MASTER

Sustainable purchasing process for transportation services; towards the next level stimulating sustainability in the cross border transportation purchasing process of Mars

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Award date:
2015

Link to publication
Sustainable purchasing process for transportation services; towards the next level.

Stimulating sustainability in the cross border transportation purchasing process of Mars.
Publication: Eindhoven
September 2014
Eindhoven University of Technology – Industrial Engineering
Series Master Theses Innovation Management

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This research has been executed in collaboration with: MARS Netherlands

Subject headings: Sustainable purchasing, sustainable supplier selection, supply chain management, responsible sourcing.
Abstract

In the past decades, the concept of sustainability gains increasingly interests by companies and their customers. This increasing interest results in the incorporation of sustainability in the daily processes of companies. These days, however, companies also become aware of their responsibility within the supply chain and try to influence the supply chain in a sustainable way. The purchasing function plays an important role in improving sustainability within the supply chain. This study will take a closer look to the purchasing function of transportation service and how this function can improve sustainability. An answer is found by making the combination of theory (literature study) and practice (interviews). It turns out that the current way of purchasing transportation service (tendering with sustainable selection criteria), can only improve the sustainability in a minor way. Shifting to a portfolio strategy, will result into a larger sustainable improvement. The largest sustainable improvement can be achieved by adopting the competitive partnership strategy.
Management Summary

Companies these days become aware of the sustainable consequences from their own operations and the sustainable consequences from the operations in their supply chain. Sustainability is therefore a new and developing concept, which increasingly plays a role in the decision making processes of companies. In several firms sustainability became a part of the business culture and is incorporated very well in their operations. The majority of the companies, however, still struggle to incorporate sustainability in their daily processes. Incorporating sustainability can be implemented in different ways and in different business functions, each on their own level of sustainable influence on the companies’ processes. One of the most powerful change agents in sustainability is the purchasing function within a company.

Problem statement

The company Mars is also aware of their sustainable responsibility and the role of the purchasing function in this topic. One of these actions is to incorporate sustainability in the purchasing of cross border transportation. They recognize however the struggle to incorporate sustainability for the long term in their purchasing process. Mars has ambitious plans to improve sustainability in their operations and in the operations in the supply chain. They therefore developed the following problem statement;

“How should Mars change their current purchasing process for European outbound cross border transport, in order to incorporate and improve sustainability. “

This study addresses the problem statement and develops recommendations on this problem. The overall objective of this study is to develop a roadmap for Mars, which enables them to increase sustainability within the transportation activities related to the operations of Mars. This overall objective is focused on the actions that can be taken through the purchasing function.

Research methodology

The research is based upon the combination of theoretical knowledge and practical knowledge. Through an extensive literature study a broader view is gained on the problem statement, which represents the theoretical knowledge. In here the implications and definitions of the sustainability concept within the literature are explored. In addition the literature study focuses on three areas; sustainable purchasing, transport purchasing and sustainable purchasing. The combination of these
focuses gains insights in possible sustainable purchasing processes for transportation services. From the literature review a research model was conducted to use as input for the interviews.

The practical knowledge is obtained through interviews, which were focused on the possibilities and limitations of sustainable transport purchasing in practice. To obtain a comprehensive understanding of the possibilities and limitations in practice, information was gained from 5 points of view. These points of views are from; benchmark companies, logistics service suppliers, sustainable transportation organizations, sustainable transportation events and associates within Mars. With the research model from the literature review, the results were obtained. The acquired practical knowledge is combined with the acquired theoretical knowledge, to come up with recommendations for Mars.

**Research model**

The used research model is based on a three-stage model of input-throughput-output. This model captures the most important aspects in sustainable transport service purchasing. The model is used as input for the interviews and to map the results of the interviews. Besides the developed research model a maturity model was conducted from the literature review. The theoretical maturity model is tested with the interviews, which resulted in several minor adaptations towards the final model.

The interviews showed that input is an important aspect in sustainable purchasing. The support of top and middle management plays an essential role in the sustainable outcome of the purchasing process. The research model also showed that three major aspects change in the purchasing process, when sustainability comes into the equation; the supplier selection process, the sourcing strategy and the supplier relationship. The final maturity model shows that there are three main sustainable purchasing processes, which have different levels of sustainable output. The final model is not a stage-gate model, but a two directional model. It shows which strategy fits best for different levels of sustainable input in the purchasing process.

**Conclusions**

The incorporation of sustainability in the purchasing function will require a change in the purchasing mind set. The conservative cost-focus within the purchasing function should change into a more comprehensive sustainable approach towards purchasing. This implies also a different approach towards the suppliers. The role of the supply chain becomes more important, whereby a mutual goal
can be achieved by customer and supplier; increasing sustainability. To achieve this mutual goal, cooperation and transparency is required, in order to optimize profitability by the supply chain benefits. For Mars, this implies that not all the transportation services should be considered as leverage services, but should be more approached as a strategic service. This needs a closer relationship with the supplier, to develop new sustainable solutions and innovations for the different routes of Mars. To implement this in the purchasing function of Mars, a portfolio is developed. This divides the transportation routes on their sustainable impact into three categories: A-routes, B-routes and C-routes. Each category has a separate strategy assigned, in order to increase sustainability in a structured way.
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### Abbreviations

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<th>Full Form</th>
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<tr>
<td>3P</td>
<td>People Planet Profit</td>
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<tr>
<td>CBT</td>
<td>Cross Border Transport</td>
</tr>
<tr>
<td>FTL</td>
<td>Full Truck Load</td>
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<tr>
<td>KPI</td>
<td>Key Performance Indicator</td>
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<td>LTL</td>
<td>Less than Truck Load</td>
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<td>MM</td>
<td>Multi modal</td>
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<tr>
<td>RFI</td>
<td>Request for Information</td>
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<td>SI</td>
<td>Sustainable Impact</td>
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<td>VMT</td>
<td>Vehicle Miles Travelled</td>
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1. Introduction
This chapter introduces the background and the outline of this study. It starts with elaborating on the research background, with the focus on sustainable purchasing transportation services. The next section explores the background of the company Mars, for which this study is executed. At the end the research problem, research objective and research questions are presented. The chapter closes with an overview of the report outline.

1.1 Research background
The past decades, sustainability awareness is increasing within companies. They become aware of their roles and responsibilities towards the environment and take action on this issue. The increasing interest of companies on this topic is mainly due to the sustainable demands of the customer (Amindoust, Ahmed, Saghafinia, & Bahreininejad, 2012). If companies are lagging in their sustainable strategy, customers become more likely to switch from supplier. Therefore it is also profitable for a company to enhance the sustainability within their business and in consequence fulfill the demands of the customer (Bhat, 1999). These actions are often referred to as part of the Green Supply Chain Management (GSCM). Rao & Holt (2005) and Srivastava (2007) state that GSCM is an effective way to improve the environmental impact of a company. Green Supply Chain Management will not only gain a competitive advantage by enhancing the green image, it is generally perceived that GSCM promotes efficiency and synergy among business partners and enhances minimizing waste and maximum cost savings.

The supply chain of a company consists of different aspects, regarding sustainability. One important contributor to sustainability in a supply chain is freight transport (Hoen K. M., Tan, Fransoo, & van Houtum, 2013) (Rogerson, Andersson, & Johansson, 2014). Richardson (2005) investigated who are the main drivers and influencers to improve sustainable freight transport, and created a sustainable freight transportation analysis framework. In Figure 1, this framework for freight transport is presented. From this framework one can conclude that two main actors influence the sustainability within transportation; the government and the market. The influence of the government is policy-driven, where the market influence is demand-driven. The role of the government is to develop and implement policies in order to manage the behaviour of freight and public transport. Sustainable policies can be aimed for example on fuel use, truck weight or safety. The role of the market is to change the behaviour of transportation suppliers, making use of their strength as customer in a leverage market. This is also
described by Hoen et al. (2011), they name two reasons for taking sustainability into account as a transportation supplier; the compliance to emission regulations of the government and or customer demand.

Figure 1 - Freight factors affecting sustainability of the transportation system (Richardson, 2005).

However, it is not as straightforward as it seems to be for the market to be the driving factor. The problem of the market’s sustainable influence is, that it will only work if the whole industry sets the same sustainable demands. The costs and benefits of sustainability in transportation are in general for an individual company out of line with each other (Richardson, 2005). Richardson (2005) suggests that a wide-scale intervention is needed, in order to have a sustainable market influence. Markley & Davis (2007) do not share the opinion that a wide-scale intervention is needed. They believe that an individual
company can gain competitive advantage in making the logistics more sustainable, especially if they are part of the early adoptors who are improving sustainable logistics.

As seen in Figure 1, companies can improve sustainable logistics by defining sustainable requirements for their logistic service providers. This can however lead to a different purchasing approach, because normally freight transport service is considered as a standard leverage product and falls for the most companies into the leverage market quadrant of Kraljic (1983) (Andersson & Norrman, 2002). This quadrant suggests to make use of the purchasing power in order to get the lowest price for the service. In recent years however, the quality and the environmental aspect of the logistic service has become more important for some companies and therefore also for the purchasing function of the logistic services (Bjorklund, 2011). This means that logistic services is no longer considered a standard leverage type by some companies, where traditionally the supplier selection has always been solely focused on economic aspects (Bai & Sarkis, 2010). The addition of the quality and possible sustainability aspect to supplier selection, is not only causing a different approach in the selection of suppliers but evolved for some companies in whole new purchasing strategies. When these additional aspects become important, it is of both companies their interests that these aspects improve. The interest of both companies in improving one or more aspects of the business will develop in a mutual goal. To achieve this mutual goal, companies will change their relationship with the supplier. When first the relationship was only based on taking advantage of the leverage power, the relationships will change into a closer and collaborative direction. This will improve the cooperation between the two parties and enhances the accomplishing of the mutual goal. A partnership approach can establish this cooperation towards the mutual goal, by sharing information and enable parties to invest in each other. Pagell, Wu, & Wasserman (2010) revealed that some companies treated their suppliers for commodity inputs as if they were strategic suppliers, which is normally the case for strategically important inputs instead for commodity inputs according to van Weele (2010). In conclusion the addition of the quality and environmental aspects to logistic service purchasing, will require a different purchasing strategy (Andersson & Norrman, 2002) (Bjorklund, 2011).

**1.2 Company background**
Mars recognizes that sustainability must become an important aspect in the purchasing process. They question however how to implement sustainability structurally into their purchasing process. Therefore this research is conducted to discover if and how the purchasing process of Mars needs to change to improve sustainability in transportation service. The company Mars was founded in 1911 in
the United States and started in the snack food industry. Nowadays they are active in several markets like pet food, snack food, food and drinks and are a worldwide company. Mars is also located in the Netherlands; in Veghel and Oud-Beijerland. In the Netherlands there are a total of 1450 employees, whereof 1200 employees in Veghel and 250 employees in Oud-Beijerland. The location in Veghel consists of the biggest chocolate factory within Mars in Europe and, the Dutch headquarters for sales and marketing.

The organization of Mars is built on their five principles; Quality, Responsibility, Mutuality, Efficiency and Freedom. These five principles are the foundation for their culture and their approach to business. The second principle Responsibility includes the focus to be responsible towards the environment and create sustainable awareness and actions within Mars. Within the context of this responsibility principle, the program “sustainable in a generation (SiG)” was created. This program aims to minimize the impact of Mars her operations on the environment. The goal of the SiG program is to eliminate fossil fuel energy use and greenhouse gas emissions from their operations by 2040. The program focuses on four strategies; Operational efficiency, Capital efficiency, New technology and Renewable energy. This program however focuses only on the environmental impact caused directly by Mars and does not take into account the environmental impact of the whole supply chain. As can be seen from Figure 2, the impact on the environment caused by the direct processes of Mars is a small percentage of the total impact on the environment in the supply chain.

![Figure 2 - Environmental impact of the supply chain of Mars (Mars, 2014)](image)

Mars feels however also responsible for the sustainability in the supply chain and develops therefore several programs to improve the sustainability in the supply chain. One project, which is
currently developed, aims for the sustainability in transportation of finished goods. This research will take a lead in the development of this project.

1.3 Research outline

1.3.1 Research problem

The current purchasing process of cross-border transport within Mars is mainly focused on costs. The freight transport market is a leverage market, where the customer can effectively make use of his purchasing power. This is effective when a company only focus on the costs of the freight transport. Mars questions, however, if this purchasing process is still effective when other criteria (like sustainability) come into the equation. Within the literature there is no clear answer to this especially when it comes to transport purchasing. The literature provides sufficient information on, transportation purchasing, sustainable transportation and on sustainable purchasing. The integration and combination of these three subjects is however rarely made in the literature (found in only 4 articles). This literature suggests that the purchasing process needs a different approach when sustainability comes into the equation of purchasing. What this different approach is and when to use it, is not explicitly mentioned and can be considered as a gap in the literature. Therefore it is not clear from the literature which strategy is applicable for Mars to take sustainability into account during their purchasing process.

1.3.2 Research objective

The overall objective of this study is to develop a roadmap for Mars, which enables them to increase sustainability within the transportation activities related to the operations of Mars. This overall objective is focused on the actions that can be taken through purchasing. The objective is limited to a part of the purchasing process. The contracting process and evaluating process will be out of scope here. To be more detailed the focus is twofold: 1) increase insights on how the purchasing process of freight transport should look like to achieve improvement of sustainable freight transport and 2) how this can be applied to the purchasing process of Mars. This objective focus is pursued by (i) gaining understanding of the concept sustainability; (ii) discover different strategies to achieve sustainable purchasing (iii) evaluating the different strategies on their impact on sustainability (iv) evaluating which strategies are applicable to Mars and (v) develop implementation plan for Mars to improve their purchasing process to enhance sustainability.

1.3.3 Research questions

This research is a result from a problem statement of Mars. The company is struggling with how to take sustainability into account during the purchasing process of transportation services. This
research takes this problem in a broader perspective. It will addresses the two insights on the problem, as well from theoretical as from a practical point of view. These two points of views are combined to develop recommendations for Mars. These recommendations are based on the analyzes of the following sub-questions;

- What is sustainability and how does this apply to transportation service?
- What are the theoretical best purchasing processes to stimulate improvement on sustainability?
- Are these also the practical best processes to stimulate improvement on sustainability?
- How can the theoretical and practical insights be combined to be the best process applicable for Mars?

1.4 Report outline
In this report the combination of theory and practice is considered very valuable. The structure of the report is based on making this combination in an organized way. Therefore first the theoretical part is described and is tested in the practice by making use of interviews. In the end of the report, the combination is made and the practical tested theory is focused on the case of Mars.

The present chapter 1 introduces the research and provides basic information to gain a general overview of the conducted research.

The point of view from the literature is presented in chapter 2 and 3. Chapter 2 starts with the literature study approach, where also the gap in the literature is revealed. The concepts of sustainability and sustainability in transportation are elaborated at the end of this chapter. In chapter 3 different purchasing strategies are presented to come to sustainable purchasing. These strategies are analyzed and reflected on their potential of sustainable improvement. Chapter 3 ends with presenting the conceptual model. This model is conducted from the literature review and represents the theoretical point of view on the research question. This theoretical framework is used as input for the analyses of the practical point of view.

Chapter 4 describes the methodology of the interview research. This chapter provides information on the selection strategy and structure of the interviews. It gains insight in the interview strategy and the coupling with the conceptual model. Chapter 4 ends with the results of the interviews. These results lead to the final model. This model is used as guiding model to make recommendations for Mars.
The recommendations for Mars are described in Chapter 5. In here the output of the valuable combination of theory and practice, will be clear. The first part of this chapter will describe the current situation at Mars, where after with the ‘valuable combination’ the desired situation is presented. The recommendations are based on how to come from the current situation to the desired situation.

This road from the current to the desired situation is presented in chapter 6. This chapter provides the implementation plan for Mars. The last part describes the actions of the implementation plan which already have been executed as part of the research and several test cases, to show how the new process will look like in practice.
2. Theoretical background and analysis
This chapter presents the literature review procedure. It will reveal a glimpse of the research area and points out the gap in the literature. This section provides insights in the concept of sustainability and how this can be related to transportation. The chapter ends with presenting the conceptual framework and a proposed maturity model.

2.1 Review procedure
The relevant articles were withdrawn from the literature, by making use of structured keyword search. This is done for the databases of JSTOR, GoogleScholar, ScienceDirect and SpringerLink. Combinations of the keywords “Transport”, “Purchasing”, “Sustainability”, “green purchasing”, “sustainable freight transport”, “transport purchasing process”, “green supply chain management” and “procurement” were used as input for the search task. In first instance the search task was executed for literature from the period 2000 – 2014, in order to conduct the most recent articles. From these results the most relevant articles were used as input for the snowball-effect-strategy (tracing references) to discover other appropriate articles. In total 51 articles appeared to be highly relevant for this research. This set was extended with articles recommend by academics from the TU/e and recommendation of associates at Mars to a total of 56 articles.

2.2 A glimpse of the research area
This literature review will combine three research areas; sustainable transport, sustainable purchasing and transport purchasing. In Figure 18 in Appendix A, the timeline of the related articles identified in the literature research is presented. From this figure one can conclude that the “sustainability” aspect gains the past 10 years more and more interest in the literature. The journals; Supply Chain Management, Physical Distribution & Logistics Management, and Production Economics were the top three consulted journals to extract publications from. In total there are 56 articles selected and are divided over the research areas as presented in Figure 3.
There are four articles identified who already contributed to the area of sustainable transport purchasing. The articles and their main contribution are presented in Table 1.

Table 1 - Articles’ main contribution to the research area

<table>
<thead>
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<th>Author</th>
<th>Main contribution to the area</th>
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| Bjorklund (2011)      | • Investigation of the factors that can influence the environmental purchasing of transportation services.  
                        | • Identified the greatest benefit opportunities of greening transportation                      |
| Evangelista et al. (2011) | • Role of buyer in sustainable transportation                                                  |
| Rogerson et al. (2013) | • Influence of contextual dimensions on different stages of the purchasing process.            |
| Wolf & Seuring (2010)  | • Impact of environmental criteria in a buying process of third party logistical services.     |

2.3 A gap in the literature

Studying the three fields of Sustainable Transport, Sustainable Purchasing and Transport Purchasing, reveals that there is enough relevant literature. The literature on the combination of these three areas is however scarce. For example the literature in the area of “purchasing” is very extensive and the combination with transportation is also well covered. Despite the rising interest in sustainability, this topic is not often taken into account in this kind of literature (Amindoust, Ahmed, Saghafinia, & Bahreininejad, 2012). Pagell, Wu & Wasserman (2010) did take sustainability into account and found a shift in strategies when a company focuses on sustainable sourcing. They discovered that in a leverage market the strategy is more focused on strategic sourcing rather than on competitive bidding. Their research was however very limited and they stated that further research needs to delve deeper on this issue. Rogerson, Andersson & Johansson (2014) revealed that the purchasing literature is mostly based
on manufacturing companies and the purchases of physical products. Transport service is more intangible than the physical products and needs therefore a different purchasing approach. These different purchasing approaches are described within the literature; it is however not clear when to use which strategy. This is considered as the gap in the literature. This research will try to cover a large part of this gap and provide insights in the use of different strategies for sustainable improvement. The next paragraph will take a lead in this, by first defining the concept of sustainability in transportation.

