Master’s Thesis

Meri Pajarinen 2018

LAPPEENRANTA UNIVERSITY OF TECHNOLOGY
School of Business and Management
Master's Degree in Supply Management

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IMPLEMENTATION OF GREEN SUPPLY CHAIN MANAGEMENT PRACTICES: A GUIDANCE FOR A FINNISH CONSTRUCTION COMPANY

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ABSTRACT

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Title: Implementation of green supply chain management practices: A guidance for a Finnish construction company

Faculty: LUT School of Business and Management

Major: Master's Degree in Supply Management

Year: 2018

Master's Thesis: Lappeenranta University of Technology
125 pages, 21 figures, 8 tables, 7 appendices

Examiners: Professor, D.Sc. (Tech.) Jukka Hallikas
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Key words: Green Supply Chain Management, GSCM, green supplier selection, Environmental segmentation model, environmental supplier development, environmental collaboration

The purpose of this study is to investigate how a Finnish construction company could convert its procurement operations into more environmentally friendly direction through the implementation of Green Supply Chain Management practices. An output of the thesis is a tangible guidance, which includes the different GSCM tools as well as drivers and barriers that should be considered throughout the implementation process. A clear need for such study and guidance is determined through acknowledging the significant environmental impact of construction industry, the history of construction companies struggling with SCM implementation as well as the lack of tangible models of GSCM in the existing academic literature. The empirical study was conducted in two stages by using the qualitative case study method with some quantitative features. The first stage addresses the capabilities and aspirations of the case company's suppliers on environmental issues. In the second stage, the case company's subsidiaries in UK and Sweden are benchmarked in order to find best GSCM practices and to identify the corporate related drivers and barriers of the implementation. The results of the study suggest that the implementation of GSCM could be successful as the existing SCM practices give a strong base for development and the suppliers would also be capable and interested in such progress. However, the implementation is still demanding, as it is a constant balancing between the significant attainable benefits and demanding barriers.

TIIVISTELMÄ

Tekijä:	Meri Pajarinen
Otsikko:	Vihreiden toimitusketjun hallinnan työkalujen implementointi: Ohjeistus suomalaiselle rakennusyhtiölle
Tiedekunta:	Kauppakorkeakoulu
Pääaine:	Hankintojen johtaminen
Vuosi:	2018
Pro Gradu –tutkielma:	Lappeenrannan teknillinen yliopisto 125 sivua, 21 kuvaa, 8 taulukkoa, 7 liitettä
Tarkastajat:	Professori, D.Sc. (Tech.) Jukka Hallikas Apulaisprofessori, D.Sc. (Econ.) Katrina Lintukangas
Avainsanat:	Vihreä toimitusketjun hallinta, vihreä toimittajavalinta, Ympäristölähtöinen toimittajien kehittäminen, segmentointi, ympäristöyhteistyö

Tämän Pro Gradu –tutkielman tarkoituksena on selvittää, miten suomalainen rakennusyhtiö voi muuttaa toimintojaan ympäristötehokkaammiksi implementoimalla vihreitä toimitusketjun hallinnan työkaluja. Tutkimuksen tulos on konkreettinen ohjeistus, jossa on huomioitu erilaiset työkalut sekä implementoinnin ajurit ja haasteet. Tutkimukselle oli selkeä tarve, ottaen huomioon rakennusalan merkittävät ympäristövaikutukset, perinteiset vaikeudet toimitusketjun hallinnan työkalujen implementoinnissa sekä konkreettisten vihreän toimitusketjun hallinnan mallien puuttumisen akateemisesta kirjallisuudesta. Empiirinen tutkimus toteutettiin kaksiosaisena kvalitatiivisena tapaustutkimuksena, jossa hyödynnettiin myös kvantitatiivista dataa. Ensimmäisessä osassa selvitettiin kohdeyrityksen toimittajien kiinnostusta ja kykyjä liittyen ympäristönäkökulmiin. Toisessa osassa parhaita käytäntöjä sekä odotettavissa olevia hyötyjä ja haasteita tunnistettiin haastattelemalla kohdeyrityksen tytäryritysten edustajia UK:sta ja Ruotsista. Tutkimuksen tulokset osoittavat, että kohdeyrityksellä on hyvät mahdollisuudet vihreän toimitusketjun hallinnan käytäntöjen implementointiin, sillä sen olemassa olevat hankinnan käytännöt antavat vahvan pohjan kyseisenlaiselle kehitykselle. Lisäksi toimittajat osoittavat sekä kiinnostusta että kyvykkyyttä tämän kaltaista muutosta kohtaan. Implementointiprosessi on silti haastava, sillä käytännössä se on jatkuvaa tasapainoilua saavutettavissa olevien hyötyjen sekä implementointia vaikeuttavien haasteiden välillä.

ACKNOWLEDGEMENTS

The past five years have passed more quickly, I could have ever imagined. The years spent at Lappeenranta have given me so much: friends, unforgettable memories, a profession, but first and foremost a curious attitude towards learning new things. For me, writing down these last words of this Thesis project also means an end of an era: Finally, my uninterrupted school career of 17 years comes to an end – at least for now! A lot of hard work has been stuffed into these years, but writing this Master's Thesis has been without a doubt the most challenging but at the same the most interesting project of my studies. Here, I would like to express my gratitude to all who supported me during these past five months.

Firstly, I would like to thank my coworkers who have been providing me their knowledge and support when needed. Furthermore, I would like to thank my interviewees from Sweden and from UK who were kind enough to donate their valuable time for my project. Your expertise brought so much value for my research.

Secondly, I would like to thank both professors Jukka Hallikas and Katrina Lintukangas from Lappeenranta University of Technology for providing their insights and instructions for my research process.

Especial thanks goes to my friends and family who have supported me throughout this process and have believed in me, even when I didn't. Finally, thank you Ville for being my rock whenever I needed one.

Helsinki, 2.3.2018
Meri Pajarinen

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1 INTRODUCTION

During the past decades, both individuals and organizations have become increasingly aware of their role in perceiving the natural resources and ensuring the environmental stability (Nasir et al. 2017; Wu & Pagell 2011). The awareness is resulting from the negative impacts the constantly increasing demand and production is causing to the environment (Rajeev et al. 2017). The clearest signs of these unwanted impacts are significantly increased levels of pollution and severe environmental catastrophes that are occurring more often than in the past (Rajeev et al. 2017). Additionally, news about environmental disruptions, caused by the production processes of large corporations, have raised interest towards sustainability (Seuring & Müller 2008; Schneider & Wallenburg 2012). As individuals have only a limited possibility to affect the environmental issues, their attempt to make a difference is often restricted to making the choice of consuming environmentally responsible goods (Hetterich et al. 2012). Hence, a large responsibility on actually changing the business practices into environmentally friendly direction is left to the organizations (Schneider & Wallenburg 2012). This has made sustainability a relevant topic for most companies (Schneider & Wallenburg 2012), as there is a need to respond both to the customer needs (Hetterich et al. 2017), and to the demand on corporate social responsibility, which is expected by other stakeholders such as NGOs, governments and investors (Seuring & Müller 2008; Kovács 2004).

The implementation of corporate sustainability is highly dependent on whether the purchasing and supply management operations of a company aim for sustainable sourcing (Lintukangas et al. 2016; Schneider & Wallenburg 2012). Even the United Nations (2013) have emphasized that Green Supply Chain Management is one of the key issues for diffusing corporate sustainability. According to Schneider and Wallenburg (2012), this is mainly because the sourcing function is usually the starting point for the material flow of the company. Thus, the purchasing unit has the opportunity, and responsibility, to choose whether the company is utilizing sustainably produced components in its operations. Furthermore, according to Krause et al. (2009) a company is just as sustainable as the suppliers allowed to be a part of the company's supply chain. Hence, the focal companies of the supply chains may also be held responsible for the environmental actions made by the utilized suppliers (Seuring & Müller 2008).

These facts have led to rapidly growing interest of both researchers and industry experts on developing traditional Supply Chain Management (SCM) towards Green Supply Chain Management (GSCM) (Rajeev et al. 2017).

Construction industry has a history of struggling with effective SCM implementation (Lönngren et al. 2010; Adetunji et al. 2008). The project-centric nature of the industry makes it more difficult to apply traditional SCM tools, such as partnerships and collaboration compared to, for example, the electronics or automotive industry (Kim et al. 2016; Gadde & Dubois 2010; Bresnen & Marshall 2000), since the parties in the supply chain may change as often as new projects emerge (Bemelmans et al. 2012). However, during the recent years, SCM has become one of the most highlighted issues in the construction industry, and regardless of the difficulties, developments such as generalization of supplier selection and expanded performance measures have been successfully implemented (Adetunji et al. 2008; Kim et al. 2016). Furthermore, as SCM practices have now been widely accepted to be a solid part of the procurement practices of construction companies, there has also been a growing attention towards sustainability issues (Adetunji et al. 2008; Kim et al. 2016) and concepts such as GSCM and environment based supplier selection have emerged in construction industry as well (Kim et al. 2016).

Emphasizing the importance of concepts such as GSCM is particularly important in the construction industry, since it is known to be one of the main causes of environmental issues (Kim et al. 2016; Giesekam et al. 2016; Krausmann et al. 2009) and one of the most significant sources of carbon emissions in many countries (Giesekam et al. 2016). Hence, one cannot deny the responsibility construction companies have in driving the sustainable values in the business world. However, the growing interest of construction companies towards greening their supply chain management actions is not only a result of increasing awareness of their Corporate Social Responsibility. The main drivers are the environmental regulations, contracts and goals to which different countries have signed into (Kim et al. 2016; Finnish Council of State 2017). Currently, the most remarkable regulative framework is the Paris Agreement, to which 166 different countries have committed to (United Nations 2017). Fulfilling the targets defined in the agreement will require remarkable actions from all the parties (Finnish Council of State 2017) and as the effect of construction industry is undeniable (Kim et al. 2016; Giesekam et al. 2015) regulations and forcing legislation may be expected. Hence, the

construction companies must find ways to integrate sustainability into its SCM actions, regardless of the difficulties the project-based industry might cause.

All in all, when combining the facts of the growing political pressure directed to construction companies to become more sustainable, the crucial role of supply chain management in turning a company into more sustainable direction, and the fact that enabling SCM actions in construction industry is remarkably more complicated than in many other industries, one can easily identify the importance for a study combining these elements. Thus, the main goals of this research are to 1) identify the GSCM actions that could be realistically utilized within a large Finnish construction company when it aims to turn its supply chain into more environmentally efficient direction, and 2) to conduct a guidance that would aid the case company at the implementation process.

1.1 Literature review

As the academic and corporate interest towards GSCM has risen considerably during the past years (Seuring & Müller 2008; Schneider & Wallenburg 2012), it can directly be seen as increased amount of academic research published regarding this issue (Min & Kim 2012; Ashby et al. 2012; Seuring & Müller 2008). According to Min and Kim (2012) the amount of academic literature on sustainable supply chain activities started to increase substantially in the late 1990s. One of the first attempts to combine environmental implications with procurement was the article on green purchasing strategies written by Sarkis in 1995. The article highlighted the potential research gap of linking environmental manufacturing into SCM (Sarkis 1995). After Sarkis' article, studies aiming to fulfil the identified research gap started to emerge (Min & Kim 2012). For example, Min and Galle (1997) examined the connection between purchasing practices and environmentalism, and proposed multiple environmental factors that influenced the supplier selection decision. This was followed by a research by Walton et al. (1998), in which was indicated that green supply chain actions might result as lower costs and improved customer satisfaction.

The current literature on GSCM concentrates heavily on supplier relationships and collaboration (Ashby et al. 2012; Nyaga et al. 2010). In addition, performance measurement (e.g. Taticchi et al. 2013), supplier selection (e.g. Igarashi et al. 2013) and supplier evaluation are widely studied (Fahimnia et al. 2015). Additionally, the

barriers and drivers of GSCM have been discussed in the academic research (e.g. Walker et al. 2008; Giunipero et al. 2012). Hence, rather concrete methods have been studied. However, Ashby et al. (2012) states that regardless of the large amount of academic papers, there are very few studies that would offer tangible outputs, such as a clear framework or a model, on how to actually implement the sustainability actions. This can be considered as an issue and an area where further research is needed, as for example, Keating et al. (2008) state that especially organizational GSCM policies determining the sustainable procurement practices are one of the most effective tools for greening the SCM operations of a company.

SCM and GSCM research traditionally concentrates on industries such as car and electronics manufacturing and food production, where the procurement processes are rather easily standardized (Kim et al. 2016; Dyer et al. 1998; Wilhelm & Kohlbacher 2011). As already mentioned, many of the main stream SCM research areas are not directly utilizable in the construction industry, since the production does not take place in a controlled factory environment and the supply chains are often only temporary structures that emerge and vanish as rapidly as projects are established and completed (Cox & Thompson 1997; Lönngren, et al. 2010; Gadde & Dubois 2010; Bresnen & Marshall 2000). Nevertheless, issues such as poor quality, low productivity and ineffective adversarial supplier relationships of construction companies, were factors that raised the interest of the SCM researchers in the 1990s, suggesting that the construction industry could and should try to benefit from more defined SCM actions (Adetunji et al. 2008; Segerstedt & Olofsson 2010). Since then, the amount of academic research on construction supply chains has increased steadily and many of the conventional SCM tools have been successfully integrated into procurement practices in construction companies (Segerstedt & Olofsson 2010).

According to Adetunji et al. (2008), the adaptation of traditional SCM tools has enabled the increasing interest towards environmental issues and GSCM actions in the construction industry as well. The existing research on the issue has been placed both to the developed and developing countries, as there are studies executed in countries such as United Kindom (Dadhich et al. 2015; Glass 2012; Adetunji et al. 2008), U.S. (e.g. Ganguly et al. 2013), Indonesia (Hermawan et al. 2017), Korea (Kim et al. 2016) and China (e.g.Tang & Ng 2014). Nonetheless, after an extensive search on the available literature, the author was not able to find academic literature on GSCM

conducted in the context of Finnish construction industry, which would propose a need for further research. What separates Finland from the more popularly studied countries is the remarkably smaller size of the market (The World Bank Group 2017). In 2016 the GDP of Finland was 236 billion USD, whereas in UK it was 2.6 trillion USD and in Korea 1.4 trillion USD (The World Bank Group 2017). This considerable difference in the sizes of the economies might affect the applicability of some of the GSCM tools in the Finnish construction industry.

1.2 Research questions

After familiarizing oneself with the existing literature, one can easily identify a research gap. As the construction industry has a remarkable impact on the climate change issues (Kim et al. 2016; Giesekam et al. 2016; Krausmann et al. 2009), but the project-based nature of the industry makes it difficult to apply traditional SCM or GSCM tools to the supply chains (Lönngren et al. 2010; Adetunji et al 2008; Gadde & Dubois 2010) but as the supply chains still set the foundation for a company's sustainability (Krause et al. 2009), there is a clear need to do research, which aims to find solutions for this dilemma. This would enable construction companies to contribute to the environmental issues more effectively. Furthermore, as Finland as a research context is lagging behind, it also gives a new perspective to the research. It was also evidenced that even though the research on SCM and GSCM is becoming more popular in the academic world, there still exists a lack of tangible models and frameworks that would give guidance to the companies on how they could actually introduce and increase the usage of sustainable business practices in their supply chains (Ashby et al. 2012). By combining all of the above-mentioned factors, the main research question of this thesis is constructed as follows:

"How can a Finnish construction company develop its Green Supply Chain Management practices?"

The main goal, when answering this research question, is to conduct a practical step-wise model on GSCM implementation that the case company could truly utilize when aiming to convert its supply chain into more sustainable direction. The model also includes the existing capabilities of the suppliers, so the short- term and long-term goals could better be determined and aligned with the suppliers' competences.

Furthermore, in order to determine the future guidelines, existing best practices should be identified. In this research, they are sought from the academic research on the topic. Moreover, ideas for higher targets are also quested from the case company's subsidiaries in UK and Sweden, where GSCM practices are much further implemented and developed than in the case company itself.

SQ1) Why should companies engage in GSCM practices?

Indeed, it is noted and widely accepted that companies have a huge responsibility in the fight against the climate change and other environmental issues. However, it is also a recognizable fact that often the pure Corporate Social Responsibility is not enough to motivate organizations to act in a more sustainable way. Thus, in order to find the incentives for the implementation of GSCM, it is vital to clarify, what is in it for the companies to engage in the proposed practices.

