DEVELOPING A MODEL FOR MEASURING THE ENVIRONMENTAL PERFORMANCE OF THE SAFCOR PANALPINA OPERATIONS AND THIRD PARTY LOGISTIC SERVICES PROVIDED TO CLIENTS, WITH A FURTHER AIM OF DEVELOPING A CONSULTANCY CAPABILITY AS A FURTHER SERVICE OFFERING

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by

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Submitted in partial fulfilment of the requirements for the degree of

BACHELORS OF INDUSTRIAL ENGINEERING

in the

FACULTY OF ENGINEERING, BUILT ENVIRONMENT AND INFORMATION TECHNOLOGY

UNIVERSITY OF PRETORIA

OCTOBER 2010

EXECUTIVE SUMMARY

''In light of current ecological concerns, investing in less-than-green ventures is tantamount to committing ecocide on a global environment and the communities it sustain'' (Omar, 2011:7).

Companies around the world are daily urged to re-design their business practices, embrace different energy sources and lifestyles to ultimately have a more sustainable relationship with their environment. Companies with reduced emissions are fast becoming the preference as clients are starting to develop a deeper understanding for eco-friendly awareness. This translates into businesses whose services are eco-sensitive being chosen above competition, which ultimately impacts positively on the profitability of the company. According to the Carbon Disclosure Project (CDP) 74% of the JSE's top 100 companies have responded to some sort of green project. This is a clear indication that environmental performance should remain sufficiently high on the agendas of South African companies (Omar, 2011).

For the purpose of this project Safcor Panalpina's Third Party Logistics (3PL) services are assessed as a holistic system. In Chapter 4, operations management approaches are followed to develop a tool to measure and improve the environmental performance of SaPA's Third Party Logistics Clients. The customized model adapted from the Green Operations Reference Model is called the SaPA GREENTool. The GREENTOOL is applied to XYZ Pharmaceuticals via a case study; thereafter recommendations based on industry related best practices are given.

The outcome of the project will not only be based on the principles of Green Supply Chain Management (GSCM) but also seek to develop a practical competitive advantage as the Environmental Management Systems (EMS) of clients gain value through using greener 3PL services. These competitive advantages will be gained through firstly giving recommendations on what SaPA's future green strategy should be and finally the development of a consultancy service in Chapter 5.

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LIST OF ACRONYMS

3PL: Third Party Logistics

CCTV: Closed-Circuit Television

CH4: Methane

CO_2: Carbon Dioxide

CO_2e: Carbon Dioxide Emission

DC: Distribution Centre

DGH: Dangerous Goods Handling

EMS: Environmental Management System

GDP: Gross Domestic Product

GHG: Greenhouse Gas

GSCM: Green Supply Chain Management

GreenSCOR model: Green Supply Chain Operations Reference model

HVC: High Value Cargo

ISO: International Organization for Standardization

KWh: Kilowatt hours

LPG: Liquefied Petroleum Gas

LNG: Liquefied Natural Gas

N_2O: Nitrous Oxide

SCM: Supply Chain Management

SaPA: Safcor Panalpina

Chapter 1: Introduction and Background

1.1. Introduction

We are confronted daily with scientific evidence of a rise in global temperatures, measured over the past hundred years and even the past decade. It is widely known that the increased greenhouse gas (GHG) concentrations are mainly caused by human actions. The impact of increased GHG has become so severe that it cannot be considered as a ‘green issue’ only. The issue stands at the very center of South Africa’s economic survival and also the survival of all species on earth. Therefore all companies are urged to re-engineer their business practices in favor of sustainable alternatives with environmental performance measures (SBT, 2007). The targets as determined by the Kyoto Protocol cover emissions of the six main greenhouse gases:

- Carbon dioxide (CO2);
- Methane (CH4);
- Nitrous oxide (N2O);
- Hydrofluorocarbons (HFC’s);
- Perfluorocarbons (PFC’s); and
- Sulphur hexafluoride (SF6)

With South Africa’s energy intensive economy it is estimated that South Africa contributes 1% of the global CO_2 emissions. The GHG emission per capita and also the CHG emission per GDP are almost double that of the world average. With the vast amount of extremely poor communities in South Africa, South Africans are particularly in danger of catastrophic outcomes with the annual change in climate conditions (SBT, 2007). Therefore it is evident that even though South Africa as a developing country is not yet constrained by the Kyoto protocol, it still has a great responsibility to mitigate GHG emission. In South Africa, up to 75% of the carbon footprint created by companies comes from transportation and logistics (van Kerken & Katz, 2008). This places great responsibility on the shoulders of companies like Safcor Panalpina. It is important that these companies invest and take the necessary steps towards a green supply chains.

1.2. Problem Description

As mentioned before the transport sector causes a large percentage of a countries total GHG emission; thus a company’s logistic operations represent a major part of its carbon footprint. As most companies outsource their logistic activities to companies like Safcor

Panalpina, they lack the activity based information and the visibility to perform a proper carbon inventory of their logistics activities. Thus, a **Carbon Footprint Analysis** tool will be developed to support the clients of Safcor Panalpina'a 3PL service with this issue. What the analysis will allow will form the project's aim and are discussed in detail in Section 1.4.

1.3. Company Background

Safcor Panalpina is a *BID*Vest Group company and a member of the Panalpina Global Network. Safcor Panalpina specializes in six product baskets namely: international supply chain management, consulting services, system integration, customs clearing, forwarding, logistics and financial services. Strategically located within the grounds of Airports Company South Africa's (ACSA), Safcor has the ability to handle high risk value cargo with increased security parameters.

Safcor Panalpina offers a vast range of supply chain management solutions. This is strengthened by the Panalpina Global Network and the extensive Third Party Logistics (3PL) offerings within the Bidfreight organization (SaPA's Home Page, 2011). Safcor Panalpina's Key industries include: Oil and Gas, Electronic Technology, Telecommunications, Automotive, Pharmaceuticals, Mining, Fast Moving Consumer Goods and Construction/ Engineering.

1.3.1. Current Environmental Actions

Safcor Panalpina is part of the Bidfreight Division of Bidvest which annually releases a Carbon Calculated Report. Bidvest collects all the relevant greenhouse emission data from all their business units. Bidvest undertakes this report in full accordance with the Greenhouse Gas Protocol, the most widely used international carbon calculation methodology, comparable with CHG standards such as ISO 14064-Greenhouse gas accounting and verification. Emitting activities include direct greenhouse (GHG) emissions resulting from fuel used by vehicles and equipment owned or controlled by Bidvest (referred to as Scope 1 emissions) which includes: diesel, biodiesel, petrol, LPG, LNG and coal.

Indirect emissions from purchased electricity are referred to as Scope 2 emissions (Hetherington, Alexander, 2010).

Because of the above mentioned report, SaPA as Part of Bidfreight Division has certain obligations and responsibilities towards its owning company to report on certain environmental factors. These environmental factors are measured per business unit and then to form the total emissions per Bidvest business division as can be seen in Table 1 and Table 2 (adapted from the Carbon Calculated Report, 2010).

Table 1: Overview of Bidfreight's CO_2-Emissions (2010)

Scope 1 Direct Emissions	**Tonnes of CO_2e**
Vehicles/Equipment consuming petrol	1 264.74
Vehicles/Equipment consuming diesel	16 233.53
Vehicles/Equipment consuming biodiesel	0
Vehicles/Equipment consuming LPG	336.58
Vehicles/Equipment consuming LNG	11.98
Vehicles/Equipment consuming Coal	0
Scope 2 Indirect Emissions	
Purchased electricity	48087.57
TOTAL SCOPE 1 & 2 EMISSIONS	**64 934.40**

As it can be seen from the above table, the factors considered to calculate the emissions per business unit and ultimately Bidvest as a whole are very broad and does not include physical measurement per process in different business units like Safcor Panalipina. The aim of this project in terms of the environmental actions that needs to take place will be to break the 3PL operations down to physical activities where industry specific measurement can be made, and client specific environmental emissions can be calculated.

1.3.2. Warehousing & Distribution

Warehousing serves as a critical part of any 3PL solution. The warehouses of SaPA provide the collection, consolidation, and clearing points within the 3PL service offered by SaPA. By law the warehouses are equipped with 350 CCTV cameras and certain lightning attributes to store high value goods. Throughout this project warehouse capacity and utilization thereof will be described as **cubes**. The measurement of a cube is a standard pallet with a height of 1200mm. According to the International Organization for

Standardization the dimension for a pallet is: 1067mm x 1067mm; thus the volume of a cube is 1.36m^3. The warehousing network of SaPA comprises of a combination of own and outsourced facilities throughout the country. For the purpose of this project Unit 1 and Unit 2 situated adjacent to OR Tambo International Airport in Ekurhuleni will be analyzed:

Unit 1: A 10 000 square meter logistics facility opened in September 2005. The 3PL service includes:

- 70% controlled by SaPA, thus 64789m^3 (0.7) = 45352m^3 of 3PL storage space available.
- Storage racks with a capacity of 34357 cubes.
- Car manufacturers also utilized storing space and for the sake of environmental emission per client; floor space utilized will be converted to cubes.

Unit 2: A 10500 square meter facility which opened in Augustus 2007 comprises of:

- 60% of the warehouse's floor space are used for de-grouping of shipment and does not form part of this project.
- Thus 40% are used for 3PL operations.
- Storage racks with a capacity of 13300 cubes.
- A 150m^2 Cool room controlled at 5℃ with a capacity of 343 cubes.
- A 30m^2 Freezer controlled at - 26℃ with a capacity of 75 cubes.

Safcor Panalpina has an extensive **distribution** network handled by an outsourced third party provider-COPServe. COPServe is a company that only serves SaPA and will thus be included in this project. SaPA provides enhancement features that can be added to any delivery to meet the client needs such as High Value Cargo Handling (HVC) or Dangerous Goods Handling (DGH). Distributions of 3PL stored goods are done only by road-freight and thus air and rail distribution are ignored.

1.4. PROJECT AIM

- Development of a tool to measure and improve the environmental emission factors occurred during a client's logistic activities, not only the distribution (transportation) but also warehousing and all in-house handling activities.
- Give Safcor Panalpina a clear view of their environmental performance in order to effectively direct their efforts to gain a competitive advantage over their competition on some fields.
- A recommendation to what the following steps can be towards greener their services.

1.5. PROJECT DELIVERABLES

A. An environmental performance measurement tool.

- A framework to measure the environmental emission of a logistics operation.
- Capability to link performance to specific process elements.
- Capability to translate environmental goals into specific targets and/or activities and rank them according to the highest environmental impact.
- Provides an improvement opportunity reference model.