2.4 Definitions & assumptions

For this research it is important to have a clear and structured definition of the concept sustainability. In particular it is important to gain understanding in what the term sustainability means in transportation and on which aspects a purchasing function can have influence. This will be elaborated in the following paragraphs.

2.4.1 Sustainability

The concept “sustainability” is a broad concept and can be interpreted in different ways. A common used definition of the term sustainability is “development that meets the needs of the present without compromising the ability of future generations to meet their needs”, which was originally founded by the Brundtland Commission in 1987 (Rogers & Carter, 2008). Shrivastava (1995) took a more micro-economic perspective and describes the term sustainability as “the potential for reducing long-term risks associated with resource depletion, fluctuations in energy costs, product liabilities, and pollution and waste management. A more recent definition on the concept of sustainability, takes a broader view with respect to the environment. Pagell & Wu (2009) considers next to the environment also the social and economic aspects when determining sustainability. They draw a parallel to the triple bottom line of Elkington (1999). In normal business the bottom line is the difference between the profit and the loss. Elkington (1999) adds two other bottom lines next to the one of profit and loss. He introduces the social bottom line and the environmental bottom line. The triple bottom line is therefore also referred to as the People, Planet, and Profit approach and is used as definition for the term sustainability (Foerstl, Reuter, Hartmann, & Blome, 2010).

Rogers & Carter (2008) state that the environmental and social aspects of sustainability can extend beyond an organization’s boundary, which will trigger supply chain activities. When these activities are coupled to economic objectives the role of supply chain management becomes important within a firm, to manage the activities outside the borders of the company. With these supply chain
management activities the three areas; environmental, social and economic will intersect, and that is where true sustainability occurs (Rogers & Carter, 2008).

Richardson (2005) defines sustainable transport as “the ability to meet today’s transportation needs without compromising the ability of future generations to meet their transportation needs”. Richardson (2005) derived five indicators of transportation sustainability; safety, congestion, fuel consumption, vehicle emissions, and access.

In transportation purchasing, the cost aspect plays an important role. Therefore in this paper the concept sustainability is defined as the triple bottom line of People, Planet and Profit, because this definition is taken into account the cost aspect and is a widely accepted sustainable definition in the literature. This definition states also that sustainability only occurs at the intersection of the three aspects. This means that an action is only a sustainable action if one or more of the three triple bottom lines is improved, without deteriorate the other of the three bottom lines.

2.4.2 Sustainability in transport

Traditionally, the lead time and transportation costs were the two main discussion points in purchasing logistic service. Nowadays also the sustainability aspect comes into the equation (Hoen K. M., Tan, Fransoo, & van Houtum, 2011). There are different aspects of transportation, to improve on sustainability. Considering the definition of sustainability, this improvement may not deteriorate the other bottom lines. In this section the sustainable improving possibilities are considered per aspect of the triple bottom line.

People

The literature on the people aspect in transportation is very minimal. Andersson & Norrman (2002) addresses the people aspect to the risk for crime. This risk is especially in freight transport a relevant aspect. Richardson (2005) associates the people aspect to the safety in freight transportation. Safety is a consequence of several factors and only a few of them can be influenced by the transport provider. The three most important influenceable factors are; truck driver behavior, compliance to government policies and vehicle miles travelled. The truck driver behavior is influenced by factors like driving hours, education level, training level, sleep deprivation, unsafe speeds and lack of experienced drivers. The transportation service provider has a significant influence on these factors. By means of training on safe driving or only hire experienced and well capable truck drivers, a transport service
provider can reduce the safety risk factor (Tzamalouka, Papadaki, & Chliaoutakis, 2005) (Mitler, Miller, Lipsitz, Walsh, & Wylie, 1997).

The government is also aware of these safety risks and developed therefore policies to reduce the safety risk factor. The transportation service provider needs to comply with these policies. It is however questioned in the literature to what degree the transportation service providers comply with these policies. Hale & Swuste (1998) stated that there is a high level of motivation among many companies to avoid compliance with the policies to pursue their own interests at the expense (in this case safety) of others.

Another factor, which is controllable by the transportation service provider and influences the safety risk on the road, is the truck vehicle miles travelled (VMT). More vehicle miles travelled implies a larger risk on incidence of crashes and thus an increasing risk on safety. This is however not only influenced by the service provider but also by the shipper. When a shipper can reduce its number of trips, by for example improving logistics planning, the risk in safety can be decreased. A transportation service provider can decrease the safety risk, by reducing its empty mileages and in consequence reduce the vehicle miles travelled. Reducing the VMT can also have a negative impact on the people aspect. When a company can reduce its VMT, there are fewer trucks needed for the same routes. This implies that it will negatively affect the employment in the transportation business.

**Planet**

The literature on the planet aspect of transportation is, in contrast to the people aspect, more extensive. The planet aspect is in the literature mostly compared to the environment aspect. Freight transport has large effects on the environment in various ways. This includes the greenhouse effect, toxic effects on ecosystems and humans, land use and resource consumption (Bauer, Bektas, & Grainic, 2010). Especially in the food and beverage sector, the logistics are energy-intensive due to high conversion and often partial loads (Cholette & Venkat, 2009). Richardson (2005) discovered three factors of freight transport which affect the planet; fuel consumption (resource depletion), congestion and emissions.

The dominant fuel source for freight transport is oil (Chapman, 2007). Figure 4 presents the fuel use in transportation, oil accounts here for 97% of the fuel usage in the transport sector. The alternative energy sources are not playing (yet) a dominant role in the fuel usage. Due to the increase of the
transportation business, road transport activities are one of the fastest-growing major sources of greenhouse gases (Velazquez-Martinez, Fransoo, Blanco, & Mora-Vargas, 2014).

Figure 4 - Fuel use in the transport sector in OECD countries (Chapman, 2007)

The market penetration of the renewables is especially for the long-haul freight transport very minimal (Lutsey, Brodrick, & Lipman, 2007). There are several actions, which the transport service provider can take, to reduce the fuel consumption and in consequence decrease the depletion of the fossil fuels. The most important one is to reduce the Vehicle Miles Travelled (VMT). This implies also to reduce the empty mileages. Another aspect of decreasing fuel consumption is the effectiveness of the truck engine and the truck driver behavior (Richardson, 2005). The last aspect is the use of intermodal transport to reduce fuel consumption, which will be elaborated in the next section.

The second aspect of congestion is determined as when demand for road-space exceeds the available supply, and the flow rate of vehicles wishing to travel on a given section of highway exceeds its capacity or ability to provide acceptable traveling conditions (van Schijndel & Dinwoodie, 2000). Congestion results in a longer time for a truck to go from A to B, which in consequence results in more pollution, more costs and more land use (van den Hemel, 2014). Van Schijndel & Dinwoodie (2000) determine that congestion can be prevented by transport service providers, when choosing for intermodal transportation; “freight which is shipped from origin to destination by a sequence of at least two transportation modes” (Bauer, Bektas, & Grainic, 2010). Choosing for rail, sea or inland water transport will also result in fewer trucks on the road, this result in the decreasing of congestion. Road transport though is flexible and enables high accessibility (Sorkina, 2012).

The emissions of the transportation impacts the planet in different ways including the greenhouse effect (CH₄, CO₂ and N₂O), toxic effects on ecosystems (acidification; by emitting CO₂, NOₓ and SO₂), toxic
effects on humans by emitting non-methane hydrocarbons, NOx, SO2 and particles (Bauer, Bektas, & Grainic, 2010). The emissions have therefore not only an impact on the planet aspect, but also on the people aspect. Hoen K. M., Tan, Fransoo, & van Houtum (2011) focused on emission reduction by choosing different transport modes and calculated the total emissions per unit for different transport modes. In Figure 5 one of the main findings is presented. The research is conducted with the focus on four transport modes; air, road, rail and water, representing respectively e1, e2, e3 and e4 in the figure. They calculated the unit emissions in kg CO2 for different distances (800km and 3000 km), product volumes (1l and 500l) and product density (100 kg/m^3 and 1000 kg/m^3). The most left column in the figure represents the different volumes, the second column on the left represents the different product density. The different distance are presented on the upper horizontal row. From this figure the ratio differences between the modalities can be conducted. For example the unit emission of an air modality (d= 800, p=100, v=1) is ten times higher than the unit emission of a road modality (d=800, p=100, v=1).

<table>
<thead>
<tr>
<th>v (l)</th>
<th>d (km)</th>
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<tr>
<td></td>
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<td>e1</td>
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<td>1</td>
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<td>500</td>
<td>1,000</td>
<td>300.950</td>
<td>19.504</td>
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Figure 5 – Unit emissions air, rail, road and water transport in kg CO2 (Hoen K.M. et al., 2014)

The calculation is based on the freight transportation from terminal A to terminal B. They found that the order of decreasing emissions is; air, road, rail, water. This would imply that from an environmental point of view, the water transport mode is the most sustainable solution. The research however did not take into account the distance from origin to terminal and the distance from the terminal to destination. This could heavily influence the outcome. Also the frequency of availability could be a bottleneck in practice.

Hoen K. M. et al. (2013) conclude in their paper that switching transport modes is an effective measure to reduce transport carbon emissions. There applies however a diminishing rate of return on emission reduction, which implies that more emission reduction involves higher costs. This means that switching transport modes is an effective measure to reduce carbon emissions from transport, but only for small emission reduction targets. Reducing the transport emissions even further, an integrated
approach that considers interactions with the transport supplier is more efficient (van den Hemel, 2014).

**Profit**

The profit aspect is related to cost reduction in the logistic activities of the service provider. Also the shipper can achieve sustainable cost reduction. A relatively easy sustainable cost reduction can be achieved by decreasing the volume of the packaged product and thus increasing the weight-fill rate of the trucks. This leads for non-weight restricted loads to a cost reduction, because the unit transportation costs decrease (Hoen K. M., Tan, Fransoo, & van Houtum, 2011). Another way to reduce costs and also reduce the effects on people and planet is the reduction of VMT and especially in reducing the empty mileages.

Hoen, Tan, Fransoo & van Houtum (2013) discovered a relationship between emission reduction and cost increase as presented in Figure 6. This relationship implies that a 10% emission reduction can be achieved with relative no total cost increase. A maximum emission reduction of 27% can be achieved at a 30% total cost increase. It can be concluded that a diminishing rate of return applies due to the law of diminishing marginal returns, i.e., emission reductions become increasingly expensive. Hoen, Tan, Fransoo & van Houtum (2013) also state that intermodal transport is not necessarily the most cost-efficient option to reduce emission targets, due to the longer lead times and additional handling costs. Increasing the fill rate for example could be for instance in several cases more cost-efficient to reduce emissions targets.

![Figure 6 - Relative cost increase and relative emission reductions (Hoen K. M., Tan, Fransoo, & van Houtum, 2013)](image-url)
Conclusion

There are different definitions of sustainability available in the literature. The most used definition of sustainability in transportation is the People, Planet and Profit approach. A buyer has significant influence on the sustainability in transportation. When focusing on People, Planet and Profit, there is one main factor which can improve all three aspects. This factor concerns the vehicle miles travelled. If this can be reduced, all the three sustainable aspects will improve. This can be done in several ways, like intermodal transport; using other modalities like short sea or train. Other solutions to reduce VMT are reducing empty mileages by making use of round trips, increase load factor, improving logistic network or horizontal collaboration.

There are other aspects which can improve to a less extend on one or more bottom lines. Making use of other fuels or engines for the trucks, can improve on profit and planet aspects. Compliance to the government rules can improve the safety aspect and also profit aspect by avoiding penalties. In the next paragraph the definition of sustainability is used to determine the conceptual model for improving sustainability in a purchasing process.

2.5 Conceptual model

From the last paragraph it can be concluded that improving sustainability in transportation has a direct link with reducing the vehicle miles travelled. It is however the question how this can be established by means of the purchasing function. The next section will elaborate further on how sustainable purchasing can be achieved with the focus on transport purchasing.

Companies these days are outsourcing their side-activities to other parties or even divest these activities, in order to focus more on their core competence. Logistic operations are one of these side-activities which are increasingly outsourced to a third logistic party (Aguezzoul, 2007). These logistic activities can include different aspects of logistics, for example warehousing, distribution, materials management, freight transport etc. Each activity needs a different purchasing strategy, in order to optimize the purchasing function. Freight transport is an activity which is for most companies located in the left upper quadrant of the Kraljic Portfolio Purchasing Model (Kraljic, 1983), implying there is more supply then demand and the financial impact is quite high (Andersson & Norrman, 2002). This results in freight transport service that is purchased in a leverage market and is focused on competitive bidding strategy (van Weele, 2010). Freight transport purchasing is complex because it requires the use of
several often conflicting criteria such as price, reliability, service, quality, on-time performance etc. (Aguezzoul, 2007).

It becomes even more complex when sustainability becomes an issue. Transport is one of the larger contributors to sustainable threats and problems. Transportation purchasing could actually be one of the most powerful sustainable change agents than any other corporate function (Bjorklund, 2011). Purchasers are the gatekeepers of the company, they determine what comes in the company and with who to do business with (Preuss, 2001). Evangelista, Huge-Brodin, Isaksson, & Sweeney (2011) suggest that the buyer’s traditional approach to purchasing logistic services needs to be innovated to increase sustainability within the transportation. How this can be achieved is elaborated below, focused on the input, the throughput and the output of the purchasing function.

**Input**

The largest influence on the sustainable purchasing performance is the priorities and awareness of the top and middle management, according to Bjorklund (2011). He describes that the focus on sustainability during the purchasing process plays an important role in the sustainable outcome of the purchasing process. The top and middle management can influence the outcome of the process, by developing sustainable goals for the purchasing function. Bjorklund (2011) states that if top and middle management lacking behind on developing sustainable goals and focus only on economic benefits, sustainable improvement will not be stimulated in the purchasing process and a purchaser is more likely to choose for the ‘quick wins’ then sustainable solutions. To improve the development of sustainable goals it is essential to make sustainability quantifiable, preferably into monetary figures (Min & Galle, 2004). Quantifying sustainability depends highly on the company her definition of sustainability. If the definition is solely based on the carbon emissions, quantifying is relatively easy. In this paper we take however the people, planet and profit approach as the definition of sustainability, which will lead to a different calculation and also outcome of the sustainability numbers.

**Throughput**

A change in the sustainability focus of the purchasing process, will lead to a change in different aspects of the purchasing strategy (Andersson & Normann, 2002) (Bjorklund, 2011). The sourcing strategy for transport service suppliers will change when the focus on sustainability extents. It is possible to only source for sustainable suppliers, and for example invite only sustainable suppliers into a tender process. The increase of sustainability focus can also lead to the use of different sourcing strategies for different routes (Hoen K.M., Tan, Fransoo, & van Houtum, 2013). The use of different sourcing strategies
is to differentiate between low and high sustainable impact routes. Routes that have a high sustainability impact will require sustainable suppliers or sustainable solutions, this account to a lesser extent for routes with low sustainability impact.

The supplier selection is another aspect of the purchasing strategy, which will change when there comes a shift in the sustainability focus (van den Hemel, 2014). The supplier selection method is normally only based on economic and quality aspects. With an increase in sustainability focus, the sustainability aspect comes also into the equation which makes the supplier selection becomes more complex (Bai & Sarkis, 2010). The extent of the sustainable focus, will determine the weight of the sustainable criteria in the selection process. The different number and sort of sustainable criteria are also dependent on the magnitude of the focus and also on the definition of sustainability.

The relationship with the supplier, will also change when the focus on sustainability changes. Pagell & Wu (2009) determines that a more collaborative relationship is needed when there becomes more focus on sustainability. They highlight two best practices in sustainable purchasing; collaboration and certification. This will lead to improvement in education of the supplier and to qualitative sustainable improvement initiatives of the supplier, because it is worth to invest in their customer and help to think in solutions (Rao & Holt, 2005). Suppliers can help to provide valuable ideas used in the implementation of environmental projects (Dresner & Carter, 2001). This will change the purchasing process to focus more on value-added service than on one dimension numbers like tendering. The change of perspective in the purchasing process can establish higher motivation to increase the value added service. Pagell & Wu (2009) also discovered that companies who incorporate sustainability in their processes, are helping their supplier to improve and vice versa. They pay even above market price for a longer term, in order to profit on the long term from the suppliers investments in their organizational processes. Improvements project initiated by the supplier are however often undertaken within infeasible timeframes by the supplier. It is therefore noted that sustainable innovation can be hampered if firms use short time horizons (Dresner & Carter, 2001). The length of the relationship is therefore also important, to give the supplier the time to develop sustainable improvements. Wolf & Seuring (2010) state that besides giving the supplier the ability to develop and implement sustainable solutions, information sharing between suppliers and buyers are essential in implementing sustainability in transportation. Close relationships can establish information sharing between suppliers and buyers which are essential in implementing sustainability in transportation according to Carter & Dresner (2001).
The external responsiveness of a company will also influence the sustainability and the operational performance of a company (Foerstl, Reuter, Hartmann & Blomme, 2010). Companies should seek active management of the continuity of the supply base. Foerstl, Reuter, Hartmann & Blomme determine also that companies with a higher sustainable focus, are willing to take more risk. The higher risk taking is needed to stimulate the development and the innovation of sustainable solutions.

**Output**

The extent of sustainability focus in the purchasing process, will determine the purchasing strategy. This purchasing strategy will result in sustainable improvement, for each purchasing strategy on a different level. It is a logic consequence that the more focus is on sustainability, the larger the sustainable improvement will be. BlAESER (2011) discovered that transport service suppliers are delevering exactly what the customer is asking and nothing more or extra’s. This implies that when there is no sustainable focus in place, sustainability is not improved or even deteriorated. Carter & Dreser (2001), found that a strategic partnership with the focus on sustainability will place a high value on the social and environmental outcomes of the company and possible beneficial for the profit outcomes. Therefore the strategic partnership strategy is considered as a strategy which can strongly enhance sustainable improvement. Regarding the definition of sustainability in this research, this means that the VMT should be decreased significantly when using strategic partnership strategy.

To conclude, there are different aspects that will drive sustainability in the purchasing process. From the input-side, the priorities and awareness of the top and middle management on sustainability is important. The top and middle management can influence sustainability, by quantifying sustainability and develop sustainable goals for the purchasing function. These actions are influenced by the adopted definition of sustainability. From the throughput-side there are five main influenceable aspects; external responsiveness, the sourcing strategy, the supplier selection, the supplier relationship, and risk taking. In the supplier relationship is not only the approach towards the supplier influenced, but also the contract length and therefore the length of the relation is influenced. From the output-side the actual sustainable results should be influenced. This can be summarized into the conceptual model as presented in Figure 7. In this model the most left box presents the input-side, the boxes in the center represents the throughput-side and the most right box reflects the output-side. Only the red section is part of the scope of this research and will be used further in this research. How this conceptual model is used for this research is explained in the next chapter.
This paragraph discovered in the literature that from a certain extent a change in sustainable purchasing focus, will lead to a different strategy approach. This strategy approach is defined by several aspects, where supplier selection, sourcing strategy and supplier relation are the aspects which fall into the scope of this project. In this project it will be determined how these aspects can change the output of the sustainable purchasing process. The next chapter will take a step ahead on this question and proposes a framework conducted from the literature.