SQ2) What are the barriers for the implementation of GSCM?

The topic of GSCM itself is rather complex, and for sure it can be expected that the implementation will not be totally unproblematic. Hence, a vital part of the guidance is also to identify the expected barriers of the implementation so that they could be tackled. Only then is it possible to go through with the implementation process in a successful manner.

1.3 Conceptual framework

The broadest concept within which this thesis is constructed is the climate change. The effects that climate change is causing worldwide have been one of the biggest inspirations for this thesis, and thus it is setting the ultimate framework for the research. The second large concept affecting the research is construction industry. This context is stemming from the significance of this particular industry on climate change, and hence the research is conducted within a large Finnish construction company. Furthermore, as the timeframe for conducting this particular research is setting some boundaries, it would have been impossible to consider the whole supplier base of the case company. Thus, the actual research is limited to concern only the framework agreement (FWA) suppliers of the case company.

Within the conceptual framework consisting of climate change, construction industry and FWA suppliers, the actual research is executed. As the main goal of this research is to build a guidance for GSCM implementation, it is essential to gain knowledge on what can be found from the existing research in terms of GSCM tools and GSCM as a concept. Furthermore, insights of the possibilities and pitfalls one must consider when aiming for greener supply chain through utilizing the procurement activities must be investigated. These concepts will also set the academic base for this study. However, it would be insufficient to only look into the theoretical concepts related to the study, as the target is to construct the guidance in a way that it will offer practical actions the case company could take when aiming to implement the GSCM practices. Hence, the conceptual framework of this study also includes the current level of GSCM in the case company, the current ability of suppliers to respond to the GSCM actions and the best practices of the subsidiaries of the case company that could potentially be benchmarked here in Finland as well. Moreover, the drivers and barriers of GSCM are addressed in the empirical research as well, so they could be better linked to the implementation context.

These presented concepts set the foundation for the conceptual framework of this Master's thesis. All of them have a role when aiming to answer the research questions but alone they would be insufficient. The framework is better visualized in figure 1.

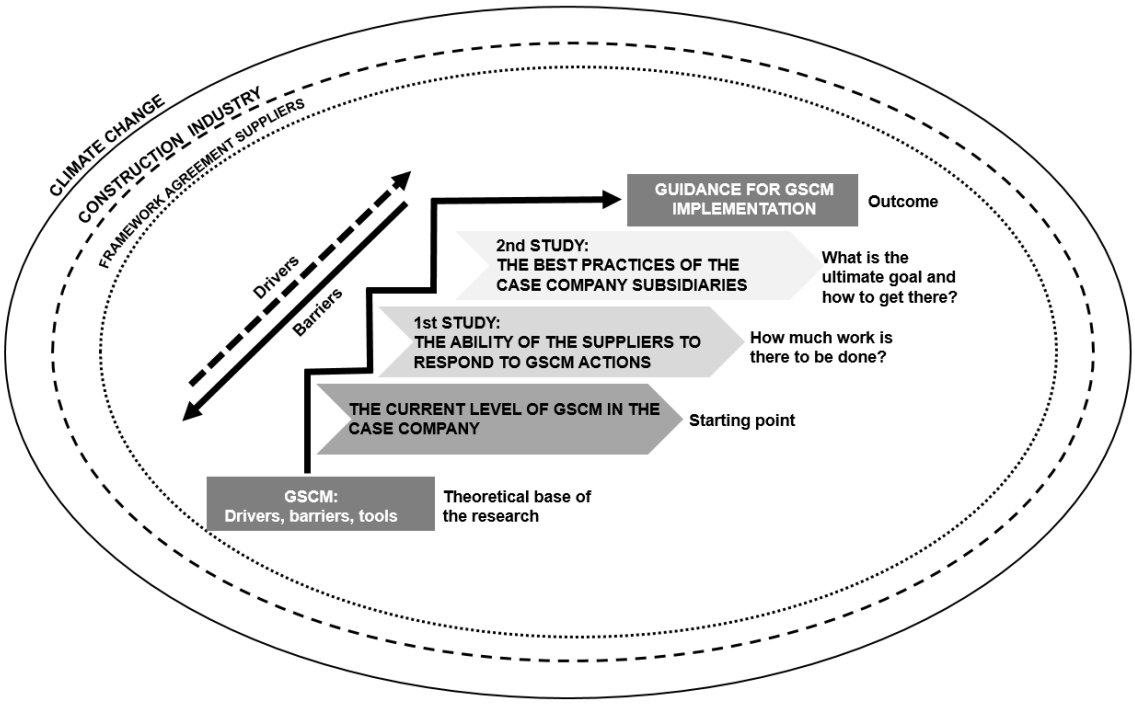

Figure 1. The conceptual framework of the research

1.4 Limitations

Making limitations to the research area is an essential part of a successful research process. If the area of research is too wide, it is very difficult to analyze the whole material thoroughly and the quality of the results may be negatively affected. Hence, when making qualitative research, one must bear in mind that the initial aim of the study is not to conduct as many interviews as possible but rather, through carefully made limitations, find the best sources of information from a manageable segment of the field of the research. (Saaranen-Kauppinen & Puusniekka 2006)

The first limitation of this study is the decision to limit the research into the context of Finnish construction industry. The limitation is logical, as according to the Finnish Ministry of Environment (2017a) Finland as a member of EU and as one of the parties of the Paris Agreement has agreed to pursue emission reductions of 40% by the end of the year 2030. As the construction industry and buildings, account for around one third of Finland's greenhouse gas emissions (The Finnish Ministry of Environment 2017a) actions towards reaching this target may be expected from the Finnish construction companies. Hence, one can easily identify the justification for this particular limitation and, thus it was natural to choose a case company, which indeed operates within the selected industry and context.

Another notable limitation made in this study, is the decision to conduct the first stage of the empirical study only by targeting the suppliers who have a framework agreement with the case company. When operating in the construction industry the amount of supplier relationships is massive. For example, the case company of this study has approximately 10 000 invoicing suppliers annually. Hence, one can argue that some limitations must be made in terms of which suppliers are included in the research. Furthermore, some limitations is also made in the second stage of the research, as only the subsidiaries located in UK and in Sweden are included, even though the case company has operations in other countries as well. This limitation is based on the fact that these two particular subsidiaries are considerably further with implementing GSCM in their procurement operations.

The final limitation made in this research is related to the concept of sustainability. According to Elkington (1997), in the business literature sustainability is often considered to consist of three aspects, which are: 1) economical, 2) environmental, and

3) social responsibility. These three layers are the base for the widely known triple bottom line of sustainability (Wilson 2015). Basically, this means that a sustainable company is able to respond to economic, environmental and social needs and requirements simultaneously (Wilson 2015; Elkington 1997). Nevertheless, in this study the concept of social responsibility is excluded from the sustainability discussion. This is purely done because the goals of this study are not related to finding solutions into social issues, but the consensus is purely on environmental aspects. However, as the study is conducted within a real business environment where the revenue and profitability are essential, the economic aspects must be included.

1.5 Key concepts and definitions

Next, the key concepts and definitions for this thesis are presented. By defining the most valid concepts and the most used definitions of the thesis, it is made easier for the reader to understand and read the research. The definitions further aid in avoiding the misunderstandings caused by poorly defined concepts. Moreover, it can be ensured that the ideas the researcher is aiming to communicate are understood as intended.

Supply Chain Management

The traditional concept of SCM saw suppliers as a way of achieving the lowest purchasing prices and assuring the availability of the needed components of the production process (Ashby et al. 2012). However, nowadays SCM is viewed as a complex process of activities, which considers designing, developing, optimizing and managing both internal and external pieces of the supply chain (Spekman et al. 1998; Ashby et al. 2012; Hervani et al. 2005). The structure of a supply chain consists of external suppliers and distributors, the company's internal functions and the customers (Hervani et al. 2005). According to Hervani et al. (2005), SCM is a vital business function, which views the production process from the sourcing of raw materials into distribution of the final product to the end customer from a strategic point of view. During the process, the aim is to produce additional value for the customer (Moeller et al. 2006).

Green Supply Chain Management

In GSCM, a focal firm of a supply chain collaborates with its suppliers in order to improve the environmental performance of its products and production processes (Simpson & Power 2005). A simple definition considers GSCM as an integrated concept of SCM practices and environmental matters, where the costs, benefits and risks of managing

and reducing the environmental impact of a company are identified (Ashby et al. 2012; Sarkis et al. 2011). According to Hervani et al. (2005), the components of GSCM are green purchasing, green manufacturing and materials management, and green distribution and marketing. Adopting GSCM into business practices might require a shift from the traditional way of measuring success from purely financial parameters into a holistic view where the environmental achievements are considered to be a part of successful business operations (Ashby et al. 2012). According to Lintukangas et al. (2016) the concepts of GSCM, environmental purchasing and sustainable supply chain management are often used as synonyms, and this is the case in this research as well.

Green Construction

In green construction the scientific management and technological progress is used in engineering construction in a way that the conservation of the natural resources is maximized, construction activities causing negative environmental impacts are reduced and the goals of four savings (energy, land, water and materials) and environmental protection are achieved. This, however, is done in a way that will not compromise the basic needs of construction projects such as quality and safety. (Shi et al. 2013)

1.6 Structure of the thesis

This thesis consists of four chapters. The first one is the introduction, where the motives, limitations and research questions are presented. The introduction is followed by the theory chapter, which provides an extensive overview of Green Supply Chain Management. The main barriers and drivers to the implementation as well as the most popular tools related to it are introduced. The chapter is concluded with a summarizing framework of GSCM, which is built based on the sections of the theory chapter. The third chapter consists of six sections. The first section is designed to lead the research towards its context as it presents the general sustainability aspects that are currently discussed within the Finnish construction sector. In the second section, the case company of the research is introduced whereas in the third one the research process of the two-staged empirical study is described. The last two sections cover the actual empirical researches, starting with the one assessing the environmental aspirations and capabilities of the suppliers, and followed with the one benchmarking the subsidiaries of the case company in terms of GSCM. Finally, the fourth, and final, chapter concludes the results of the study and provides a structured guidance for GSCM implementation. In addition, the reliability, validity, and managerial implications are discussed.

2 GREEN SUPPLY CHAIN MANAGEMENT

The importance of SCM has been growing since the early 1990s, even though the concept was introduced already in the early 1980s (Svensson 2007). For a long period of time, procurement and SCM were seen as strategically insignificant parts of business that had no impact when companies aimed to gain competitive advantage (Moeller et al. 2006; Whipple & Frankel 2000; Dyer et al. 1998; Reid & Plank 2000). For example, it was not common to strive for collaborative supplier relationships, since the main approach to the relationships was mainly perceived as adversarial and transactional (Whipple & Frankel 2000; Vitasek & Manrodt 2012). It was thought that the most efficient and profitable model for supplier relations was to form so called arms-length relationships, where the parties were operating in an opportunistic manner, and the goal was thus purely to exploit the other party as much as possible (Dyer et al. 1998; Whipple & Frankel 2000; Vitasek & Manrodt 2012). Basically, this meant that there were no channels formed where, for example, information or innovations could have flown between the business partners (Vitasek & Manrodt 2012).

However, the perceptions on SCM have drastically changed throughout the past decades, and nowadays companies often include strategic aspects to their procurement activities (O'Neall & Haraburda 2017; Moeller et al. 2006; Whipple & Frankel 2000). According to Wilhelm and Kohlbacher (2011) and Dyer et al. (1998), one significant influencer for this was the remarkable success of Japanese automotive industry. For example, Toyota was able to gain significant competitive advantage compared to its competitors, by changing its perspective from purely adversarial point of view into a more integrated, collaborative and strategic direction (Wilhelm & Kohlbacher 2011; Dyer et al. 1998). Additionally, as the awareness on the fact that external purchases may represent as much as 75% of a companies' cost structures has spread across the business world, so has the interest towards the business opportunities strategic SCM might offer (Dubois & Gadde 2000). According to Svensson (2007), the key aspects of strategic SCM are: 1) considering the whole supply chain from the point of origin to demolition, 2) embracing the long-term point of view over short-term view, and 3) striving for close collaboration with suppliers that show potential and are compatible with the company and its values.

As the SCM has established its position as a vital strategic aspect in business operations throughout the past decades (O'Neall & Haraburda 2017; Moeller et al. 2006; Whipple & Frankel 2000; Beske & Seuring 2014), at the same time the public interest towards environmental issues and corporate sustainability has been steadily increasing due to more severe natural disasters, growing pollution levels and increased knowledge of people on the causes for these unwanted effects (Nasir et al. 2017; Rajeev et al. 2017; Wu & Pagell 2011). The world's population has grown tremendously over the last century, and in 2011, it reached seven billion, which is 430% more than at the beginning of 20th century (Min & Kim 2012). Without discovering systematic ways to sustain the resources of this planet, the quality of lives will deteriorate rapidly (Min & Kim 2012). The growing awareness on these facts has led to an increasing discussion on corporate social responsibility (CSR) and the role of organizations, when it comes to reacting to the deterioration of the environment, has been increasing (van Lakerveld & van Tulder 2017; Walker et al. 2008). As discussed earlier, it has been recognized by many researchers that eventually the level of corporate sustainability and responsibility is stemming from the supply chain (Lintukangas et al. 2016; Krause et al. 2009; Seuring & Müller 2008). This has led to the situation where environmental aspects have been included to the concept of traditional SCM leading to the development of the GSCM concept (Giunipero et al. 2012; Walker et al. 2008). Indeed, GSCM has developed significantly during the past decades, as it has evolved from initial practical sense-making into a rigorous and theory based area of empirical and analytical studies (Fu et al. 2012; Seuring & Müller 2008)

In practice, the transition from SCM to GSCM is done by integrating the natural environment concerns into the SCM processes (Fu et al. 2012). Thus, GSCM can be described to be a theoretical and practical extension of SCM, where sustainability criteria are added to the traditional SCM actions, such as supplier selection, segmentation and supplier development (Svensson 2007; Beske & Seuring 2014; Fu et al. 2012). Hence, the most remarkable difference between SCM and GSCM lies in the dedication to the values of Triple Bottom Line (TBL) (Beske & Seuring 2014). In conventional SCM, the focus is solely on the economic aspects, whereas GSCM is including the environmental aspects as well (Beske & Seuring 2014). Table 1 further elaborates the differences and similarities of conventional SCM and GSCM.

Altogether, the greening process of the supply chain represents a significant opportunity for all stakeholders that are concerned with issues related to environmental business performance and sustainable consumption (Gilbert 2000). Gilbert (2000) further points out that the true challenge lies in changing the patterns of mass production and mass consumption. Therefore, the foundation for GSCM is constructed at the mindset of a company (Beske & Seuring 2014; Pagell & Wu 2009). Only by incorporating the value-base of GSCM at the strategic level and in the overall values of the company, can actual change towards sustainable supply chain operations happen within an organization (Beske & Seuring 2014).

Table 1: Comparison between conventional SCM and GSCM (formulated based on Beske & Seuring 2014)

SCM	GSCM
Orientation	
Performance objectives and measurement limited to the economic dimension	Dedication to the economic and environmental aspects of the Triple Bottom Line
SCM seen from a strategic point of view and incorporated to the everyday decision making	SCM seen from a strategic point of view and incorporated to the everyday decision making. Green aspects are included as sustainability is rooted in the organization culture.
Continuity	
Long term-contracts and relationships in order to gain e.g. quality, competitive advantage, increased performance.	Close and mutually beneficial relationships to gain quality, competitive advantage, increased performance etc. AND environmental effectiveness
Formalized supplier selection in order to detect the most capable suppliers	Formalized supplier selection to detect the most capable and environmentally aware suppliers
Supplier development	Supplier development (environmental aspects included)
Collaboration	
Collaboration	Collaboration to enhance sustainability performance
Enhanced communication through information flow	Enhanced communication through information flow and transparency
Some integration of technology and logistics with the supplier	Deep integration of technology and logistics with the supplier
Joint development	Joint development of practices to make the supply chain more environmentally effective
Risk management	
Requiring e.g. quality certificates from suppliers	Requiring environmental certificates from the suppliers
Monitoring supplier performance	More specific monitoring of supplier performance. E.g. requiring the supplier to comply with a Code of Conduct where company specific requirements on environmental issues are set.
Supplier selection	Green supplier selection
Proactivity	
Some level of proactivity in innovativeness	High level of proactivity
	Including aspects such as Life Cycle Assessment to the product innovations
	Including Stakeholder Management

2.1 The drivers of GSCM implementation

When discussing GSCM, a relevant question that might emerge is, why should companies engage themselves in actions that, according to Igarashi et al. (2013), can be stated to be complex and time consuming? Regardless of the complexity, a vast amount of research has stated that by including green practices into a company's procurement operations multiple different benefits may be gained (Walker et al. 2008; Giunipero et al. 2012; Green et al. 1996; Klassen & Vachon 2003). However, sometimes the attainable benefits are not the initial reason companies make the decision to get involved with GSCM practices, but they are rather pressured to do so due to external pressure coming from different sources (Giunipero et al. 2012; Walker et al. 2008; Green et al. 1996).