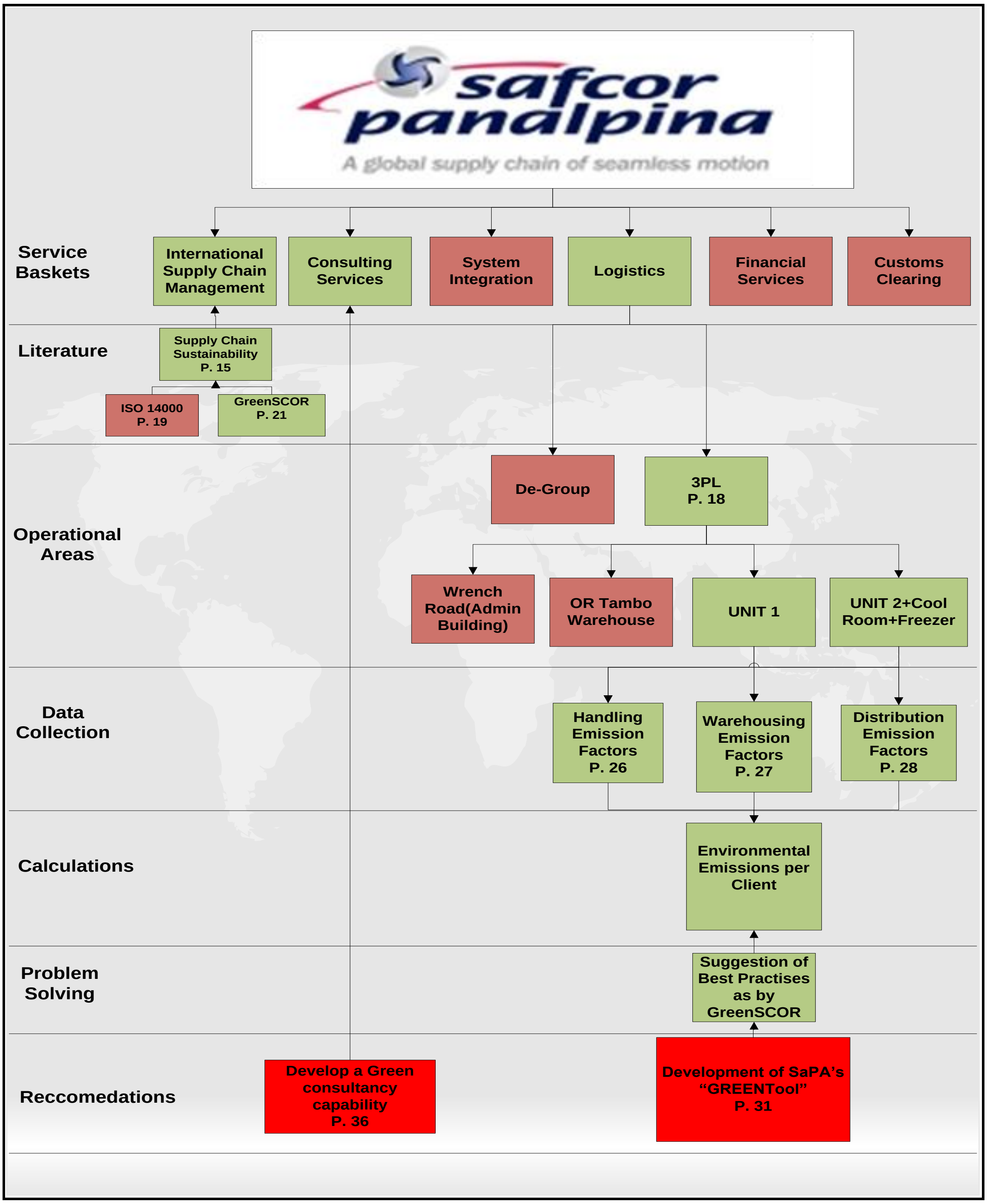
B. An in-house consultancy capability

- Identification of ways in which SaPA can add value to a clients supply chain.
- A Capability to investigate improvement opportunities of client's environmental performance.

1.6. PROJECT SCOPE

The Scope of the project is graphically depicted below. **Pink** blocks do have an influence on the project but are not included in the scope and thus no further attention is given to it. **Green** block as part of the scope and more attention are given to it on page numbers indicated in the process block.

Figure 1: Work Breakdown Structure of the project scope



CHAPTER 2: LITERATURE REVIEW

2.1. GREEN OPERATIONS BACKGROUND

2.1.1. GLOBAL WARMING

Global warming is a mere reality and the main cause for it is human activity. Industrialisation is the most significant factor and has increased the amount of Greenhouse Gases in the atmosphere, trapping the sun energy in the atmosphere and heating up the earth.

The **effects** of Global Warming: rise in sea level, extinctions, precipitation patterns changing, extreme weather conditions, etc. The main consensus in the industrial sector is that the problem has been well defined, and action needs to be taken (Sundarakani et al., 2010).

> **''Global warming is a modern problem - complicated, involving the entire world, twisted up with difficult issues such as poverty, economic development and population growth. Dealing with it will not be easy. Ignoring it will be worse'' (*Feeling the heat, UNFCCC publication).***

2.1.2. INTERNATIONAL RESPONSE

The world's primary international agreement on reducing greenhouse gas emissions is called the **Kyoto Protocol**, negotiated in 1997, now adopted by more than 180 countries, committed to specific targets for emissions of GHG gases by 2012.

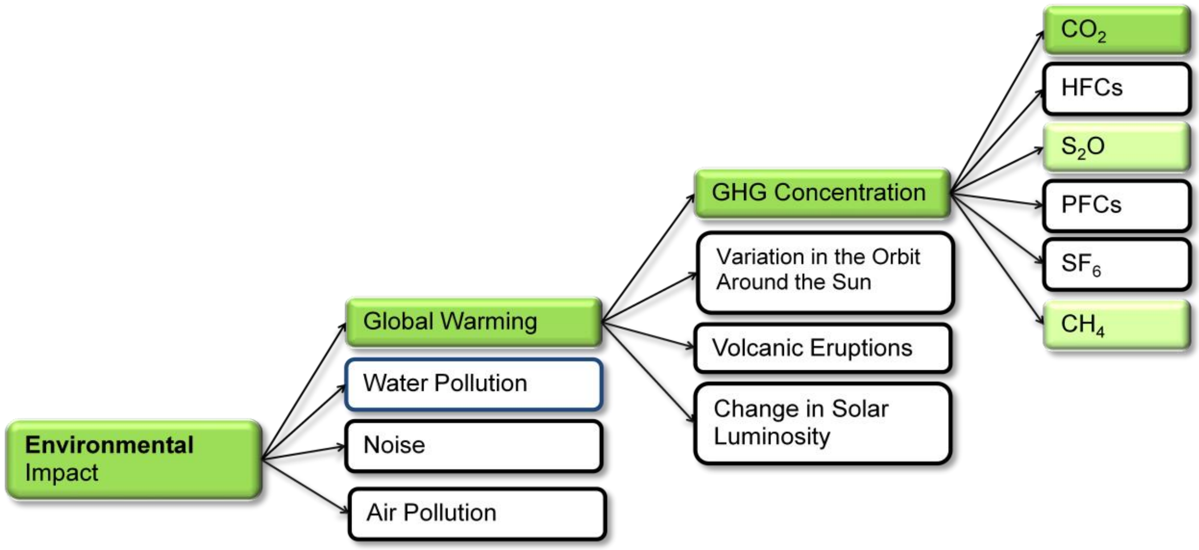
Many countries are taking steps to reduce emissions through national policies such as:

- **Carbon/Energy taxes**, etc. (Carbon taxes are not yet a reality in South Africa, but talks are that it will soon be introduced).
- Introduction of **emissions trading programs** (carbon markets) allowing companies to sell or purchase carbon credits, depending on their allowances, e.g. the EU Emission Trading Scheme (ETS).
- **Voluntary programs** (recycling initiatives, earth hours, green weeks, paperless operations, etc.)

2.1.3. Carbon foot printing

Carbon foot printing focuses on global warming and climate change and calculates the amount of Greenhouse Gases (GHG) emitted, all converted in carbon dioxide equivalents (CO_2e). Considering logistic activities relevant to 3PL, the major Greenhouse Gases emitted are CO_2, S_2O and CH_4. Therefore; the study to follow will only focus on these three gases. Water and air pollution are included in the GreenSCOR model, and will thus also be included in this study.

Figure 2: Environmental Impact Breakdown



2.1.4. Reasons for calculating Carbon Footprint

According to Sundarakani (2010). Some companies within specific industrial sectors are already subjected to regulations and participate in Emission Trading Programs; more companies will follow in the near future. Companies all around the worlds must understand and manage their GHG risks to ensure sustainable success in a competitive business environment. Companies should also be prepared to adhere to future climate policies.

In a post-Kyoto situation (2012), companies will most likely need to:

- Annually report on their GHG emissions (their carbon footprint).
- Buy/Sell their additional or surplus emission CAP on the local carbon trade market.

For the purpose of this project the most important objective of calculating the carbon footprint of a service is to find innovative and practical ways to reduce emissions. Calculating carbon footprint of a service is an effective tool for environmental management and serves as the first step in measuring the environmental performance of a company. As previously discussed 3PL play an important role in determining the carbon emission for the part of the customers supply chain for which they are responsible for. Thus by calculating the environmental performance per customer by using carbon foot printing and other factors, and publicly disclosing this information, organizations can increase customer satisfaction and thereby ultimately profitability.

2.1.5. Benefits of calculating Carbon Footprint

According to Srivastava (2007), organisations that actively participate in the fight against global warming can gain various benefits from it, these benefits include:

- **Increased customer satisfaction:** By capitalising on the important marketing, global communication and media opportunities, customer satisfaction increases as companies become more aware of their obligation to choose green partners.
- **Regulation:** Understanding the potential carbon related taxes, tariffs and other legislation applicable to certain industries. Precautionary acting to comply with all industry related legislation.
- **Improved reputation:** Differentiating companies as green leaders; thus enhancing goodwill of clients towards particular service offered**.**
- **Reduced general operating costs:** By implementing industry related best practises related to green supply chain management, the overall efficiency increases. Increasing the efficiency of the supply chain can result in decreased resource employment and therefore lower operating costs.

2.2. Supply Chain Sustainability

Even though sustainability has a different meaning and emotional connotation for each individual, it has become an aspect of every effective supply chain that needs to be explicitly addressed. According to (Cholette, 2007) the best way to examine supply chain sustainability is through the lens of the Triple Bottom Line (3BL) which defines the three core elements as *Social Responsibility, Environmental Stewardship* and *Economic Viability*. First coined by Shell in can be termed “People, Planet, and Profits”. This project concerns only the environmental performance of SaPA’s 3PL operations and thus only *Environmental Stewardship* will be included in this study.

Environmental Stewardship addresses how a company like Safcor Panalpina can avoid depleting recourses which they use, pollution prevention, reduction of ecological footprint, and implementation of environmental management best practises. Companies should consider how material can be reused, recycle and financially feasible disposed of in their waste management programs. Sustainability has only recently become a mainstream topic in the classroom and as a research topic. Therefore there is not yet acknowledged path to sustainability in terms of Environmental Stewardship. A few approaches considered for measuring or improving the environmental aspects of sustainability will be discussed below:

The *input-output framework* delivers carbon emissions per country as a whole according to what is imported and the again exported in a relative timeframe (Wang & Watson, 2007). According to the Green Design Institute (2008) the input-output model uses financial and environmental data to deliver the total carbon emission of a country as a percentage of the world's emission. This model will ultimately be influenced by 3PL logistical operations, but the project aim is to determine the environmental performance of the 3PL logistic operations that SaPA offer. Thus this measurement will not be suitable for the scope of this project.

A *Life Cycle Assessment* (LCA) is an analysis of the environmental aspects and potential impacts associated with a product, process, or service. Despite the inclusion of environmental management standards into the ISO 14000 family, there is no industry related universal standard for the impact categories that needs to be evaluated. This model can be used to systematically asses the energy use associated with the lifecycle of a service provided. In the case of 3PL operations the lifecycle of the service will birth when goods are received until it is delivered to the client.

The *ecological footprint framework* is a framework defined by Wackernagel and Rees (1996) as the quantified land and water mass a population uses to produce resources it will consume and the absorption of the waste thereof. This is a framework which is relevant to each consumer as it is clear the earth has reached its 'carrying capacity'. The framework can be compared to the life-cycle approach except that it focuses on consumption instead of carbon footprint production. Ecological footprint can be calculated per individual based on water usage, resource usage, and electricity usage.

Life Cycle Assessment entails the interrelation of the following three parts (U.S Environmental Protection Agency, 2010), bracketed are the tools utilized to perform tasks.

- Compiling an inventory of energy resources and materials used throughout the supply chain.
- Evaluation of the potential environmental impacts.
- Assessment and implementation of emission reduction opportunities.

Figure 3: High Level Life-cycle of SaPA's 3PL service

In Summary, sustainability in terms Environmental Stewardship is a relatively new concept in 3PL services offered in South-Africa. It is estimated that in the United States there are over 300 eco-labels in the food industry alone, and already five third party green certification agencies in the wine production industry. When considering the above statement there is no reason to believe that the green logistics industry in South Africa will not follow the same route as legislations and carbon taxes are mere realities in the near future.

2.2. The role of 3PL companies in clients green supply chain.

The environmental sustainability aspect of supply chain management known as green supply chain management (GSCM) is gaining increasingly more interest from stakeholders and researchers. This is not only because of the fact that the natural environment is deteriorating, but also because companies have recognised possible competitive advantages to be gained by implementing environmental policies. Nowadays it is generally perceived that green supply chain management promotes efficiency between business partners and their lead corporations, it enhances environmental performance, waste minimization and decreased financial input (Rao and Holt, 2005). This efficiency is expected to enhance the company image, competitive advantage and gives marketing exposure. It is evident that some companies are improving their environmental performance to gain a competitive advantage above clients (Bacallan, 2000).

According to (Langley & Capgerrini, 2008) early adopters will find that green projects and initiatives will generate savings, produce revenues while reducing the impact of the environment. To make sense of the vast amount of information available we should:

- Become educated.
- Measure the environmental performance (carbon footprint) of a company and identify best practices to implement.
- Embark on sustainable green-initiatives.