2.6 Proposed maturity model

From the literature it can be conducted that there are three main strategies that can be used to come to sustainable purchasing, each on their own level. Transportation service is a commodity product;
there is enough supply available and switching costs are very low. Transportation services are, in large companies, often bought in large volumes and a small change in price can have a relatively strong impact on the total product end price. Therefore these services are considered as leverage products, where the buyer should exert aggressive sourcing and tendering among prequalified suppliers (van Weele, 2010). In the normal tender strategy the supplier is mainly selected on the final bid. Although the price is not the only criteria, it is still the most important criteria in the decision making. Risk and quality are the other important criteria, in a traditional tender strategy.

It is important to mention first that the cost structure of a logistic service provider for hauling on one lane of traffic, is highly influenced by its business across his network. A logistic service provider can place a more sharp bid when he has also a return load, then when he has to return empty. Therefore the tender proces on itself can to some extend already be considered as a sustainable proces. This is however not structurally assured, therefore other possibilities should be considered to take sustainability into account.

The sustainable improvement with this strategy, depends on the selection weight of the sustainable criteria. When the price is still the leading factor in the selection process and the allocation depends to a little extend on the sustainable criteria, the improvement on sustainability will be very low. Within the tender strategy, there is little room for improvement and development. The supplier is asked to return a bid on several routes. He has however not the chance to test or develop different sustainable methods for the route, because the tender strategy is mostly focused on a short time-frame. A short time frame is not desirabel when a new solution needs to be developed. A supplier will not invest in new equipment (like light-weight containers), if the contract is only focused on one-year and therefore the supplier not is assured of long term business with the new equipment. In consequency the tender strategy is determined to have low sustainable improvement capacity.

A company should actually decide on which routes they want to develop sustainable solutions, and therefore use longer time frames and supplier approach, and which routes they still want to hold in the tender. To differentiate the routes one can make use of a portfolio. The route-portfolio will provide a framework to execute the environmental projects in a structured way. The portfolio turns out to be effective in reducing emissions at minimal costs. The portfolio strategy aims to focus first on the routes that have the highest potential to improve on sustainability. (Hoen K. M., Tan, Fransoo, & van Houtum, 2013). To measure the potential of sustainable improvement of each route, several aspects should be
taken into account. As can be conducted from chapter 2.4.2 ‘Sustainability in transport’, the VMT is the most important aspect to focus on when improving sustainability in transportation. The potential of sustainable improvement can roughly directly be linked to the number of VMT for each route.

In the previous paragraph it was discussed that the supplier relationship is important when stimulating sustainability in transportation services. Collaboration is essence to have a large sustainable improvement, which can be established by strategic partnerships. The three previous mentioned strategies are combined into the proposed maturity model as is presented in the below Figure 8.

![Proposed maturity modeled framework](image)

**Figure 8 – Proposed maturity modeled framework**

The framework implies that the three different purchasing strategies can come to sustainable transport purchasing, but all in different levels. The first strategy is the tender strategy with sustainable selection criteria. The second strategy is the portfolio strategy, where one makes use of different strategies for different routes. For a route with high sustainable improvement potential, one can make use of the strategic partnership strategy in order to jointly search for a sustainable improvement solution for the route. For a route with low sustainable improvement potential, one can make use of the tender-strategy. The last strategy will focus on the strategic partnership for every route; in here one can choose for example for only one or two suppliers for all the routes. Within in the literature it is considered that the largest sustainable improvement will be achieved with strategic partnership. Making use of a tender with sustainable criteria, only a little improvement on sustainability can be
accomplished. This is due to the difficulty in this strategy to give suppliers the space for coming up with innovative and sustainable improvements on routes, in order to reduce VMT.

This framework also implies that each strategy has its limits. For example a tender with sustainable criteria is a good strategy to achieve low sustainable improvement. The tender however has its limits, because it does not allow radical sustainable improvements in the routes. When the bottom is reached of sustainable improvement in a tender, the company should go to the next level and switch to the portfolio effect using different strategies to improve sustainability. When the level of partnership strategy is reached, the model implies that the highest sustainable level is reached. A company can choose to stay on this level, when however the sustainable targets are met and the sustainable focus becomes less a company can also choose to take a step back to portfolio strategy or even to the tender strategy.

This chapter presented a short review on the available literature on the subject of sustainable transport purchasing. Within the literature a gap was identified, where the combination of sustainable purchasing and transport purchasing was barely made. This gap was explored further, by first gain a better understanding of the sustainability concept. The definition of this concept is used as input for the development of the conceptual model. This model states that the sustainable purchasing focus is highly influencing the purchasing strategy and consequently its outcome. A framework is proposed on how the strategy, based on literature, will change due to a shift in sustainability purchasing focus. This proposed maturity model is tested in the next paragraph.
3. Research methodology and results

In this section the research methodology is presented. The proposed maturity model will be tested by making use of the conceptual model for the interviews. This section presents how the interviews are selected and which structure is applied to these interviews. A short analysis is conducted from the interview methodology used, where after the results are presented of the qualitative research.

3.1 Research methodology

The purpose of the research is to gain insights in the drivers of sustainable transportation service purchasing and how transportation services are currently purchased within Mars. The research is therefore oriented at the discovery of qualities of things, which requires a qualitative research method rather than a quantitative research method (van Aken, Berends, & van der Bij, 2007). The research is an explorative research, which aims to gain insights from different directions on this topic. Because this research is explorative of nature and aims for insights on different directions, it was chosen to use the interview method to explore the different insights.

Five different directions are chosen to conduct insights from for this research. These points of view are considered to provide a good overall insight on the research objective. These points of views are from:

1) Associates within the company Mars

2) Purchasers from benchmark companies

3) Sustainable transportation organizations

4) Sustainable Transport events.

5) Logistic Service Suppliers

The associates within the company Mars are interviewed, because they have the daily knowledge about what is possible and what is not within the company. They also have knowledge about the current purchasing process of Mars. The purchasers from benchmark companies are interviewed, because they also have the daily knowledge of their current situation and the possibilities within their market. The sustainable transportation organizations are interviewed, because they have a broad view on this topic. These organizations set up different projects and worked with a lot of different companies, and have therefore a broad view of what is the current trend and what are the possibilities within the
sector. The sustainable transport events were attended, because these events were focused on the sustainable transport improvement within the sector. Within these events discussions and ideas are raised, which gave a good overview of the possibilities and the limits of sustainability in transportation. The information gained at these events, was considered as information gained from an interview. At last the logistic service supplier point of view was important, to understand what the limitations and possibilities are for the supplier.

For each point of view different companies and persons were selected to interview. How this selection was made and more details about the interviewed person or company can be found in Appendix B. The next table will shortly present the companies/events that were selected for the interviews;

<table>
<thead>
<tr>
<th>Table 2 - Selected companies and events for the interviews</th>
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<tbody>
<tr>
<td><strong>Associates within the company Mars</strong></td>
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<td>Mars Veghel (5 associates)</td>
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<td>Mars USA (2 associates)</td>
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<tr>
<td><strong>Purchasers from benchmark companies</strong></td>
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<td>Benchmark 3</td>
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<td><strong>Sustainable Transport event</strong></td>
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<td>European Supply Chain Forum (eSCF)</td>
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<td>New Hauliers Event</td>
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<td>Logistic service supplier 1</td>
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<td>Logistic service supplier 2</td>
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How the insights are gained in the interviews is explained in the next paragraph. This will elaborate on the structure of the interviews and the model that is used to map the interview results.
3.2 Interview structure

As mentioned before, the purpose of the interviews is to discover how transportation services are currently purchased and how this would change when there is a larger focus on sustainability. Therefore the interviews with the benchmark companies and the internal associates were focused on the current and the desired purchasing process. The other interviews were only focused on the desired purchasing process, because they don’t have a current transportation purchasing function in place. This was considered as valuable information from the interviews, because in here the interviewees were challenged to think outside the box. In their normal activities they can see opportunities to improve the purchasing process, but are hindered due to restrictions (on time, resources etc.) or management support.

To achieve the purpose of the interviews, the conceptual model as presented in chapter 2 in Figure 7 - Conceptual model was used to frame the interviews. The conceptual model focuses on the input, throughput and output of a sustainable purchasing process. Therefore, the input (sustainable purchasing focus), throughput (purchasing strategy) and the output (sustainable improvements) are the key points in the interviews. For each key point the different underlying concepts, as presented in the conceptual model, are discussed in the interviews. These key points are discussed in a semi-structured way to gather as much information as possible and discover the underlying key drivers for sustainable purchasing. The interview will be closed by proposing the proposed maturity model from Figure 8, where asked for their feedback and insights on the framework. The maturity model is only shown at the end to the interviewed person, so they were not pushed into a direction at the beginning of the interview. A deeper analysis of the interviews is presented in the following paragraph.

3.3 Interview analysis

The difficulties in preparing the interviews, was connecting to the right people in the different companies. The associates at Mars were willing to cooperate with the interviews, this was however not the case at several other companies. Therefore a lot of time was spent to search and target the right person to interview. In Table 3 the persons are presented that were found willing to do the interviews with. More detailed information on the selected persons and their companies can be found in Appendix B.
Table 3 - Persons selected for the interviews

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</tbody>
</table>

Within the interviews, the sustainable improvements so far were asked. This resulted in a lot of variable answers, which went from the CO2 reduction to the percentage of multi-modal. These answers were however difficult to compare. The interviewees who replied with CO2 reduction could be compared, but the calculation of these reductions are not standardized. It is therefore also hard to compare the reductions with each other. To have a fair comparison in sustainable improvement, the output of the lean & green program is used. This program distinguishes three levels of sustainable improvement. The Lean & Green award is the lowest level, which can be achieved when a plan is developed to improve sustainability in transportation. The second level is the ‘lean and green’ star; this one is awarded when the plan is actually executed. The highest level is the second start, which is awarded when a company is highly active and realizes significant sustainable improvements. All companies were connected to this program, which creates a fair comparison.

All the desired data was gathered from the interviews, as stated before. The structuring of this information and the results are presented in the following section.
3.4 Interview results

The results of the first part of the interviews are summarized in Table 4, according to the conceptual model. The results for the current situation are presented according to the input, throughput and output. The results for the desired situation are presented according to only the throughput and output. This is because it is assumed in the interviews that the input in the desired situation has already a high sustainable purchasing focus. From Table 4 it can be conducted that there is a relationship between the sustainable purchasing focus and the purchasing strategy and consequently the sustainable improvement.

Sustainable purchasing focus

Benchmark 1 and Benchmark 2 are companies, who have sustainable goals in place. These goals are focused on the CO2 equivalent emissions. This is not in line with their definition of sustainability; they explained that this was an easy and quick measurement. The definitions of sustainability is different among the companies, three have the triple bottom line approach (3p). Benchmark 1 focuses on the Quality, Environment and Economic aspects, where Benchmark 3 solely focuses on the CO2 emissions.

Purchasing strategy

The purchasing strategy differs among the companies. This difference is mainly in their approach towards the supplier relationship and the sourcing strategy. Benchmark 2 uses different sourcing strategies for different routes. For routes with high sustainable impact, they source for suppliers who can develop improvement solutions for these routes. Routes with low sustainable impact are approached as a normal leverage product. Benchmark 1 focuses more on the partnership relation and is therefore sourcing from a small selection of suppliers. They source only from supplier who can add sustainable value to them and with whom they have a cultural business fit. Mars incorporated sustainable sourcing by implementing a green tender. This means that before a supplier can participate into the tender process, the sustainability aspects of the company are screened. If these do not meet the standards of Mars, they are not invited to the tender process.

The supplier selection process is in every company based on economic and quality aspects. Besides these aspects different companies also have other aspects in place. Benchmark 2 selects their suppliers also on the ability for network optimization of the supplier. Where Benchmark 1 selects their suppliers also on the sustainable value the supplier will add to the company.
The relationship with the supplier differs among the company. It is noticeable that companies with high sustainable purchasing focus have a partnership approach towards their suppliers. Benchmark 2 has a competitive approach in this, where Benchmark 1 has a more strategic approach in the partnership. The partnership approach results also in longer contract terms. Companies with a business relationship towards their suppliers, have shorter contract terms.

**Sustainable improvement**

The multi modal solutions are often mentioned as sustainable improvement achievements. Companies with high sustainable purchasing focus are also more likely to focus on horizontal collaboration as sustainable improvement area. Benchmark 3 achieved sustainable improvement by internal innovation optimizing the load factor.

<table>
<thead>
<tr>
<th>Sustainable Purchasing focus</th>
<th>Benchmark 2</th>
<th>Benchmark 1</th>
<th>Benchmark 3</th>
<th>Mars</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sust. Goals</td>
<td>CO2 goals</td>
<td>CO2 goals</td>
<td>No goals</td>
<td>No goals</td>
</tr>
<tr>
<td>Sust. Def.</td>
<td>3P</td>
<td>QEE</td>
<td>CO2</td>
<td>3P</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Purchasing strategy</th>
<th>Portfolio</th>
<th>Partnerships</th>
<th>Tender</th>
<th>Tender</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sourcing strategy</td>
<td><em>Portfolio</em></td>
<td><em>Partnerships</em></td>
<td><em>Tender</em></td>
<td><em>Tender</em></td>
</tr>
<tr>
<td>Supplier selection</td>
<td><em>Economic and quality aspects</em></td>
<td><em>Economic and quality aspects</em></td>
<td><em>Economic and quality aspects</em></td>
<td><em>Economic and quality aspects</em></td>
</tr>
<tr>
<td>Supplier relationship</td>
<td><em>Small competitive partnerships</em></td>
<td><em>Strategic partnerships to improve routes on sustainability</em></td>
<td><em>Business relationship</em></td>
<td><em>Business relationship</em></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Sustainable Improvement</th>
<th>Medium</th>
<th>High</th>
<th>Low</th>
<th>Low</th>
</tr>
</thead>
<tbody>
<tr>
<td>Improvements</td>
<td><em>Dead miles reduction</em></td>
<td><em>Multimodal</em></td>
<td><em>Optimizing load factor</em></td>
<td><em>Multimodal</em></td>
</tr>
<tr>
<td>L&amp;G</td>
<td>Star</td>
<td>2nd Star</td>
<td>Award</td>
<td>Award</td>
</tr>
</tbody>
</table>

If we reflect the results of the current situation on the proposed maturity model, the companies can be situated in the proposed maturity model according to Figure 9. This indicates that the proposed maturity model is an accurate model.
The results of the second part of the interview are presented in Table 5. These results concern the desired situation when the sustainable purchasing focus is high.

**Sourcing strategy**

Different sourcing strategies are mentioned for the desired situation. Benchmark 1 mentions that in the idealistic situation they have only one supplier and that the supplier gives them no reason to switch. Sourcing from only a few suppliers and portfolio sourcing are the most mentioned sourcing strategies. The EVO organization mentioned that it is better to have a large group of suppliers to source from, in order to stimulate competition among the companies. Mars USA and Associate 2 confirm this sourcing strategy, where competition among suppliers is stimulated.

**Supplier selection**

Besides the economic and quality aspects, sustainable aspects are often mentioned for the supplier selection. These criteria are then used in a multi criteria selection process, where the sustainable criteria have a certain selection weight. The fit between the supplier and the company is also important according to the results. There are different fits mentioned; cultural fit, collaboration fit and trust. It is important for a partnership that there is a cultural fit that both the company and the supplier are on the same level. This is also reflected within the collaboration fit, where the focus is more on the ease of collaboration between each other. Trust is mentioned during the eSCF as an important enabler.
for sustainable solution development. Pure-birds see the supplier selection as a pitch process, where the supplier should pitch their sustainable ideas/projects to the company. With this process the company can decide which project/ideas fit best to their company and their goals.

Supplier relationship

The partnership relation is often mentioned during the interviews. There are two kinds of partnerships mentioned; competitive and strategic. Competitive partnerships are partnerships which are challenged and benchmarked among other companies, in order to keep the partner sharp and active. The strategic partnership approaches the supplier more as a part of the company and does not see them as a short term and easy replaceable partner.

The results show that it is important to aim for information sharing in the relationship. Transparency is mentioned during the Smart Match meeting as a key issue in developing sustainable solutions. Sharing information and communicating what the company expects from its suppliers, will activate the knowledge of the supplier. This will improve the development of the sustainable solutions. The GFE organizations states that the company should educate her supplier and help them to become more sustainable. Mark Schenkius mentions that the feedback loop in a relationship is important, so that both parties know what they expect from each other and how they can improve to meet up with that expectation.

Contract Term

The contract terms are mostly 3 to 5 years; this is due to the partnership relation. A partnership relation is not effective when there is only a short term contract in place. It will not activate the supplier to intensively search for sustainable solutions, if they are not assured for the business next year. In the internal interviews, they are reluctant for the very long term contracts. They agree however that more than one year contract is acceptable.

Improvements

Horizontal collaboration is an improvement area which is often mentioned in during the interviews. The combination of different loads and therefore enable multi modal solutions for example, will cause large sustainable improvements. Also the vertical collaboration is mentioned, which has an overlap with supply chain optimization. Vertical collaboration is focused improving routing, for example direct deliveries. Associate 5 thinks that in the area of loading factor, large improvements can be
achieved. This is also directly linked to collaboration with the supplier, to investigated possibilities to improve the loading factor.