In this chapter, the most highlighted GSCM drivers are presented. Based on a thorough investigation of the existing literature the drivers are divided into the following categories: 1) monetary benefits, 2) society, 3) customers, 4) competition, 5) suppliers. Since GSCM can be stated to consist of both internal and external aspects (Zhu et al. 2006; Kim et al. 2016), both of these points of views are included. Figure 2 illustrates the areas of which these drivers consist of. In the following sub-chapters, each of these drivers are further discussed.

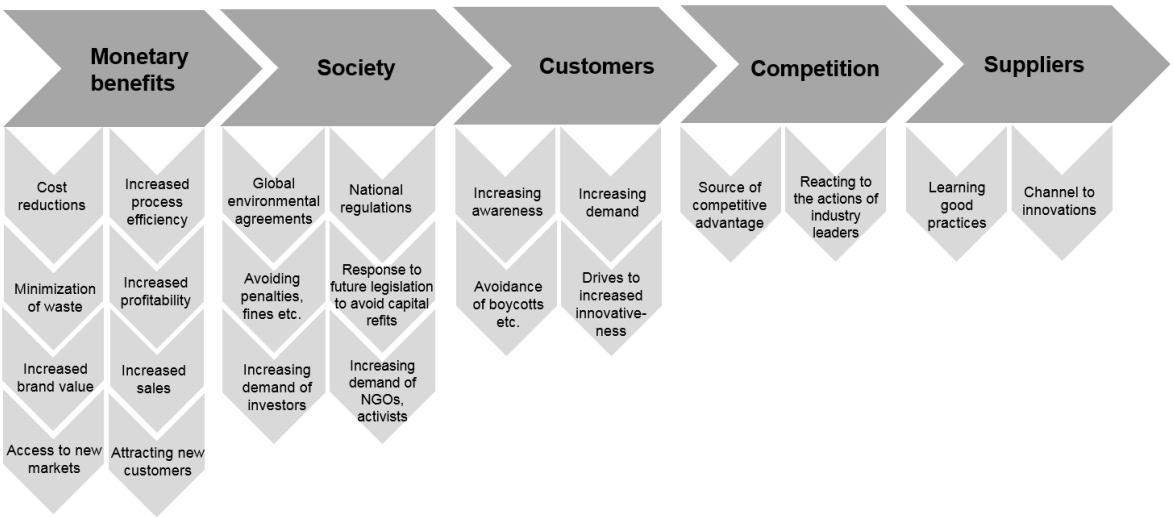

Figure 2. Summary of the GSCM drivers

Monetary benefits

One of the most highlighted drivers for GSCM implementation in companies is no doubt the monetary benefits it may bring to the organization (Gilbert 2000; Walker et al. 2008; Carter & Dresner 2001). Giunipero et al. (2012) state that regardless of the common

statement within the GSCM literature of the additional intangible value sustainability is producing to the companies, the reality is that in practice the economic aspects are currently the most critical drivers for the implementation of sustainable procurement practices. For example, in the study by Handfield et al. (1997) it was argued that GSCM activities were purely initiated by a focus on cost reductions, waste elimination, and quality improvement, ruling out for example the aim for environmental compliance. According to Gilbert (2000), this, however, is not an issue, since the economic goals and environmental goals often are not exclusive.

Indeed, studies have concluded that it is financially beneficial to practice business in an environmentally sustainable way (Giunipero et al. 2012; Carter & Dresner 2001), since the corporate social performance and profitability are highly and positively connected (Waddock & Graves 1997). This is due to the fact, that basically when a company decides to turn the point of view of from traditional SCM into GSCM, it often means that more attention is paid to the effectiveness of the production processes and to the minimization of waste produced throughout the whole supply chain (Gilbert 2000; Walker et al. 2008). Another example is the optimization the logistics processes: by streamlining the processes, fewer deliveries are made in shorter distances and less packaging materials are needed as the goods are delivered in larger orders (Azevedo et al. 2012). This simultaneously decreases the costs of fuel and packaging materials while also decreasing the environmental effects caused by the logistics (Azevedo et al. 2012). Indeed, many of the GSCM actions simultaneously increase the effectiveness and profitability of the supply chain, decrease the production costs, and reduce the environmental impact of the company (Hervani et al. 2005; Carter & Dresner 2001; Giunipero et al. 2012; Walker et al. 2008). For organizations, operating in industries with low margins, reduced supply chain costs may lead to remarkable market advantages (Gilbert 2000). Hence, the desire for reduced costs often is the common driving force for supply projects aiming for environmentally positive results (Walker et al. 2008; Carter & Dresner 2001; Green et al. 1996; Hervani et al. 2005).

However, the monetary benefits of GSCM are not only stemming from cost reductions and increases in process effectiveness. Many researchers are also highlighting the positive influence of the GSCM on the company brand and image (Pil & Rothenberg 2003; Walker et al. 2008). Hence, as green initiatives may enhance a firm’s reputation, it might then result as increases in the sales and in the brand value (Walker et al. 2008).

Gilbert (2000) also brings up that companies might gain the opportunity to access new markets, and thus increase their revenue, by expanding their business operations to the area of sustainability. Furthermore, if a company is able to offer a product that is competitive in terms of performance, price, as well as sustainability, it is an effective way of attracting new customers (Walker et al. 2008; Gilbert 2000).

Society

When discussing GSCM drivers, an area that cannot be dismissed is the requirements stemming from the society. Many studies indicate that the regulations and legislations set by the governments are one of the most remarkable drivers for companies' environmental efforts (Giunipero et al. 2012; Berns et al. 2009; Handfield et al. 1997; Green et al. 1996). According to Torielli et al. (2011) the amount of environmental legislation and international environmental agreements have expanded significantly since the early 1990s, which has been driving remarkable global environmental policy changes and new ways of managing environmental issues within companies. For example, the ISO 14000 environment management system standard was developed in response to the United Nations Conference on Environment and Development held in Rio de Janeiro in 1992 (Torielli et al. 2011). Additionally, the United Nations Framework Convention on Climate Change (UNFCCC) was entered into force in 1994, with the ultimate goal of stabilizing greenhouse gas concentration (United Nations 2014a). This was followed by the Kyoto Protocol in 1997, which aims to commit the parties involved in the UNFCCC by setting internationally emission reduction targets (United Nations 2014b). The most contemporary environmental contract is the Paris Agreement from 2016, in which, for the first time, all nations are brought into a common cause to undertake the ambitious efforts to fight the climate change and adapt to the effects it is causing (United Nations 2014c).

The Paris Agreement is requiring all the committed parties put forward national determined regulations that will eventually lead to the goal of keeping the global temperature well below 2 degrees Celsius above pre-industrial levels (United Nations 2014c). As there are 169 countries involved in the agreement, companies all over the world will face these national regulations and will be forced to modify their operations into a less carbon and emission intense direction (United Nations 2014c). According to Giunipero et al. (2012) and Berns et al. (2009), these regulations are indeed needed, since currently the sustainability efforts seen in the companies are mainly the result of

compliance to government regulations. In many companies, the importance of complying with the regulations has been understood due to the increasing penalties, fines and legal costs that may emerge in the case of insubordination (Giunipero et al. 2012). Additionally, Giunipero et al. (2012) suggest that some companies are also implementing green practices into their business operations, since they are trying to avoid the expensive capital refits by responding to future legislation before they are even fully implemented.

However, not only is the pressure to integrate sustainability in to the organization processes coming from the above-mentioned regulations and legislation, but also from other stakeholders (Gualandris & Kalchschmidt 2016; Walker et al. 2008). According to Green et al. (1996), it nowadays is common that the investors are requiring green operations from the companies they are investing in, since the risks related to sustainability are appreciated much higher than in the past. Additionally, demands towards more sustainable SCM can also be expected from, for example, NGOs, activists and green pressure groups (Gualandris & Kalchschmidt 2016; Hall 2001; Walker et al. 2008). In the past, it may have been possible not to react to the demands of these stakeholders, but nowadays they cannot be ignored as they can have remarkable resources, and thus the ability to harm the public image of the unsustainable companies (Gualandris & Kalchschmidt 2016; Walker et al. 2008). Hence, due to the stricter regulations and increased pressure stemming from the society, companies must effectively integrate environmental concerns into their everyday practices and long-term strategies, in order to be able to operate without significant disruptions (Zhu et al. 2008).

Customers

Another critical driver for companies to engage in GSCM practices is the need to respond to the customer demands (Seuring & Müller 2008; Walker et al. 2008; Green et al. 1996; New et al. 2000). The deterioration of the environment, which has been going on over the recent decades, has significantly increased the awareness of the public on environmental issues (Nasir et al. 2017; Walker et al. 2008). Nowadays, the reputation of a company on sustainability issues can highly influence the purchasing decisions of the customers (Berns et al. 2009; Walker et al. 2008), as many customers believe their consuming habits will have an effect in solving the environmental problems (Giunipero et al, 2012). This mind-set has led into even more broad awareness of customers on sustainability, where they are not only expecting the focal firm to be

sustainable but also are expanding the requirement to their first, second, and even third tire suppliers (New et al. 2000). In addition, according to Seuring and Müller (2008), the pressure initiated by the customers to engage in GSCM actions is extremely important, since the supply chain is only justified if the customers end up "accepting" the products and services that the supply chain is producing as its end product. Thus, organizations may also be afraid of the consequences potential sustainability disruptions detected in the supply chain might do to their reputation if the customers were to, for example, boycott their products (Seuring & Müller 2008). Furthermore, according to Carter and Dresner (2001) it has been shown that customer needs and demands can even lead to improved innovativeness of companies as the tightening requirements often are not reachable without making significant changes in the products and processes. Altogether, one can argue that the demand for more environmentally friendly products and production processes has increased and will most likely increase even more in the future (Walker et al. 2008).

Competition

Nowadays, companies are operating in an environment where the competition is constantly accelerating and the search for competitive advantage is never-ending (Cosimato & Troisi 2015; Tseng 2014; Al-Abdallah et al. 2014). In today's market, where sustainability emerges as a major force (Gilbert 2000), GSCM should be seen as one of the potential sources of this competitiveness (Zhu et al. 2008; Walker et al. 2008; Gilbert 2000). Indeed, Giunipero et al. (2012) state that an increasing amount of companies are engaging in green procurement activities in order to gain or maintain their competitive position in the market. Moreover, it is even argued that usually companies do not adopt environmental purchasing strategies in order to "save the world" but rather because it helps them to gain competitive advantage, and is thus positively influencing their financial performance (Gonzalez-Benito & Gonzalez-Benito 2005). The competitive advantage attained through GSCM is largely based on deploying the capabilities of suppliers, as it is common that the buying company itself does not possess the competences but gets an access to them through carefully selecting the suppliers with whom to cooperate with (Kim et al. 2016).

According to Walker et al. (2008) and Giunipero et al. (2012), another competition related driver for GSCM implementation might be reacting to the practices in which the main competitors are engaging in. If the competitors are highly involved in the

environmental business practices, and have the possibility to position themselves as industry leaders, they might be able to set the industry norms the other actors operating in that field must then follow (Walker et al. 2008). This, however, is not the ideal situation or driver for GSCM implementation, since by letting the competitors determine and lead the environmental innovation within the industry, the moment for attaining competitive advantage will be lost (Cosimato & Troisi 2015).

Suppliers

According to Walker et al. (2008), the amount of literature of suppliers as GSCM drivers is limited. However, Carter and Dresner (2001) suggest that suppliers can have a key role when implementing environmental practices, as they are the experts in their business meaning that they have the most valuable ideas and practices on how to develop their products and services in to greener direction in a way that will aid the focal company as well. Hence, GSCM should be seen as mutual collaboration, meaning that not only is the aim of GSCM implementation to educate and steer the suppliers towards sustainable business practices through closer relationships, but also learn from the subcontractors in a way that both engaging parties are benefitting from it (Walker et al. 2008). Furthermore, according to Schiele (2012) suppliers can be one of the main channels of new innovations for organizations. For example in the automotive industry, the majority of the patent applications are registered for the suppliers, not for the manufacturers (Schiele 2012). This indicates that if a company detects an environmentally innovative supplier from its supplier base, it should determinedly aim for cooperation with that supplier, and thus the supplier could act as a driver for even further implementation of green practices. Nevertheless, Carter and Dresner (2001) state that suppliers usually are not the main driving force for GSCM adaptation but rather a supportive influencer when a company is already engaging in green activities.

2.2 Barriers of GSCM implementation

Regardless of the many benefits and relevant reasons for GSCM implementation, one must bear in mind that there often are barriers the companies will face during the implementation process (Gilbert 2000; Carter & Dresner 2001; Giunipero et al. 2012; Walker et al. 2008). An organizational barrier can be defined as a difficulty of implementing fundamental changes within an organization (Luthra et al. 2011). The implementation of GSCM can indeed be stated to be fundamental (Luthra et al. 2011), and it will most likely not be successful without a careful consideration of the presumably

occurring barriers and obstacles. Therefore, in the following sections, the most commonly appearing barriers of GSCM implementation are presented. Based on the review on the existing literature on the issues, they are divided into the following categories: 1) lack of consistency in the corporate strategy, 2) costs, 3) lack of knowledge, 4) lack of supplier cooperation, 5) fear of image risks, and 6) industry and context specific barriers. These categories consist of many different sub-areas that are also further discussed. Again, both organization's internal and external aspects are considered as the concept of GSCM includes them both (Zhu et al. 2006; Kim et al. 2016). Figure 3 clarifies the entity as a whole.

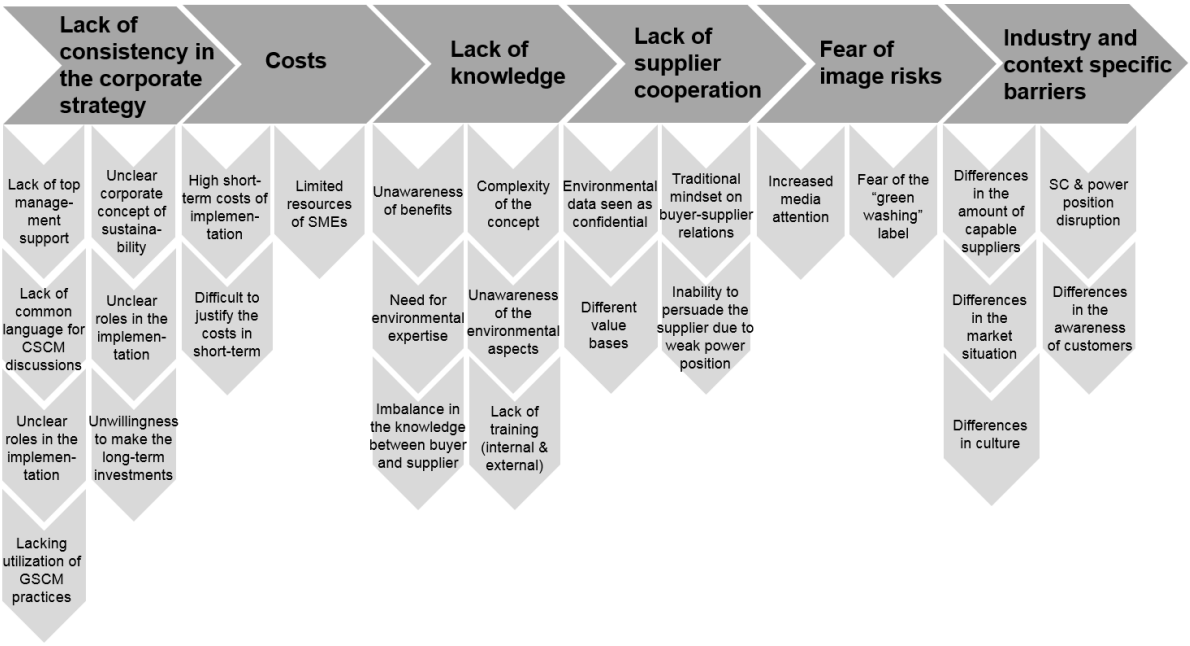

Figure 3. The barriers of GSCM implementation

Lack of consistency in the corporate strategy

The first identified barrier of GSCM implementation is the lack of consistency in the corporate strategy. This barrier consists of multiple areas, but the most highlighted part is the lack of top management support (Luthra et al. 2014; Giunipero et al. 2012; Berns et al. 2009; Min & Galle 2001; Luthra et al. 2011). Top management support is essential for the success of all kinds of strategic projects (Luthra et al. 2011). According to Giunipero et al. (2012) and Carter and Dresner (2001), the clear message and initiatives stemming from the top management are one of the most important factors in whether environmental aspects become a solid part of a firm's strategy or not. This is because the members of top management are responsible for leading the environmental management of their company and "selling" the ideology to the other levels in the

organization in a way that the environment becomes a common area of consideration in all of the business operations (Giunipero et al. 2012; Luthra et al. 2011). Hence, if the top management is not fully invested in the environmental projects, the motivation in the operational level towards changing the working methods will most likely be compromised (Carter & Dresner 2001). Furthermore, according to Carter and Dresner (2001), lack of top management support can also reflect to the company's ability to act on inertia that is likely to emerge as the employees are asked to change their working methods radically. Hence, one can state that the less the management level is involved and invested, the more unlikely it is that the green values are successfully integrated to the company's operations and culture.