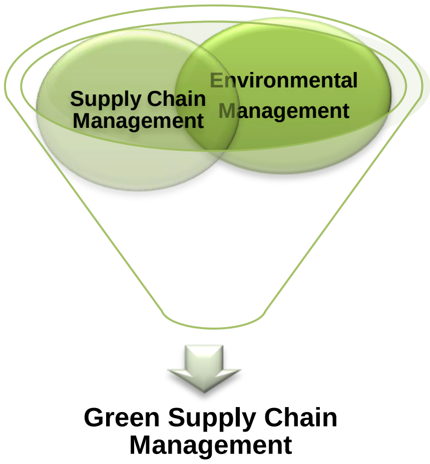
It is also stated that green initiatives should clear three acceptance hurdles namely: financial feasibility, environmentally friendliness and also socially responsible. As green supply chains are implemented all over the world, companies that outsource their logistics functions will inevitably rely on 3PL companies like Safcor Panalpina to help satisfy their environmental performance targets. There are various options for greening a 3PL service operations which ranges from small process changes like retraining forklift drivers to large capital investments.

2.3. Green Supply Chain Management - frameworks

Green supply chain management (GSCM) methods are constantly gaining interest amongst company directors and practitioners of supply chain management, operations and logistics, especially over the past few years. The fact that GSCM is more important that a few years ago has mainly been driven by environmental concerns, such as environmental pollution accompanying recent industrial development (*Sheu et al, 2005*), temperature rises, waste sites reaching capacity. At the same time government regulation, change of client demand,

and the recent development of international certification agencies (Ash, 2011) have led companies to give more attention to GSCM initiatives. However, despite the importance of Environmental management in GSCM general supply chain practises remains critically important (*Sheu et al, 2005*), as can be seen in Figure 4.

Figure 4: Green Supply Chain Management (GreenSCOR, Supply Chain Council, 2008)



To effectively incorporate green practises into a supply chain in is necessary to develop a holistic measurement model and thereafter assessment of different smaller supply chains in a system to optimize the life cycle thereof. For the purpose of this project the 3PL operations of SaPA will be analysed in term of input and output at each functional process. In the next phase of this review, two different frameworks that can be used to meet the project deliverables are discussed where after one is chosen to be implemented.

2.3.1. ISO 14000 Family

ISO (International Organisational for Standardization) has a membership of over 160 national standards institutes from companies around the world, like SABS in South Africa. ISO's portfolio of more than 18000 standards provides practical tools for all three core parts of sustainable development as discussed above: economic, environmental and societal (Environmental Management, 2009).

ISO has developed standards that help organisations to act on environmental issues: the ISO family of environmental management standards which can be implemented in any type of organization from the public to private sectors. Below is a list of what is broadly included in the ISO 14000 family of standards:

- Environmental Management Systems (EMS)

- Environmental Aspects of Products
- Environmental Labels
- Greenhouse gas Accounting & Verification
- Environmental Communication
- Life-cycle Analysis
- Environmental Performance Evaluation

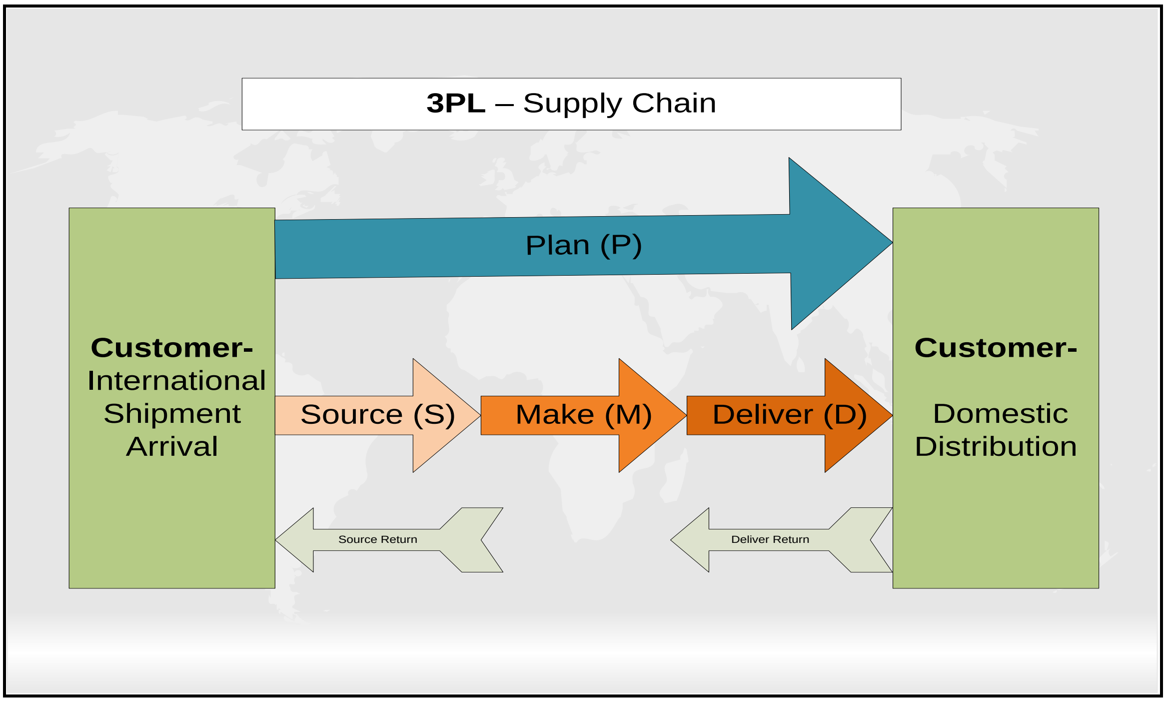
ISO 14001 does not specify environmental performance, but does give generic requirements for a general environmental management system (EMS). The environmental policy of SaPA serves as a common reference to communicate clients on environmental performance (ISO Essentials, 2011). In terms of the environmental policy, the aim of this project is to translate environmental goals into specific targets and/or activities within SaPA's 3PL service. Thus the ISO model will not be suitable for this study as is it focuses on the environmental performance of the company as a whole. Further investigations into what model will be suitable to study logistical operations on ground level in terms of environmental performance are done below.

2.3.1. Supply Chain Operations Reference Model (SCOR)

The Supply-Chain Operations Reference model (SCOR) is the product of the Supply-Chain Council (SCC) an international association whose methodology, diagnostic and benchmarking tools that assists companies to make dramatic changes improvements to certain supply-chain processes. The SCOR-model provides a unique framework that links business processes, metrics, best practices and new technologies into a single model to support communication among supply chain partners and to improve the effectiveness of the supply chain. Through the best practises supply chain related improvements are suggested (GreenSCOR, Supply Chain Council, 2008).

The SCOR-model describes the logistic activities associated with all phases of satisfying a client's demand. It the case of SaPA's 3PL service, logistic activities differs for each client and thus a generic logistics activity framework will be used (included in annex). As can be seen in Figure 6 below, the Model itself contains several phases and is organized around the five primary management processes of Plan, Source, Make, Deliver, and Return.

Figure 5: SCOR Building Blocks (Supply Chain Council)



By describing supply chains using these process building blocks, the Model can be used to describe supply chains that are very simple or very complex using a common set of definitions within each building block. (GreenSCOR, Supply Chain Council, 2008). Full definitions of each building block are included in Appendix B. Compared to the ISO family of standards the model does not have to describe an organization as a whole, but has been able to describe and provide a basis for supply chain improvements for global projects as well as site or service specific projects. Thus the SCOR-model will be a suitable model to measure and improve the environmental performance of the 3PL logistics operations of SaPA.

2.3.2. GreenSCOR

The SCOR model was used as a basis for developing a green supply chain management tool. The GreenSCOR tool is an instrument for structuring and communicating green supply chain management (GSCM) programmes ''to get faster, repeatable, collaborative results'' (GreenSCOR, Supply Chain Council, 2008). Table 2 below illustrates examples of possible best practises that can be implemented to reduce the environmental impacts of GreenSCOR Level 1 - Level 3 processes. The GreenSCOR model integrates best practises and metrics into the supply chain while focussing on each step of the 3PL service offered. The model is also used to identify opportunities to reduce the carbon emission of the service offered as a whole.

Table *2*: Examples of best practices per process-level (GreenSCOR version 9.0)

SCOR process level			Best Practise
Level 1	**Level 2**	**Level 3**	
Plan	P1		Measure environmental impacts of the supply chain
		P1.1 P1.2	Consider environmental impacts when identifying requirements
		P4.3 P4.4	Maximize load size; minimize transportation runs
Source	S1		Select suppliers with active EMS systems
		S1.3	Monitor product environmental compliance (including packaging)
		S1.4	Utilize high fuel efficiency vehicles
Make		M1.3	Implement pollution prevention program
		M1.4	Use recyclable packaging
		M1.6	Implement hazardous materials "pharmacy" system
Deliver		D1.3	Establish spill controls
		D1.3	Include environmental costs in inventory carrying cost
		D1.7	Select carriers that have not violated environmental laws
Return		DR1.1	Avoid returns beyond economic repair

The GreenSCOR model incorporates warehousing in the design of the supply chain but do not focus on the processes and sub-processes that are part of warehousing itself. The SCOR principals will be used to customize the 3PL GreenSCOR model to incorporate warehousing principles. It is proved by numerous companies that by implementing green supply chain practises supply chain efficiency as well as environmental impacts can be improved. The Customized GreenSCOR model will enable this. Included in Annex A is Figure 10 of sub-processes (GreenSCOR level 4) within the 3PL logistics operations.

There are various strategic environmental metrics that can be added to the SCOR Model to effectively allow the SCOR Model to be used as a framework for environmental accounting. The proposed metrics are listed in the table below:

Table 3: Environmental Footprint Metrics (GreenSCOR, Supply Chain Council, 2008)

Metric	Units	Basis
Carbon Emissions	Tons CO_2 Equivalent	This is the unit of measure currently used for green house gas emissions and is a measure of the climate impact from CO2 and other global warming air emissions.
Air Pollutant Emissions	Tons or kg	This would include emissions of major air pollutants (COx,SOx,NOx) Volatile Organic Compounds (VOC) and Particulate.
Liquid Waste Generated	Tons or kg	This includes liquid waste that is either disposed of or released to open water or sewer systems (these emissions are generally listed on water emissions permits).
Solid Waste Generated	Tons or kg	The total solid waste generated by the process.
% Recycled waste	Percent	The percent of the solid waste that is recycled.

These five metrics can be measured for each of the SCOR Level 3 processes and then summed to create a Level 2 and Level 1 metric. The metrics which are not available by SaPA will be obtained by:

- Emissions factors developed by environmental agencies.
- Monitoring Programs.
- Common Documents - Regulatory Reports, Waste shipping documents, Environmental permits, etc (GreenSCOR, Supply Chain Council. 2008).

2.3.3. Benefits of GreenSCOR

According to Cash and Wilkerson (2003), the implementation of the GreenSCOR results in these three primary benefits:

Improved green management

The main goal of GSCM is to analyse a specific supply chain to identify opportunities to lower carbon emission. GreenSCOR makes it possible to do so by identifying supply chain best practises. Environmental management benefits by from GreenSCOR by being able to track certain environmental impacts to certain logistical operations.

Improved SCM performance

Implementing green best practises directly translates into improved SCM. Best practises and a clear set of metrics given by GreenSCOR simplify the process of improving the efficiency of a supply chain.

Improved GSCM

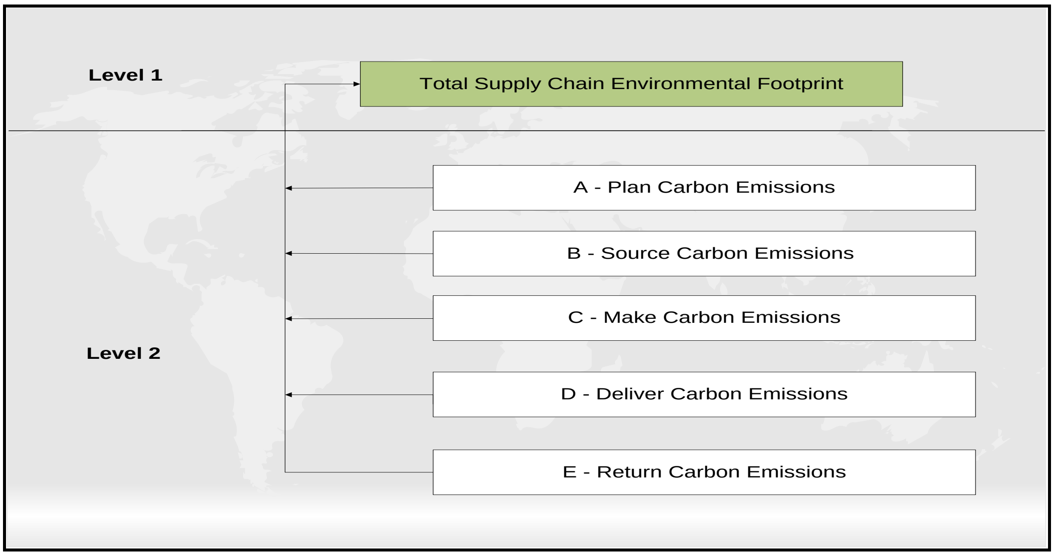
By implementing environmental best practises into the supply chain the impact of environmental factors becomes more visible. As environmental SCM improves, performance improves, operations efficiency is enhanced, and improved client satisfaction improves.