Table 5 - Interview results desired situation

<table>
<thead>
<tr>
<th>Benchmarks</th>
<th>Sourcing Strategy</th>
<th>Supplier Selection*</th>
<th>Supplier Relationship</th>
<th>Contract Term</th>
<th>Improvements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Benchmark 2</td>
<td>Few suppliers</td>
<td>Sustainable aspects</td>
<td>Competitive partnerships</td>
<td>1-3 year</td>
<td>-Horizontal collaboration</td>
</tr>
<tr>
<td>Benchmark 1</td>
<td>One supplier</td>
<td>Adding sustainable solutions and value</td>
<td>Strategic partnership</td>
<td>3-5 year</td>
<td>-Horizontal collaboration</td>
</tr>
<tr>
<td>Benchmark 3</td>
<td>Few suppliers</td>
<td>Sustainable aspects</td>
<td>Competitive partnerships</td>
<td>3 years</td>
<td>-Multi modal</td>
</tr>
<tr>
<td>Branche</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>-Horizontal collaboration</td>
</tr>
<tr>
<td>Connekt</td>
<td>Portfolio sourcing</td>
<td>Sustainable aspects and certification</td>
<td>Information sharing Collaboration solution based</td>
<td>2-3 year</td>
<td>-Vertical collaboration</td>
</tr>
<tr>
<td>Pure-birds</td>
<td>Solution based sourcing</td>
<td>Solution pitch</td>
<td>Information sharing Mutual goals</td>
<td>3-5 year</td>
<td>-Revealing hidden improvements/costs -Activating knowledge</td>
</tr>
<tr>
<td>GFE</td>
<td>Few suppliers</td>
<td>Cultural fit</td>
<td>Supplier education</td>
<td>5 year</td>
<td>-Horizontal collaboration -Multi modal</td>
</tr>
<tr>
<td>EVO</td>
<td>Sustainable pre selection large group suppliers</td>
<td>Sustainable aspects</td>
<td>Competitive partnerships</td>
<td>2-3 year</td>
<td>-Vertical collaboration</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Shippers</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Logistic service supplier 2</td>
<td>Portfolio sourcing</td>
<td>Total cost of solution</td>
<td>Collaborative partnerships with mutual goals</td>
<td>3-5 year</td>
<td>-Multi modal -Horizontal and Vertical collaboration</td>
</tr>
<tr>
<td>Logistic service supplier 1</td>
<td>Few suppliers, solution based</td>
<td>Collaboration fit</td>
<td>Competitive partnerships</td>
<td>3-5 year</td>
<td>-Optimizing network</td>
</tr>
<tr>
<td>Events</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Smart Match</td>
<td>Portfolio sourcing</td>
<td>Network optimization</td>
<td>Information sharing</td>
<td>2-3 year</td>
<td>-Horizontal collaboration -Multi modal</td>
</tr>
<tr>
<td>eSCF</td>
<td>Few suppliers</td>
<td>Trust and cultural fit</td>
<td>Competitive partnerships</td>
<td>3-5 year</td>
<td>-Reducing dead miles -Vertical collaboration</td>
</tr>
<tr>
<td>New Hauliers Event</td>
<td>Few suppliers</td>
<td>Sustainable aspects</td>
<td>Competitive partnerships Information sharing</td>
<td>2-3 year</td>
<td>-Optimizing load factor -Vertical collaboration</td>
</tr>
<tr>
<td>Internal</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Person x</td>
<td>Portfolio sourcing</td>
<td>Solution based and sustainable aspects</td>
<td>Competitive and collaborative partnerships Information sharing</td>
<td>2-3 year</td>
<td>-Multi modal -Network optimizing</td>
</tr>
<tr>
<td>Person y</td>
<td>Sustainable pre selection large group suppliers</td>
<td>Sustainable aspects</td>
<td>Competitive partnerships</td>
<td>1-3 year</td>
<td>-Multi modal</td>
</tr>
<tr>
<td>Person z</td>
<td>Portfolio sourcing</td>
<td>Sustainable aspects</td>
<td>Competitive partnerships Information sharing</td>
<td>2-3 year</td>
<td>-Network optimizing</td>
</tr>
<tr>
<td>Person u</td>
<td>Portfolio sourcing</td>
<td>Network fit and sustainable aspects</td>
<td>Collaborative partnerships</td>
<td>2-3 year</td>
<td>-Loading factor -Network optimizing</td>
</tr>
<tr>
<td>Person v</td>
<td>Sustainable pre selection large group suppliers</td>
<td>Collaborative fit and sustainable aspects</td>
<td>Feedback relationship Information sharing</td>
<td>1-2 year</td>
<td>-Feedback loop -Mindset change</td>
</tr>
<tr>
<td>Person w</td>
<td>All supplier sourcing</td>
<td>Solution based</td>
<td>Solution based relationship</td>
<td>1 year</td>
<td>-Multi modal -Reducing dead miles</td>
</tr>
</tbody>
</table>

Postulate

From the interviews about the desired situation, it can be concluded that the framework should not be a one way framework. The partnership is meant to develop improvement on routes. If these
improvements are developed and executed with the partner, it is likely that this solution is going to be tendered after a while because of the leverage market. Therefore the framework should be two directional that a company can also return back to the tender strategy. This however not means that the sustainable improvement, which is made in the partnership, disappears. Therefore the y-axis is described as the relative sustainable improvement. The revised framework is presented in the next paragraph.

3.5 Revised framework

In Figure 10 the revised framework is presented, this is the proposed model from the literature with the adjustments from the results of the interviews. The results of the interviews confirmed more or less the framework proposed form the literature. Some little adjustments need to be made. The final model presents on the x-axis the sustainable purchasing focus of a company. If the focus of a company is only on costs, they will be on the left side of the x-axis. If the sustainability focus increase, by implementing for example sustainable purchasing goals, the company will move to the right side of the x-axis. On the y-axis the sustainable improvement is presented, this represents the sustainable improvement that can be achieved. This is measured relative to their current sustainable situation. The sustainable improvement can for example be measured relative to a company her current CO2 equivalent emissions, because this can easily be calculated. It is however dependent on the sustainable definition of a company how the sustainable improvement is calculated.

There are three sustainable purchasing strategies in the framework; tender strategy with sustainable criteria, portfolio strategy and the competitive partnerships. When there is more focus on costs than on sustainability, the tender strategy with sustainability criteria can best be applied. This however implies that there will be a low relative sustainable improvement possible. When there is a high focus on sustainability in purchasing, a company can best look for competitive partnerships. With this strategy they can obtain the highest sustainable improvement. The framework is a two-directional framework, because the sustainability focus of a company can change. If for example the sustainability-focus increases, one can move to the portfolio strategy. When there is a certain level of sustainability improvement achieved, the cost focus can become more dominant again. Then the company will go back to the tender strategy with sustainability criteria. When however the sustainability level is not achieved already, they can move onwards to competitive partnerships.
This chapter concerns the practical point of view of this research. This point of view was established by making use of interviews. To get a good understanding of the practice, the interview selection was focused on five points of view. The interviews were semi-structured to gather as much relevant information as possible. The right and desired information was gathered and is presented by means of two tables. From these results it can be concluded that the proposed maturity model, was more or less true. With some little adjustments, the revised framework is presented in the end of this chapter. This revised framework and the conceptual model will be used as input to extract a solution direction for the Mars case.
4. Mars case

The revised framework is used to develop solution directions for Mars. First the current situation is analyzed in on how they purchase and what role sustainability plays here. There after three solution directions are presented for the Mars case, where one solution will be chosen to develop further.

4.1 Current situation

The Cross Border Transport team of Mars is responsible for purchasing all the transport services on the cross border outbound routes within Europe. These are in total 883 routes, with on each route one or more (up to 2800) loads to fulfill each year. In the current situation the Cross Border Transport team purchases their transportation services by means of a tender strategy, which is executed each year for all routes. The tender process is presented in Figure 11. A detailed description of this process can be found in Appendix C. In this section only the important parts for the case are discussed.

![Figure 11 - Tender process current situation](image-url)
The tender process is a well-structured and detailed process, which is divided into four phases. The first phase is the preparation phase, where the essential parts for the tender process are discussed like the output of the RFI-document, the contract set up and the criteria for the supplier selection. In this phase the route set up is also conducted in collaboration with the internal stakeholders. Other practical decisions are made in this phase like the roles and responsibilities of the CBT buyers and the project timings.

A second step in preparation phase is the invitation of suppliers to the tender process. These suppliers consist of the existing suppliers, the suppliers who took part in the last tender years but were not allocated (non-successful suppliers), and several new suppliers. These new suppliers are following a screening process before they receive the invitation.

A new supplier has to initiate to Mars that they want to take part in the process. Mars aligns first the expectations of the supplier and those of Mars, when this is aligned the new supplier receives a request for information. In this RFI there is also a sustainable question part, where Mars ask the supplier to fill in several sustainability questions. This RFI document is scanned by Mars and they determine if this supplier meets the requirements to participate in the tender process. The non-successful suppliers and the existing suppliers receive each year a financial RFI, to determine their financial status. If this meets the requirements of Mars, they also are invited to the tender process. This invitation process can be visualized as presented in Figure 12.

![Figure 12 - Invitation process for tender process](image-url)
The second phase is the tender phase, where the tender process is executed. The tender process consists of three rounds. The first round is a very simple one, where the suppliers can place their bid on the presented routes in an online tender platform. In the second round an auction strategy is applied, where the suppliers can outbid each other in the online platform. After this round, the CBT-buyers make a draft allocation based on the following selection criteria ranked in order of importance;

1. Quality of service
2. Total cost of solution
3. Soft factors
4. Modality

When the draft allocation is made, the top 20 biggest suppliers and potential new suppliers in the draft allocation are invited for further negotiation. Thereafter the final allocation is conducted by the CBT buyers.

The final allocation is communicated in the implementation phase to all stakeholders. In this phase the new route allocation is implemented and executed. The last phase of the current process is the evaluation phase. In here the suppliers as well the internal stakeholders are evaluated. This is based on the pay for performance program, but also on the feedback from the suppliers and internal stakeholders.

From the internal interviews results the current purchasing process of Mars can be reflected on the finale maturity model as presented in Figure 13. Mars is using the tender strategy and has with the sustainable part of the RFI, sustainable criteria in place. Also the modality plays a role in the decision making, which is considered as a sustainable criterion. Because Mars wants to investigate how to improve sustainability with this thesis, the focus on sustainability in the purchasing process is increasing. Therefore they are placed on the upper line which has a direction to the right side.
If we reflect this on the conceptual model, there are several aspects in their strategy which needs to be changed when there becomes more sustainable purchasing focus. These aspects are marked “red” in Table 6 below, which is conducted from the interview results as presented in Table 4 - Interview results current situation in the previous chapter. The red marked aspects are different then the benchmark companies and are therefore considered to change, in order to achieve the same sustainable improvements.

Table 6 - Reflection on conceptual model

<table>
<thead>
<tr>
<th>Sustainable Purchasing focus</th>
<th>Mars</th>
<th>Average</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sustainable Goals</td>
<td>No goals</td>
<td></td>
</tr>
<tr>
<td>Sustainable Definition</td>
<td>3P</td>
<td></td>
</tr>
<tr>
<td>Sustainable Calculation</td>
<td>Yes – CO2</td>
<td></td>
</tr>
<tr>
<td>Purchasing strategy</td>
<td>Tender</td>
<td></td>
</tr>
<tr>
<td>Sourcing strategy</td>
<td>* Sustainable sourcing through RFI (Green Tender)</td>
<td></td>
</tr>
<tr>
<td>Supplier selection</td>
<td>*Economic and quality aspects</td>
<td></td>
</tr>
<tr>
<td></td>
<td>*Small sustainable criteria</td>
<td></td>
</tr>
<tr>
<td>Supplier relationship</td>
<td>*Business relationship</td>
<td></td>
</tr>
<tr>
<td></td>
<td>*Supplier engagement</td>
<td></td>
</tr>
<tr>
<td></td>
<td>*1 year contract</td>
<td></td>
</tr>
<tr>
<td>Sustainable Improvement</td>
<td>Low</td>
<td></td>
</tr>
<tr>
<td>Improvements</td>
<td>* Multimodal</td>
<td></td>
</tr>
<tr>
<td>L&amp;G Award</td>
<td>Award</td>
<td></td>
</tr>
</tbody>
</table>
This reflection discovers that Mars has to change their sustainable goals, their sourcing strategy, their supplier selection or their relationships with the supplier if they want to achieve a larger sustainable improvement than their current improvement. How these aspects need to be changed is explained in the next section, where the desired situation is described.

4.2 Desired situation
The rising focus on sustainability within the CBT purchasing team of Mars implies that they want to achieve a larger sustainable improvement than they currently have. This is also conducted from the problem statement. In order to establish a larger sustainability improvement, they should move into the right direction within the proposed maturity model. It is questionable how far they should move in the right direction and what aspects of the conceptual model they need to change. Three solution directions are developed where Mars move to the right within the framework, where each direction will represent a different movement and different aspects of the conceptual model. Remark for these solution directions is that it accounts for all solution directions, that sustainable goals needs to come in place. This is however the task of the top and middle management and are therefore not considered in the solution directions.

Solution direction 1 – Tender strategy with sustainable selection criteria
The first solution direction is to improve the current tender strategy and change the supplier selection aspect of the strategy. Currently there are already sustainable criteria in place in the tender process. It is however questioned how well the criteria represent the level of sustainability and how they assure that sustainability is improved, because the criteria do not cover all aspects of Mars their definition of sustainability. Therefore a well-defined set of criteria should be developed to select the supplier on. These criteria should be developed in a way that they can be implemented in the RFI. The set of questions in the RFI should be combined to one or more selection aspects. Dependent on the sustainability focus of the top and middle management, the criteria will be assigned with different selection weight.

It can also be considered to only invite sustainable suppliers to the tender process. This will however harm the core of a tender strategy, namely making use of the leverage power. Only inviting sustainable suppliers will reduce the leverage power. The sustainable selection is therefore made within the tender process and not before the tender process.
This solution direction will imply only a little improvement in the sustainability within the transportation. The process change is however also very limited, so that with little change little improvement can be established.

**Solution direction 2 – Portfolio strategy**

The second solution direction is focused on a step to the right in the maturity model. This implies that Mars should adjust their sourcing strategy and supplier relationships. Mars should adopt a different purchasing strategy, the portfolio strategy. This portfolio strategy implies that the CBT team should use different strategies for different routes. The aim of this strategy is to improve the sustainability in a structured way and in a logical sequence. This is achieved by making a sustainable portfolio of the routes in place. In this portfolio the routes are sorted by the sustainability impact they have. This sustainable portfolio will be used as a guideline to allocate the right strategy to the right routes. Routes with a high sustainability impact have potential for the competitive partnerships strategy, in order to improve sustainability. Routes with low sustainability impact have not the potential for a large sustainable improvement. These routes should not be the sustainable focus points of Mars, therefore the tender strategy with sustainable criteria can still be in place for these routes.

Using multiple strategies, instead of one overall strategy requires more resources. To create resources for using multiple strategies, the resource-efficiency of both strategies should be improved. For the tender strategy, this can be achieved by looking for example to longer contract terms. With longer contract terms, the tender process does not have to be executed each year. This will save resources, which can be used for the other strategies. Improving the competitive partnership strategy can be done for example to divide the lead of the partnerships. For several routes Mars should take the lead in the partnership and for other routes the supplier will take the lead.

This solution direction implies a medium improvement in sustainability, but also a change in the purchasing process. The tender strategy can still be applied to a part of the routes, so the change impact will not be that high.

**Solution direction 3 – Competitive partnerships strategy**

The third solution direction is focusing on the most right side of the maturity model, where the largest sustainable improvement is achieved. This entails the strategy of competitive partnerships. In here as well, the sourcing strategy and the supplier relationship should be changed. Adopting this strategy, means that the purchasing process is radical changed. The focus is not on the short term, but
on the long term with dependency in both directions. Mars should look for different partnerships in different parts of Europe. It is however difficult to divide Europe in parts, because this concerns cross border transport. It is therefore possible to determine the partnerships on the fit of the supplier his network layout and the network lay out of Mars. One partnership is not desirable, because this creates too much dependency for Mars which is in opposition to their five principles. Several partners are needed where each partner has its own specialty.

The small supplier base can improve communication between suppliers and therefore enhance the development of sustainable solutions. Mars can arrange quarterly meetings with the several partners, to have discussion on the current processes. During these quarterly meetings, the suppliers can learn from each other how to improve. These meetings will create a more direct link between suppliers and also between the suppliers and Mars, which will reveal hidden possibilities. Because the supplier and Mars have now a partnership relation, there exists a mutual goal. This will activate the supplier to actively search for (sustainable) improvement solutions for Mars. This is difficult to achieve within a tender process, it could be achieved during a portfolio strategy when the supplier is encouraged and informed to do such efforts.

It is important when moving to the partnership strategy to find the right partners. Cultural fit is essential in here, in order to develop mutual goals. It is also important to have good contracts in place. Because the focus is on the long term, the chance exist that supplier are not challenged anymore after a while and their effort to Mars will decrease. With for example performance based contracting this motivation can be kept high over the long term. It is also important to actively stimulate commitment and engagement among the suppliers. Communication is essential, so that the supplier knows what Mars expects from their activities.

Choice of solution direction

The three solution directions have different impact on the process and different impacts on the sustainability improvements; this is also presented in Table 7.
Table 7 - Choice of solution directions

<table>
<thead>
<tr>
<th>Solution direction 1 – Tender process with sust. Criteria</th>
<th>Sustainable Improvement</th>
<th>Process change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low</td>
<td>Incremental – Change in supplier selection process</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Solution direction 2 – Portfolio strategy</th>
<th>Medium</th>
<th>Semi-radical – Change in sourcing strategy and partly in supplier selection process and supplier relationship</th>
</tr>
</thead>
</table>

| Solution direction 3 – Competitive partnerships         | High                    | Radical – Change in sourcing strategy, supplier selection process and supplier relationship |

Mars has an ambitious program with the Sustainable in Generation program. If they also want to draw a parallel to transportation and take their sustainable responsibility in the supply chain, they should focus on medium or high sustainable improvement. This means that solution direction 1 is not an option. It is desired for Mars to gradual move to another process rather than radical change the purchase process. Radical changing the process implies also a higher risk of failure, which in consequence can also lead to violating sustainability instead of improving sustainability. It is therefore considered to go for solution direction 2, where the sustainable improvement is of a medium level and the process change is semi-radical.

Solution direction 2 has as advantage that Mars can gradually implement the new strategy. The tender strategy can still be in place and after the developing of the sustainable portfolio, new strategies can gradually be assigned to different routes. For this solution direction a small mind set change is needed for as well the suppliers as for Mars. Gradually moving to this strategy can enhance the success of the mindset change. Radical changing to solution direction 3 will also violate the mutuality principle of Mars. The supplier base will be largely reduced at solution direction 3, which causes that there will be a large number of suppliers see their business with Mars disappearing. This will harm the businesses of these suppliers and is not in line with the principles of Mars.

Another advantage of solution direction 2 is that Mars can get accustomed to partnerships. Currently they have less or even none experience with partnerships in within the CBT team. With this
solution direction, small partnerships will be developed. It will also give Mars insights and experience in finding the right partner, who fit to the culture and business of Mars. This is important in partnerships and can be helpful in the future for Mars. When the focus on sustainability increases over years, Mars should according to the maturity model move into competitive partnerships strategy. This is then a less radical change, because Mars already has experience with partnerships and has an idea which suppliers fit to them.

This chapter presents a solution for the Mars case. The current situation was first described and was compared to the proposed maturity model and the conceptual model. From this comparison three solution directions were distracted. One solution direction is chosen, for further development. This solution direction will be further developed in the next chapter.
5. Implementation plan

This section provides an implementation plan for Mars how to implement the chosen solution direction from previous chapter. First an implementation plan is developed consisting of four steps. These steps are further elaborated. The last part of this section describes the execution of different parts of the implementation plan.

5.1 How should Mars go there

To improve sustainability in the purchasing process, Mars should transform the current process into the desired process of the portfolio strategy. Before switching to the desired state, several steps need to be executed. These steps are presented in the implementation plan. This implementation plan consists of four main steps; 1) Develop sustainable portfolio 2) Develop and allocate strategies 3) Develop control panel 4) Improve efficiency of strategies. The implementation plan is presented in Figure 14.

![Figure 14 - Implementation plan](image-url)
This implementation plan is a stage gate plan, where the previous step should be completely finished before starting with the next one. Only the last step is a continuous improvement step. The implementation plan will be further elaborated in the remaining of this paragraph.