Another component of this specific GSCM barrier is the incoherency of the already ongoing green strategies of the companies (Berns et al. 2009; Giunipero et al. 2012). Berns et al. (2009) state that in many organizations the concept and meaning of sustainability is rather unclear among the business leaders as well as the employees. Sometimes there is even a lack of common language for discussing sustainability due to the varying perceptions on the concept (Berns et al. 2009; Giunipero et al. 2012). Hence, as some of the organization members consider sustainability and green initiatives more narrowly, and some more broadly, the common and fluent interaction of the environmental strategy might be difficult to establish (Berns et al. 2009; Giunipero et al. 2012). If the strategy and the concept as a whole is unclear, it will be demanding for the employees to understand their role in the implementation process (Carter & Dresner 2001; Berns et al. 2009). This can indeed become a barrier for the implementation, as the employees are initially responsible for putting the strategy into practice at the operational level (Carter & Dresner 2001; Berns et al. 2009). Hence, if the concept of sustainability is unclear or poorly defined in the company, the GSCM strategy will become unclear in the eyes of the employees, which in turn will make it much more difficult to implement the green strategies or reach the targets set in them (Carter & Dresner 2001; Berns et al. 2009).

The incoherence can also be related to the conception of time (Carter & Dresner 2001; Giunipero et al. 2012). In some cases, it has been seen that the top management is not willing to make the short-term investments that would be needed when converting the SCM actions into more sustainable direction, even though the long-term goals and strategies are built around the idea of greening the business operations (Giunipero et

al. 2012). Furthermore, according to Carter and Dresner (2001) the inability to change the perspective from short-term into long-term is one of the main causes for failure in environment oriented projects, since in the short-time basis it is difficult to recognize the full value of GSCM.

The last component of the barrier caused by lack of consistency in the corporate strategy is the lacking utilization of the GSCM practices (Igarashi et al. 2013). If a company decides that it will execute the transformation of SCM into GSCM by simply adding some minor environmental aspects to its traditional SCM strategy, the company will most likely not gain the expected benefits very effectively and the procurement process will not become truly green (Igarashi et al. 2013). Furthermore, if the benefits that were expected when agreeing to act on the GSCM strategy are not realized, it is very likely that after a while, the company will abandon the green initiatives and return to the former business practices (Igarashi et al. 2012; Luthra et al. 2011). Hence, in order to be successful, the implementation of GSCM will require extensive investments of resources and true engagement, as the pure “add-on” approach will most likely be insufficient (Igarashi et al. 2013).

Costs

The second identified barrier for successful implementation of green values in the SCM actions is the fear of increasing costs (Luthra et al. 2014; Walker et al. 2008; Giunipero et al. 2012; Min & Galle 2001; Luthra et al. 2011). Historically, the main performance measure has been costs (Luthra et al. 2011). Indeed, according to Min and Galle (2001), a research conducted within US companies revealed that concerns regarding costs were one of the most serious obstacles for including environmental factors in procurement processes. For SMEs, the inevitable implementation costs might truly become a barrier, since they generally have fewer resources available, and are thus forced to make trade-offs between different business aspects (Walker et al. 2008; Fu et al. 2012). In the short-term basis the implementation of green perspectives is indeed an expensive process, as companies engaging in such actions must invest for example in energy efficient machinery and recycled materials (Giunipero et al. 2012; Luthra et al. 2011). The green materials also tend to be more expensive, and might thus have an influence on the total cost of the product (Giunipero et al. 2012; Luthra et al. 2011). GSCM implementation also requires IT enablement, adoption of technology advancements, hiring skilled employees, and motivating and training the current

employees on GSCM practices (Luthra et al. 2011). When considering the costs of GSCM from this kind of a short-term perspective, it can be difficult for the companies to justify the implementation costs (Luthra et al. 2014). According to Giunipero et al. (2012) this uncertainty of the costs and the financial benefits were considered as a constraint both in the buyer and supplier side.

Indeed, many companies are convinced that the greener they become the less competitive they will be (Giunipero et al. 2012), since considerable investments are required but immediate financial benefits might not be seen (Nidumolu et al. 2009). However, it is vital to understand that in most cases the costs only become a barrier for GSCM implementation if the company is unable to broaden its conception of time. When stretching the time perspective, it is clear that GSCM will reduce the overall production costs, as for example the material and energy efficiency is improved in the company (Hervani et al. 2005; Carter & Dresner 2001; Giunipero et al. 2012; Walker et al. 2008). Therefore, the barrier for implementation caused by short-term costs is mainly caused by the lack of knowledge on the benefits that could be attainable in the long run (Carter & Dresner 2001; Walker et al. 2008).

Lack of knowledge

By deriving from the previous chapter, it is clear that one of the remarkable obstacles of GSCM implementation is the lack of knowledge on what the greening of the supply chain actually requires and what are the benefits stemming from the implementation (Luthra et al. 2014; Gilbert 2000; Walker et al. 2008; Carter & Dresner 2001). This issue considers both the buying companies and their suppliers (Giunipero et al. 2012). The lack of knowledge is at least partly a result of the complexity of environmental questions (Igarashi et al. 2013). According to Preuss (2002), the environmental issues are more complex than traditional procurement questions, since their time-scale is longer and the interaction between the included variables is more complex. Furthermore, Igarashi et al. (2013) state that including environmental aspects to the traditional SCM processes will not make the practices any easier, but will indeed increase the complexity, as there is yet one more aspect to consider. The measurement practices, such as the life cycle assessments (LCA), that are used for determining and following up the environmental effects of the supply chains, are also highly complex, which means that the proper utilization of such practices will require substantial amounts of environmental expertise

(Gilbert 2000). Hence, many companies might not have the knowledge to conduct practices such as LCAs immediately (Gilbert 2000).

However, the barrier related to the lack of knowledge can stem from as deep as the unawareness on the environmental aspects of the company's products (Gilbert 2000). Hence, it might be that both the buyer and the parties in its supply chain do not know what are the critical environmental issues related to their products or their components (Gilbert 2000). Furthermore, the imbalance in the level of knowledge can also set some barriers (Igarashi et al. 2013). If, for example, the buyer decides to become more environmentally oriented and starts to require the green business methods from its suppliers, the environmentally unaware suppliers might not understand their role in the greening process, and how the buyer is going to utilize the environmental data it collects from the suppliers (Igarashi et al. 2013). If the suppliers do not understand the reasons behind the new requirements, it is unlikely to get them truly engaged in them (Carter & Dresner 2001). Therefore, it is vital to evaluate if the suppliers are receiving enough and appropriate information in every stage of the GSCM implementation process (Igarashi et al. 2013). By doing so, it is possible to minimize the gaps between the expectations and perceptions of the buyer and the suppliers (Igarashi et al. 2013).

The barrier of the lack of knowledge can also be linked to the difficulties companies might have in understanding the regulations and incentives set both in the global and national level (Giunipero et al. 2012; Walker et al. 2008; Luthra et al. 2011). Often the barrier of implementation is not purely a result of poor environmental knowledge of the employees in the company, but the obscurity of the set regulations (Giunipero et al. 2012). According to Luthra et al. (2011), the government regulations can both encourage and discourage the implementation of green initiatives. If the regulatory requirements are too time consuming, complex and unclear, especially the smaller firms may be discouraged to use their scare resources for projects that remain indefinite for them (Luthra et al. 2011). Furthermore, if the regulative parties fail to establish well-defined sustainability standards and leave organizations guessing at the direction of future government policy on sustainability, the lack of understanding will eventually become an implementation barrier for the larger companies as well (Giunipero et al. 2012). Altogether, a common barrier of implementation caused by the lack of knowledge is stemming from the fact that governments are requiring the implementation of GSCM

at an accelerating level without offering a sufficient amount of institutional support for the actual implementation process (Luthra et al. 2011).

Overall, it is vital to understand that for many the environmental issues might be an area in which they have never fully familiarized themselves with. Therefore, when a company decides to transform their SCM actions into GSCM actions, it must ensure that there is enough training available for both to the employees of the company as well as to the suppliers on what are the gains that can be expected, what is the time scale in which these benefits are attainable, and what will be required from all the parties in order to make the set goals achievable (Luthra et al. 2011; Carter & Dresner 2001; Walker et al. 2008; Igarashi et al. 2013). If this is not done, the lack of knowledge will indeed become a barrier for the implementation as neither of the parties will not get engaged with the ideology, since the attainable advantages are not being recognized (Carter & Dresner 2001).

Lack of supplier cooperation

The fourth identified barrier for launching GSCM initiatives is the lack of cooperation from the supplier side. It is not possible to produce truly green products if the suppliers in the supply chain are not involved (Luthra et al. 2011; Krause et al. 2009; Luthra et al. 2011). Therefore, if the suppliers are reluctant to cooperate with the buyer in the green issues, it can become a severe barrier for the GSCM implementation (Walker et al. 2008; Luthra et al. 2011). Many suppliers might find the environmental information on their company confidential, and therefore are not willing to share it with the buyer company (Igarashi et al. 2013; Walker et al. 2008). However, the utilization of many GSCM tools may require detailed information, and an increased level of collaboration and openness (Igarashi et al. 2013). Thus, if a company fails to form collaborative relationships with its suppliers, the GSCM implementation might be compromised (Wolf & Seuring 2010; Igarashi et al. 2013; Walker et al. 2008). Additionally, the suppliers' reluctance to engage in green practices might be due to their traditional mindsets on buyer-supplier relationships where the parties expect the other to try to exploit the other as much as possible (Mudgal et al. 2010; Luthra et al. 2011). Also, the value bases of the buyer and supplier companies may differ, meaning that the supplier might not see the environmental issues as important as the focal company (Mudgal et al. 2010; Luthra et al. 2011).

The lack of supplier cooperation can be closely related to the power balance of the supply chain (Igarashi et al. 2013; Gilbert 2000). If the suppliers have leverage over the buying company, they will have the opportunity to determine the level of environmental information they are sharing with the buying company (Igarashi et al. 2013; Gilbert 2000). Therefore, highly advanced GSCM tools that require specific data throughout the upstream supply chain might not be suitable in situations where the purchasing organization does not have the power to persuade its suppliers to share their environmental data with them (Igarashi et al. 2013). Hence, the weak power position of the focal company can act as a barrier for the GSCM implementation, as it cannot reach the wanted level of environmental consciousness in the organization, since it does not have the power to get the suppliers to comply with its set environmental business practices (Gilbert 2000).

Fear of image risks

The fifth acknowledged obstacle for greening the supply chain is the fear of image risks. As it was discussed in the chapter of GSCM drivers, in many cases companies engaging in green initiatives get the opportunity to improve their brand image (Pil & Rothenberg 2003; Walker et al. 2008). However, by becoming highly visible on environmental issues, the amount of pressure and attention will simultaneously be multiplied (Bowen 2000; Walker et al. 2008). This means that companies publically highlighting their environmentally friendly business practices need to take actual and provable actions or the reputation of the company might be at risk (Bowen 2000). Some external stakeholders are also viewing environmental supply initiatives with skepticism, and might see the as “green washing” or PR exercises (Walker et al. 2008). Hence, the fear of increasing public attention and the need for truly make changes in the business operations might act as a barrier for some companies to engage in GSCM actions, as they might not be willing to take the risk of compromising their brand image.

Industry and context specific barriers

The sixth and final identified barrier for GSCM implementation is the industry and context specific obstacles companies may face when aiming for GSCM activities. It has been found, that the barriers cannot be fully generalized, since they can vary depending on the context and industry in which the company is operating in (Zhu & Sarkis 2006; Walker et al. 2008). For example, the market situation, number of potential environmentally aware suppliers and culture vary significantly depending on the

industry, country and business context (Walker et al. 2008). Therefore, the barriers for the implementation of GSCM can be very connected to the context (Walker et al. 2008). For example, if there is only a few environmentally capable suppliers, a company might struggle with the implementation of GSCM as strict sustainability requirements from suppliers could lead to extremely reduced supply base and thus to the disruption of the supply chain and the power position of the buying company in it (Beske & Seuring 2014; Krause et al. 2009). Hence, for example the proactiveness or reactiveness with regards to environmental supply initiatives is usually very industry and context specific (Walker et al. 2008).

Another example of both an industry and context related barrier is the unawareness of the customers (Green et al. 1996; Walker et al. 2008; Zhu & Sarkis 2006; Luthra et al. 2011). In some industries, the customers may be very unaware or conservative when it comes to the environmental questions (Green et al. 1996). This may be due to, for example, long industry specific traditions that are not in line with the environmental practices or the complex nature of a certain industry in which it is difficult to recognize the environmental aspects (Walker et al. 2008). Hence, the companies may face a true barrier of implementation, if their customer base does not see the benefits of the green initiatives, since GSCM will not be profitable if the customers are not “green-appreciative” (Green et al. 1996). According to Luthra et al. (2011), the Indian automotive industry is a model example of an industry where the companies have faced barriers valid in a specific context. Due to the unawareness of the Indian customers on the benefits of the green products, the organizations operating in that industry cannot invest and start producing environmentally friendly cars, since the demand for them has not been established (Luthra et al. 2011). The situation is almost the opposite in the U.S market, since there approximately 80% of the consumers claim that they would be willing to pay more for green products (Luthra et al. 2011).

Overall, one can state that when aiming to transform the SCM actions into GSCM practices successfully, it is not enough to assess the most common barriers, such as costs or lack of supplier commitment, of the implementation. Every industry and business context has its own particularities that should be considered as they can cause barriers that might not be an issue in most cases. Only by designing the implementation plan to fit the context, is it possible to respond to the right barriers with the right pressure.

2.3 The most common GSCM practices and tools

According to Lu et al. (2007), companies have two main goals when engaging in GSCM activities. Firstly, the companies aim for the situation where all the participants in their supply chains are meeting the specified environmental performance criteria. This is partly done by promoting the responsible corporate environmental behavior among all the parties in the supply chain. Secondly, the companies try to help their suppliers to understand their role in solving the environmental issues. The suppliers are further encouraged for such environmental behavior by supporting them in their own improvement initiatives. (Lu et al. 2007) Reaching these targets is not a simple task and therefore tools and practices that give guidance and operational structure for companies when setting up the GSCM processes, have been developed.

The GSCM practices and tools are very similar to the conventional SCM practices. Beske and Seuring (2014) have even stated that GSCM could be referred as “SCM-plus”. The main difference is the broadened point of view, where environmental aspects are considered to be a significant part of the processes, and the purely economic aspect to procurement is left behind (Beske & Seuring 2014; Svensson 2007). However, the concept of sustainability can be rather complex and including the environmental aspect to the procurement practices may increase the complexity of the processes (Igarashi et al. 2013). Nonetheless, if the conventional SCM practices are well implemented within a company, the actual step towards GSCM is not that dramatic due to the similarities of the tools. In this chapter, the most common GSCM practices and tools are discussed and it is being presented how the familiar and traditional SCM tools can be modified to respond to the needs of the contemporary business world where environmental issues have become a critical area of consideration (Giunipero et al. 2012; Gilbert 2000).