Using the GreenSCOR Model as an environmental measuring framework has additional benefits as well. Firstly the framework clearly ties the various emissions to the originating processes. This provides a structure for not just measuring performance, but identifying where action can be taking to improve the performance of SaPA and their clients. Secondly the hierarchal nature of the GreenSCOR Model allows for strategic environmental footprint goals to be easily translated to targets in specific activities. Likewise, when strategic goals are not being met, the framework provides a structure for root cause analysis (GreenSCOR, Supply Chain Council. 2008).

2.3.4. GreenSCOR Metric Structure

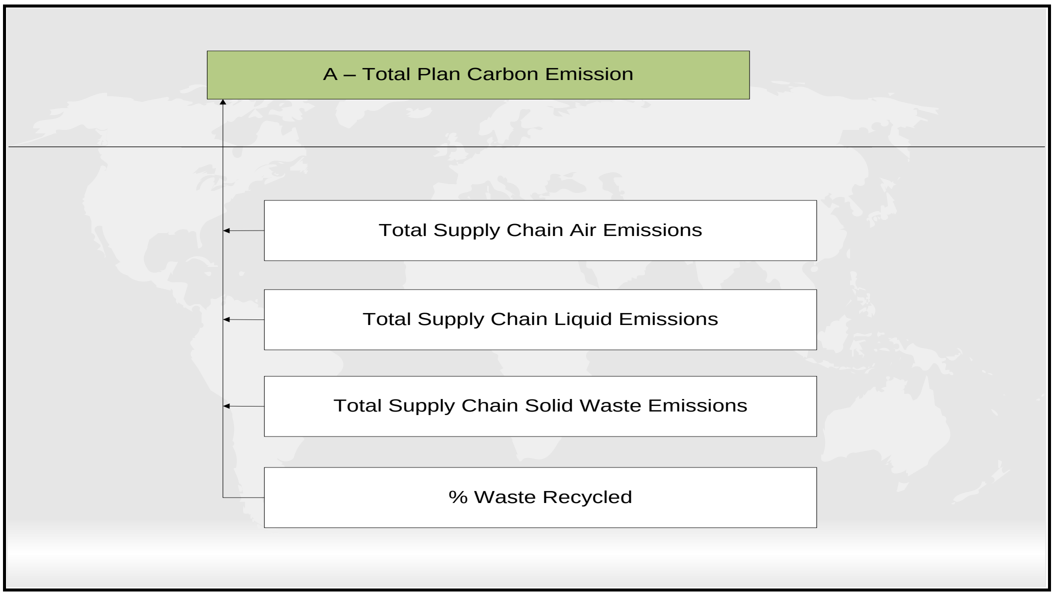
As illustrated in figure 6. The total supply chain carbon footprint is the sum of the carbon equivalent emissions associated with the SCOR Level 2 processes: Plan, Source, Make, Deliver, and Return.

Figure 6: Hierarchical Metric Structure (GreenSCOR, Supply Chain Council, 2008)



Within each building block (A-E) the environmental footprint metrics defined in Figure 7 are accumulated to form the total environmental footprint per building block. Percentage of waste recycled are subtracted from the solid waste generated when calculating the total supply chain environmental footprint.

Figure 7: Environmental Metric Factors for Building Blocks A-E



CHAPTER 3: DATA COLLECTION

The following three section points are the main areas where emissions occur and data is thus collected for these three phases of a service life-cycle. Within the metric structure discussed in Figure 5 these are the main emission factors and most attention will be given to them in this section. All conversion factors and usage data are sourced from DEFRA, Eskom, SA Water online and SaPA's annual carbon footprint analysis for the Gauteng region. All input data in terms of emissions and usage are from data accumulated during SaPA's financial year (1July 2010-31June2011). The results obtained in this section will be used to configure the model (GREENTool) at a later stage.

3.1. HANDLING EMISSION FACTORS

All handling operations within the 3PL service are done by hand and forklifts.

Table 4: Environmental Metrics Related to Handling Factors.

Forklifts-LPG			CO_2	CH_4	N_2O	Total Direct GHG	Usage/Generation per year	Total Direct GHG	38460 cubes(80% utilization)*
Metric	**Units**	**x**	**kg CO_2 per unit**	**kg CO_2e per unit**	**kg CO_2e per unit**	**kg CO_2e per unit**	**Units**	**Total kg CO_2e per year**	**Total kg CO_2e per cube**
Carbon & Air Pollutant Emissions	Litres	**x**	1.4902	0.0006	0.0012	1.4920	14877	22196.5	0.6
Liquid Waste Generated	Kilolitres	**x**	1.7807	0	0	1.7807	3.9	7	0.0
Unit 1							80093.0	80093.0	2.1
Solid Waste Generated	Kg	**x**	1**	0	0	1			
Unit 2							83 088	83 089	2.2
Recycleble Waste	Kg	**x**	1**	0	0	1	-34216.4	-34582.8	-0.9
Total Evironmnetal Footprint/Cube processed								**Unit 1**	**1.8**
								Unit 2	**1.9**

Assumptions/Notes:

**Of the total warehousing space available, it is assumed that both Unit 1&2 are 80% utilized at all times.*

***According to the GreenSCOR model 1Kg waste generated = 1Kg CO2e.*

From the above figure it can be seen, that the environmental footprint for every pre-defined cube to move from where cargo is received at the receiving dock to the where trucks are loaded at the dispatch dock is: Unit 1- **1.8 CO_2e** & Unit 2-**1.9 CO_2e.**

3.2. Warehousing Emission Factors

The warehousing procedure for each client differs and thus the warehousing emissions factors are broken down to total kg CO_2e per cube per day (CO_2e/cube/day). It will thus be possible to calculate the warehousing emissions factor per client on a day to day basis depending on what the client's warehousing requirements are.

Table 5: Environmental Metrics related to Warehousing

Warehousing				CO_2	CH_4	N_2O	Total Direct GHG	Usage/Generation per year	Total Direct GHG			80% utilization*
Metric		**Units**	**x**	**kg CO_2 per unit**	**kg CO_2e per unit**	**kg CO_2e per unit**	**kg CO_2e per unit**	**Units**	**Total kg CO_2e per year**	**Total kg CO_2e per day**	**Capacity (Cubes)**	**Total kg CO_2e/cube/day**
Carbon & Air Pollutant Emissions	**Unit 1**	kWh	x	1.03	0	0	1.03	643935.5**	663253.6	1817.133	38460	**0.0472**
	Unit 2	kWh	x	1.03	0	0	1.03	643935.5	663253.6	1817.133	38460	**0.0472**
	Coolroom	kWh	x	1.03	0	0	1.03	131400***	135342	370.8	343	**1.0810**
	Freezer	kWh	x	1.03	0	0	1.03	87600****	90228	247.2	75	**3.2960**
Liquid Waste Generated	**Unit 1**	Kilolitres	x	1.7807	0	0	1.7807	50*****	89.035	0.2439	38460	**0.00**
	Unit 2	Kilolitres	x	1.7807	0	0	1.7807	50	89.035	0.2439	38460	**0.00**
	Coolroom	Kilolitres	x	1.7807	0	0	1.7807	5	8.9035	0.0244	343	**0.00**
	Freezer	Kilolitres	x	1.7807	0	0	1.7807	5	8.9035	0.0244	75	**0.0003**
Solid Waste Generated	**Accounted for in material handling.**											
Recycleble Waste	**Accounted for in material handling.**											

<u>Assumptions/Notes:</u>

**All four warehousing spaces (Unit1&2, cool room, freezer) are 80% utilized at all times.*

***The total electricity usage for the previous financial year of SaPA was 1 883 589 kWh, it is assumed that 80% are allocated to the 2 main warehousing units. The cool room and freezer are separated from unit 2 in this regard.*

****The assumption is made that the cool room uses 15 000 Watt engines. 15000W x 24hours/day x 365days/1000=131 400 kWh/year*

***** The assumption is made that the freezer room uses 10 000 Watt engines. 10 000W x 24hours/day x 365days/1000=87 600 kWh/year*

*****50 000 Liters of water are used annually to wash both Unit 1&2 (no chemicals are added to the water)*

3.3. Distribution Emission Factors

As previously mentioned, the distribution of all 3PL goods are done by an outsourced company that serves only SaPA, and thus the distribution emissions factors are considered in calculating a client's environmental performance.

Table 6: Vehicle Constraining Factors

Vehicle	Distribution Constraining Factors		
	Volume Capacity (m^3)	Cube Capacity (Cubes)	Maximum Payload (Kg)
1-ton	4	3	1000
4-ton	16	12	4000
8-ton (closed body)	47	36	8000
8-ton (open body)	49	37	8000
18-ton (open body)	102	77	18000

Table 7: Environmental metrics related to distribution by diesel trucks

Distribution-Diesel Trucks					CO_2	CH_4	N_2O	Total Direct GHG	Km/Litre Consumed	Total Direct GHG		
Metric	Vehicle	Truck %-Utilized*	Units	x	kg CO_2 per unit	kg CO_2e per unit	kg CO_2e per unit	kg CO_2e per unit	Kilometre	Total kg CO_2e per Km	Capacity (Cubes)	Total kg CO_2e/cube/Km**
Carbon & Air Pollutant Emissions	1-ton	0	Litres	x	2.6413	0.0015	0.0292	2.6720	10.04	0.266135	3	**0.0887**
		100							8.8	0.303636		**0.1012**
	4-ton	0	Litres	x	2.6413	0.0015	0.0292	2.6720	5.08	0.525984	12	**0.0438**
		100							4.33	0.61709		**0.0514**
	8-ton(open)	0	Litres	x	2.6413	0.0015	0.0292	2.6720	5.08	0.525984	36	**0.0146**
		10							4.33	0.61709		**0.0171**
	8-ton(closed)	0	Litres	x	2.6413	0.0015	0.0292	2.6720	5.08	0.525984	37	**0.0142**
		100							4.33	0.61709		**0.0167**
	18-ton(open)	0	Litres	x	2.6413	0.0015	0.0292	2.6720	3.43	0.779009	102	**0.0076**
		100							2.38	1.122689		**0.0110**
Liquid Waste Generated	Liquid Waste Generation Occur when vehicles are washed, distribution are outsourced and thus this figures are not available											
Solid Waste Generated	Accounted for in material handling.											
Recyclable Waste	Accounted for in material handling.											