**Develop sustainable portfolio**

The first step towards the desired situation is to develop the portfolio. Because this strategy is used to improve the sustainability on the routes, the portfolio should be based on sustainability improvement. Therefore the portfolio will rank the routes on the potential to improve sustainability. As seen in Chapter 2, sustainability in transportation has a direct link with VMT. If the VMT can be reduced, by using for example intermodal solution or optimizing load factor, the sustainability improves.

Because of the direct link between VMT and sustainability, the main criterion in the portfolio is the VMT per route on one year basis. This is calculated by taking into account the distance between origin and destination on a route ($D_x$), the number of loads per year ($L_x$) and the percentage which is travelled by truck in the last tender year ($V_x$). This last aspect is taken into account because some routes are already an intermodal solution. Therefore not all the kilometers can be calculated as Vehicle Miles Travelled. When there is a new route, the percentage of miles that is travelled by truck is assumed to be 100%. The VMT on each route is calculated as follows:

$$ VMT \text{ on route } x = D_x \cdot L_x \cdot V_x $$

With this calculation for each route the total projected VMT for the given tender year can be calculated. This number will be used to divide the routes into three different categories. These categories represent routes with; A) High sustainable improvement potential B) Medium sustainable improvement potential and C) Low sustainable improvement potential. Routes with high number of VMT are categorized as Route A, routes with medium number of VMT are categorized as Route B and routes with a low number of VMT are categorized as Route C. The categorization of these routes will help to navigate the sustainability focus of Mars on the routes with high sustainability improvement potential.

**Develop and allocate strategies**

When the sustainable portfolio is developed, different strategies can be allocated to the different categories.
**A-routes - Competitive partnership Mars leading**

The A-routes are the routes with the highest sustainable improvement potential, and are the routes where Mars should focus on in terms of sustainability. Therefore this needs a strategy which explores and develops the improvement potential. From the literature study in Chapter 2 it can be conducted that these improvement potentials are possible in several aspects. The most important improvement potentials are listed below;

- Reduce empty mileages
- Increase fill rate
- Affect truck driving behavior
- Increase truck driver safety
- Choose optimal intermodal solution
- Fuel efficient truck investments

To develop this potential, internal knowledge, external knowledge, creativity and innovation is required. These four requirements can hardly be achieved in a tender process. Therefore Mars should look into close collaboration with suppliers to activate the external knowledge and create possibilities for innovation and creativity. This can be achieved in partnerships.

Because the routes in this category have high sustainable improvement potential, Mars should actively look for possible improvements and partnerships. This means that Mars should explore the improvement possibilities in the market, and find the right partner to develop these possibilities into solutions.

**B routes - Competitive partnership Supplier leading**

The B routes are the routes with medium sustainable improvement potential. These routes require also the sustainable focus of Mars but to a lower extent as on the A routes. The potential of these routes should be explored, but in here the supplier should be leading in the exploration of the potential. Mars has to communicate to the suppliers, what the B routes are and that they want to improve on sustainability on these routes.

The B-routes account however still for a significant part of the total yearly transportation costs. Mars should not neglect their leverage power on these routes and should still use the tender strategy with sustainable criteria for these routes. However, the supplier can propose to Mars on or more sustainable solutions on specific routes outside of the tender. If Mars approves this solution, the route
will be taken out of the tender and a competitive partnership will be formed on that specific route to develop the solution. This mechanism, attempts to activate the supplier to explore and develop the sustainable possibilities on the B-routes. Their reward on the effort they put into the exploration of these solutions, is the competitive partnership which will be established on that specific route.

The role of Mars in the exploration of the possibilities is limited; the main focus should be on the A-routes. However Mars should not be the bottleneck in the exploration of the supplier onto sustainable solutions. They should provide the supplier with enough information, in order that the supplier can explore and develop the solution sufficiently.

*C routes - Tender strategy with sustainable criteria*

The C routes are the routes with the lowest sustainable improvement potential. The sustainable focus of Mars should be limited on these routes. The purchasing strategy for these routes should be very simple and still efficient in order to provide more time and effort on the A and B routes, but still receive good rates on these routes. This requires again also a tender strategy approach with sustainable criteria. However, to save time and effort for using on the A&B routes this tender strategy should have a longer time frame then one year. Moving to a time frame for example of two years, this will save the time which is normally spend to prepare and execute the tender process of another year. The potential loss that will be incurred because of the longer time frame can be rewarded in the improvements on the A & B routes.

*Develop control panel*

To analyze and control the effectiveness of the new strategy, a control panel should be developed. This control panel should give insights on the sustainability of the purchasing process. Therefore this control panel has several key performance indicators. These key performance indicators are focused on the definition of sustainability; People, Planet & Profit. For each bottom line a separate KPI is developed, there is also an overall KPI established. These KPI’s should be applicable for each route, in order to control and analyze on different levels. These levels can be for example; route-level, strategy-level and overall-level. It is important to develop the KPI’s in such a way, that they are comparable over the years. The KPI’s used for the control panel will be elaborated below.

*KPI – People*

Richardson (2005) associates the people aspect to the safety in freight transportation. Safety is a consequence of several factors and only a few of them can be influenced by the transport provider. The three most important influenceable factors are; truck driver behavior, compliance to government
policies and vehicle miles travelled. The truck driver behavior is difficult to measure; it depends on different aspects like experience of the driver, training etc. The aspect of compliance to government policies is captured in the code of conduct of Mars, which is a 12-page document which suppliers have to sign. This document captures rules concerning compliance to government policies and to policies of Mars. The last aspect of Vehicle Miles Travelled can be influenced during the purchasing process and is less difficult to measure than the truck driver behavior. Therefore the Vehicle Miles Travelled will represent the people KPI. When the VMT is reduced, the risk on accidents on the roads is also reduced. VTM reduction will also imply less congestion on the roads and less CO2 equivalent emissions.

The KPI of People is therefore focused on the VMT. This KPI represents the percentage of the miles travelled, which is not done by truck/road. This is calculated by dividing the vehicle truck miles travelled on the n-number of routes by the total miles travelled on the n-number of routes. This will represent the percentage of miles travelled by road, 1 – this percentage will give the percentage of miles travelled not by road. This is calculated according to the following formula;

$$\% \text{ Miles Travelled not by road} = 1 - \frac{\sum_{x=1}^{n} \sum_{y=1}^{m} A_{xy} \cdot D_x \cdot L_x \cdot M_{xy1}}{\sum_{x=1}^{n} D_x \cdot L_x}$$

In this equation the total miles travelled by truck on route x is calculated according to;

$$\sum_{y=1}^{m} A_{xy} \cdot D_x \cdot L_x \cdot M_{xy1}$$

Where;

- \(x\) = Route number
- \(y\) = Supplier bid number
- \(z\) = Modality (1 = Road, 2 = Rail, 3 = Water)
- \(L_x\) = Total loads per year for route number x
- \(D_x\) = Distance on route number x
- \(M_{xyz}\) = Percentage per modality type \(z\), per supplier bid \(y\), per route number x
- \(A_{xy}\) = Allocation percentage per route number \(x\) per supplier bid \(y\)
In here \( A_{xy} \) is the allocation percentage of supplier \( y \) to route \( x \). \( D_x \) is the distance on route \( x \), \( L_x \) is the loads per year on route \( x \) and \( M_{xy1} \) is the percentage of miles that is travelled by truck on route \( x \) by supplier \( y \). These miles are calculated for \( n \) routes, which is determined by the analyze level. If for example the level is overall, the \( n \) will represent the total number of routes included in the purchasing process. This leads to the formula \( \sum_{x=1}^{n} \sum_{y=1}^{m} A_{xy} * D_x * L_x * M_{xy1} \). The total miles travelled are calculated according to \( \sum_{x=1}^{n} D_x * L_x \). Dividing the VMT by the total miles travelled makes the KPI well comparable over the years.

**KPI – Planet**

Richardson (2005) discovered three factors of freight transport which affect the planet; fuel consumption (resource depletion), congestion (land use) and emissions. The aspect of congestion is already taken into account within the People KPI. The two other aspects of fuel consumption and emissions are interrelated to each other. Bauer, Bektas & Grainic (2010) describes different emissions from transportation; greenhouse gas emissions (CH\(_4\), CO\(_2\) and N\(_2\)O), toxic emissions on ecosystems (acidification; by emitting CO\(_2\), NO\(_x\) and SO\(_2\)) and toxic emissions on humans (by emitting non-methane hydrocarbons, NO\(_x\), SO\(_2\) and particles). From the interviews it can be concluded that the benchmark companies focus their Planet KPI on the emission of CO\(_2\) equivalent, because this is easy to calculate. To benchmark this KPI with other companies, the Planet KPI is therefore also focusing on CO\(_2\) equivalent emissions. The CO\(_2\) emissions are calculated by the following formula;

\[
\text{gram CO2 equivalent per tonnes/kilometer} = \frac{\sum_{x=1}^{n} \sum_{y=1}^{m} \sum_{z=1}^{o} D_x \cdot L_{xyz} \cdot M_{xyz} \cdot A_{xy} \cdot E_z}{\sum_{x=1}^{n} W_x \cdot D_x}
\]

Where; 

\( W_{Rx} + CR_x = 1 \)

\( x = \) Route number

\( y = \) Supplier bid

\( z = \) Modality (1 = Road, 2 = Rail, 3 = Water)

\( L_{xyz} = \) Total loads per year per modality type \( z \), per supplier bid \( y \), per route number \( x \)

\( D_x = \) Distance on route number \( x \)

\( W_x = \) Total Weight in tonnes per year per route number \( x \)

\( M_{xyz} = \) Percentage modality type \( z \), per supplier bid \( y \), per route
number \( x \)

\[ A_{xy} = \text{Allocation percentage per route number } x \text{ per supplier bid } y \]

\[ E_z = \text{Emission factor gram CO2 eq./tonnes/km per modality type } z \]

\[ \text{WR} = \text{Weight Restricted } [0, 1] \]

\[ \text{CR} = \text{Capacity Restricted } [0, 1] \]

In here the total loads per year is separately calculated. This is to differentiate between sustainable and normal solutions. For example for a weight restricted route, a supplier can choose to increase the payload by making use of light-weight containers and therefore reduce the number of loads. For a capacity restricted route, a supplier can choose for a ‘LZV’ combination and reduce in consequence the number of loads.

**KPI – Profit**

The profit aspect is from an economical point of view essential to measure and analyze. This KPI is focused on the savings with respect to the market standards. The market standards are conducted from the tender. Routes which are taken out of the tender are compared to similar routes, which are in the tender. The savings are calculated by determining the average price per tonnes. This average price is compared to the price paid per tonnes. The difference between the average price per tonnes and the paid price per tonnes is multiplied by the total tonnes on that specific route. The savings are summed up by all the \( n \)-routes. This number is divided by the average market price on those routes. This will return the savings percentage.

\[
\text{Savings percentage} = \frac{\sum_{x=1}^{n} \left( \frac{\sum_{y=1}^{m} \text{Price per tonnes}_{xy}}{m} - \sum_{y=1}^{m} \text{Price per tonnes}_{xy} \cdot A_{xy} \right)}{\sum_{x=1}^{n} \left( \frac{\sum_{y=1}^{m} \text{Price per tonnes}_{xy}}{m} \right)}
\]

**KPI – Sustainable Improvement**

The last KPI is focused on the sustainability improvement (SI) with respect to last year. This KPI is established to determine if there is real improvement in place in sustainability. The other three KPI’s are compared to last year KPI’s, where from each KPI the percentage of improvement is determined. The sum of these percentages represents the output of the KPI Sustainable Improvement. A sensitivity analysis is needed to determine the weight of the each KPI’s. There is however no historic data of the profit KPI, due to confidentiality. Therefore this sensitivity analysis is not possible to execute. Therefore in here the weight of the KPI’s improvement is considered equal over all three KPI’s. This is done
because it is considered that all three KPI’s are of even importance. The sum of the percentage improvement is divided by three, to get an overall sustainable improvement percentage.

\[ SI = \frac{People_y + People_{y-1}}{People_{y-1}} + \frac{Planet_y + Planet_{y-1}}{Planet_{y-1}} + \frac{Profit_y + Profit_{y-1}}{Profit_{y-1}} \times 3 \]

**Improve strategies**

The last part of the implementation plan is the improvement of the strategies. This is a continuous process, which should be in close relation to the control panel. Within the control panel the efficiency of the strategies can be analyzed, if the efficiency is not as desired the strategy should be adapted. This accounts also for the allocation of the routes to the strategies and the development of new strategies, within the sustainable portfolio. This process is presented in Figure 15, which should be a continue loop.

![Diagram](image)

**Figure 15 - Optimizing loop**

5.2 Elaboration of implementation plan

There are several steps from the implementation plan which are executed during this research. This section describes the execution of these steps and the choices that are made. The first step is the development of the sustainable portfolio and the allocation of strategies to this portfolio.

**Allocation routes**

There are in total in the tender year of 2014, 883 routes, these routes entails in total 82.560.817 VMT. In Figure 16 the cumulative percentage of VMT’s are plotted against the cumulative percentage of routes. In this figure it can be determined that in 10% of the routes, there is 50% of the total VMT’s. To be more specific, in only 4 routes there is 10% of the VMT’s travelled. Another conclusion is that in 80%
of the routes, there is only 20% of the total VMT’s. This has a direct line with the 80/20 rule as described by Van Weele (2002). Van Weele (2002) however describes the 80/20 rule according to the purchasing spend. In here the 80/20 rule also accounts for the sustainability impact. From this graph it can be concluded that there are only several routes, which capture a large part of the VMT’s. These routes require therefore a different strategy approach, to find sustainable optimizations for these routes.

![Percentage of total VMT in number of routes](image)

**Figure 16 - Vehicle Miles Travelled vs Routes**

To categorize the routes to the A, B, or C- categories a choice has to be made, how to divide the routes into these categories. The routes with the highest sustainable impact are categorized as A-routes, the routes with medium sustainable impact as B-routes and routes with the lowest sustainable impact as C-routes. There are different options to divide the routes into these categories. What have to be considered when dividing these routes are the strategies that will be allocated to these routes. To the A-category routes, a strategy will be allocated which will be resources intensive. It is therefore preferred to keep the number of routes low, in order not to acquire extensive number of resources. To the C-category routes a strategy will be allocated which is a not resource intensive, therefore it is possible to allocated a large number of routes to this category. With this in mind, the categorization is developed. The categorization is based upon the sustainability impact (VMT) a route causes. The routes are sorted on their sustainability impact for the categorization.

As described before it is preferable to have a small number of routes categorized as A-routes. In Table 8 - % of total VMT in # of routes category Ais presented how many routes are categorized as A-route, when choosing for a different % of total VMT they cause. There are currently only two buyers in
the CBT team and improving a route on sustainability requires time. Therefore is chosen for only 5 A-routes, which cause 10% of the VMT's.

The first portfolio categorization rule is therefore; **The A-routes capture 10% of the total VMT.**

<table>
<thead>
<tr>
<th>% of total VMT</th>
<th># of Routes</th>
</tr>
</thead>
<tbody>
<tr>
<td>10%</td>
<td>5</td>
</tr>
<tr>
<td>20%</td>
<td>12</td>
</tr>
<tr>
<td>30%</td>
<td>24</td>
</tr>
<tr>
<td>40%</td>
<td>40</td>
</tr>
<tr>
<td>50%</td>
<td>62</td>
</tr>
<tr>
<td>60%</td>
<td>92</td>
</tr>
<tr>
<td>70%</td>
<td>137</td>
</tr>
<tr>
<td>80%</td>
<td>203</td>
</tr>
<tr>
<td>90%</td>
<td>321</td>
</tr>
<tr>
<td>100%</td>
<td>884</td>
</tr>
</tbody>
</table>

Table 9 - % of total VMT in # of routes category B

For the categorization of the B-routes, the same process can be conducted. In Table 9 is assumed that the first 10% of the total VMT are already categorized as A-routes. The remaining routes can be divided according to this table. For this category the supplier has to take initiative to develop new solution on these routes. There are approximately XX suppliers in place at Mars. To give every supplier a change to develop a new solution for Mars for a route that fit to their network, 57 routes will be categorized as B-routes. This captures 40% of the total VMT’s and will be enough number of routes to give every supplier a change to develop a sustainable solution.

The second portfolio categorization rule is therefore; **The B-routes capture 40% of the total VMT.**

<table>
<thead>
<tr>
<th>% of total VMT</th>
<th># of Routes</th>
</tr>
</thead>
<tbody>
<tr>
<td>10%</td>
<td>7</td>
</tr>
<tr>
<td>20%</td>
<td>19</td>
</tr>
<tr>
<td>30%</td>
<td>35</td>
</tr>
<tr>
<td>40%</td>
<td>57</td>
</tr>
<tr>
<td>50%</td>
<td>87</td>
</tr>
<tr>
<td>60%</td>
<td>132</td>
</tr>
<tr>
<td>70%</td>
<td>198</td>
</tr>
<tr>
<td>80%</td>
<td>316</td>
</tr>
<tr>
<td>90%</td>
<td>879</td>
</tr>
</tbody>
</table>
The remaining routes are thus categorized as C-routes. These routes cause 50% of the total VMT’s and capture in the current situation 822 routes.

The third portfolio categorization rule is therefore; **The C-routes capture 50% of the total VMT.**

The sustainable portfolio is now developed and the previous mentioned strategies can be assigned to the routes.

**Control panel**

It is important to keep control of the effectiveness and results of the new strategy; therefore a control panel is developed. The four KPI’s are developed in the previous section. In here the implementation of these KPI’s are described. Also a short example is given how these KPI’s would have look like in the two previous tender years.

The people-KPI is an easy to implement KPI, the struggle however within Mars is that this KPI cannot be benchmarked. The main reason for this is that Mars will be one of the first companies who will put KPI’s on the real meaning of sustainability. Most sustainable KPI’s that companies have in place are focused on the CO2 emissions or on CO2 equivalent emissions. This study shows however that sustainability is not only the planet aspect, but also the people and the profit aspect. This is also the sustainability definition of Mars and therefore the KPI’s should be focused on those aspects, although not all can be benchmarked. The main reason to develop these KPI’s for Mars is that the company can track themselves and benchmark their activities to last year performance. In this way sustainable purchasing improvement can be measured. For the KPI-people the percentage of multimodal solutions is easily calculated through a pivot table. Below the figures from 2013 and 2014 are presented in Table 10.

<table>
<thead>
<tr>
<th>% multi modal</th>
<th>2013</th>
<th>2014</th>
</tr>
</thead>
<tbody>
<tr>
<td>A - Route</td>
<td>26%</td>
<td>36%</td>
</tr>
<tr>
<td>B - Route</td>
<td>16%</td>
<td>20%</td>
</tr>
<tr>
<td>C - Route</td>
<td>35%</td>
<td>37%</td>
</tr>
<tr>
<td>Overall</td>
<td>28%</td>
<td>32%</td>
</tr>
</tbody>
</table>

The numbers in this table represents the percentage of the total miles that is not travelled by road for each category. It can be conducted from the table that already an improvement is made in the last year. There is however still a large part of the total miles travelled by road, so still a lot of
improvement is possible. The ultimate goal is to have these numbers on 100%, this is however currently not practical achievable, due to capacity, flexibility, network layouts etcetera.