Green Supplier Selection

When making purchasing decisions, an essential part of the decision-making process is the evaluation of the potential suppliers before the selection (Iloranta & Pajunen-Muhonen 2012, 236; Igarashi et al. 2013). According to Iloranta and Pajunen-Muhonen (2012, 236) there are basically two main reasons for the evaluation of suppliers, which are: 1) selecting appropriate suppliers, and 2) developing the selected suppliers. By basing the final purchasing decision on the evaluations made on the suppliers, it is more likely that the access to the right materials and solutions is ensured with a competitive price (Igarashi et al. 2013; Iloranta & Pajunen-Muhonen 2012, 236). This practice is

widely known as *supplier selection* (Iloranta & Pajunen-Muhonen 2012, 236). However, the increased pressure coming from multiple different stakeholders and directions towards environmental effectiveness has led to the situation where traditional supplier selection might not be enough to ensure that the company meets the customer demands, since ensured access or high quality of products are not the only things customers are expecting from the products they buy. This has led to the increasing interest towards green supplier selection (GSS), where new, environment related, evaluation criteria are raised alongside the traditional supplier selection criteria, such as quality and operational performance, enabling the companies to ensure the access to the right *and environmentally effective* materials and solutions with a competitive price (Igarashi et al. 2013; Zimmer et al. 2016; Govindan et al. 2015; Lu et al. 2007; Handfield et al. 2002). However, the concept of GSS is still rather recent, since environmental aspects have been considered as potential supplier selection criteria only within the last decade (Govindan et al. 2015).

Many researchers have recognized the importance of supplier management and especially GSS when a company aims for more environmentally effective supply chains (Igarashi et al. 2013; Govindan et al. 2015; Lu et al. 2007; Handfield et al. 2002; Zimmer et al. 2016). The significance of GSS as a GSCM tool has increased throughout the past decade, since outsourcing the less competitive and non-core operations to supply chain partners has become a mainstream organizational strategy (Govindan et al. 2015), leading to the situation where it is not uncommon that the supply chains generate up to 80% of the added value of the final product (Zimmer et al. 2016). The increase in the importance of the supply chain basically means that in order to become truly sustainable, it is not enough that only the focal company itself is operating in an environmentally effective way (Igarashi et al. 2013; Zimmer et al. 2016). Thus, GSS can also be considered as a risk management tool (Jabbour & Jabbour 2009) as it is a way for the companies to screen and select those suppliers as their business partners who have the competence, capability and willingness to operate according to the set organizational regulations on environmental sustainability so that environmental breaches can be avoided (Govindan et al. 2015).

When discussing supplier selection, the process is often referred as a single activity, when actually it consists of several separate tasks (Igarashi et al. 2013; Zimmer et al. 2016). The steps and the multi-staged GSS process is illustrated in figure 4. The

supplier selection process starts with identifying the needs and specifications (Igarashi et al. 2013; Zimmer et al. 2016), and in the case of GSS they refer to the need to find the environmentally capable suppliers. The process is followed by the formulation of the selection criteria (Igarashi et al. 2013; Zimmer et al. 2016). The formulation of environmental selection criteria is an essential part of the GSS process and is thus discussed in more detail later on in this chapter. The third step of the process is evaluating and pre-qualifying the suppliers (Igarashi et al. 2013; Zimmer et al. 2016). Basically, in this step, a large scope of suppliers is screened, and the suppliers that turn out to be unfit or incapable are eliminated from the process already at this stage (Deng & Xu 2010; Igarashi et al. 2013). The fourth and final step of the actual supplier selection process consists of evaluating the remaining suppliers and making the final selection from a number of qualified suppliers (Igarashi et al. 2013; Zimmer et al. 2016). In GSS, the environmental capabilities of suppliers have a significant value in the final selection (Govindan et al. 2015).

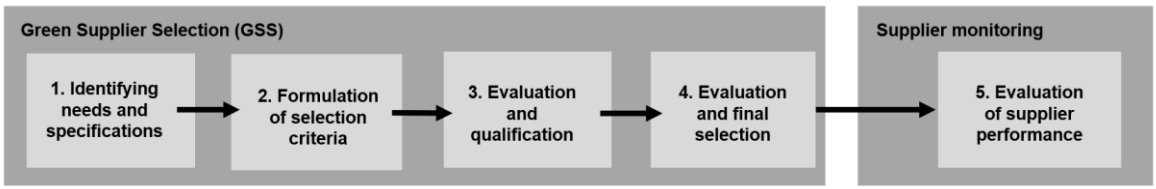

Figure 4. The GSS process (Adopted from Zimmer et al. 2016; Igarashi et al. 2013)

In the supplier selection process presented by Igarashi et al. (2013), also the evaluation of supplier performance is considered to be a solid part of the actual selection process. However, in this research the process of GSS is adapted from both the researches of Igarashi et al. (2013) and Zimmer et al. (2016). In the study conducted by Zimmer et al. (2016), the evaluation of supplier performance is separated from the initial supplier selection process, as it can also be considered as an individual process of supplier monitoring. Hence, the fifth and final step of the integrated GSS process is simultaneously the first step of the supplier monitoring process (Zimmer et al. 2016). Supplier monitoring refers to the continuous analyzing and evaluation of the supplier and its performance on environmental issues as well as other selection criteria such as effectiveness and quality (Hervani et al. 2005). Furthermore, a vital aspect is to monitor whether the supplier is compliant with the environmental requirements that were defined during the initial selection process (Hervani et al. 2005; Zimmer et al. 2016). Hence, according to Zimmer et al. (2016), based on the performance of the supplier, the

monitoring process may act as a trigger for further supplier development (in case of good performance), further monitoring efforts (medium performance), or for the replacement of the supplier (in case of poor performance).

The increasing popularity of heavy outsourcing activities has made it rather common for companies to have established supplier selection processes (Jabbour & Jabbour 2009; Zimmer et al. 2016). However, as these processes are usually designed to help the company tackle the traditional risks of outsourcing such as deteriorating of quality and decelerating supplier and performance improvement (Jabbour & Jabbour 2009), the most used supplier selection criteria are often not highlighting the environmental aspects (Jabbour & Jabbour 2009). Nevertheless, there are still studies conducted on the most used GSS criteria as well (Govindan et al. 2015; Nielsen et al. 2014; Zimmer et al. 2016). Most of the studies are in line with each other when stating that the most common criterion for GSS is the existence of environmental management system (Govindan et al. 2015; Zimmer et al. 2016; Nielsen et al. 2014; Jabbour & Jabbour 2009). The environmental management system is an entity, which consists of sub-criteria, such as environmental policies, ISO14001 certification and environmental planning (Govindan et al. 2015). Of these sub-criteria, especially the ISO14001 certificate is highlighted as the most used GSS criterion (Torielli et al. 2011; Giunipero et al. 2012, Handfield et al. 2002). A more detailed description of this certificate can be found from appendix 1. Furthermore, requiring the suppliers to comply with organizational sustainability mandates, such as codes of conduct, is also rather commonly used selection criterion (Keating et al. 2008).

Jabbour and Jabbour (2009) argue that the popularity of the environmental management system as the main GSS criterion is resulting from the fact that it is the easiest one to integrate to the existing supplier selection criteria. If criteria that are more complex are applied, it often leads to significant changes in the procurement processes, making organizations reluctant to engage themselves in the more enhanced decision-making models (Handfield et al. 2002). Furthermore, the popularity of using standards and certifications as the main selection criterion also stems from the fact that they are a relatively easy way to turn the supply chain into a more environmentally friendly direction (Seuring & Müller 2008; Beske & Seuring 2014; Torielli et al. 2011). However, environmental management systems are not the only criteria applied, since criteria related to, for example, capabilities on waste management, green logistics, use of

environmentally friendly materials and technology, and use of renewable energy have been identified by the researchers (Igrarashi et al. 2013; Govindan et al. 2015; Min & Kim 2012). Ideally, the GSS criteria should be versatile, combining both qualitative and quantitative (Jabbour & Jabbour 2009), and both product related and organization related criteria (Igarashi et al. 2013). Furthermore, the criteria should be deeply rooted in the company's environmental strategy (Igarashi et al. 2013). Humphreys et al. (2003) conducted a comprehensive framework for GSS criteria (Figure 5) that takes into account both qualitative and quantitative criteria (Humphreys et al. 2003), as well as the product aspects such as recyclability, and organizational criteria such as certifications and environmental policies, that were highlighted by Igarashi et al. (2013).

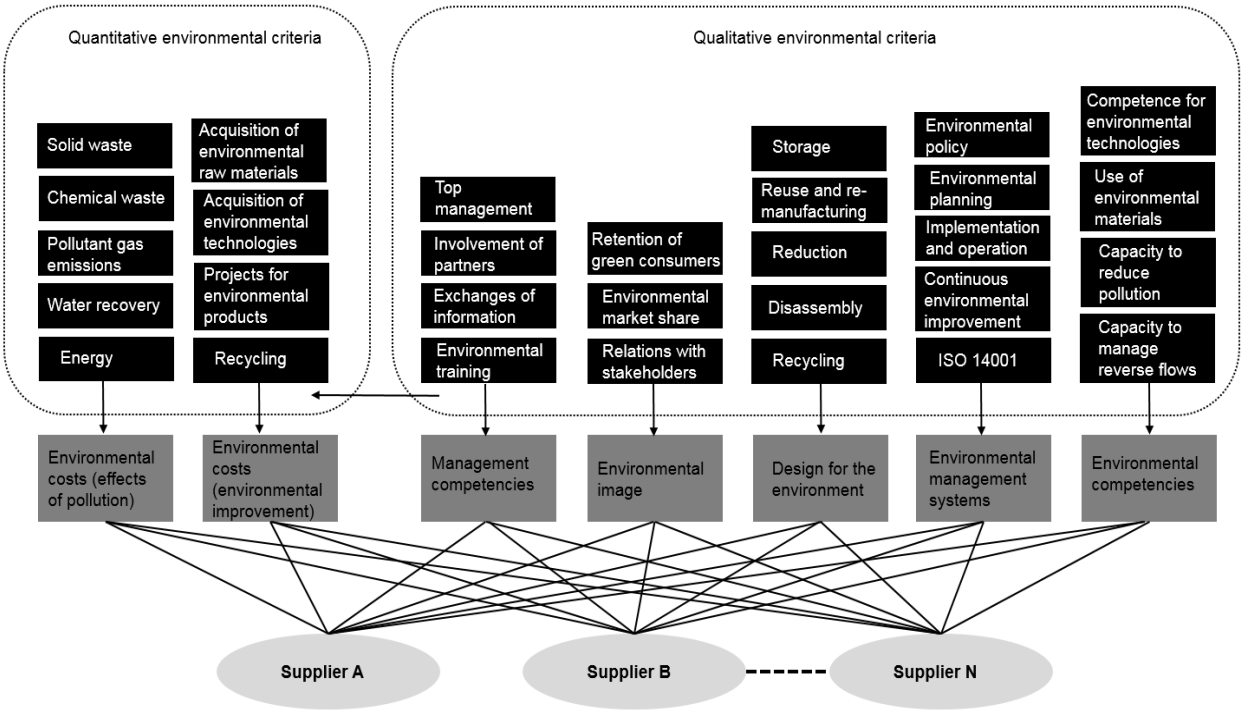

Figure 5. A framework for GSS criteria (adopted from Humphreys et al. 2003)

The model constructed by Humphreys et al. (2003) is extensive, and if properly implemented, it offers a genuine opportunity for companies to integrate sustainability into its supply chain. Hence, it is a good model to use for benchmarking when the ambition level for GSS is set high. However, as in many cases the companies do not have the possibility to implement such broad a range of criteria, Govindan et al. (2015) propose that when designing the GSS criteria it should be done so that they first offer a baseline for the supply chain sustainability by requiring the suppliers to meet the regulatory requirements. After the rudimentary level is reached, more advanced criteria

such as ability for collaborative green product design or capability to perform product Life Cycle Assessments, can be set (Govindan et al. 2015; Jabbour & Jabbour 2009).

It is vital to remember that due to the rather recent nature of the concept of GSS, the integration process of the environmental selection criteria is still incomplete in many companies (Govindan et al. 2015; Jabbour & Jabbour 2009). The fact is that the implementation of GSS is demanding (Jabbour & Jabbour 2009; Igarashi et al. 2013; Zimmer et al. 2016), since in order for that to happen, organizations need to complicate their supplier selection models (Govindan et al. 2015; Zimmer et al. 2016), because not only do the buyers need to purchase products and services at the lowest cost, best quality and highest flexibility but also from suppliers who are simultaneously environmentally responsible (Zimmer et al. 2016). According to Govindan et al. (2015), companies engaging in GSS must also make numerous and evident tradeoffs between environment and economics, making the selection process even more complex. Therefore, it is essential for companies to evaluate and strictly determine how high or low the environmental selection criteria are appreciated compared to the traditional performance and quality-based selection criteria (Igarashi et al. 2013). Finding the balance between different criteria and the way to measure them is one of the critical aspects on whether the implementation of GSS will be successful, and can thus act as pitfalls for the whole implementation (Igarashi et al. 2013; Jabbour & Jabbour 2009).

Altogether, the academic literature has shown that GSS is a multidimensional and complex concept that cannot be implemented without significant contributions by the organization and its purchasers (Igarashi et al. 2013). However, the actual process does not differ significantly from the traditional supplier selection process, as the main differentiator is the used selection criteria, making the implementation slightly easier (Igarashi et al. 2013). However, as stated, the implementation will require efforts from the company, but they are worth it, since a company's GSCM targets are likely to fail without the integration of environmental issues to its supplier selection practices (Govindan et al. 2015; Igarashi et al. 2013). This is because in the contemporary business environment a company cannot call itself green if it cannot guarantee that its suppliers are considering environment in their operations as well (Igarashi et al. 2013; Zimmer et al. 2016; Krause et al. 2009; Lintukangas et al. 2016).

Environment driven supplier segmentation

One of the most iconic SCM tools is the Kraljic's matrix that was introduced by Peter Kraljic in the *Harvard Business Review* in 1983 (Caniëls & Gelderman 2004). The matrix is designed to help procurement professionals in categorizing the suppliers and products based on the financial impact and the procurement risk (Kraljic 1983). Based on this categorization different supply strategies can be applied with the suppliers, and companies can, for example, find the most strategic suppliers with whom the close collaboration is ideal, as well as the generic suppliers with whom the more traditional tendering-based relationship is suitable (Kraljic 1983; Caniëls & Gelderman 2004).

One of the most remarkable criticisms towards this segmentation tool is the fact that as it reduces the procurement issues only to consider two dimensions it fails to capture other relevant aspects of the contemporary business world (Dubois & Pedersen 2002; Mello et al. 2017). According to Pagell et al. (2010), many aspects have changed in the supply chains since 1983. For example, sustainability is nowadays an essential part of SCM practices, but the Kraljic's matrix does not include this aspect at all (Mello et al. 2017). However, according to Keating et al. (2008), the matrix as a tool is still valid at least in a modified form as the one-size-fits-all approach should be avoided also in case of GSCM, since there is no point using tremendous amounts of resources for greening the business practices of smaller and totally incompetent suppliers. Therefore, it is justifiable to state that the modified versions of the segmentation tool that include the environmental aspects to the model and help companies detect, which kind of greening strategy is appropriate with each supplier, are one of the most vital GSCM tools.

Upgraded versions of the traditional segmentation model, that include the sustainability aspects to the segmentation process, have been emerging during the past years. For example, Pagell et al. (2010) and Krause et al. (2009) offer alternatives for the traditional Kraljic's matrix. The revision proposed by Pagell et al. (2010) increases the amount of categories from the original four (non-critical, bottleneck, leverage and strategic) to six (non-critical, bottleneck, strategic commodity, transitional commodity, true commodity and strategic), as the axis emphasizing the impact on result has been replaced with an axis that indicates the threat to Triple Bottom Line. Since the emphasis of this research is only on the environmental and economic aspect of the TBL, it can be stated that for this study the model proposed by Krause et al. (2009) is more valid than the one suggested by Pagell et al. (2010). The modified segmentation tool proposed by Krause

et al. (2009) consists only of the four traditional supplier categories that were already the key in the traditional matrix. Thus, the main difference and development of the model is the fact that the traditional priorities such as quality, costs, reliability, timeliness, flexibility and innovation are accompanied with the new priority of sustainability (Krause et al. 2009; Mello et al. 2017). In order to include environmental aspects in all types of supplier relationships, it is critical to incorporate sustainability in all four quadrants of the segmentation matrix (Krause et al. 2009; Mello et al. 2017), as further elaborated in figure 6.