Assumptions/Notes:

**The trucks are either 100% utilized on delivery of 0% utilized on return, the utilization per client are described as a percentage of the cube capacity in the following chapters.*

*** CO_2e are calculated per cube per km for each vehicle option. Example: 10km is travelled with a 4-ton truck, 7 cubes of client 1, 5 cubes of client 2. Client 1: (10km x 7cubes x (0.0438+0.0514) = 66.64 kg CO_2e for the delivery and return trip.*

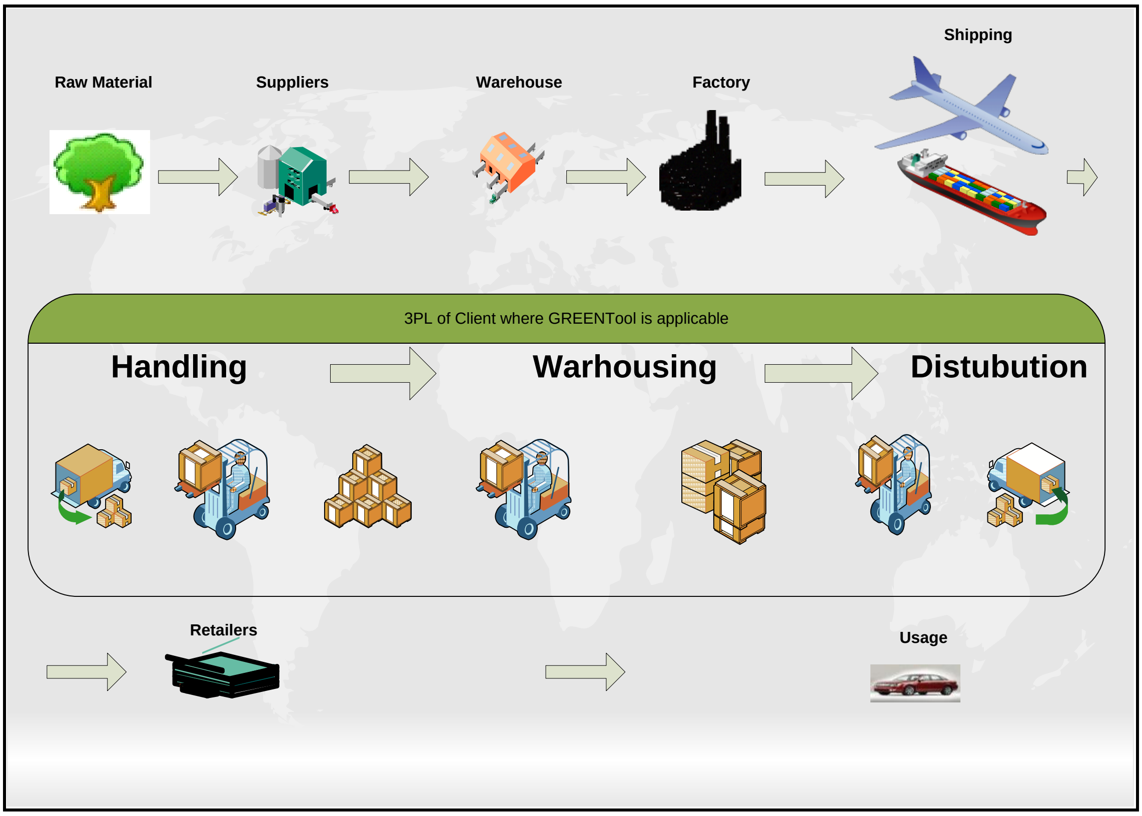
CHAPTER 4: MODEL CONFIGURATION-'SAPA GREENTOOL'

4.1. INTRODUCTION TO THE SAPA GREENTOOL

In order to gain visibility of the environmental performance of a client's supply chain, the development of an ''**GREENTool**'' (environmental performance measurement model) is necessary. A tool is developed based on the students own methodology and the GreenSCOR model as previously discussed is used as a guideline.

The student will focus on the effects from handling, warehousing and distribution by using inputs from historical data, carbon footprint reports, emissions factors developed by environmental agencies and monitoring programs. The ideal output for the model will be to calculate the environmental performance per client, per warehouse, per process within the GreenSCOR model. As can be seen in the figure below, the GREENTool only applies to the small part of the supply chain for which SaPA is responsible.

Figure 8: Client Specific Supply Chain with GREENTool Applicable area.



4.2. Application of the 'GREENTool' via a case study

With data collected in Chapter 3 it will be possible to calculate the environmental performance of any 3PL client by using the generic model with the GreenSCOR model as reference.

4.2.1. Case Study

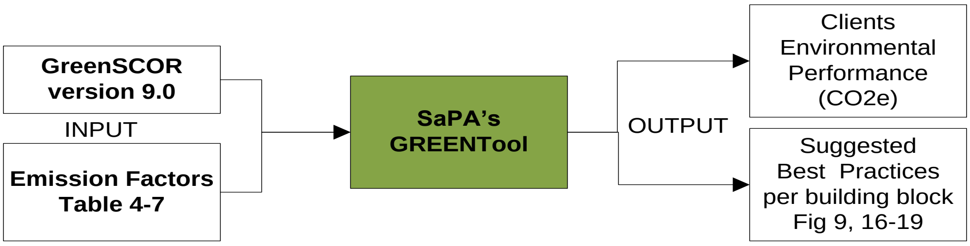
Challenge:

A global pharmaceutical leader approaches SaPA with a request for support in identifying and calculating the environmental performance within their supply chain. The calculation needs to be done where SaPA is in control of the client's logistic operations as indicated in Figure 8.

Solution:

In order to gain visibility of the environmental emissions within a Client's supply chain, the GREENTool will be used. The GREENTool focuses on the effects from **transportation**, **warehousing** and **handling**. As input, real historical data from the XYZ Pharmaceuticals Warehousing Account are used. To show the versatility of the model, some assumptions and adoptions will be made. An assumption is made that all goods received in a year are also again shipped in that year; thus all data are populated for one year.

Figure 9: Input & Output of case study



4.2.2. Client Data

The case study will be done on the operations of a pharmaceutical company. To stay within the confidentiality agreement, the company is called XYZ Pharmaceuticals. XYZ Pharmaceuticals is chosen because of its information availability and the large extent to which warehouses are utilized by them. All data are converted to a monthly average. Thus the output of the model is average monthly environmental emissions. Data collection sections include: Inbound shipment data, Warehousing data, Distribution orders data, Vehicle selection data and Delivery distance data.

Table 8: XYZ Pharmaceuticals Logistic operations data

XYZ Pharmaceuticals Warehousing Account															
	Inbound Shipment		Warehousing				Distribution Orders		Vehicle Selection					Delivery Distance	
Month	Volume (m^3)	Cube Quantity	Unit 1	Unit 2	Cool Room	Freezer	Volume (m^3)	Cube Quantity	1-ton	4-ton	8-ton(closed)	8-ton(open)	18-ton	AVG DELIVERY Distance (Km)	AVG RETURN Distance (Km)
Jan	6057.48	4589	2831	1611	85	9	2623	1987	2	3	15	13	12	15.2	15.9
Feb	4711.08	3569	2202	1253	66	7	6057	4589	0	8	20	25	37	16.9	22.6
Mar	7641.48	5789	3572	2032	107	12	6765	5125	3	8	25	26	41	15.2	20.2
Apr	6031.08	4569	2819	1604	85	9	7521	5698	2	11	24	25	49	14.5	14.2
May	8610.36	6523	4025	2290	121	13	8253	6252	0	13	29	20	56	19.5	18.5
Jun	5621.88	4259	2628	1495	79	9	5970	4523	2	8	18	25	37	12.6	19.2
Jul	8610.36	6523	4025	2290	121	13	7859	5954	0	14	28	21	52	22.8	18.9
Aug	6031.08	4569	2819	1604	85	9	7422	5623	0	2	28	18	51	19.4	14.2
Sep	6879.84	5212	3216	1829	96	10	5941	4501	0	2	28	18	51	12.6	15
Oct	5621.88	4259	2628	1495	79	9	6067	4596	2	3	15	19	43	15	20.2
Nov	6021.84	4562	2815	1601	84	9	5577	4225	0	1	14	17	40	15	15
Dec	2620.2	1985	1225	697	37	4	4402	3335	2	1	9	6	36	15	14
TOTAL	74458.56	56408	34804	19799	1044	113	74459	56408	13	74	253	233	505	194	208
AVG	**11455.16308**	**4701**	**2900**	**1650**	**87**	**9**	**6205**	**4701**	**1**	**6**	**21**	**19**	**42**	**16**	**17**

The average amount of Cubes received as Inbound Shipment per month.

The average amount of cubes per storing - space per month.

The average amount of Cubes distributed as Distribution Orders per month.

Vehicle usage average per month.

The average distance travelled to and from the Client.

4.2.3. Results

Table 9: Total monthly emissions from handling

Handling			
Storing Space	AVG Cubes Handled/Month	Total CO_2e per cube (Kg)	Total CO_2e/month (Kg)
Unit 1	2900	1.8	5220
Unit 2	1650	1.9	3135
Cool Room	87	1.9	165.3
Freezer	9	1.9	17.1
			8537.4

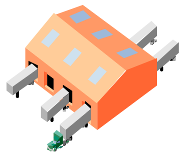
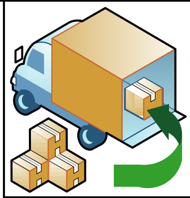
Table 10: Total monthly emissions from warehousing

Warehousing				
Storing Space	AVG Cubes stores/Month	Total CO_2e per cube per day(Kg)	Total CO_2e per cube per month(Kg)	Total CO_2e/month
Unit 1	2900	0.0472	1.416	4106.4
Unit 2	1650	0.0472	1.416	2336.4
Cool Room	87	1.081	32.43	2821.41
Freezer	9	3.296	98.88	889.92
				10154.13

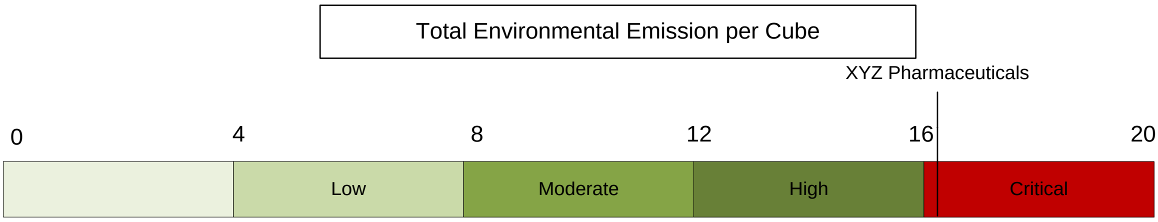
Table 11: Total monthly emissions from distribution

Distribution									
Vehicle	Truck % - Utilized	Cube Capasity (Cubes)	AVG DELIVERY Distance (Km)	AVG RETURN Distance (Km)	AVG Amount of trips/Month	AVG Km Travelled/ Month (Km)	Cubes Transported /Month	Total kg CO_2e/cube/ Km	Total CO_2e/Month
1-ton	0	3	16	17	1	17	3	0.0887	4.5237
	100					16		0.1012	4.8576
4-ton	0	12	16	17	6	102	72	0.0438	321.6672
	100					96		0.0514	355.2768
8-ton(closed)	0	36	16	17	21	357	756	0.0146	3940.4232
	100					336		0.0171	4343.6736
8-ton(open)	0	37	16	17	19	323	703	0.0142	3224.3798
	100					304		0.0167	3568.9904
18-ton	0	77	16	17	42	714	3234	0.0076	17548.9776
	100					672		0.011	23905.728
									57218.498

Table 12: Total monthly environmental emission of XYZ Pharmaceuticals

	Total Environmental Emission (CO_2e-Kg)			
				
	Handling	Warehousing	Distribution	TOTAL
CO_2e-Kg/month	8537.4	10154.13	57218.4979	**75910.03**
%	11.2	13.4	75.4	**100**
CO_2e-Kg/Cube	1.82	2.16	12.17	**16.15**