The planet-KPI is already more or less in place within Mars. They already have a CO2 equivalent calculation. Therefore the implementation for the planet-KPI can be directly related to this calculation. Through a pivot-table the scores on this KPI can easily be retained. The scores for 2013 and 2014 are presented in Table 11. In this table there is differentiated between weight limited and space limited routes, because this influences the overall number highly. Therefore these are separated to give a better overview of the KPI-scores.

Table 11 - Scores KPI - Planet last two years

<table>
<thead>
<tr>
<th>Row Labels</th>
<th>MARS EFVM 2013</th>
<th>MARS EFVM 2014</th>
</tr>
</thead>
<tbody>
<tr>
<td>A - Routes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Space limited</td>
<td>74.3</td>
<td>68.9</td>
</tr>
<tr>
<td>B - Routes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Space limited</td>
<td>81.1</td>
<td>79.8</td>
</tr>
<tr>
<td>Weight limited</td>
<td>74.0</td>
<td>69.7</td>
</tr>
<tr>
<td>C - Routes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Space limited</td>
<td>73.1</td>
<td>73.0</td>
</tr>
<tr>
<td>Weight limited</td>
<td>67.8</td>
<td>62.1</td>
</tr>
<tr>
<td>Grand Total</td>
<td>73.7</td>
<td>70.6</td>
</tr>
</tbody>
</table>

The KPI-profit is not possible to implement, because the financial data is confidential. The implementation would be however also relatively easy, because the buyers already have to report their savings to their manager. Also the KPI-overall sustainability cannot be implemented due to the lack of savings data. In Table 12 is an example presented on how the KPI-dashboard will look like when fully implemented.

Table 12 - KPI dashboard example

<table>
<thead>
<tr>
<th>KPI-People</th>
<th>KPI-Planet</th>
<th>KPI-Profit</th>
<th>KPI-Overall</th>
</tr>
</thead>
<tbody>
<tr>
<td>% multi modal</td>
<td>Gram CO2 per Ton/KM</td>
<td>% savings</td>
<td>% overall improvement</td>
</tr>
<tr>
<td>Category - A 26%</td>
<td>36%</td>
<td>74.3</td>
<td>68.9</td>
</tr>
<tr>
<td>Category - B 16%</td>
<td>20%</td>
<td>77.5</td>
<td>74.75</td>
</tr>
<tr>
<td>Category - C 35%</td>
<td>37%</td>
<td>70.45</td>
<td>67.55</td>
</tr>
<tr>
<td>Overall 28%</td>
<td>32%</td>
<td>11.6</td>
<td>11.7</td>
</tr>
</tbody>
</table>
Optimizing strategies

The strategies should be optimized in order to run an effective purchasing process. This is important to make the portfolio strategy work; therefore each strategy should be improved where possible. Currently the tender strategy is in place, which is the strategy what could already be optimized. The tender process is executed each year, which captures a large part of the purchasers their time. If this time can be reduced, more time can be spent on the focus of the A and B routes. A possibility is to take a longer time frame within the tender process, so that it is not a one-yearly process but for example a two-yearly process.

To develop this investigation on a longer time frame a bit more, the data of the past four years of the tender process is analyzed. This concerns the tender processes of the year 2011, 2012, 2013 and 2014. The focus is in here on the allocation of the suppliers to the routes. Each route separately was analyzed on which suppliers were allocated in the last four years to that route. It turns out that for most routes the same supplier(s) was in place for the last four years. This can also be conducted from Table 13.

<table>
<thead>
<tr>
<th>Loads</th>
<th>Percentage of total loads</th>
</tr>
</thead>
<tbody>
<tr>
<td>4 year allocated, 100%</td>
<td>X 10%</td>
</tr>
<tr>
<td>4 year allocated, less than 100%</td>
<td>X 30%</td>
</tr>
<tr>
<td>3 year allocated, 100%</td>
<td>X 4%</td>
</tr>
<tr>
<td>3 year allocated, less than 100%</td>
<td>X 14%</td>
</tr>
<tr>
<td>Total</td>
<td>X 58%</td>
</tr>
</tbody>
</table>

Table 13 - Allocation Times

In here the analysis focused on the number of loads, to have a more fair comparison of the magnitude. On the left column state the number of years the loads had the same supplier and to what extend the supplier was allocated to that load. For example ‘4 year allocated, 100%’ means that a supplier was for the past four years allocated each year for 100% to a route with x-number of loads. When there was less than fully 100% allocation, it means that a supplier was the last four years allocated but for less than 100% each year. It is possible that there were for example the past four years on a route two the same suppliers allocated to that route, which was for example the case for the route Olen – Boigny sur Bionale. The allocation of suppliers to this route is shown in Figure 17.
Table 13 shows that for 58% of the loads, a supplier is already allocated for three years or longer. This means that each year a tender process was executed, but in the past three years 58% of the loads were allocated to the same supplier as the previous year. The supplier participates each year in the process and gets each year allocated, because the supplier can give each year the best rates. There is not much shifting in suppliers regarding to the loads, which can preach for longer term contracts. If a time-frame of two years will be used, this won’t change much on the allocation of the suppliers. It will however imply a possible change in costs, because the price is fixed for the coming two years. When the prices drop, Mars still pays the big price for the transportation. This can be overcome by having a decent contract in place and capture price fluctuation in the contract. The risk of a longer term contract is that the market price will fluctuate much in two years, which can hinder the quality of the service or causes that Mars is paying above market price for their logistics activities. Therefore a good contract should be in place, which captures a clause which states that the agreed price will fluctuate with the same fluctuation as the market price.

5.3 Test cases

To test the new strategy several test cases are developed, to show that it is beneficial to take routes outside of the tender and search actively for sustainable improvements. In total there are six small test cases developed. All five A-routes are investigated in detail and determined what could be done differently and what would be the benefit from these actions. The last test case concerns a B-route, for which the improvement should be intended by a supplier. The test cases are reviewed on their values for the planet-KPI, which is determined on the CO2 equivalent emissions reduction. This is done because there are no financial figures available and the People-KPI is somehow interrelated with the planet-KPI. For the calculation of the CO2 equivalent emissions in this paragraph, the standards of Mars
are used. These standard emissions values are presented in Table 15. The values for Road are dependent on a fixed value and a variable value which is determined by the fill rate. For example a truck with a 100% fill rate emits per kilometer \((0.71092 + 100\% \times 0.72547)\) 1.43639 KG CO2.

<table>
<thead>
<tr>
<th></th>
<th>KG CO2 per KM</th>
<th>KG CO2 per Ton/KM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Road Fixed</td>
<td>0.71092</td>
<td></td>
</tr>
<tr>
<td>Road Variable</td>
<td>0.72547</td>
<td></td>
</tr>
<tr>
<td>Rail</td>
<td></td>
<td>0.03161</td>
</tr>
<tr>
<td>Sea</td>
<td></td>
<td>0.0126</td>
</tr>
</tbody>
</table>

**A-route test cases**

From the sustainable portfolio developed in the previous section, it can be conducted that there are five routes with a high-sustainability impact (A-routes). The information on these routes is presented in Table 15. The routes are ranked on their sustainability impact; in consequence route A1 has the highest sustainability impact of all routes. Remarkable from this table is that for all A-routes it concerns weight-limited routes, when looking to the tonnes per truckload. This implies that the truck is in terms of weight not fully loaded, so this offers possibilities for projects focused on increasing the fill rate.

**Table 15 - A-Routes information**

<table>
<thead>
<tr>
<th>Route No.</th>
<th>From</th>
<th>To</th>
<th>KM</th>
<th>Loads</th>
<th>Tonnes per truckload</th>
</tr>
</thead>
<tbody>
<tr>
<td>A1</td>
<td>X</td>
<td>Y</td>
<td>2020</td>
<td>Z</td>
<td>12.8</td>
</tr>
<tr>
<td>A2</td>
<td>X</td>
<td>Y</td>
<td>1807</td>
<td>Z</td>
<td>15.7</td>
</tr>
<tr>
<td>A3</td>
<td>X</td>
<td>Y</td>
<td>1520</td>
<td>Z</td>
<td>18.2</td>
</tr>
<tr>
<td>A4</td>
<td>X</td>
<td>Y</td>
<td>2665</td>
<td>Z</td>
<td>19</td>
</tr>
<tr>
<td>A5</td>
<td>X</td>
<td>Y</td>
<td>1791</td>
<td>Z</td>
<td>17.9</td>
</tr>
</tbody>
</table>

Increasing the fill rate can be established in different ways. In Europe there exists an LZV combination, which allows trucks to load more capacity. This is however not allowed for cross-border transportation, which is therefore not possible. Another possibility is to use double-stack trailers or increasing pallet height. These are however all projects which should be developed in combination with the transport supplier or internal stakeholders. Table 16 gives a short overview of what sustainable reduction can be achieved when increasing the fill rate. To give an example an average truck (70% fill rate) that travels around the world (40.000 km) emits approximately 50000 kg CO2 equivalent. A 5%
increase in fill rate on route A1, implies that the emissions of an average truck that travels 3.7 times around the world can be saved on yearly basis.

Table 16 - KG CO2 equivalent reduction for a certain fill rate increase

<table>
<thead>
<tr>
<th>Route No.</th>
<th>5%</th>
<th>10%</th>
<th>15%</th>
<th>20%</th>
<th>25%</th>
<th>30%</th>
</tr>
</thead>
<tbody>
<tr>
<td>A1</td>
<td>186209</td>
<td>355490</td>
<td>510050</td>
<td>651731</td>
<td>782077</td>
<td>902397</td>
</tr>
<tr>
<td>A2</td>
<td>92983</td>
<td>177513</td>
<td>254692</td>
<td>325440</td>
<td>390528</td>
<td>450610</td>
</tr>
<tr>
<td>A3</td>
<td>55008</td>
<td>105015</td>
<td>150673</td>
<td>192527</td>
<td>231032</td>
<td>266575</td>
</tr>
<tr>
<td>A4</td>
<td>113676</td>
<td>217018</td>
<td>311374</td>
<td>397866</td>
<td>477440</td>
<td>550892</td>
</tr>
<tr>
<td>A5</td>
<td>91008</td>
<td>173742</td>
<td>249282</td>
<td>318527</td>
<td>382232</td>
<td>441037</td>
</tr>
</tbody>
</table>

Besides increasing the fill rate it is also possible to choose for multi modal solutions. For 4 of the 5 A-routes there exist already multi-modal solutions (A1, A2, A4, & A5). These solutions are however not fully utilized or different and even more sustainable multi modal solutions are possible. Information and details about the A-routes and their multi modal solutions are presented in Appendix D. For route A1 there is already a multi modal solution developed and for 60% allocated. It is however the question in here why it is not fully allocated to the multi-modal solution. In Table 17 four different allocation scenarios are presented and their sustainable impact. It can be conducted from this table that a 10% extra allocation to the multi-modal solution, implies roughly also a 10% reduction in the overall CO2 equivalent emissions on this route.

Table 17 - Different allocation scenarios for route A1

<table>
<thead>
<tr>
<th></th>
<th>Current situation</th>
<th>Scenario 1</th>
<th>Scenario 2</th>
<th>Scenario 3</th>
<th>Scenario 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Allocated MM</td>
<td>60%</td>
<td>70%</td>
<td>80%</td>
<td>90%</td>
<td>100%</td>
</tr>
<tr>
<td>Allocated Road</td>
<td>40%</td>
<td>30%</td>
<td>20%</td>
<td>10%</td>
<td>0%</td>
</tr>
<tr>
<td>Kg. CO2 eq. MM</td>
<td>1733913</td>
<td>2022899</td>
<td>2311884</td>
<td>2600870</td>
<td>2889855</td>
</tr>
<tr>
<td>Kg. CO2 eq. Road</td>
<td>2640155</td>
<td>1980117</td>
<td>1320078</td>
<td>660039</td>
<td>0</td>
</tr>
<tr>
<td>Total</td>
<td>4374068</td>
<td>4003016</td>
<td>3631962</td>
<td>3260909</td>
<td>2889855</td>
</tr>
<tr>
<td>Kg. CO2 eq. reduction</td>
<td>0</td>
<td>371052</td>
<td>742106</td>
<td>1113159</td>
<td>1484213</td>
</tr>
<tr>
<td>% CO2 eq. reduction</td>
<td>0%</td>
<td>8%</td>
<td>17%</td>
<td>25%</td>
<td>34%</td>
</tr>
</tbody>
</table>

Recommendations for Route A1: Explore possibilities to allocate more loads to the multi modal solution.
Route A2 has also already a multi-modal solution, but this solution is only for 11% allocated. The reason that this solution is only allocated for several percentage, could be due to the extra costs or the low departure moments of the train. It is in here for the buyer the task to investigated in collaboration with the supplier, how to overcome these problems. In Table 18 different allocation scenarios are presented for route A2. In here an increase in allocation percentage for multi-modal solution, implies a small CO2 equivalent emission reduction. In here it would therefore be more beneficial to look into increasing the fill rate, where the reduction of the CO2 equivalent emissions is larger.

<table>
<thead>
<tr>
<th>Table 18 - Different allocation scenarios for route A2</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Allocated MM</strong></td>
</tr>
<tr>
<td>-------------------</td>
</tr>
<tr>
<td>Allocated MM</td>
</tr>
<tr>
<td>Allocated Road</td>
</tr>
<tr>
<td>Kg. CO2 eq. MM</td>
</tr>
<tr>
<td>Kg. CO2 eq. Road</td>
</tr>
<tr>
<td>Total</td>
</tr>
<tr>
<td>Kg. CO2 eq. reduction</td>
</tr>
<tr>
<td>% CO2 eq. reduction</td>
</tr>
</tbody>
</table>

**Recommendations for Route A2:** Develop projects to increase the fill rate and/or look into other multi-modal solutions.

Route A3 has only a road-solution, but a deeper look into this route shows that there is also a possible multi-modal solution. If this solution is applicable for Mars, it has to be explored further by the buyers of Mars and overcoming objects should be tried to solve in collaboration with a supplier. It could be for example that the road solution is more cost-beneficial than the multi-modal solution. In collaboration with the supplier could be explored what the cost structure is of the new route and where both parties can help to reduce the costs. Mars could for example look into horizontal collaboration to create more support and loads for this route, which could in consequence lower the costs. A side remark which should be made here is that the suppliers that are currently allocated are already four years on a row in place on this route. The three allocated suppliers should have therefore good knowledge about the route, the hidden costs in the route and the improvement possibilities. These possibilities can be discovered by a buyer when a closer relationship is established and a mutual benefit can be developed.
The new multi-modal solution has interesting results, which are shown in Table 19. When the route is totally switched from road to the new multi-modal solution, a reduction of almost 50% in CO2 equivalent emissions can be established.

| Table 19 - Different allocation scenarios for route A3 |
|-----------------|----------|----------|----------|----------|
|                 | Current situation | Scenario 1 | Scenario 2 | Scenario 3 | Scenario 4 |
| Allocated MM    | 0%       | 10%      | 50%       | 80%       | 100%       |
| Allocated Road  | 100%     | 90%      | 50%       | 20%       | 0%         |
| Kg. CO2 eq. MM  | 0        | 110338   | 551693    | 882710    | 1103387    |
| Kg. CO2 eq. Road| 2103514  | 1893163  | 1051757   | 420703    | 0          |
| Total           | 2103514  | 2003501  | 1603450   | 1303413   | 1103387    |
| Kg. CO2 eq. reduction | 0 | 100013  | 500064    | 800101    | 1000127    |
| % CO2 eq. reduction | 0% | 5%      | 24%       | 38%       | 48%        |

**Recommendations for Route A3:** Explore the suggested multi-modal solution further. This can lead in best case to a reduction in 50% of the CO2 equivalent emissions.

The A4-route is already for a large part a multi-modal solution. The multi-modal solutions is however still not optimal, because 1379 km is still travelled by road on this route. If there are no other possibilities here, the buyer can look to another direction of sustainability which is the people-aspect. A question can be asked, how both parties can reduce the risk on accidents on these 1379 kilometers of this route. Can for example the supplier provide Mars with information about the driving behavior of the truck driver, and influence in this way the behavior of the truck driver in a safer way. There are currently two multimodal solutions in place, however there is a large difference in allocation percentage. From Table 20 it can be conducted that it has no large impact to switch from multi modal solution. In here it would also be more interesting to look into increasing the fill rate, because this will have a larger impact.
Table 20 - Different allocation scenarios for route A4

<table>
<thead>
<tr>
<th></th>
<th>Current situation</th>
<th>Scenario 1</th>
<th>Scenario 2</th>
<th>Scenario 3</th>
<th>Scenario 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Allocated MM</td>
<td>70%</td>
<td>40%</td>
<td>80%</td>
<td>60%</td>
<td>50%</td>
</tr>
<tr>
<td>Allocated MM 2</td>
<td>10%</td>
<td>40%</td>
<td>10%</td>
<td>40%</td>
<td>50%</td>
</tr>
<tr>
<td>Allocated Road</td>
<td>20%</td>
<td>20%</td>
<td>10%</td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td>Kg. CO2 eq. MM</td>
<td>2063046</td>
<td>1178884</td>
<td>2357767</td>
<td>1768326</td>
<td>1473605</td>
</tr>
<tr>
<td>Kg. CO2 eq. MM2</td>
<td>287784</td>
<td>1151139</td>
<td>287784</td>
<td>1151139</td>
<td>1438923</td>
</tr>
<tr>
<td>Kg. CO2 eq. Road</td>
<td>834458</td>
<td>834458</td>
<td>417229</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Total</td>
<td>3185288</td>
<td>3164481</td>
<td>3062780</td>
<td>2919465</td>
<td>2912528</td>
</tr>
<tr>
<td>Kg. CO2 eq. reduction</td>
<td>0</td>
<td>20807</td>
<td>122508</td>
<td>265823</td>
<td>272760</td>
</tr>
<tr>
<td>% CO2 eq. reduction</td>
<td>0%</td>
<td>1%</td>
<td>4%</td>
<td>8%</td>
<td>9%</td>
</tr>
</tbody>
</table>

Recommendations for Route A4: Develop projects to increase the fill rate. Switching to the other multi-modal solution will have a limited influence.

For the A5-route there already exists a multi-modal solution, a closer look however develops also another more sustainable multi-modal solution. The disadvantage of this solution is that the lead time becomes longer. Therefore it is important for a buyer to investigate how in collaboration with the supplier the lead time can be reduced, to become competitive with the road-solution. It can be concluded from Table 21, that it is interesting to develop the new multi-modal solution further. If however this new solution turns out not applicable for Mars, it is still interesting to explore and use the current multi-modal solution more. A 20% more allocation will almost result in a 20% reduction on CO2 equivalent emissions.