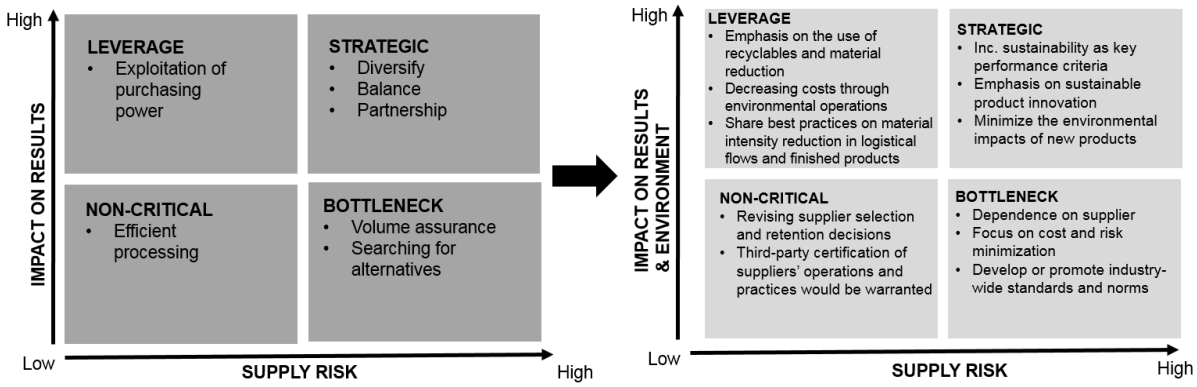

Figure 6. Transformation of sustainable segmentation model (adapted from Kralijic 1983; Caniëls & Gelderman 2004; Mello et al. 2017; Krause et al. 2009)

With strategic suppliers, the most vital thing is to ensure collaborative supplier relationship and that they include sustainability in their product and process innovations (Krause et al. 2009; Mello et al. 2017), as with them the existing collaboration may enable remarkable environmental innovations that can result as increased environmental effectiveness of both parties involved. Furthermore, sharing knowledge and best practices on environmental effectiveness is a key part of strategic supplier relationships (Krause et al. 2009; Mello et al. 2017). With suppliers offering the leverage items, emphasis of the relationship should rather be on reducing the usage of raw materials or increasing the utilization of recyclable materials (Krause et al. 2009; Mello et al. 2017), since such actions are effective in both reducing the production costs and decreasing the environmental impact of the production process (Hervani et al. 2005; Carter & Dresnen 2001; Giunipero et al. 2012; Walker et al. 2008). Both of these effects are required when trying to tackle the high impact on both environment and economic results (see figure 6). Furthermore, with bottleneck suppliers, it is more difficult to require the inclusion of the environmental issues as the buyer is dependent on the supplier and does not have the bargaining power over the supplier (Krause et al. 2009;

Mello et al. 2017). Therefore, with these kinds of suppliers, the purchasing organization should try to encourage them to comply with industry-wide standards and certifications (Krause et al. 2009; Mello et al. 2017). Finally, with suppliers offering non-critical items, which have both a low supply risk and a low impact on result and environment, including rather simple practices is enough to ensure sustainability within the supplier relationship (Krause et al. 2009; Mello et al. 2017). Basically, revising the supplier selection criteria to include sustainable aspects can be enough (Mello et al. 2017; Krause et al. 2009).

Altogether, the core idea behind sustainable supplier segmentation is the fact that, just as with conventional SCM or supplier management, due to the limited nature of resources, there is no point in trying to pursue same kind of relationship with all suppliers (Olsen & Ellram 1997; Caniëls & Gelderman 2004; Keating et al. 2008; Mello et al. 2017). Thus, the "one-size-fits-all" approach in supplier relationships is not valid as suppliers differ from each other remarkably in terms of capabilities and nature (Keating et al. 2008). Basically, this means that companies should try to benefit from the varying kinds of relationships in different ways and for example minimize the use of resources with the insignificant suppliers in order to release assets for the collaboration with more environmentally capable suppliers (Dyer et al. 1998; Keating et al. 2008). Furthermore, the sustainable segmentation tool should also be used for evaluating the other GSCM tools and their applicability with each supplier.

Environmental supplier development

In the existing GSCM literature, it is common to suggest that one of the best ways of greening the supply chain is requiring the suppliers to attain environmental certifications or to include green practices to their business processes through mandates (Fu et al. 2012; Torielli et al. 2011; Zimmer et al. 2016; Govindan et al. 2015). Alternatively, the greening process has been suggested to be managed through selecting only environmentally capable suppliers as business partners (Fu et al. 2012; Igarashi et al. 2013; Zimmer et al. 2016; Govindan et al. 2015). However, it is vital to notice that not all of the potential suppliers are capable of improving their environmental performance on their own, as embracing GSCM may represent a remarkable change in the supplier's business philosophy (Fu et al. 2012; Keating et al. 2008). Therefore, companies should expand their existing supplier development programs, used for cost, delivery and quality improvements, to consider also the development of their suppliers' green performance (Fu et al. 2012).

There is a wide selection of different green activities and functions companies may require from their suppliers (Fu et al. 2012). They can vary from simple goals on environmental compliance to goals on reducing materials used in the manufacturing process to even joint development of processes and materials (Fu et al. 2012). As discussed in the chapter of GSCM barriers, especially SMEs can face severe issues in involving themselves in such processes due to a lack of resources (Walker et al. 2008; Fu et al. 2012). Thus, in environmental supplier development processes it is essential that the larger and more resource rich supply chain partners offer support and become involved in the greening process of the smaller supply chain members (Fu et al. 2012). Furthermore, Zhu et al. (2008) suggest that building the environmental capabilities of these smaller suppliers requires integration of resources for example in the form of knowledge and technology. Thus, the key aspects in the process of developing suppliers' environmental capabilities are mutual commitment and a collaborative mind-set (Fu et al. 2012; Zhu et al. 2008).

The actual environmentally oriented supplier development practices can be divided into three main categories. These categories and the supplier development as a concept is illustrated in figure 7. The first category is the ***green knowledge transfer and communication*** (Fu et al. 2012). At its most basic, this refers to training the suppliers on environmental issues (Fu et al. 2012; Torielli et al. 2011; Gilbert 2000). This can be executed for example through conducting trainings and education programs for the personnel of the supplier, or by simply sharing knowledge and best practices with the supplier on environmental issues (Fu et al. 2012). What makes supplier development crucial for the implementation of GSCM is the fact that companies cannot form or develop truly sustainable supply chains without having accurate knowledge on the capabilities of their suppliers (Kim et al. 2016). Thus, audits and performance assessments that can be considered to be a part of the first category of supplier development activities (Wagner & Krause 2009; Fu et al. 2012) are extremely essential in the greening process of supply chains. However, the development will not happen only by assessing the existing environmental performance of the suppliers (Wagner & Krause 2009). Therefore, formalized processes for giving feedback and setting improvement targets are also needed (Fu et al. 2012; Wagner & Krause 2009).

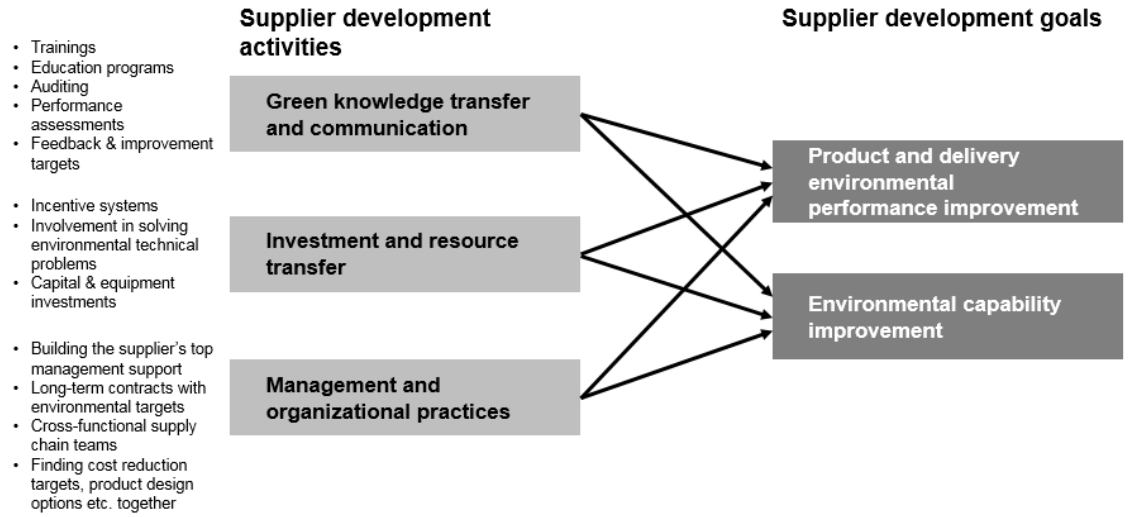

Figure 7. Concept of environmental supplier development (adapted from Wagner & Krause 2009; Fu et al. 2012; Dou et al. 2015)

The second category for green supplier development practices is ***investment and resource transfer*** (Fu et al. 2012)***.*** The development activities in this category may for instance refer to incentive systems, where the buyer gives promises of future business or increased volumes in case the supplier succeeds to improve its environmental performance (Dou et al. 2015; Fu et al. 2012). Furthermore, the buying firm could also promise to get involved in solving the supplier's environmental technical problems (Fu et al. 2012) or even make direct capital and equipment investments to its suppliers (Dou et al. 2015). As one can see, these supplier development activities require a higher level of involvement from both the buyer and the supplier. It is widely recognized that the more effort the establishment of a new process requires, the more reluctant the companies are to engage in them (Jabbour & Jabbour 2009). However, if a company succeeds in overcoming this kind of reluctance and successfully implements the more involving development activities, it is more likely that these development initiatives will lead to better results and higher level of environmental supplier development.

The supplier development activities in the third, and final, category are related to ***management and organizational practices.*** In practice, these development activities refer to formalized development programs initiated by the buying company that aim to influence the suppliers' managerial organization level. (Fu et al. 2012) Basically, the buying company can, for example, help to build the top management support for environmental performance improvement in the supplier's organization (Dou et al. 2015; Fu et al. 2012). Fu et al. (2012) suggest that this could be initiated through binding long-

term contracts with the organizational management of the suppliers where the management agrees to plan and execute environmental improvement throughout the contract period. Even constructing cross-functional supply chain teams that aim to identify cost reduction targets, environmentally friendly product design options and other environmental performance improvement areas, are an option for the development actions (Dou et al. 2015; Fu et al. 2012).

Overall, it can be stated that there are several different environmental supplier development activities that can be utilized when aiming to improve the supplier's environmental performance. However, the level of involvement and inputs required from the involved parties vary from each other quite significantly in each of the development practice categories. Nevertheless, regardless of the differences, all of the development initiatives aim for the same goals that are 1) product and delivery environmental performance improvement, and 2) environmental capability improvement (Wagner & Krause 2009; Dou et al. 2015; Fu et al. 2012). In an ideal situation, a company aiming for GSCM operations could utilize more than just one of the supplier development activities when reaching for the supplier improvement targets. Furthermore, ideally a company could be able to detect which activity can be used with which supplier. However, as often this is not possible, Fu et al. (2012) propose that a successful implementation of environmental supplier development activities should always start with evaluating and prioritizing the development initiatives and forming the supplier development program based on that evaluation.

Environmental collaboration with suppliers

Finally, the fourth GSCM practice presented in this thesis is the environmental collaboration with suppliers. As stated by Svensson (2007), one of the main goals of traditional SCM is to identify the suppliers with whom it would be possible to strive for close collaboration, since collaboration is one of the best ways of gaining competitive advantage (Moeller et al. 2006), improving the quality of the products (Dyer et al. 1998; Bemelmans et al. 2012), and getting an access to the supplier innovations (Schiele et al. 2012; Nidumolu et al. 2009). In case of GSCM, these goals are at least as valid, since greening the supply chain requires remarkable innovations, and both product and process improvements within the supply chain that can be mainly achieved through collaborative supplier relationships (Vachon & Klassen 2008; Laari et al. 2016; Gilbert 2000). Indeed, both Mello et al. (2017) and Gilbert (2000) state that many of the more

significant benefits related to GSCM are only attainable with suppliers with whom the company has succeeded in establishing a deep supplier collaboration. Thus, it is justifiable to state that supplier collaboration certainly is one of the most vital GSCM practices.

In environmental supplier collaboration, independent companies choose to commit in a strategic partnership, where the goal is to reduce the environmental impacts of the business operations, while simultaneously producing products with high quality and with a competitive price (Vachon & Klassen 2008; Laari et al. 2016; Kumar 2012). Thus, aspects such as mutual environmental goal setting, joint environmental planning, and cooperation are considered to be a vital part of the partnership (Vachon & Klassen 2008; Kumar 2012). In order to reach the environmental goals set for the collaboration, the parties are required to exchange technical and organization related information with each other meaning that the establishment of mutual trust between the business partners is an essential part of the collaboration (Vachon & Klassen 2008; Torielli et al. 2011). In both the traditional supplier collaboration as well as in the environment-driven collaboration, the interdependence between the business partners increases substantially, which can lead to reluctance in engaging in such collaborative relationships (Monczka et al. 1998; Laari et al. 2016).Therefore, in order to ensure the commitment of the parties involved, it is essential to ensure that there truly is a mutual win-win situation (Vachon & Klassen 2008; Whipple & Frankel 2000).

As said before, the importance of collaboration should not be underestimated when it comes to reaching the GSCM targets (Mello et al. 2017; Gilbert 2000). For example, Gilbert (2000) states that widely conducted product Life Cycle Assessments have indicated that as much as 70% of the environmental impact and resource demand of a product are determined at the design phase. Thus, in order to get the wanted features, such as recyclability and energy efficiency, integrated to the product it would be essential that the buying company could act as an influencer already at the product design phase (Gilbert 2000). However, without a collaborative supplier relationship, this is unlikely, since without mutual goals and an established win-win situation, the supplier will not have incentives to let the buying company influence its product design and production processes (Gilbert 2000).

According to Torielli et al. (2011), constructing collaborative partnerships with suppliers is perhaps the most demanding part of the GSCM process. Indeed, the success rate of strategic partnerships is very low, since as much as 70% to 80% of them fail to achieve the originally set targets (Whipple & Frankel 2000; Kumar 2012). However, Torielli et al. (2011) argue that regardless of the high possibility of failure, environmental collaboration should be pursued, since eventually, it offers the greatest potential for companies to become environmentally sustainable. Whipple and Frankel (2000) examined the success factors of collaborative partnerships from both the buyer and the supplier point of view. They found out that there are five aspects that have the most influence on whether the collaboration succeeds or not. The buyers and suppliers found the same aspects as the "top five" success factors, but the prioritization differed depending on the point of view (Whipple & Frankel 2000). Thus, the high probability of failure may be at least partly tackled by ensuring the existence of these success factors. The success factors are illustrated in table 2.

Basically, the most important thing is to establish trust and senior management support of the collaboration parties, as they were considered as the top two aspects both suppliers and buyers found to have most effect on the success of the collaboration (Whipple & Frankel 2000; Kumar 2012). Furthermore, the ability to meet and measure the set targets for performance was also considered as a vital factor, and buyers and suppliers also agreed on the priority level of this aspect (Whipple & Frankel 2000; Kumar 2012). Finally, as collaboration should not be pursued with all, ensuring the compatibility of the partners was seen as a success factor by both suppliers and buyers (Whipple & Frankel 2000). However, buyers prioritized the existence of clear goals over the partner compatibility (Whipple & Frankel 2000), as clear goals may often also act as a motivator for the collaboration, since they enable easier tracking of whether the initially set targets are reached or not.