Critical emission factors

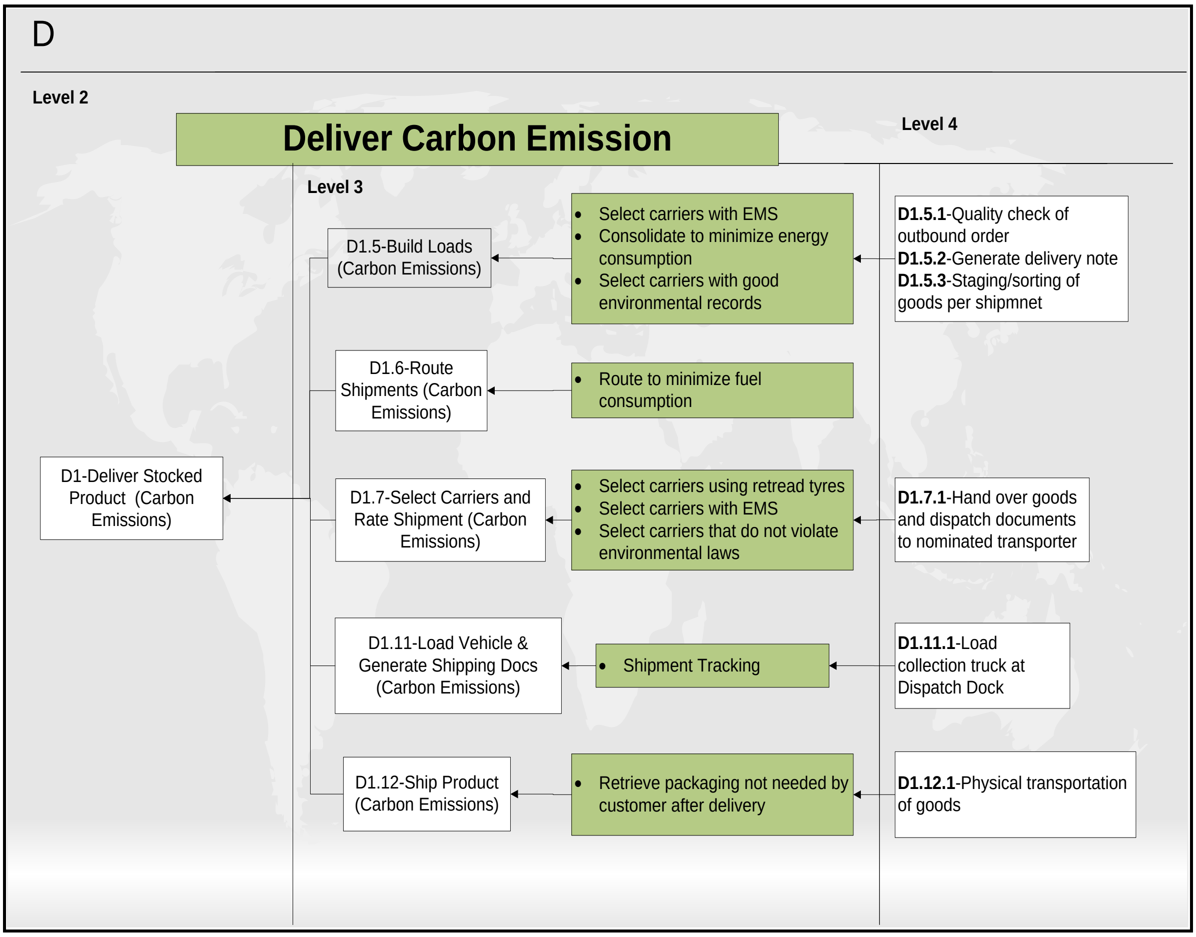


4.2.4. Identification of Improvement Opportunities

Within each GreenSCOR building block there are various industry related best practices for certain Level 2 and Level 3 GreenSCOR processes in the supply chain of each client. In the following Figure the suggested best practice are shown as a green input into each applicable process or sub-process. In the results section it can be seen that the critical emissions factors are mainly from the distribution of goods. Illustrated in Appendix A, distribution of goods is part of the deliver building block of SCOR. Thus the best practices suggested in Figure 9 below will be ranked highest in terms of importance.

After the best practices suggested in Figure 9 have been addressed, best practices in Figures 16-19 should be addressed according to importance ranking.

Figure 10: Best practices related to the Deliver-Process (GreenSCOR, Supply Chain Council, 2008)



According to the reference model in the figure above, the most important best practices to consider are:

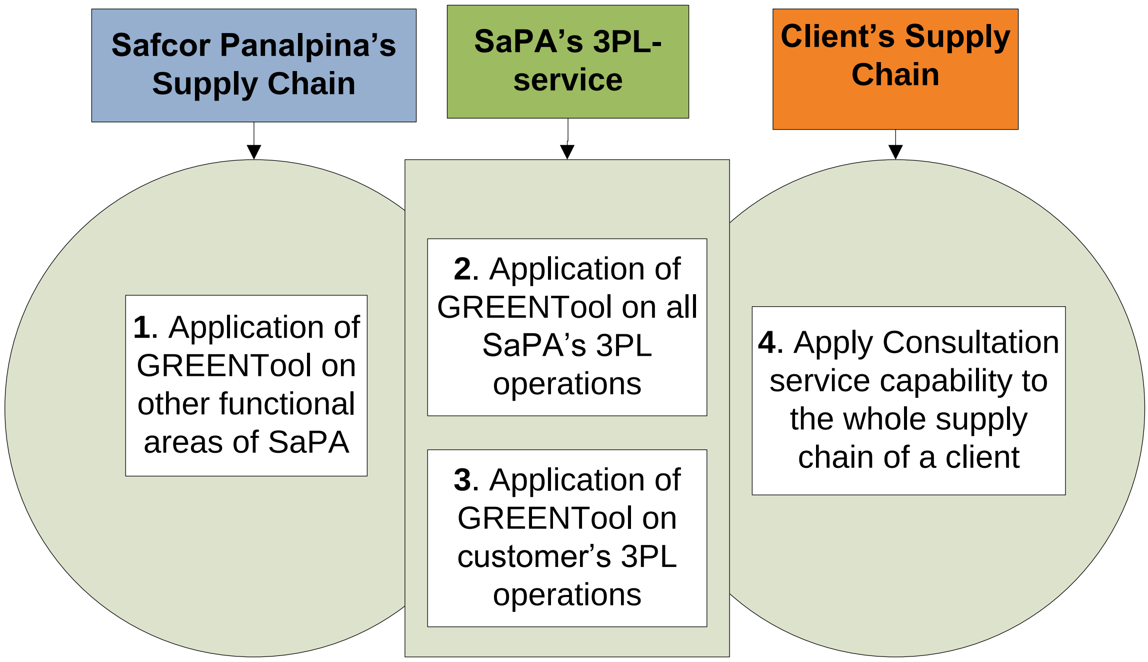
Table 13: Most Important Best Practices Applicable

	Best Practise	Description/Definition	Process
1	Select carriers w ith EMS	Select carriers that have adopted an EMS or otherw ise demonstrated environmental commitment	D1.5, D1.7
2	Consolidate to minimize energy consumption	Consolidate to minimize fuel/energy consumption	D1.4
3	Select carriers w ith good records	Select carriers w ith good environmental records	D1.5
4	Route to minimize fuel consumption	Route to minimize fuel consumption	D1.6
5	Select carriers using retread tires	Select carriers using retread tires	D1.7
6	Select complaint carriers	Select carriers that have not violated environmental law s	D1.7
7	Shipment Tracking	Shipment Tracking to measure shipment	D1.11
8	Retrieve packaging after delivery for re-use	Retrieve packaging after delivery	D1.12

CHAPTER 5: FUTURE WORK

5.1. RECOMMENDATIONS

Figure 11: Scope of Recommendations



1. **Application of GREENTool on other functional areas of SaPA.**

   It is suggested that supply apply the developed tool to other parts of its business activities. For example:

   - On the de-grouping department.
   - On other warehouses throughout the country.

2. **Application of GREENTool on all SaPA's 3PL operations**

   The application of the GREENTool on all 3PL operation will allow SaPA to:

   - Calculate total warehousing emission, total handling emission and total distribution emission of SaPA 3PL operations
   - Define critical emission factors.
   - Apply industry related best practices to reduce the total emission.

3. **Application of GREENTool on customer's 3PL operations**

   As it was illustrated in the case study in Chapter 4, application of the GreenTOOL allows:

   - SaPA to give client specific emission data.
   - SaPA to offer a 'greener' service at a lower price.

- The customer to measure their supply chain's total environmental footprint, from a raw material stage to the products final usage.

4. **Develop a Consultation capability to apply to the whole supply chain of clients.** The steps of the proposed consultancy service (SAFGreen®) is discussed in detail in Section 5.2

5.2. Greening Initiatives

Table 14 below is adopted from a report that presents the finding from the 2008, 13th Annual Third Party Logistics Study, which tracks the opinions and experiences of users of third-party logistics (3PL) services across the globe, is a table included below. The percentages in the headings are indications of the amount of people that agree with the statement. In the right-hand column is the importance ranking (most important=1, least important=9) of the different greening initiatives.

Table 14: Important ranking of internal greening initiatives

Solutions Area Actions	**Overall**		
	Critically Important (%)	**My 3PL Currently Performs (%)**	**Importance Ranking**
Improving transportation efficiency, and thereby reducing environmental emissions, through effective shipment consolidation, routing, and mode selection	77	31	2
Reducing the use of non-recyclable packaging materials	53	15	3
Managing energy efficient distribution centres	50	15	4
Improving transportation and/or dock scheduling to reduce the environmental emissions associated with demurrage	49	22	5
Providing consultative advice with regards to measuring and improving clients environmental performance	**79**	**8**	**1**

Using alternative fuels, such as liquefied petroleum gas or compressed natural gas, to reduce greenhouse gas emissions	47	8	6
Facilitating reverse logistics processes to recover wasted materials (SCOR-Return)	46	19	7
Providing effective inventory management system that reduces the need for small sized expedited shipments	43	15	8
Use of hybrid electric vehicles (internal combustion engine / electric motor powered by a rechargeable battery)	40	8	9

These are the main industry related solutions to move towards greener operations. These recommendations are independent of best practices suggested by the GreenSCOR model and are only internally applicable to Safcor Panalpina's logistical operations. Specific activities can be used to translate environmental goals into specific greening initiatives. To implement recommendations a tradeoff between financial and environmental impact is necessary. Attached in Appendix C is the environmental policy of SaPA. To adhere to these commitments, the practical suggested solutions above serve as pro-active actions to meet these commitments.

5.3. Consultancy Service - SAFGreen®

To move towards greener operations, it is suggested that Safcor Panalpina develop a consultancy services on different parts of a clients supply chain. It is suggested that SaPA invest in adding a service to their service basket be able to offer clients expert advice on:

- **Environmental Footprint Analysis**
- Network optimization (incl. intermodal)
- Route optimization

To stay within the scope of this project, focus will only be on the steps of Environmental Footprint Analysis as a consultancy service.

5.3.1. Consultancy Service Objectives

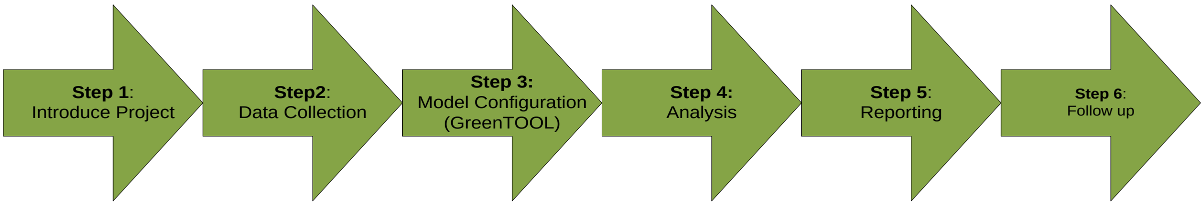
The objectives of the consultancy service include:

- Facilitation of the environmental goals of SaPA's clients.
- Building internal capabilities to position SaPA as the leader of green-focussed incentives amongst competition.
- Making sustainable business decisions.
- Documentation of green initiatives and results to serve as a marketing tool.
- Continuous research to stay informed on regulations and market trends.
- Positioning SaPA to adhere to industry needs, government compliance and client demand.

5.3.2. Consultancy Steps

The following six steps are introduced to facilitate the environmental footprint analysis.

Figure 12: Steps of proposed consultation capability (SAFGreen®)



Step 1 - Introduce Project

The first step will focus on customizing a framework in which the analysis will take place. The following activities are considered important for introduction:

- Identification and nomination of key team members, project stakeholders and project sponsors - Safcor Panalpina has different role players for each client to offer the 3PL service.
- Alignment with other green initiatives already in place in the Client's organization.
- Agreement on the scope of the study and the level of detail the study.
- Milestone planning and planning of all activities for which the Client is required.

Step 2 - Data Collection

This step will consist of collecting an accurate set of data applicable to the customer. The following activities will contribute to Step 2:

- Indentify sources of equivalent CO_2 emissions in the Client's logistics operations (Handling, Warehousing and Distributions).

- Collect operational data from various sources in SaPA (Route maps, fleet programs, contract description)
- Check accuracy of the data.
- Validate data with client.

Step 3 - Model Configuration

This step focuses on applying the generic GREENTool (Chapter 4) to a client's specific case. The following steps will contribute to ensure a personalized calculation per client:

- Create a specific version of the GREENTool adapted to the specific requirements of the Clients Supply Chain requirements.
- Adapt the scope decided upon in Step 1.
- Adapt the level of detail decided upon in Step 1.
- Compile a list of necessary assumptions.
- Validate the assumptions and the version of the tool with the Client's specific requirements.

Step 4 - Analysis

This step will focus on interpreting the results of the calculation of equivalent CO_2 emissions performed by the GREENTool. The following activities will form part of the analysis phase:

- Identify the main source of emissions of the client's 3PL specific logistic operations.
- Make a comparison between different clients, different transport methods, different carriers, etc.
- Perform a sensitivity study of the results, data and parameters.
- Identify improvement opportunities to reduce the client's logistic environmental footprint by considering relevant best practices given by the Supply Chain Council on GreenSCOR process activities.
- Validate analysis outcomes.

Step 5 - Reporting

This step will focus on building the report presenting a client's environmental performance. The following activities are part of the reporting phase:

- Compose a detail environmental emissions report.
- List deliverables designed to consider the purpose of the study.

- Report on reasons for study (ranging from: identifying improvement opportunities, stakeholders demand and preparation for future regulation).
- Aligning the report to completed other initiatives of the specific client.