Table 21 - Different allocation scenarios for route A5

<table>
<thead>
<tr>
<th></th>
<th>Current situation</th>
<th>Scenario 1</th>
<th>Scenario 2</th>
<th>Scenario 3</th>
<th>Scenario 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Allocated MM</td>
<td>60%</td>
<td>80%</td>
<td>0%</td>
<td>0%</td>
<td>40%</td>
</tr>
<tr>
<td>Allocated MM 2</td>
<td>0%</td>
<td>0%</td>
<td>60%</td>
<td>80%</td>
<td>40%</td>
</tr>
<tr>
<td>Allocated Road</td>
<td>40%</td>
<td>20%</td>
<td>40%</td>
<td>20%</td>
<td>20%</td>
</tr>
<tr>
<td>Kg. CO2 eq. MM</td>
<td>931161</td>
<td>1241548</td>
<td>0</td>
<td>0</td>
<td>620774</td>
</tr>
<tr>
<td>Kg. CO2 eq. MM2</td>
<td>0</td>
<td>0</td>
<td>661929</td>
<td>882572</td>
<td>441286</td>
</tr>
<tr>
<td>Kg. CO2 eq. Road</td>
<td>1468748</td>
<td>734374</td>
<td>1468748</td>
<td>734374</td>
<td>734374</td>
</tr>
<tr>
<td>Total</td>
<td>2399909</td>
<td>1975922</td>
<td>2130677</td>
<td>1616946</td>
<td>1796434</td>
</tr>
<tr>
<td>Kg. CO2 eq. reduction</td>
<td>0</td>
<td>423987</td>
<td>269232</td>
<td>782963</td>
<td>603475</td>
</tr>
<tr>
<td>% CO2 eq. reduction</td>
<td>0%</td>
<td>18%</td>
<td>11%</td>
<td>33%</td>
<td>25%</td>
</tr>
</tbody>
</table>
**Recommendations for Route A5:** Explore the new suggested multi-modal solution, this has a large potential for sustainable improvement. If this solution is not applicable for Mars, try to allocate more loads to the existing multi-modal solution.

**B-route test case**

The B-routes are the routes where suppliers should intend new solutions on these routes. To show that this could be beneficial for as well the supplier as well for Mars, this test case is developed. After a short brainstorm session with Robbie Schers, buyer of transport within Mars, one route was selected to develop a test case for. It concerns the route from Veghel to Minden, with XXXX loads and a distance of 334 kilometer. The distance is relative to other routes very short, which makes it interesting for trying a new and more sustainable fuel; LNG. This fuel is not (yet) available at the gas stations and should therefore be filled up at a home based gas station. Therefore a short route is preferable, because the truck can in this case be filled up at a home based gas station in for example Veghel.

With this in mind other short routes from Veghel were explored, if they were suitable for using LNG-trucks. Seven other routes were found to be applicable for using LNG-trucks, which can be filled up at a home-based station. This was determined by taking into account the range of a LNG truck (800km), so this would only applicable for routes with a distance of 400 kilometer or shorter. These routes are presented in Table 22.

<table>
<thead>
<tr>
<th>Route KM</th>
<th>Loads</th>
<th>From</th>
<th>To</th>
</tr>
</thead>
<tbody>
<tr>
<td>344</td>
<td>X</td>
<td>VEGHEL 5466</td>
<td>BISCHOFSEIM 65474</td>
</tr>
<tr>
<td>337</td>
<td>X</td>
<td>VEGHEL 5466</td>
<td>MINDEN 32423</td>
</tr>
<tr>
<td>385</td>
<td>X</td>
<td>VEGHEL 5466</td>
<td>VERDEN 27283</td>
</tr>
<tr>
<td>130</td>
<td>X</td>
<td>VEGHEL 5466</td>
<td>TISSELT / WILLEBROEK 2830</td>
</tr>
<tr>
<td>350</td>
<td>X</td>
<td>VEGHEL 5466</td>
<td>BISCHOFSEIM 65474</td>
</tr>
<tr>
<td>308</td>
<td>X</td>
<td>VEGHEL 5466</td>
<td>MINDEN 32423</td>
</tr>
<tr>
<td>385</td>
<td>X</td>
<td>VEGHEL 5466</td>
<td>VERDEN 27283</td>
</tr>
<tr>
<td>88</td>
<td>X</td>
<td>VEGHEL 5466</td>
<td>VIERSEN 41751</td>
</tr>
</tbody>
</table>

The truck has to return to Veghel to refill his fuel-tank, therefore it is also interesting to take into account the routes to Veghel. There were five routes found applicable to be part of a certain roundtrip for the LNG truck. These routes are presented in Table 23.
Table 23 - Return loads routes applicable for LNG trucks

<table>
<thead>
<tr>
<th>Route KM</th>
<th>Loads</th>
<th>From</th>
<th>To</th>
</tr>
</thead>
<tbody>
<tr>
<td>314</td>
<td>X</td>
<td>MINDEN 32423</td>
<td>VEGHEL 5466</td>
</tr>
<tr>
<td>130</td>
<td>X</td>
<td>TISSELT / WILLEBROEK 2830</td>
<td>VEGHEL 5466</td>
</tr>
<tr>
<td>381</td>
<td>X</td>
<td>KIRCHLINTELN 27308</td>
<td>VEGHEL 5466</td>
</tr>
<tr>
<td>381</td>
<td>X</td>
<td>VERDEN 27283</td>
<td>VEGHEL 5466</td>
</tr>
<tr>
<td>111</td>
<td>X</td>
<td>VIERSEN 41751</td>
<td>VEGHEL 5466</td>
</tr>
</tbody>
</table>

From Table 22 and Table 23 it can be concluded that there could be business for LNG trucks for in total 1,491,673 kilometers. For this test case a comparison is made between “old” Diesel trucks (Euro 5), “new” Diesel trucks (Euro 6) and LNG trucks. To calculate the sustainable and economical outcomes of these solutions, the parameters from Table 24 are used as input for the calculation (LNG24, 2014) (DAF-Trucks, 2014).

Table 24 - Parameters used for calculation LNG solution

<table>
<thead>
<tr>
<th></th>
<th>Diesel Truck Euro 5</th>
<th>Diesel Truck Euro 6</th>
<th>LNG Truck Euro 6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fuel price Consumption</td>
<td>1.48 Euro/Liter</td>
<td>1.48 Euro/Liter</td>
<td>1.17 Euro/Kg</td>
</tr>
<tr>
<td>Lifetime</td>
<td>7 year</td>
<td>7 year</td>
<td>7 year</td>
</tr>
<tr>
<td>CO2 eq. emissions</td>
<td>1.22 KG/km</td>
<td>0.85 KG/km</td>
<td>0.73 KG/km</td>
</tr>
<tr>
<td>NOx</td>
<td>1.6 gram/km</td>
<td>0.38 gram/km</td>
<td>0.16 gram/km</td>
</tr>
<tr>
<td>PPM</td>
<td>0.03</td>
<td>0.0094</td>
<td>0.002</td>
</tr>
<tr>
<td>Noise production</td>
<td>80db</td>
<td>80 db</td>
<td>72 db</td>
</tr>
</tbody>
</table>

To calculate first the economic figures, the additional purchase cost is translated to the extra costs per kilometer. It is assumed that a truck drives 100,000 kilometer each year. The lifetime of a LNG truck is 7 years, in which he drives consequently 700,000 kilometer. The additional purchase cost per kilometer is (65.000 euro / 700,000 kilometer) 0.09 euro. When this input is reflected on the 1,491,673 kilometers which are suitable for LNG trucks, the following table can be conducted as presented in Table 25.
This table is a minimal comparison, because it would involve different other factors to make a fair comparison. The main aspects are however taken out, which gives a good idea of the comparison. It can be concluded that the LNG solutions is from a cost perspective not interesting. However from a sustainable point of view it is highly interesting. The LNG solution reduces the NOx emissions with more than 50% and has a noise reduction of also 50 percent.

This test case shows that it is interesting for a supplier to develop new solutions for Mars. If the LNG solution could also work cost-wise, the supplier can get the whole business and Mars gets a sustainable solution. This is a win-win situation and creates a mutual goal for both parties. It is however important that Mars is transparent on which routes they want to improve and that they cooperate if a supplier has new ideas.

This chapter explores the chosen solution direction for Mars. The first section describes how Mars could get to the new desired purchasing situation. Thereafter several parts of this plan are elaborated and implemented, by developing a sustainable portfolio and allocate strategies to this portfolio. The last part show several test cases, which shows how the new strategies can be applied and what the benefits would be for Mars in terms of sustainability.
6. Conclusion
This chapter describes the conclusions from this research. It will also elaborate the implications and limitations of this research. Finally several directions for further research are presented.

6.1 Conclusions
This research is a result from a problem statement of Mars. The company is struggling with how to take sustainability into account during the purchasing process of transportation services. This research takes this problem in a broader perspective. This research addresses four main questions, in order to give an overall view on the general problem statement. The conclusions to these four main questions are elaborated below.

What is sustainability and how does this apply to transportation service?

The concept “sustainability” is a broad concept and can be interpreted in different ways. A common used definition of the term sustainability in the literature is “development that meets the needs of the present without compromising the ability of future generations to meet their needs”, which was originally founded by the Brundtland Commission in 1987 (Rogers & Carter, 2008). Pagell & Wu (2009) considers next to the environment aspects also the social and economic aspects when determining sustainability. They draw a parallel to the triple bottom line of Elkington (1999). In normal business the bottom line is the difference between the profit and the loss. Elkington (1999) adds two other bottom lines next to the one of profit and loss. He introduces the social bottom line and the environmental bottom line. The triple bottom line is therefore also referred to as the People, Planet, and Profit approach and is frequently used as definition for the term sustainability in the literature (Foerstl, Reuter, Hartmann, & Blome, 2010). This concept of sustainability is the only definition found in the literature that takes into account the cost aspects. In transportation, the cost aspect plays an important role. Therefore in this paper the concept sustainability is defined as the tripple bottom line of People, Planet and Profit. This definition states also that sustainability only occurs at the intersection of the three aspects. This means that an action is only a sustainable action if one or more of the three tripple bottom lines is improved, without deteriorate the other of the three bottom lines.

Richardson (2005) applies this concept on the transportation activities. For the people bottom line it can be considered that there are three main factors who influence this bottom line; Truck driver behavior, Compliance to government policies, and Vehicle Miles Travelled. This last aspect is due to the risk on collisions and risk to congestion. For the planet bottom line there are also three influencable
aspects; Fuel Consumption, Congestion and Emissions. Congestion influences the land use of roads and the time a truck is on the road (and polluts hazardous emissions). The last bottom line captures the profit aspect, which is related to the costs of the logistic activities of the service provider.

The Vehicle Miles Travelled is the only aspect that influences all three bottom lines. It influence the people bottom line, by affecting the risk on collisions and congestion. It affects the planet aspect by the emissions and the profit aspects by it’s costs. Therefore the VMT plays an important role, when discussing sustainability in transportation.

*What are the theoretical best purchasing processes to stimulate improvement on sustainability?*

To determine what the best purchasing process is to stimulate sustainable improvement, a simple three stage process is considered with the focus on input, throughput and output. From the input side it is determined by Bjorklund (2011) that the largest influencing factor on sustainable improvement through purchasing is the support from the top and middle management. It is in here important that the top and middle management put goals in place to stimulate the sustainable improvement. It is therefore important to make sustainability quantifiable, preferably into monetary figure (Min & Galle, 2004).

A change in the sustainability focus of the purchasing process, will lead to a change in different aspects of the throughput; purchasing strategy (Andersson & Normann, 2002) (Bjorklund, 2011). The sourcing strategy for transport service suppliers will change when the focus on sustainability extents. Such a sourcing strategy can be focused on only sourcing from sustainable suppliers or a distinction can be made between high and low sustainability impact lanes, to use different sourcing strategies for different lanes. The supplier selection is another aspect of the purchasing strategy, which will change when there comes a shift in the sustainability focus. The supplier selection method is normally only based on economic and quality aspects. With an increase in sustainability focus, the sustainability aspect comes also into the equation which makes the supplier selection becomes more complex (Bai & Sarkis, 2010). The relationship with the supplier, will also change when the focus on sustainability changes. Pagell & Wu (2009) determines that a more collaborative relationship is needed when there becomes more focus on sustainability. Suppliers can help to provide valuable ideas used in the implementation of environmental projects (Dresner & Carter, 2001). This will change the purchasing process to focus more on value-added service than on one dimension numbers like tendering. The change of perspective in the purchasing process can establish higher motivation to increase the value added service. It is noted that sustainable innovation can be hampered if firms use short time horizons (Dresner & Carter, 2001). The
length of the relationship is therefore also important, to give the supplier the time to develop sustainable improvements. Wolf & Seuring (2010) state that besides giving the supplier the ability to develop and implement sustainable solutions, information sharing between suppliers and buyers are essential in implementing sustainability in transportation. Close relationships can establish information sharing between suppliers and buyers which are essential in implementing sustainability in transportation according to Carter & Dresner (2001).

The extent of sustainability focus in the purchasing process, will determine the purchasing strategy. This purchasing strategy will result in sustainable improvement, for each purchasing strategy on a different level. It is a logic consequence that the more focus is on sustainability, the larger the sustainable improvement will be. Blaeser (2011) discovered that transport service suppliers are delevering exactly what the customer is asking and nothing more or extra’s. This implies that when there is no sustainable focus in place, sustainability is not improved or even deteriorated. Carter & Dreser (2001), found that a strategic partnership with the focus on sustainability will place a high value on the social and environmental outcomes of the company and possible beneficial for the profit outcomes. From this literature overview a conceptual model is conducted as presented in Figure 7.

Are these also the practical best processes to stimulate improvement on sustainability?

To determine the best processes in practice, an interview method is used. To gain different insights on the topic, 19 interviews were conducted from 5 different points of view. A semi-structured interview strategy was used in combination with the presented conceptual model. From these interviews it could be concluded that from the input-point of view it is important to have sustainable goals and sustainable calculation in place to improve sustainability in transportation. It was also determined that supplier relationship differs when sustainability becomes in the purchasing equation. Benchmark companies chose for competitive or strategic partnerships to improve sustainability, instead of using a tender process and have a very basically relationship with the supplier. Another conclusion from the interviews is that through a tender process only small improvements can be achieved. When making a portfolio and put the focus on the large sustainability-impact routes, a larger improvement can be achieved. This requires however a longer time perspective, which makes it interesting for both parties to invest in the relationship.

The interviews evolved in the proposed maturity stage model presented in Figure 10. In here it can be concluded that there are three main different purchasing strategies to improve sustainability in
transportation. Using a tender process with sustainable criteria, only achieves small improvements. Developing a portfolio for the lanes and allocated different strategies to these lanes will have a larger sustainable improvement. The largest improvement can be achieved when competitive or even strategic partnerships are established, in order to collaborate to improve the routes in a sustainable way. In conclusion the theoretical best practices have a large overlap with the practical best practices.

*How can the theoretical and practical insights be combined to be the best process applicable for Mars?*

From the proposed maturity stage model recommendations can be extracted for Mars. The current purchasing process of Mars is focused on a tender process with sustainable criteria. When Mars want to take their purchasing process to the next level, they should move to another purchasing process. From the input-side, sustainable goals should be developed and targeted by the top or middle management. The purchasers can achieve these goals by using a different sourcing strategy and supplier relationship. A sustainable portfolio is developed, in where the transport lanes are ordered on their sustainability impact. According to this portfolio the routes are categorized in A, B or C-routes. For the A-routes, which have the highest sustainability impact, a close relationship with the suppliers should be established. This close relationship can improve the collaboration and in consequences improving and innovating the lanes in a sustainable way. The purchasers of Mars should take the lead in this improving process. For the B-lanes the supplier should take initiative in the improving process. The C-routes are still assigned to the tender process, where a longer contract time frame is used in order to make resources free for focusing on the A and B routes.

**6.2 Implications**

From a theoretical point of view this research generated some interesting implications. When sustainability comes into place in a purchasing process, different aspects change. This change can be in different directions. From the literature study three directions are extracted each at their own level. This level is determined by the input-side of the process, which means the sustainability focus in the purchasing process. A low sustainability focus will still require making use of the leverage position in a transport purchasing market. The difference in here is the supplier selection process, where sustainable criteria are added. When a higher sustainability focus comes in place, the tender process with sustainable criteria will not hold any longer. Companies should move to a portfolio approach, where they divide their purchasing focus. By developing a sustainable portfolio, they can assign different strategies to their routes and use a more solution based strategy for the most sustainable important
routes. The largest sustainable improvement can be achieved when developing competitive or even strategic partnerships. This is focused on collaboration, to improve and to innovate the routes in a sustainable way. The collaborative aspect should develop mutual benefits for both parties. This is to activate the supplier’s knowledge.

For Mars, this research evolved in an implementation plan to improve sustainability in the purchasing process. Making use of the developed sustainable portfolio and the assigned strategies, Mars can achieve large sustainable improvements. This is shown in the developed test cases. It is important to mention that this can only be achieved when there is support from top and middle management, by developing sustainable goals. These improvements can be measured by means of the developed sustainable KPI dashboard. This dashboard is focused on the People, Planet and Profit approach. With this dashboard, over the years, the portfolio and the assigned strategies can be controlled. If the dashboard shows that the portfolio holds no longer, a review of the portfolio strategies should be conducted.

6.3 Limitations and future research

This research has also some limitations. These limitations have to be taken into account when considering the results of this research. The limitations are also possibilities for future research. An important limitation in this research is the scope of the conceptual model. Other aspects are important in a purchasing process, but are not all considered in this research. It is for example possible that contract design is also an aspect what changes when sustainability becomes important. One could choose for a more performance based contract design when using competitive partnerships. This is an area what is not taken into account in this research, but is considered as an important aspect of the purchasing process. Also the risk taking behavior was not taken into account in the research framework. This can however also affect the sustainable outcome of the purchasing process and is therefore important to investigate further.

The drivers of a supplier to activate his knowledge, in order to improve the client in a sustainable way is an aspect which is not very clear highlighted in this research. Research to these drivers can be very valuable to this research. The explored drivers should then be targeted by the purchasers in order to have an efficient collaboration. The drivers can also be used to effectively activate the knowledge of supplier, in order to sustainable improve routes.
From the input-side there could be other factors that influence the sustainability focus of the purchasing process. The external factors, like the media, can influence this focus. The media influences the customer, who in his turn influences the companies. This factor could play a large role in the development of sustainable solutions in transportation. These factors are however not taken into the scope of this project.

The definition of sustainability in this project can be considered as another limitation. This project is built upon the triple bottom approach as sustainability definition. Using another definition could result in different results from this research. It is therefore important to keep in mind that this research is not generalizable for companies who have a different definition. The KPI-dashboard for example will look a lot different when another definition is taken into account.
7. References


8. Appendices

8.1 Appendix A

Figure 18 - Number of articles per year
8.2 Appendix B

In this appendix the background of the interviewed person or company is elaborated.

Internal interviews

Internal associates

The associates to interview within the company are selected on basis of the function within the company. The associates of Mars who are responsible for the purchasing of the transportation service within the company are selected for the interview. These are three associates; Associate 1, Associate 2 and Associate 3. Besides these three associates also two associates were selected, who were active in development projects of sustainable transportation of Mars.