Table 2: Success factors of supplier collaboration (Adapted from Whipple & Frankel 2000)

Buyer point of view	Supplier point of view
Trust	Senior management support
Senior management support	Trust
Ability to meet the set performance targets	Ability to meet the set performance targets
Clear goals for the collaboration	Partner compatibility
Partner compatibility	Clear goals for the collaboration

Overall, deriving from the presented literature, one can state that when a company decides to transform its SCM practices into GSCM actions, it is clear that establishing collaborative partnerships with suppliers is required. However, the companies must prepare themselves for the fact that forming successful collaborative supplier relationships is demanding and in many cases they fail to reach the goals that were originally set for them. Nevertheless, by taking into account the collaboration success factors presented by Whipple and Frankel (2000) (table 2), it is more likely that the environmental aspects are successfully integrated to the supply chain activities, and they thus become a solid part of the GSCM activities of the organization.

2.4 SUMMARY: The framework of GSCM

In the past chapters, the concept of GSCM has been discussed from various perspectives. In order to bind these aspects together and summarize the theory chapter, a framework for GSCM is constructed. When looking at the framework, it is vital to comprehend that, basically, the focal companies and their suppliers face the same drivers and barriers related to GSCM. Thus, it is unnecessary to categorize them in that sense but rather see them as the overall boundaries within which the companies and their suppliers are aiming for successful implementation of the GSCM practices. The framework for this is illustrated in figure 8 and further discussed in this chapter.

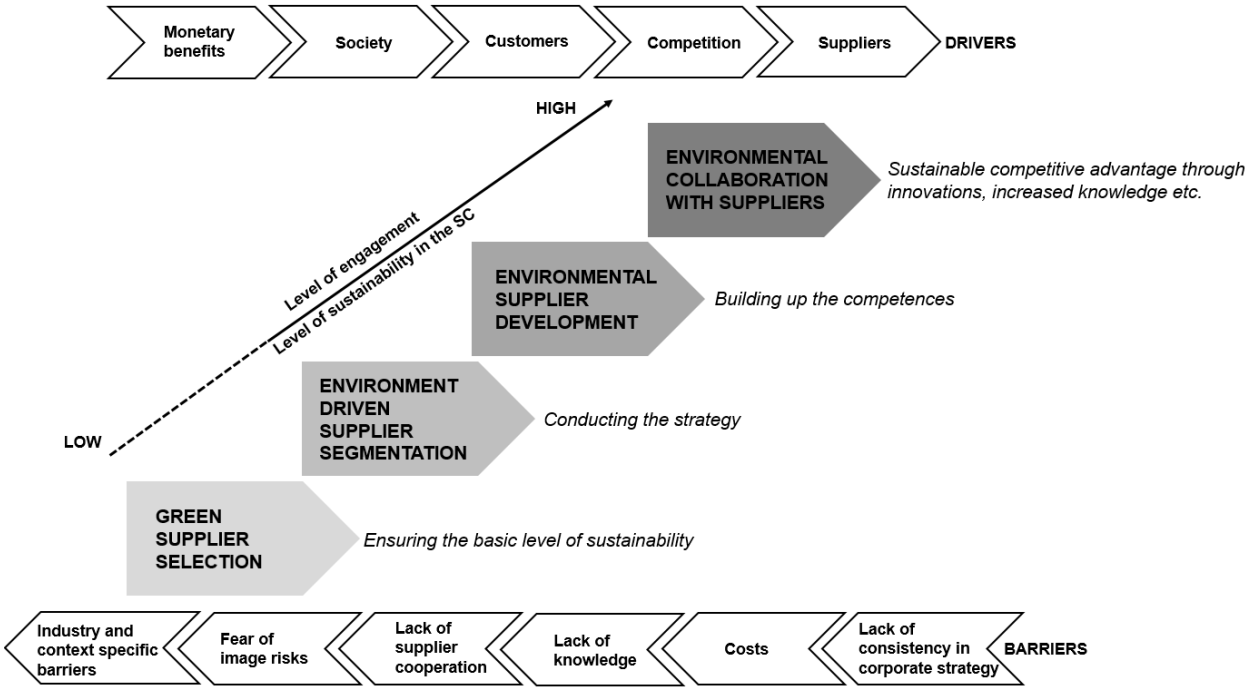

Figure 8. The framework of GSCM

It is clear, that in a contemporary business environment, organizations have multiple reasons for implementing green into their traditional SCM practices. As discussed earlier, the drivers for implementation may vary from simply the possibility to attain economic benefits, to the need to answer to the demands of different stakeholders, to even the search of sustainable competitive advantage. Furthermore, one can argue that by acting on these drivers, organizations initially aim for ***increasing the supply chain benefits*** while simultaneously ***reducing the supply chain costs*** and ***mitigating the supply chain risks***. Thus, when the implementation of GSCM is done successfully, the company may gain the opportunity to operate in a way that increases both the financial and the environmental value of the organization.

The greening process, however, is not unproblematic as there are several possible barriers the companies may face throughout the implementation process. However, it is vital to comprehend that the majority of the barriers are actually a result of poor knowledge or wrong time-scale through which the GSCM as a whole is being evaluated. For example, the needed implementation costs, which may act as a trigger for the resistance will, in most cases, get compensated in a long run, as the processes and the material usage become more effective, leading to cost savings. Yet, for smaller firms with fewer resources the rather high implementation cost may act as a real barrier.

Basically, the greening process of the supply chain happens through the utilization of GSCM tools. As presented, the most commonly used tools vary from rather simple supplier selection tools that may be implemented with low level of effort, to even deep, resource intensive collaborative relationships with suppliers where innovations and best practices are developed together. The selection and implementation process of the tools requires constant balancing between the different drivers and barriers as well as the internal ambition level of the organization for GSCM: for lower level of ambition, simpler tools may be enough. However, based on the researched literature, one can state that a high level of sustainability cannot be attained only through implementing the most basic GSCM tools (such as GSS), since true environmental effectiveness will require high level of engagement from both the buying company and its suppliers, which can only be done through the implementation of the more advanced tools and through increasing the level of engagement between the different parties.

When starting from the situation where there is no existing GSCM practices in place, it can be said that the base for GSCM is then conducted through green supplier selection, as it can be used for ensuring the basic level of sustainability in the supply chain through requiring the business partners to comply at least with the basic sustainability requirements of the company. The next step in the process is to conduct a more detailed GSCM strategy, which can be done by utilizing the environment driven supplier segmentation tool. For example, for non-critical suppliers the compliance with the GSS criteria can be enough but with suppliers located in other categories, development activities or collaboration targets may be needed. Thus, the natural next step in the GSCM implementation is establishing the practices for environmental supplier development that can be used for aiding the poorly performing suppliers to become more sustainable. It can also be used as a tool for enhancing the environmental performance of potential or even well performing suppliers through pushing them even further. Finally, the most effective and also most demanding part of GSCM is to construct environmental collaboration with suppliers. Collaborative relationships should be pursued at least with suppliers that were identified as strategic in the segmentation process or with the ones that are highly capable and might thus offer an opportunity for increased level of knowledge or even competitive advantage for the organization. Furthermore, suppliers that succeed in the development process could also become potential collaboration partners.

In an ideal situation, all of the aspect of the GSCM framework are utilized simultaneously: the suppliers are screened through GSS, appropriate strategies are set with different suppliers, the potential suppliers are constantly developed, and opportunities for collaboration are continuously searched and found. Additionally, the drivers are identified within the organization and used for tackling the potential barriers, which in turn enables the implementation and existence of GSCM. However, this kind of a level of implementation requires remarkable investments of resources and time, and thus in many cases the implementation should start with the steps that require lower level of engagement. After ensuring that the basic environmental aspects are being considered in the supply chain, could a company move towards the more advanced stages of GSCM.

3 CASE STUDY: TOWARDS GREEN SUPPLY CHAIN MANAGEMENT IN A CONSTRUCTION COMPANY

After a thorough examination of the theoretical aspects on GSCM, the research proceeds to the empirical sections of the study. The chapter begins with description of the sustainability aspects in the Finnish construction industry. This is followed with a description of the case company and its existent SCM practices and their green features. Then, the execution of the two-staged empirical study is elaborated. Especially the data collection and analysis methods are being discussed. The last two sections of this chapter cover both of the empirical researches conducted for this thesis.

3.1 Sustainability in Finnish construction industry

During the past decades sustainability issues have become an essential area of consideration in the construction industry (Adetunji et al. 2008; Kim et al. 2016), as the high environmental impact and the amount of emissions caused by buildings and the building process itself have been widely realized (Kim et al. 2016; Giesekam et al. 2016). According to Ruuska and Häkkinen (2014) improved construction practices could influence 42% of energy consumption, around 35% of greenhouse gas emissions and more than 50% of all extracted materials in the area of European Union. Finland has agreed with multiple international environmental agreements from which the Paris Agreement, with the target of emission reductions of 40% by the end of the year 2030, is the most remarkable one (The Finnish Ministry of Environment 2017a). As construction industry accounts for approximately 33% of Finland's emissions (The Finnish Ministry of Environment 2017a), it is clear that a huge responsibility of reaching the target is directed to the Finnish construction companies. Furthermore, as a member of European Union, Finland has to obey the new energy efficiency directive, which requires that by 2020 the energy level of all new buildings should be at the near-zero level (European Comission 2017). Additionally, the Finnish Ministry of Environment ordered an investigation in 2016 with an aim to find out, how carbon emissions could be managed through legislation in construction industry by the mid-2020s (Ympäristöhallinto 2016; Bionova 2017). The report was completed in the summer of 2017, and the main result of it is a road map, which describes the actions that need to be taken that by 2025 the emission levels of all construction projects can be controlled so that they will fall below the set targets (Finnish Council of State 2017). Thus, it is

justifiable to state that sustainability and environmental effectiveness already are, and especially will be, a critical area of consideration in Finnish construction industry throughout the upcoming decades.

Energy and especially energy efficiency has been the leading green trend in the construction industry in Finland throughout the past years, as it has been identified as the main source of greenhouse gas emissions of construction projects. Indeed, significant improvements have been made in the energy efficiency of the buildings and the emissions caused by energy usage have dropped drastically. (The Finnish Ministry of Environment 2017b; Ruuska & Häkkinen 2014) However, when analyzing the emissions caused by construction projects throughout their whole life cycles, it becomes clear that the construction materials are the second largest and also a significant source of emissions (Ruuska & Häkkinen 2014; Bionova 2017). Furthermore, as the buildings are becoming more and more energy efficient and the heating solutions are developing to be less emission intensive, the significance of the building materials in decreasing the emissions of construction projects will become even more important (Ruuska & Häkkinen 2014; Bionova 2017). In low-energy buildings the effect of materials in the total emissions can rise as high as 50% (Sartori & Hestnes 2007), and ultimately, if buildings reach the zero-energy level, all the energy consumption and greenhouse gas emissions stem from the construction materials (Hernandez & Kenny 2011). The division of the emissions during the whole lifecycle of a typical Finnish residential construction project is further illustrated in figure 9.

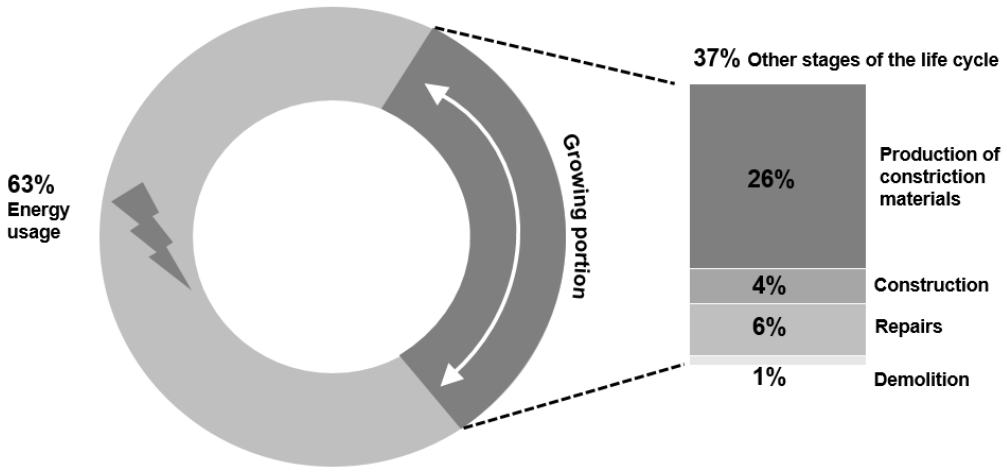

Figure 9. The division of emissions in a typical Finnish residential construction project (Adapetd from Ruuska & Häkkinen 2014; Bionova 2017)

As the importance of building materials in influencing the environmental impact of construction projects is increasing (Ruuska & Häkkinen 2014; Sartori & Hestnes 2007; Hernandez & Kenny 2011), it is logical to state that so is the role of the procurement operations of the construction companies, as in the end the sourcing decisions will determine whether the company is utilizing suppliers who are able to offer the low emission products and services. This can also be identified from the latest guidelines conducted by the Finnish Ministry of Environment that aim for advising construction companies on how to source low emission materials (Finnish Council of State 2017; The Finnish Ministry of Environment 2017b; Bionova 2017).

Furthermore, as the consensus in the Finnish construction sector is moving from energy efficiency towards the low-emission materials, several different sustainability practices related to that are becoming an active subject of consideration within the context of Finnish construction industry. Ultimately, all of these practices are bind together, since they aim for the same goal: reduction of carbon emissions and environmental effects of construction industry. Based on the different reports published during the recent years, the Finnish construction industry “hot topics” can be stated to be Life Cycle Assessments (LCAs), carbon footprinting, and material decisions.

In the heart of construction projects with lower emission levels, there are the Life Cycle Assessments (Kuittinen & le Roux 2017). This is because, by extracting the different emissions sources from each other, it is not possible to find solutions that would lead to truly low-emission buildings (The Finnish Environment Institute 2012). In the report conducted the Finnish Environment Institute (2012), it is also highlighted that it is not enough to try to influence the emission levels when they occur. Rather, it is vital to invest in better design tools, as the majority of the future emission levels are already determined at the design phase, and it is much more expensive and difficult to influence them after the decisions on the designs are made (The Finnish Environment Institute 2012). Currently, the emissions emerging during the whole life cycle of a building are not regulated in Finland (The Finnish Ministry of Environment 2017a; Bionova 2017). Thus, conducting LCAs on the emissions of the construction projects is voluntary, and they are often only done, when the aim is to gain environmental certificates, such as LEED, for the building (Bionova 2017; The Finnish Environment Institute 2012). However, the report ordered by the Finnish Ministry of Environment revealed that there is a substantial lack of capabilities in the Finnish construction companies when it comes

to conducting the LCAs (Bionova 2017). According to the report, there are only around 100 people who are trained to conduct emission calculations on buildings, and basically, the amount of people who actively work with the calculations is only some dozens. Thus, currently the contractors are mostly forced to utilize external parties to conduct their LCAs when they are needed (Bionova 2017).

According to Keating et al. (2008), issues that cannot be measured, can neither be managed. Thus, the second “hot topic” of Finnish construction industry can be stated to be carbon footprinting, as in order to influence the significant carbon emissions of construction industry, the sources and their amounts must be identified and calculated (The Finnish Environment Institute 2012). Carbon footprinting connects closely with LCAs, as the evaluation of the carbon footprint should be based on an LCA of a construction project (The Finnish Environment Institute 2012). An issue related to this is the fact that currently the quality of the information on the CO2 levels of the building products varies significantly based on the information source (Bionova 2017). This issue is aimed to be managed through standardizing the information through utilizing the common EN 150804 standard (Bionova 2017). Furthermore, currently there is no forcing legislation in Finland that would require companies to inform or measure their carbon footprints (Bionova 2017). As said earlier, legislative actions can, however, be expected during the next decade, and models for that have been benchmarked from other European countries where regulations have already been implemented (Ympäristöhallinto 2016; Bionova 2017). For example, in the Netherlands there is an obligation to count the CO2 emissions of buildings and in Belgium extended environmental captions are required (The Finnish Ministry of Environment 2017c; Bionova 2017). Furthermore, in France there is an ongoing piloting project, where the construction companies are required to take into account not only the energy efficiency levels, but also all the environmental effects emerging during the whole life cycle of new construction projects (The Finnish Ministry of Environment 2017c).