Step 6 - Follow Up

This step will focus on how client should continuously move towards greener their operations. The following steps will depend on the initial objective of the Client:

- If the Client wants to materialize the improvement opportunities by implementing the best practices suggested, the next phase will be to set up a migration plan.
- If the Client only wants to report on it logistic emissions, the next step will be to conduct the carbon footprint analysis annually.
- If the Client wants to expand its carbon footprint analysis to other parts of its supply chain, the next step will be to offer an expanded consultancy service to deal with a clients supply chain as a whole.

5.4. Conclusion

There are various methods, tools and techniques that companies can use to re-design their business practices towards more sustainable operations. It is found in this project that redesigning any aspects of environmental stewardship, it is firstly necessary to find a customized model to make any worthwhile contribution to sustainability. Environmental policies without a pro-active involvement from all relevant stakeholders will in the near future not be sufficient. Secondly it is important to address the fact that environmental awareness and profitability of a company needs to go hand in hand. Environmental performance measurement can not only be used as a marketing tool, but also as way to save money by adhering to current and future regulations.

To address the environmental performance of Safcor Panalpina and their clients, a customized tool was developed to measure and improve the environmental emission factors of 3PL logistics activities. The tool developed is based on the Supply Chain Operations Reference model and is called the 'SaPA GREENTool'. To show the capabilities of the developed tool, it was applied to a pharmaceutical company's 3PL logistics operations. An importance ranking of possible future work was introduced, where a consultancy capability was suggested as a further service offering of Safcor Panalpina. The student believe that by building internal capabilities like this it will position SaPA as the leader of green-focused incentives, which will ultimately lead to SaPA being the largest 3PL service provider in South Africa.

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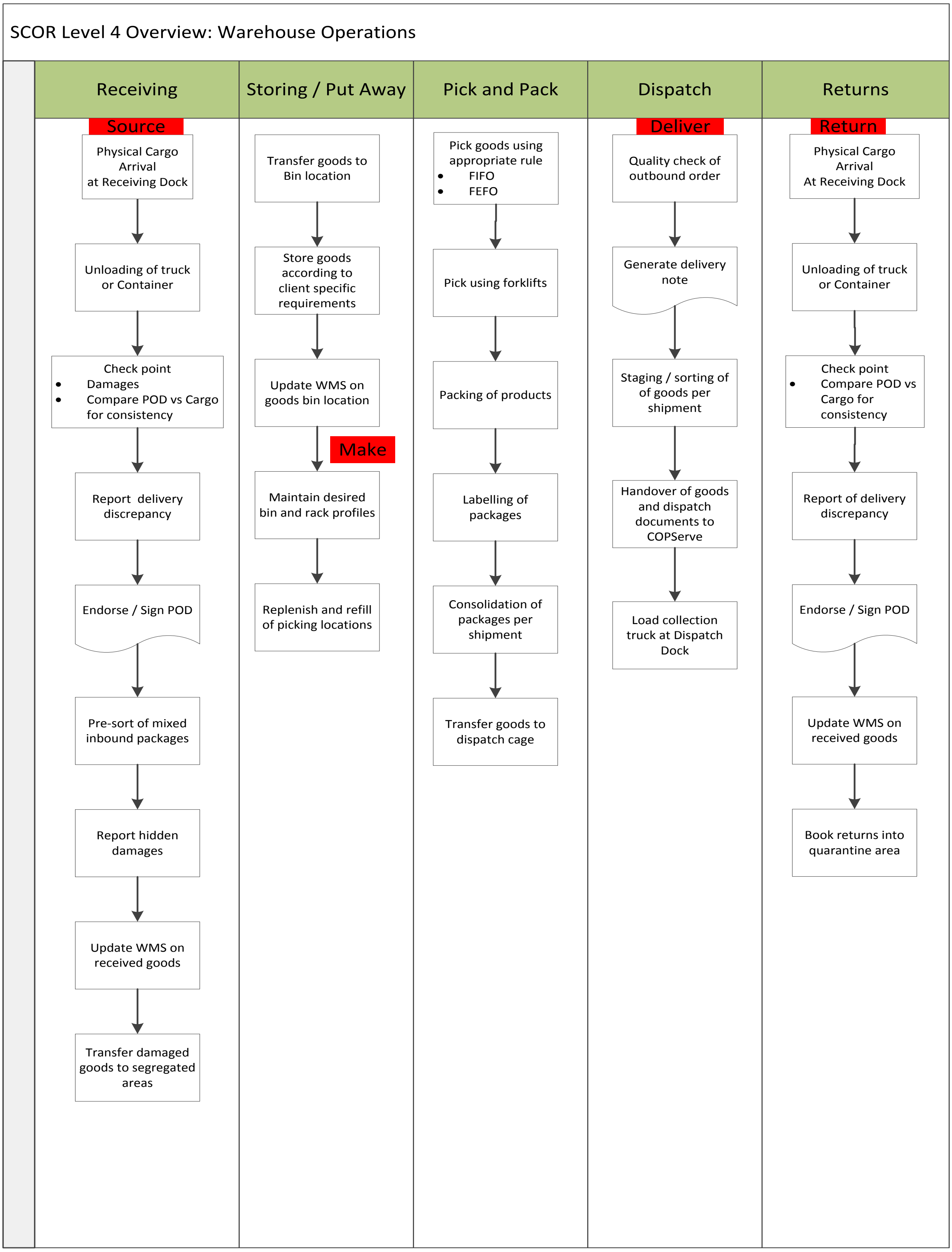
APPENDIX A

Figure 13: Fourth level SCOR processes within SaPA's 3PL logistic operations



APPENDIX B - SCOR PROCESSES DEFINED

Figure 14: PLAN-Definitions

Process	Sub Process	Definition
P1 Plan Supply Chain		The development and establishment of actions to be taken over specified time periods that represent a projected appropriation of 3PL requirements to meet 3PL resources.
	P1.1 Identify, Prioritize and Aggregate Supply Chain Requirements	The process of identifying, aggregating and prioritizing the demand for the 3PL service of. A forecast of the amount of clients depicts the service that needs to be offered.
	P1.2 Identify, Prioritize and Aggregate Supply-Chain Resources	The process of identifying, prioritizing and aggregating all sources of the 3PL service that is required to accommodate the products at the service level.
	P1.3 Balance Supply Chain Resources with SC Requirements	The process of identifying and measuring the gaps between the requirements and resources in order to determine how best to resolve the variance though plans or actions to optimize the 3PL service.
	P1.4 Establish & Communicate Supply-Chain Plans	To establish and communicate the course of action to be taken over time, representing a projected appropriation of 3PL resources to meet resource requirements.
Process	**Sub Process**	**Definition**
P2 Plan Receiving		The development and establishment of actions over time to that represent a projected appropriation of product to receive to meet customer demands.
	P2.1	The process of identifying, prioritizing and

	Identify, prioritize and aggregate receiving requirements	aggregating all products to be received at the warehouses.
	P2.2 Identify, asses and aggregate receiving resources	The process of identifying and considering all resources to be used to accommodate receiving.
	P2.3 Balance receiving resources with receiving requirements	The process of developing a course of action that commits the receiving resources to meet the receiving requirements.
	P2.4 Establish receiving plans	The establishment and communication of actions over time that represent a project appropriation of warehouse resources to meet receiving requirements.
Process	**Sub Process**	**Definition**
P3 Plan Make		The development and establishment of courses of action over specified time periods that represent a projected appropriation of production resources to meet production requirements.
	P3.1 Identify, Prioritize and Aggregate Production Requirements	The process of identifying, prioritizing, and considering as a whole with constituent parts, all sources of demand in adding to a product or service.
	P3.2 Identify, Assess and Aggregate Production Resources	The process of identifying, evaluating, and considering, as a whole with constituent parts, all things that add value in the creation of a product or performance of a service.
	P3.3 Balance Production Resources with Production	The process of developing a time-phased course of action that commits creation and operation resources to meet creation and operation requirements.

	Requirements	
	P3.4 Establish Production Plans	The establishment of courses of action over specified time periods that represent a projected appropriation of supply resources to meet production and operating plan requirements.
Process	**Sub Process**	**Definition**
P4 Plan Deliver		The development and establishment of courses of action over specified time periods that represent a projected appropriation of value adding resources to meet production requirements.
	P4.1 Identify, Prioritize and Aggregate Delivery Requirements	The process of identifying, prioritizing, and considering, as a whole with constituent parts, all sources of demand in the delivery of a product or service.
	P4.2 Identify, Assess and Aggregate Delivery Resources	The process of identifying, evaluating, and considering, as a whole with constituent parts, all things that add value in the delivery of a product or service.
	P4.3 Balance Delivery Resources and Capabilities with Delivery Requirements	The process of developing a time-phased course of action that commits delivery resources to meet delivery requirements.
	P4.4 Establish Delivery Plans	The establishment of courses of action over specified time periods that represent a projected appropriation of delivery resources to meet delivery requirements.
Process	**Sub Process**	**Definition**
P5		A strategic or tactical process to establish and

Plan Return		adjust courses of action or tasks over specified time periods that represent a projected appropriation of return resources
	P5.1 Assess and Aggregate Return Requirements	The process of identifying, evaluating, and considering, as a whole with constituent parts, all sources of demand for the return of a product.
	P5.2 Identify, Assess, and Aggregate Return Resources	The process of identifying, evaluating, and consideration for all resources that add value to, execute, or constrain the processes for the return of a product.
	P5.3 Balance Return Resources with Return Requirements	The process of developing courses of action that make feasible the commitment the appropriate return resources and or assets to satisfy return requirements.
	P5.4 Establish and Communicate Return Plans	The establishment and communication of courses of action over specified time periods that represent a projected appropriation of required return resources and or assets to meet return process requirements.

Figure 15: SOURCE-Definitions

Process	Sub Process	Definition
S1 Source Stocked Product		The process of ordering, receiving and transferring bulk items, sub-assemblies, product and or services based on aggregated demand requirements.
	S1.1 Schedule Product Deliveries	Scheduling and managing the execution of the individual deliveries of product against an existing contract or purchase order.
	S1.2 Receive Product	The process and associated activities of receiving product to contract requirements.
	S1.3 Verify Product	The process and actions required determining product conformance to requirements and criteria.
	S1.4 Transfer Product	The transfer of accepted product to the appropriate stocking location within the supply chain. This includes all of the activities associated with repackaging, staging, transferring and stocking product.

Figure 16: MAKE-Definitions

Process	Sub Process	Definition
M1 Make-to-Stock		The process of manufacturing in a make-to-stock environment adds value to products through mixing, separating, forming, machining, and chemical processes.
	M1.1 Schedule	Given plans for the production of specific parts, products, or formulations in specified

	Production Activities	quantities and planned availability of required sourced products, the scheduling of the operations to be performed in accordance with these plans.
	M1.2	The selection and physical movement of sourced/in-process product (e.g., raw materials, fabricated components, subassemblies, required ingredients or intermediate formulations) from a stocking location (e.g., stockroom, a location on the production floor, a supplier) to a specific point of use location.
	Issue Material	
	M1.4	The series of activities that containerize completed products for storage or sale to end-users. Within certain industries, packaging may include cleaning or sterilization. Within certain industries, packaging may include cleaning or sterilization.
	Package	
	M1.5	The movement of packaged products into a temporary holding location to await movement to a finished goods location. Products that are made to order may remain in the holding location to await shipment per the associated customer order.
	Stage Product	
	M1.6	Activities associated with post-value adding documentation, testing, or certification required prior to delivery of finished product to customer.
	Release Product to Deliver	
	M1.7	Activities associated with collecting and managing waste produced during the produce and test process including scrap material and non-conforming product.
	Waste Disposal	

Figure 17: DELIVER-Definitions

Process	Sub Process	Definition
D1 Deliver Stocked Products		The process of delivering product that is sourced or warehoused based on aggregated customer orders, projected orders/demand and inventory re-ordering parameters.
	D1.5 Build Loads	Transportation modes are selected and efficient loads are built.
	D1.6 Route Shipments	Loads are consolidated and routed by mode, lane and location.
	D1.7 Select Carriers and Rate Shipments	Specific carriers are selected by lowest cost per route and shipments are rated and tendered.
	D1.11 Load Vehicle & Generate Shipping Docs	The series of tasks including placing/loading product onto modes of transportation, and generating the documentation necessary to meet internal, customer, carrier and government needs.
	M1.12 Ship Product	The process of shipping the product to the customer site.