Mars USA

Mars USA is the same as Mars Europe, the purchasing functions are however separated. For this interview two associates of Mars USA were found to be willing to do the interview. These were Avetik Matevosion and Jeremy Search. Avetik Matevosion is global logistics project manager and Jeremy Search is the manager C@MTT of temperature controlled transport. The interviews are combined to one, to get a good overview of Mars her purchasing function in the USA and what is already established there regarding sustainable purchasing.

External interviews

Purchasers from benchmark companies

Benchmark companies were selected based on their effort to improve sustainability in transportation. This effort was determined on the ranking of “lean and green”, which is a Dutch program to improve sustainability in transportation. This program provides awards to companies who take action on sustainable transport. Companies who improve transport sustainability through the purchasing process are also eligible to receive one of the awards. Four companies who received an award through improvement in the purchasing process, were selected based on similarities with the company of Mars (size of the company, number of routes etc.). The companies Benchmark 2, Benchmark 1, Benchmark 3 and Mars were selected to do the interview.

Benchmark 2

The company Benchmark 2 is an Anglo-Dutch multinational company who produce food, beverages, cleaning agents and personal care products. It is one of the biggest companies in the world in this sector. Benchmark 2 has an overall sustainable goal in place which is: “Halve the greenhouse gas impact of our products across the lifecycle by 2020”. In relation to this goal, they are also participating in
the Green and Lean program. For the interview person x represented for Benchmark 2, she is part of the Benelux supply chain management and is also partial responsible for the purchasing of transportation service.

**Benchmark 1**

The H.J. Benchmark 1 Company is a United States food processing company. They produce products on six continents and market these products in more than 200 countries. Benchmark 1 has a clear goal towards transportation services. They committed to a 10% reduction in fossil fuel consumption by 2015. For this company Person X was interviewed, he is the logistic purchasing manager of the Benelux. He is also part of the European team for logistic purchasing.

**Benchmark 3**

Benchmark 3 is a Dutch company which process potatoes to different potatoes products, which they market within Europe. Currently they are building a processing factory in China. Benchmark 3 has an overall goal to gain a 79% CO2 reduction in 2015 with respect to 2010. Person x was willing to cooperate with the interview; he is the general transport manager within the company Benchmark 3.

**Mars**

Mars is the company for which this project is developed. Mars is active in several markets like pet food, snack food, food and drinks and is a worldwide company. Mars has a sustainable program in place named ‘Sustainable in a Generation’. The goal of the SiG program is to eliminate fossil fuel energy use and greenhouse gas emissions from their operations by 2040. The data is gathered by means of the internal interviews.

**Sustainable Transport Organizations**

After a short internet study, the most prominent sustainable transport organizations were selected to do the interview with to gain insight from sustainable transport organizations. These companies are PureBirds, GreenFreightEurope and Connekt.

**PureBirds**

PureBirds is a Dutch organization, which helps organizations to improve on sustainability and gain within this respect market advantage. The organization is focusing on the collaboration between companies and especially between a company and her suppliers. Pure Birds consulted already for more than 200 companies, to improve sustainability on mostly transportation services. For the interview, the owner, Person X, was found to be willing to do the interview. PureBirds is known for setting up the Duplo project within the Netherlands.
Green Freight Europe

The Green Freight Europe is a voluntary program initiative, which aims at improving environmental performance of road freight transport in Europe. This program is focused on generating strong market incentives to engage companies across the supply chains in green procurement of transportation services in order to stimulate long-term improvements. The concept is to gather service logistic providers who comply to the environmental improvements. Shippers who are connected to the program have to do their purchasing process among those service logistic providers. This can be seen as a pre-selection process executed by the Green Freight Europe organization. Currently the organization has approximately 250 organizations connected to the program. For the interview Person X was available, he focusses on optimizing sustainable freight transportation within Green Freight Europe.

Connekt

Connekt is an independent network of companies and authorities that links up parties to improve sustainable mobility in the Netherlands. This is done by sharing knowledge, know-how and initiatives and connecting members. Connekt is a public-private co-operation consisting of 125 authorities, companies, and knowledge institutions. Connekt is the developer of the Lean and Green program, which is already attended by approximately 300 companies. For the interview Person X was found willing to do the interview with. Person X is from origin supply chain entrepreneur and is advisor for several projects of Connekt.

Sustainable Transport Events

Three sustainable transport events were attended. The Smart Match meeting and the Mars Haulers Event, was recommended by Mars. The European Supply Chain Forum meeting was recommended by dhr. Van Weele.

Smart Match

The Smart Match meeting found place on 13 may 2014 at the Abbott Logistics warehouse department in Breda. Within this meeting the companies Samsung, Sabic, FujiFilm Europe, VION, Abbott Logistics, RICOH, Lamb Weston, Cloetta and Sensus were presented. The meeting was focused on information sharing and transparency, in order to bundle flows of goods in a sustainable way. The discussion point, how to be transparent and how to bundle those flows in a sustainable way were central in this meeting. The meeting was organized by Rewin West-Brabant B.V., Midpoint Brabant, NHT and Brabantse Ontwikkelings Maatschappij. This event was supported by the lean and green program.
**Mars Haulers Event**

The Mars Haulers Event took place in Arnhem on June 26th 2014. This event, in the form of a Seminar, is a bi-yearly event for all the current logistic service suppliers of Mars. The purpose of the event is to announce relevant news of Mars for the logistic service suppliers and supplier engagement. There are also several short session for supplier discussion/education in for example sustainable sourcing.

**European Supply Chain Forum**

The workshop of the European Supply Chain Forum (ESCF) took place on June 11th 2014 at Eindhoven University of Technology. The ESCF is an association which connects their members with internationally ambitious companies with a focus on long-term partnership that add value to their members. The ESCF is focused on optimizing the supply chain, by educating their members and discuss opportunities and limitations in the supply chain. The subject of the workshop was performance contracts in logistics, with the focus on optimizing the supply chain. Sustainability is part of the supply chain, which made the conference relevant for the qualitative research. At this workshop the companies Access Business Group, Bausch+Lomb Valleant, DHL, Dow Chemical, Eastman Chemical, Hilti Corporation, Philips, Shell, Styron, Vos Logistics and Wim Bosman Transport were present.

**Logistic Service Suppliers**

This point of view is taken into account, because it will provide insights from the other direction. The logistic service suppliers are dealing every day with the purchasing processes of their customers. They will have a good and broad view if sustainability is an issue in the purchasing process and how this is taken into account. There were two suppliers of Mars found to do the interview with. These suppliers are one of the greater suppliers and/or are active in sustainable improvements.

**Logistic service supplier 1**

The company Logistic service supplier 1 is a global logistics company offering transport and related services by land, sea, rail and air. Logistic service supplier 1 has offices in 24 countries and employing 1300 people around the world. Logistic service supplier 1 is one of the larger suppliers of Mars and provides in the possibilities of multi-modal solutions.

**LOGISTIC SERVICE SUPPLIER 2**

LOGISTIC SERVICE SUPPLIER 2 is a transport company specialized in loads from and to the United Kingdom, Benelux and Germany. The company is a new and fresh company within the transport market.
and is located in Moerdijk. The company is a medium supplier for Mars, which develops together with Mars sustainable and supply chain solutions.

**Internal interviews**

The internal interviews are important to gain insight in the limitations of the purchasing process of Mars. It is also valuable to gain insight from different associates, in order to create a more general picture of the current and desired situation.
8.3 Appendix C

Current process
The CBT team is acting in a leverage market and is therefore focused on the competitive bidding strategy. This strategy is executed by means of a tendering process, where the bidding strategy is central. The current process is defined in four phases; preparation phase, tender phase, implementation phase and the evaluation phase. The current process is seen as continuous process whereby the four phases are executed within a time frame of one year. In Figure 19, a schematic representation of the process is given, where every color represents a phase. Below each of the main steps are shortly described and elaborated, where the focus is on the supplier selection aspect.

![Diagram of the current process]

Figure 19 - Current process

Preparation phase
In the preparation phase there are several steps. The largest part is the preparation process, where several tasks are executed. The invitation to the suppliers to participate in the tendering process is also
considered as part of the preparation phase. An essential part of this phase, before the tender process can start, is the accepting of the contract terms.

**Preparation process**
In the preparation process several critical points for the tender phase are discussed. The most important points regarding the supplier selection are discussed below. The preparation process also focuses on improving the tender process taken into account the evaluation of last tender and the feedback from suppliers and stakeholders.

**Request for Information**
The request for information (RFI) is an online document which is sent to new suppliers to gather more information about their business. This information is used to gain a good impression if the supplier is capable for doing business with Mars. To get a good impression it is important that the right information is collected in the RFI. The RFI contains around 90 questions of information about the following subjects; Company profile, Safety and security, Compliance and quality, Culture and communication, Environment, Finance, Capacity and Performance Risk.

Based on all the answers on these subjects, the buyers can make a good decision if the supplier is capable of doing business with Mars. If the buyers decide that they are not capable, they are not allowed in the tender process. For the supplier it costs a lot of effort to gather the information on the 90 questions, if a supplier answers all these questions it is a sign for Mars that they are willing to put effort for the business of Mars. During the preparation process the output of the RFI is discussed consequently which information they want from a new supplier. For example last year the environmental part was added to the RFI, to have a better understanding of the sustainable performance of the supplier.

**Selection criteria**
In the preparation process it is also discussed how and on which criteria the suppliers are going to be selected and awarded to a route. Every buyer has his own method for selecting the supplier, but there are several lines to follow in the supplier selection. The criteria are determined by taking into account the targets for the CBT team, which are set by the middle layer of Mars. There are four main criteria points that have the largest influence in the decision making. The order of importance is for every buyer different and also for every rout different. The four factors are as follow;

1. Quality of service
2. Total cost of solution
3 Soft factors

The quality of service is currently in the most routes the number one important criteria. To determine the quality of the service the buyer makes use of the information on the placed bid, the RFI and the past data of the Pay for Performance (P4P) program. The P4P program is a program which controls the supplier on its operational performance, which will be explained further on. If for example a supplier bids on a route with 10 loads a week and the supplier can handle maximum 10 loads a week and the booking notice is 5 days, the flexibility is very low and is considered as low quality of service.

The total cost of solution does not only include the bid price. It also includes the transit time, the booking notice time, the loading capacity of the trucks etc. The total cost of solution gives a more accurate figure of the total cost for Mars then only the bid price.

Soft factors are considered as non-fact based factors. This depends on the buyer, but also on the past experience of Mars with the supplier. Soft factors include trust, past experience and guts feeling towards the supplier. The experience of the buyer is important but also information and experience sharing within the CBT team.

Modality is also considered as an important aspect of the selection criteria. This criterion can be considered as a sustainable criterion, because multi-modal solutions are preferred over road solutions. This criterion is not directly related to one of the targets of the CBT team. Due to future perspectives and sustainable enthusiasm of the CBT team this is taken into account.

Route set up

In combination with the internal stakeholders, like the factory transport planning, the route set up is constructed in the preparation process. This route set up is the input for the tender process and therefore it is important that this is well-defined for a successful and effective tender process. If for example it is required to load in the weekends or at night, it is important that the supplier takes this into account when making a bid. If this is information is not included in the route set up, the bid is not accurate and the supplier will experience extra costs during the year which will be charged to Mars. Therefore it is important that all the information is in the route set up, so that the supplier can offer a good and accurate bid.
After the completion of the matrix, the routes are uploaded to an online tender platform. Not only the completion of the route set up is constructed in here but also the design, how it will be presented to the potential suppliers.

**Contract**
During the preparation the contracts are also designed. Every year the contract design is reviewed and improved to protect from unnecessary discussions and work.

**Pay for Performance**
The pay for performance program is to ensure and enhance the quality of the supplier. Within the pay for performance program the arrival time accuracy and compliance to the rules of the system are measured. These quality measures are quarterly reviewed and results are fed back to the supplier. If the quality measures are not met with the given quality standards of Mars, they are penalized in the next quarter on their route price. With this program Mars wants to keep the supplier motivated to deliver quality, the program is also a good control mechanism for controlling the performance of the suppliers. Each year the input and output of the pay for performance program is reviewed. Currently there are no sustainable aspects in the pay for performance program, mainly due to the difficulty in monitoring sustainability.

**Tender Timings**
The timings and deadlines within the tendering phase are discussed. It is discussed when to bring out the tender, and how long round 1 and 2 should take. To have an idea about the timings, the tender timings for 2013 are presented in Figure 20.

![Tender Timings 2013](Image)
Also the roles and responsibilities within the CBT team are determined in order to have an efficient tendering process. In the current tender process there are three CBT buyers, who are each responsible for three areas in Europe. Each buyer is also responsible for one or more parts within the tendering phase.

**Invitation process**
Another part of the preparation phase is the invitation of the suppliers to participate in the tendering process. Existing suppliers are invited, but also suppliers who were in the last tender process but didn’t get a route awarded (so called non-successful suppliers). Also several new suppliers are invited, but only after they passed the supplier selection test. This invitation process is presented in Figure 21 below. It can be seen that a distinction is made between existing/non-successful suppliers and new suppliers.

![Figure 21 - Invitation to tender process](image)

The right part of the figure starts with the new suppliers. Mar is not actively sourcing for new suppliers, the initiative lies with the new supplier. A new supplier can contact Mars, via factory or directly, to inform if it is possible to participate within the tendering process. The buyer first executed a short check, via mail or phone, to determine whether the expectations are aligned with the expectations of Mars. If these expectations align the supplier is added to the group of potential for invitation suppliers. Several weeks before the start of the tendering phase a RFI document is sent to the potential suppliers.

When the RFI is approved by the buyers, they are invited to the tender phase. Roughly the same accounts for the existing suppliers and the suppliers who were not successful in the last tender. They are
sent only the financial section of the RFI, in order to determine each year the financial health of a supplier. After the approval of the financial RFI those suppliers are also invited to the tender phase.

When a new supplier is invited to the tendering process, he is also invited to the “new haulers” seminar. During this event Mars introduce themselves to the suppliers and the buyers can meet the suppliers face to face. This event is also meant to explain the tender process of Mars and how they should participate. In here for example it is explained how, when and where they can place a bid and what the different tender rounds involve.

**Contract terms**
The last part of the preparation phase is the signing of the contract terms. Suppliers have to sign these contract terms before participating in the tender phase. This is to have no discussions during the tender phase and to make sure that all suppliers are aware of the contract terms. If the suppliers have signed these contract terms, they are allowed to take part in the tender phase. It is a small but essential step in the process, because when they don’t sign this they cannot participate in the tender process.

**Tendering phase**
*In the tendering phase there are formally three rounds. In each round there is another degree of feedback and another degree of bidding. These three rounds are focused on the competitive bidding strategy.*

**Tendering round 1**
Mars uses an online tender platform, to execute a part of the tender process. In the first round the suppliers can place in the online tender platform on each lane one or more bids. It is up to the supplier on how many lanes he places a bid. At the end of round one there is on every lane normally one or more bids placed. These bids are the input for round two. It is for a supplier possible to place more bids on a route if they have different solutions. For example a supplier can place a bid for a road-solution and a bid for a multi-modal solution.

**Tendering round 2**
In the second round an auction strategy is applied, to stimulate the competitive bidding strategy. This auction strategy consists of a dynamic system feedback to the supplier. A supplier gets at the start of this round feedback on their bid they placed in round one. The bids per lane are ranked from lowest to highest and the supplier gets feedback on how their bid is ranked. If their bid is ranked on a place higher then 10, they will only see that they are not in the top 10 of the lowest bids. When they are ranked
between place 10 and 3, they will see their actual place in the ranking. When a bid is part of the three lowest bids, the supplier only sees that he is part of top 3 bids but not on which place he is ranked. This is the feedback the supplier receives at the start of round two and can be considered as the starting point of the supplier. After they received their start ranking, they can modify their bid from round one into the online tender platform. After they modified their bid, they directly get feedback on which place they are ranked with the new bid. It is only possible to lower your bid, when a bid is uploaded it is not possible any more to raise this bid. This dynamic system feedback stimulates the competitive bidding process. The last hour of round two the dynamic system feedback is shut down and the ranking is no longer visible for the supplier. This action is done to prevent discussion on their final ranking in the end and to give an extra impulse to the competitive bidding process.

**Draft allocation**
After the second round the results of the bids are conducted from the online tender platform. With these results the CBT buyers make a draft allocation. This draft allocation is a manual process and is based on several criteria and a standard framework. This framework consists of some simple rules concerning for example dependency, flexibility and capacity. A supplier must comply with this framework, only then a route can be awarded to the supplier. In here there is an exception to this rule. When a supplier cannot comply with all aspects of the framework but can add significant value to Mars, a buyer can decide to still award one or more routes to the supplier. The buyer makes use of the selection criteria developed in the preparation phase to select the suppliers. Despite the pre-developed selection criteria, it is the buyer who makes the final selection decision. At last the selection is also based on a premium for change. This means that an existing supplier is not simply replaced for a new supplier when the price advantage and the extra value to Mars is minimal. This is enclosed by giving the existing supplier a certain percentage discount on his bid offer. After taking all these aspects into account, the buyer selects per route one or more suppliers.

When each buyer has made his draft allocation, they put all the allocations together. They discuss the total allocations of each supplier and check for violations of dependency rule. The dependency rule is based on the dependency of the supplier on Mars. If the business of the supplier depends more than for example 30% on Mars, the supplier becomes dependent on the actions of Mars. This brings a lot of responsibilities for Mars, which is not desirable. Therefore Mars do not want suppliers to be dependent on them.
**Review with stakeholders**
When the draft allocation is composed, it is communicated and discussed with the stakeholders. This is an important step to align all the stakeholders with the new allocation. This is difficult because every stakeholder has other desires. For example the ideal situation for a factory logistic planner is that he has only one logistic partner, so that he only has one contact person. This situation is for a CBT buyer not an ideal situation; because the best market price is often not reached when only using one supplier.

**Tendering round 3**
In the third round of the tender a “bid summit” event is organized. For this event the twenty biggest and most interesting suppliers in the draft allocation are invited. During this event the allocated routes are discussed in a face to face conversation with the supplier. The buyer and supplier looks for mutual solutions, where both the supplier as the buyer sees advantage for themselves. The negotiation part is important during this event, it drives the costs down and it optimizes the allocation.

After the third round, the final allocation is conducted. The final allocation is based on the draft allocation, the review with the stakeholders and the output of the third tender round. The buyers discuss with each other which suppliers they use and for which routes. In this process the buyers make sure that dependency, quality and best price are secured in the final allocation.

**Transition phase**
After the final allocation is conducted, the new allocation should be communicated to all the stakeholders. The suppliers must sign the final contract and will receive the contact information for the routes they have been assigned to. Also the factory logistic planners receive the contact information for their suppliers who are assigned to them.

**Evaluation phase**
The evaluation phase consists of two sided feedback, on the one side feedback from the supplier and on the other side feedback from the stakeholders. The feedback from the suppliers is done by supplier engagement sessions and supplier engagement surveys. This is not only to receive feedback, but also to bind the supplier to Mars. This is done to make the supplier enthusiastic and motivated to work for Mars and therefore deliver better quality. The feedback from the stakeholders is done by personal conversations via a TC or face to face, in order to determine the problems and bottlenecks with the supplier.
8.4 Appendix D

Due to confidentiality not accessible.