deadweigh	UK	0.0041
Watercraft - Shipping - Small Container Vessel (2500 tonnes deadweight	UK	0.02
Watercraft - Shipping - Large Container Vessel (20000 tonnes deadweigh	UK	0.0125

Source: (http://www.ghgprotocol.org/calculation-tools/all-tools).

Intentionally, I select the emission factors for the region *UK* as shown in the above table. The GGP provides the option of choosing between the regions *UK, US* and *Other*. These factors have been computed based on vehicle types used within the specific region. The supply chain under consideration connects the Far East with South Africa and hence the logical conclusion is to pick the region *Other* for the calculation of CO2 emissions. I have chosen not to adhere to this methodology for the following reasons:

1. Vehicles used for road transport in the *US* have different characteristics compared with those used in the coastal region of China and in Sri Lanka due to transportation in the *US* typically being focused on long haul, overland modes.

2. One generic emission factor is used for all vehicle types in respect of for road transportation under the classification *Other*. This factor is: 0.297 kg of CO2 per tkm. Different vehicle types within the supply chains under review – in particular the multimodal transportation – require the use of a more differentiated selection of emission factors, which is provided by the categorization for the region *UK*.

It is for these reasons that I applied the chart above rather than that below.

	CO2 Emission Factors by Weight Distance (i.e. Freight Transport)		
2			
3	***Vehicle and Size***	***Region***	***CO2***
4	Air - Domestic	Other	1.96073
5	Air - Short Haul	Other	1.47389
6	Air - Long Haul	Other	0.61324
7	Rail	Other	0.0252
8	Road Vehicle - HGV - Rigid - Engine Size 3.5 - 7.5 tonnes	Other	0.297
9	Road Vehicle - HGV - Rigid - Engine Size 7.5 - 17 tonnes	Other	0.297
10	Road Vehicle - HGV - Rigid - Engine Size >17 tonnes	Other	0.297
11	Road Vehicle - HGV - Rigid - Engine Size Unknown	Other	0.297
12	Road Vehicle - HGV - Articulated - Engine Size 3.5 - 33 tonnes	Other	0.297
13	Road Vehicle - HGV - Articulated - Engine Size >33 tonnes	Other	0.297
14	Road Vehicle - HGV - Articulated - Engine Size Unknown	Other	0.297
15	Road Vehicle - HGV - Type Unknown	Other	0.297
16	Road Vehicle - Light Goods Vehicle - Petro - Engine Size ≤1.25 tonnes	Other	0.297
17	Road Vehicle - Light Goods Vehicle - Diesel - Engine Size ≤3.5 tonnes	Other	0.297
18	Road Vehicle - Light Goods Vehicle - LPG or CNG - Engine Size ≤3.5 tonn	Other	0.297
19	Road Vehicle - Light Goods Vehicle - Fuel Unknown	Other	0.297
20	Watercraft - Large RoPax Ferry	Other	0.048
21	Watercraft - Shipping - Small Tanker (844 tonnes deadweight)	Other	0.048
22	Watercraft - Shipping - Large Tanker (18371 tonnes deadweight)	Other	0.048
23	Watercraft - Shipping - Very Large Tanker (100000 tonnes deadweight)	Other	0.048
24	Watercraft - Shipping - Small Bulk Carrier (1720 tonnes deadweight)	Other	0.048
25	Watercraft - Shipping - Large Bulk Carrier (14201 tonnes deadweight)	Other	0.048
26	Watercraft - Shipping - Very Large Bulk Carrier (70000 tonnes deadweigt	Other	0.048
27	Watercraft - Shipping - Small Container Vessel (2500 tonnes deadweight)	Other	0.048
28	Watercraft - Shipping - Large Container Vessel (20000 tonnes deadweigt	Other	0.048

Source: (http://www.ghgprotocol.org/calculation-tools/all-tools).

The chargeable weight and the distances are required in order to obtain the tkm travelled in rows 24 to 27.

The GGP emission factors are defined as kg of CO2 per tkm, e.g. 0.61324 kg of CO2 per tkm.

One tkm equals the weight in tons multiplied by the number of km travelled (http://stats.oecd.org/glossary/detail.asp?ID=4273).

My CO2 calculation tool provides the chargeable cargo weight in kg. The distances between two transport nodes are given in km. Thus, the tkm is defined as:

([Chargeable cargo weight in kg * Distance between two transport nodes in km] /

1, 000.00).

The GGP emission factors stipulate the number of kg of CO2 per tkm. However, the CO2 footprint is defined as the number of CO2 ton equivalents. For this reason, I divide the GGP emission factors by 1, 000.00 and multiply them by the number of tkm as shown in the following example:

The GGP emission factor for a long-haul aircraft is 0.61324 kg of CO2 per tkm.

The chargeable weight on a lane between two airports is 1, 000.00 kg.

The distance between the two airports = transport nodes is 6, 546.00 km.

The number of tkm inclusive of the *km uplift factor* is defined as:

([[1, 000.00 kg * 6, 546.00 km] / 1, 000.00] * 109 %) = 7, 135.14 tkm.

The above emission factor multiplied by the tkm results in a CO2 footprint of 0.61324 * 7, 135.14 km = 4, 375.55 kg of CO2 = 4.376 metric tons.

In order to simplify calculations, I divide the emission factor by 1, 000.00 and multiply this factor by the number of tkm to immediately arrive at the CO2 footprint in metric tons in the calculation tool:

(0.61324 / 1, 000.00) = 0.00061324 * 7, 135.14 tkm = 4.376 metric tons of CO2

(Own derivation and illustration).

I then calculate the CO2 metric ton equivalents in lines 29 to 32 through the multiplication of the number of tkm by the emission factor.

Distances between sea ports are obtained from www.searates.com for the multimodal tools involving ocean freight transportation.

7.9 Appendix 9 to Section 4.1

The following ITAC stipulations must be adhered to by the rebate user (SARS, 2009:11):

- Reference to the HS heading, value and quantity of the export product must be made.
- Registered rebate users are allowed to utilize the assistance of other manufacturers. However, the liability for the unpaid duties and taxes lies with the rebate user at all times.
- The SARS registration process on a form DA185 must be completed before the application process with ITAC can commence.
- The issued permit explicitly mentions the materials allowed for importation under the permit and the product to be manufactured therefrom.
- The permit must be handed over for each import clearance made during the period of validity.

7.10 Appendix 10 to Section 4.3.1

Carrier-Haulage is defined as the *Movement of the container from Point A to Point B under the control of the shipping line using a haulage contractor nominated by the shipping line* (http://shippingandfreightresource.com/2011/03/01/what-isthedifference-between-carrier-haulage-merchant-haulage-what-are-the-implications/).