Figure 18: RETURN-Definitions

Process	Sub Process	Definition
DR1 Deliver Return Defective Product		The receipt and disposition determination of defective products as defined by the warranty claims, product recall, non-conforming product and/or other similar policies including appropriate replacement.
	DR1.1 Authorize Defective Product Return	The process where the last known holder or designated return centre receives a defective product return authorization request from a customer, determines if the item can be accepted and communicates decision to the customer.
	DR1.2 Schedule Defective Return Receipt	The process where the last known holder or designated return centre evaluates the defective product handling requirements including negotiated conditions and develops a schedule that tells the Customer when to ship the product.
	DR1.3 Receive Defective Product (includes verify)	The process where the last known holder or designated return centre receives and verifies the returned defective product against the return authorization and other documentation and prepares the item for transfer.
	DR1.4 Transfer Defective Product	The process where the last known holder or designated return centre transfers the defective product to the appropriate process to implement the disposition decision.

APPENDIX C - ENVIRONMENTAL POLICY

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ENVIRONMENTAL POLICY

The adoption of responsible environmental business principles and a proactive approach to environmental management are part of sustainable business practices. All corporations, irrespective of their sector, have an impact on the environment and thus need to play a pro-active role in using their spheres of influence to develop economically, environmentally and socially sustainable operations. Safcor Panalpina recognizes its responsibilities in this regard.

Safcor Panalpina commits to:

- *Adhere to or exceed environmental regulations relevant to its operations internationally.*
- *Identify, mitigate and manage the environmental impacts and risks of its products and services.*
- *Optimize consumption of raw materials and energy, and minimize waste through applying a 'reduce, re-use, recycle' philosophy.*
- *Work in partnership with its suppliers, customers and other relevant business partners, within its sphere of influence, to redesign and reduce the environmental impact of products, services and other business activities.*
- *Unlock the creative potential for sustainable solutions by working with employees to embed an environmental consciousness throughout the organization.*
- *Include environmental considerations in its business decisions.*
- *Work with its appropriate government departments, civil society groups and other stakeholders to identify and resolve environmental issues relevant to Safcor Panalpina.*
- *Set measurable targets and timelines.*

Regions and Functions are responsible for staying abreast of environmental best practices relating to their areas of operation and developing innovative solutions to environmental issues. The Safcor Panalpina Environmental Policy is endorsed and supported by the Safcor Panalpina Board and is the responsibility of the Risk Committee. This Committee will oversee the establishment and maintenance of relevant management structures and processes to achieve the objectives of this environmental policy. The policy objectives will be reviewed periodically and, if necessary, updated. The committee will review performance against objectives, which will be reported annually in the Bidvest Sustainability Report.

APPENDIX D - IMPROVEMENT OPPORTUNITIES

Figure 19: Best Practices related to the Plan-Process (GreenSCOR, Supply Chain Council, 2008)

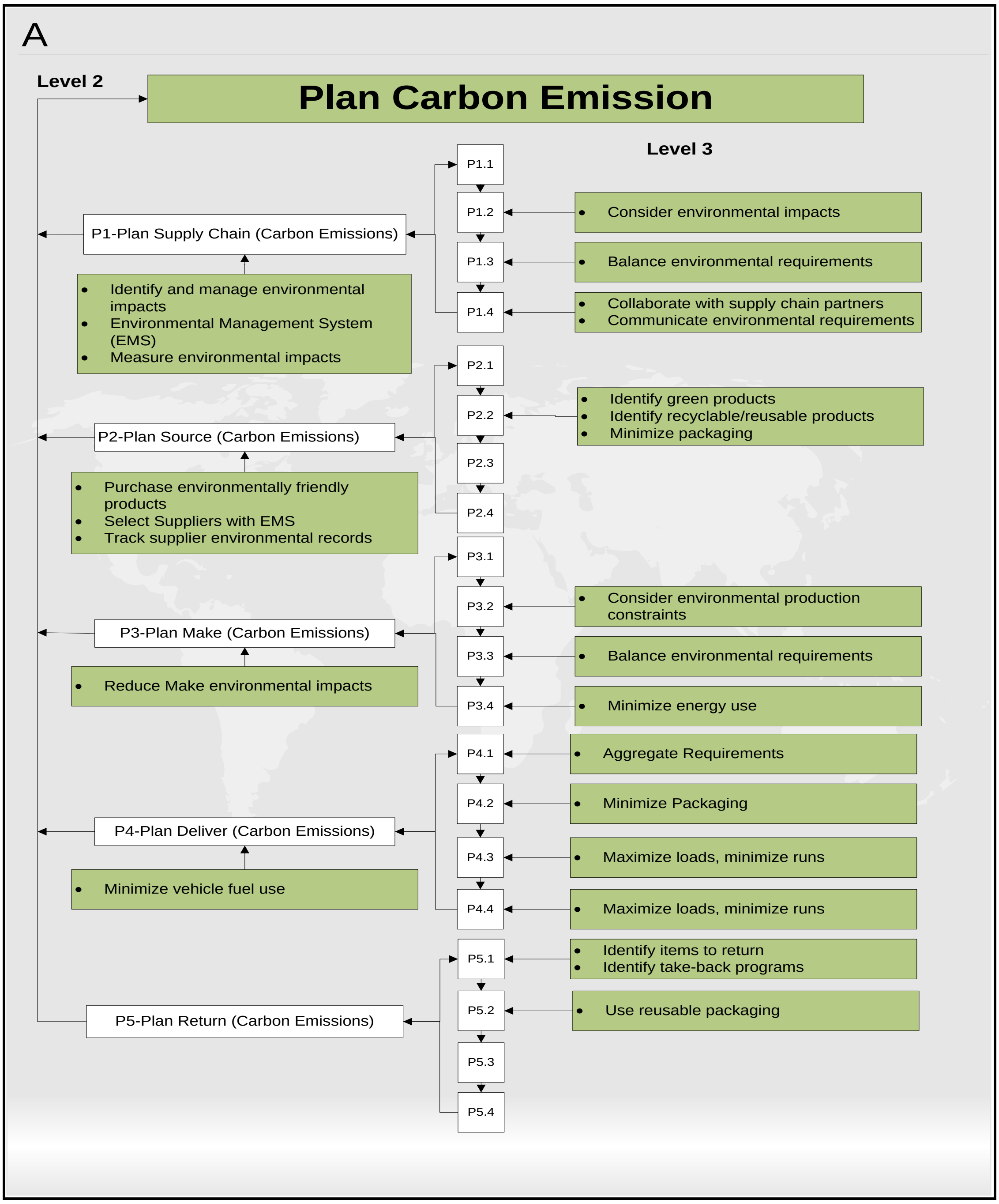

Figure 20: Best practices related to the Source-Process (GreenSCOR, Supply Chain Council, 2008).

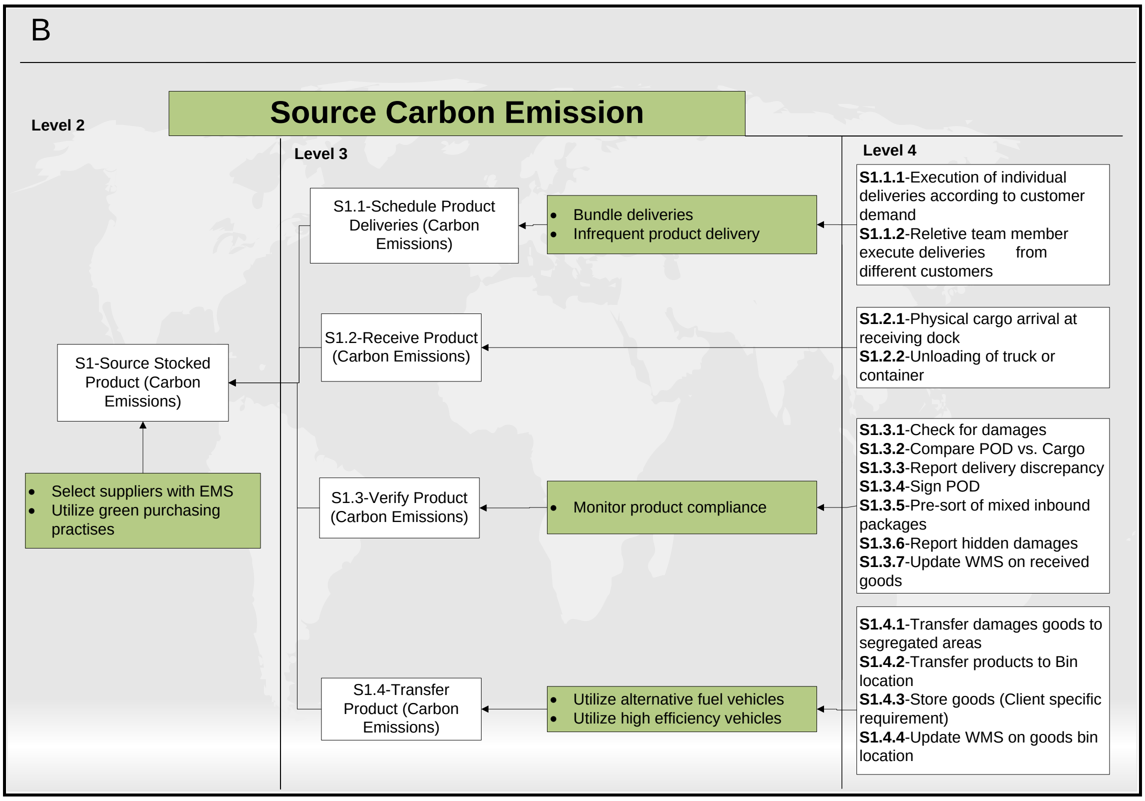

Figure 21: Best practices related to the Make-Process (GreenSCOR, Supply Chain Council, 2008)

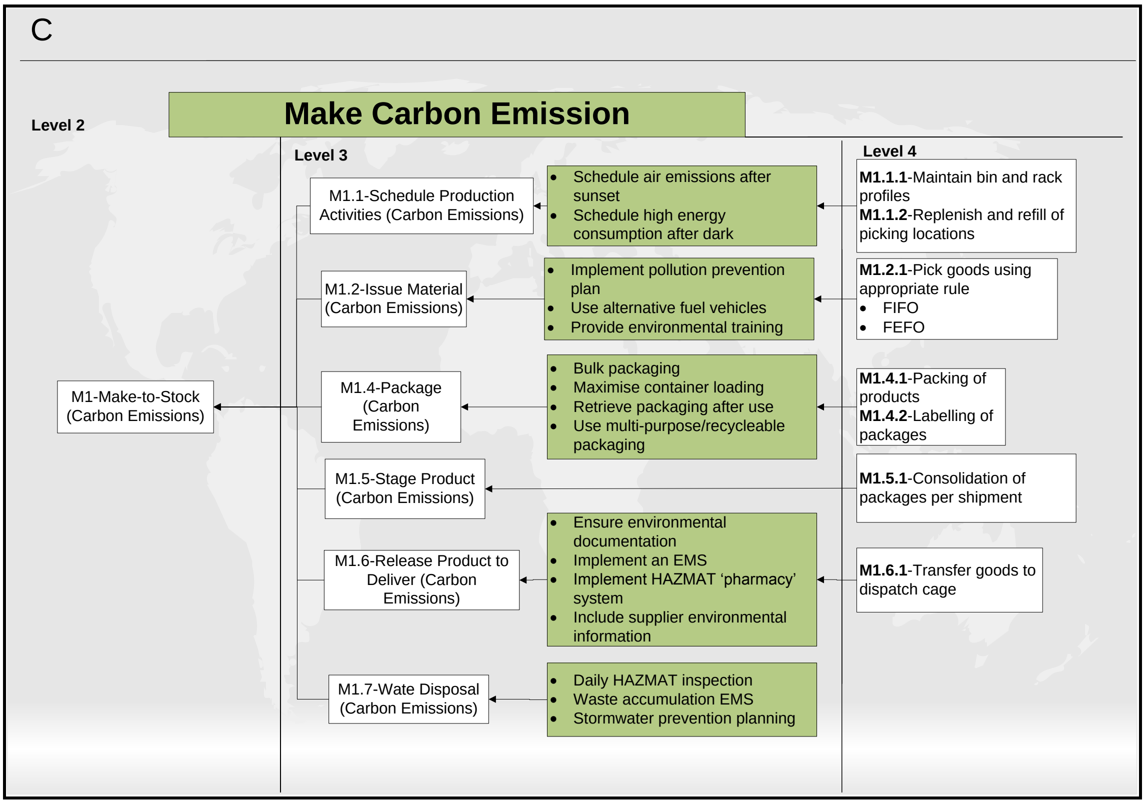

Figure 22: Best practices related to the Return-Process (GreenSCOR, Supply Chain Council, 2008)