As the environmental discussion within the scope of construction industry is moving from energy efficiency to the environmental effects of the construction materials (Ruuska & Häkkinen 2014; Bionova 2017), at the same time the debate on which construction materials are the most environmentally efficient is increasing (The Finnish Environment Institute 2012; Rakennusteollisuus 2011; Green Building Council Finland 2011). The discussion has been especially heated and controversial when it comes to

comparing wood and concrete as construction materials. The most recent studies have concluded that the carbon footprint of a concrete apartment building can be even 75% higher than a similar building made of wood (VTT 2017). Furthermore, a study ordered by Sitra and conducted by Bionova in 2011, also concluded that the carbon footprint of wooden buildings throughout the whole life cycle of the buildings are smaller, even though they state that the difference would be only around 5-11% (Pasanen et al. 2011; Sitra 2011). On the other hand, according to Green Building Council Finland (2011), when comparing the emissions of concrete and wooden apartment buildings throughout their life cycle (100 years), no significant differences were found. However, the Finnish Environment Institute (2012) states that it is evident that the wooden construction causes less greenhouse gas emissions compared to steel or concrete, if wood indeed can be used in such way that it can replace the operational goals of these materials while preserving the quality and energy efficiency of the building. Nevertheless, concrete or steel are not completely replaceable as construction materials, meaning that the potential of wood as a substitute material is only a few percent in Finland (The Finnish Environment Institute 2012). Furthermore, some researchers state that the substantial carbon uptake resulted by cement carbonation is often left out of the environmental comparisons between wooden and concrete construction (Xi et al. 2016). According to Xi et al. (2016) a significant amount of the carbon dioxide emissions caused by the energy intensive production process of cement will be compensated throughout the life cycle of the concrete buildings due to the cement carbonation, making concrete less harmful for the environment than often considered.

Altogether, one can state that the current trends of construction industry in Finland are rather heated, as there are remarkable changes to be expected. Furthermore, it is evident that there is a significant need for increasing the capabilities on both LCAs and carbon footprinting, as they will most likely be expected of the construction companies, when the legislative actions take place by 2025. It can also be expected, that the discussion on the environmentally efficient construction materials will continue. Furthermore, as it is becoming a trend at concrete companies to develop so-called “green concrete” with fewer emissions (Rudus Oy 2017; Betoni 2012), the debate on the most suitable construction material in the contemporary and environmentally aware business environment, will become even more complex than it already is.

3.2 Case company description

The case company of this research is one of Finland's largest construction companies. Since the case company wishes to stay anonymous, from now on it is being referred as *Green Ltd.* in this research. Green Ltd. is a part of an international corporation, which operates both in Europe and in the US. The Green Corporation is listed among the ten largest construction companies worldwide. Internationally it has around 40 000 employees and it has over 10 000 ongoing projects in yearly bases. In Finland, Green Ltd.'s operations, cover construction services, public-private partnerships, and both residential and commercial project development services. The construction services are further divided into building construction, building services, and environmental and civil construction. In 2017, Green Ltd.'s sales in Finland were hundreds of millions of euros and the company employed over 2000 people.

Green Ltd.'s strategy evolves around the concepts of safety, ethics and sustainability. During the past years, Green Ltd. has done tremendous amount of work in order to improve the level of occupational safety within its sites. Furthermore, equality and diversity among the employees has been highlighted throughout the corporation. However, the corporate social responsibility concerning especially the environmental issues has been growing its importance during the recent years and one of Green Ltd.'s strategic goals has become to be the first choice when a customer is looking for green solutions. Furthermore, in 2017 Green Ltd. decided to commit to the emission reduction targets set in the Paris Agreement at the corporate level.

The procurement organization of Green Ltd. in Finland can be stated to be a rather decentralized function with features of centralization. For a long time, the purchasing operations had no level of concentration, but a couple of years ago, a centralized procurement unit was formed, combining some of the Nordic purchases. Nowadays, there are approximately 100 national and regional framework agreements in total. Furthermore, the establishment of the procurement unit has resulted as the implementation of e-procurement systems and different tools for both supplier and supply chain management. The category managers and the regional purchasing managers working in the procurement unit have a central role in developing the purchasing operations of Green Ltd. They are responsible for, for example, supplier relationship management and supplier development.

Regardless of the existing centralized procurement unit, the project-specific or title-specific purchases still represent around 50 % of Green Ltd.'s purchasing volume. Indeed, in many cases the final decision of which supplier to use is made at the projects. This has led to the situation where the amount of suppliers invoicing Green Ltd. annually is around 10 000. Majority of these suppliers are project-specific with no prospect for deeper supplier relationship development. The vast amount of suppliers also makes it significantly more difficult to ensure that all of the suppliers used at Green Ltd.'s projects comply with their environmental, safety and ethical requirements.

Overall, even though the purchasing operations of Green Ltd. are not fully centralized, this research is conducted within the scope of the centralized procurement unit and the framework agreement suppliers coordinated by it. This is because both the suppliers and the employees working with or in the unit have better capabilities and knowledge on a more strategic level of procurement due to the experiences gained throughout the existence of the unit. Thus, piloting aspects, such as environmental effectiveness, that often require a deeper level of cooperation is more easily kicked-off with suppliers and procurement professionals that have worked with this kinds of aspects earlier.

At Green Ltd., the supply chain management and supplier management basically happens through the utilization of different SCM practices and tools. In general, they are divided into four main categories; 1) supplier pre-qualification, 2) supplier audits, 3) supplier feedback and development, and 4) collaboration. These tools have mainly been developed after the centralized procurement unit was founded and thus many of them are still under constant development. Furthermore, there are also several other SCM practices that are utilized within Green Ltd., but they just are not considered as a part of the core SCM operations. The official and some of the unofficial SCM practices are presented in table 3. Furthermore, their connection to green issues is also presented in order to offer an understanding of the current level of environmental aspects in the SCM of Green Ltd.

When looking at table 3, it is evident that Green Ltd. has several different SCM tools in place. However, the somewhat recent implementation can be reflected on the fact that for many of the tools the main aim is to ensure performance levels and quality rather than advanced environmental aspects. The safety issues are also more highlighted in the SCM tools, as it has been one of the big focus area of Green Ltd. throughout the

past years. Of course, the environmental issues are also included in many of the tools, but they are mainly used to ensure that the suppliers obey the legal requirements rather than some extended Green Ltd. specific necessities. For example, both the pre-qualification and supplier audits highlight the traceability of wooden and stone materials as well as the proper handling of chemicals, but these requirements are set by legislation.

Furthermore, by assessing the information presented in table 3, it is clear that Green Ltd. has a lot more to do if it seeks to have fully implemented GSCM practices. Especially, supplier development and collaboration are not considering green very extensively. The development tools (evaluations and e-school) are currently not addressing the environmental aspects directly at all. Moreover, as many of the supplier development initiatives are derived from the feedback reports and supplier evaluations, it is clear that the current system does not encourage the procurement and category managers to specifically address and develop the suppliers' environmental knowledge and capabilities. Furthermore, as the process for establishing supplier collaboration in general is still in progress, it is clear that in that area there is still a lot to be done.

However, the fact that Green Ltd. already has several SCM practices in place and that some of them do include green in some level, is a good starting point for more extensive GSCM. Furthermore, some of the "unofficial" practices have great development potential and the fact that several of them are related to environmental aspects would indicate that Green Ltd. has a clear goal and desire for further environmental improvements in its procurement operations.

Table 3: The existing SCM practices and their green aspects in Green Ltd.

SCM practice	Description	Includes green?	How?
Official practices			
Supplier pre-qualification	Used to ensure that the suppliers of Green Ltd. comply with both legal and company specific requirements. A self-assessment survey for the suppliers with different areas of interest addressed. The answers are utilized for conducting a pre-q status for the supplier to its company information in the eProcurement system of Green Ltd. Only some of the 45 questions affect the status and some are only used for gathering information.	Yes	Ensures: 1. An access to the material safety data of used chemicals 2.That the used products have CE-markings 3.Compliance with Code of Conduct and different company specific environmental documents 4.Traceability of wooden and stone materials 5.That the supplier follows the recycling guidelines 6.That the supplier is able to deliver needed certificates if it has stated to be able to join LEED projects 7.That the supplier has an appointed person at Green Ltd.'s sites who can tell more about the environmental aspects of their work 8. If the supplier has ISO14001 or other environmental management system or not *(only for information)*
Supplier audits	Used for assessing the products, services, processes and performance of suppliers. Also both a risk management tool and a way of enhancing the cooperation and implementing Green Ltd.'s ethical, environmental, and safety values. There are questions from 7 different categories, scoring from 0 to 3. The total points determine the result (good, acceptable, risk, not approved)	Yes	The environmental capabilities is one area of assessment. 4 out of 5 of the environment questions are "stopping parameters" so if they occur cooperation cannot be launched or continued without corrective actions. 1) the suppliers are required to have some kind of environmental management system (even their own), 2) supplier is required to fulfill the environmental requirements of Green Ltd., 3) the origin of wooden and stone materials must be traceable, 4) requirements on chemicals must be fulfilled at the sites, 5) suppliers are expected to have a waste management system *(not a stopping-parameter)*
Supplier feedback and development	The site managers give feedback on the performance of the suppliers on scale 1-5 via the e-procurement system. Areas of evaluation consider safety, reliability/performance, and quality. The feedback is used for reports that are a tool for procurement and category managers when meeting suppliers. Also, when constantly scoring low, the issue is addressed through a deviation process.	No	Environmental aspects are neglected in the process. Environmental capabilities are not addressed in a separate area/question. As many of the development initiatives are derived based on the feedback, it is clear that the system does not encourage the procurement and category managers to address and develop especially suppliers' environmental knowledge and capabilities.
Collaboration	Currently there is no officially established way of managing supplier collaboration. However, there is an ongoing piloting project on supplier segmentation where a more systematic way of determining potential collaboration partners and actions is being developed	-	When the segmentation model is fully implemented, it is possible to identify the potential collaboration partners. Why not also the suppliers for environmental collaboration.
"Unofficial" practices			
Environmental discussions with suppliers	A practice launched in 2017, where environmental aspects of the suppliers' operations are widely discussed from different perspectives. Emphasis is purely in discussions and learning from another. This is not an audit	Yes	A purely green practice, where the Green Ltd. learns from the environmental capabilities of its suppliers. Also a great channel for promoting the environmental values and goals of Green Ltd.
Environment weeks	1 per year. Different environmental aspects are widely addressed during this week. Workshops, information letters, seminars etc. Also, suppliers are included e.g. by inviting them to some of the discussions and seminars.	Yes	Suppliers are included in some of the activities during the environment weeks. Also well performing suppliers are sometimes rewarded for their environmental work.

E-procurement status for suppliers	The e-procurement system has several integrations with different external databases. The system combines the data and connects it with Green Ltd.'s internal information about the supplier. As a result, the supplier gets a status to its company information in the e-procurement system. The systems banns making contracts with suppliers who have too low a status.	No	The status does not consider any environmental information.
E-schools for suppliers	Online platform where the suppliers can take different e-schools. Currently there are e-schools, for example, for the Code of Conduct and health and safety issues. The idea is to both educate the suppliers on areas perceived as important for Green Ltd. as well as implement those values to the supply chain. Some regions of Green Ltd. even require that suppliers must finish some of the courses before a contract can be written.	No	Currently there are no e-school courses for suppliers on environmental issues.

3.3 Methodology

The research method utilized in this thesis is the case study method combining both qualitative and quantitative data. According to Yin (2009, 5-13), a case study is a valid research method when the target of the research is to conduct a deep understanding of a certain event or entity. Due to the diverse and unexclusive nature of the method, it has been very popular in many different fields of sciences, such as economics, psychology and sociology (Yin 2009, 4). When choosing a case study as a research method, it does not automatically rule out the usage of quantitative data (Yin 2009, 10-13; Metsämuuronen 2003; 170-175). However, case study is better known as a qualitative research method and according to Metsämuuronen (2003; 170-171) it is one of the most important qualitative data gathering strategies.

The case study method fits well as the research method for this thesis: the research is exploratory in nature as the aim is to gain deep understanding on how to develop supply chain management actions into more sustainable direction and what are the key issues related to such a process. Hence, the cases in this study are 1) the existing and future SCM and GSCM practices of the case company and its subsidiaries, and 2) the abilities of the FWA suppliers to respond to the advanced sustainability concentrated requirements and 3) the drivers and barriers that should be considered when aiming for GSCM. According to Yin (2009), the utilization of multiple data sources is common for case studies. Certainly, one of the main reasons for choosing the case study as a

method for this research was the possibility to use versatile sources of data as a thorough understanding of the cases in hand would require utilization of many different sources of information.

The target of deeper understanding sets some boundaries to the research questions, and according to Yin (2009, 5-13) a common feature of case studies are the descriptive research questions that are trying to answer to questions such as “why” and “how”. Indeed, as typical for this research method, the main research question is constructed to be in a descriptive form and it aims to find an answer to a question “how”. The target and research question setting in qualitative studies means that when conducting such researches, the researcher must accept that often the results cannot be generalized as widely as in purely quantitative studies (Hirsjärvi & Hurme 1985, 15; Yin 2009, 15). Thus, the goal of the study is not to find answers to specific hypotheses or identify connections with different phenomena (Hirsjärvi & Hurme 1985, 15-18; Yin 2009, 15). Rather, the aim should be gaining a truthful and specific description of the case at hand, and thus to increase the amount of knowledge on the researched area (Yin 2009, 14-15). However, according to Metsämuuronen (2003, 171) it is still possible to identify connections with different entities that later on might turn out to be generalizable.

3.4 Execution and design of the research

It was recognized early on during the research process that as the goal is to get a comprehensive overview of the possibilities for further implementation of GSCM practices, a research conducted from the point of view of only one party of the supply chain would not be sufficient. Therefore, the decision was made to conduct the research in two separate but interconnected stages. According to Yin (2009), when conducting a case study, it is recommended to use several sources of data and evidence as the goal is to come up with an extensive overview of the case. In a case-based study, the data often refers to written or tapped record of interviews, the documents and information the case company is willing to provide, as well as to the own observations of the researcher (Stuart et al. 2002), but quantitative data may also be utilized (Yin 2009, 10-13; Metsämuuronen 2003; 170-175).

The goal in the first stage of the empirical study is to find out how well are the suppliers of the case company currently considering the environmental issues in their business practices, and what are their attitudes towards possible future development initiatives.

The research was conducted by sending out a standardized online survey to all of the national FWA suppliers of Green Ltd. (50 suppliers in total). The survey consists of questions with a Likert scale, open questions, as well as multiple-choice questions. It is further presented in appendix 2. The choice to limit the survey to consider only the FWA suppliers was made together with a representative of the case company and was based on the fact that the FWA suppliers as a group represent the supplier base of Green Ltd. well. The FWAs are made with suppliers from various different product and service categories and with both subcontractors and material suppliers. Furthermore, they all have a history of cooperating with Green Ltd., so the questions on for example further collaboration are not absurd for them.

When sending out the survey, the suppliers were given a week and a half to answer. 19 suppliers out of the 50 suppliers answered the questionnaire and thus, the final answer rate ended up to be 38 %. As the answer rate is closely related to the quality and reliability of the research (University of Jyväskylä 2009), several attempts were made to increase the rate. After sending the first message with the request to answer the survey, two rounds of reminding messages were send out. Furthermore, a covering letter with a request to answer was written by the category manager of Green Ltd. and was attached to the message. Furthermore, it is known that if the questionnaire is constructed to be easy and light to answer, the answer rate is going to be better (University of Jyväskylä 2009). Thus, the survey was designed to take approximately 10 minutes to answer. Additionally, in the covering letter it was clarified that without the supplier's permission, only the researcher has an access to the identified answers. This decision was made in order to lighten the pressure to answer and also to get more realistic answers from the suppliers.

Conducting surveys is one of the most traditional data gathering methods of quantitative analysis (University of Jyväskylä 2009). Traditionally, surveys have been used to measure population characteristics and to find quantitative features from a smaller sample that could be further generalized into a larger group (Jansen 2010). However, surveys can be used in a qualitative research as well, when the aim is not to establish frequencies, but rather to determine the diversity of a certain topic of interest (Jansen 2010). Indeed, in this research the data collected through the survey is not used to find correlations or regressions. It is rather utilized as a tool to gather insights on the environmental issues and capabilities of suppliers from a larger scope than would have

been possible if the data would have been collected through interviews. Furthermore, another vital goal was to find out the commonness of certain environmental management practices among the suppliers of Green Ltd. and for finding this out, a survey was also a valid tool.

The respondents of the survey are presented in appendix 3. In the research, they will be addressed as suppliers 1 to 19. As can be seen from the appendix 3, the suppliers represent a large scope of different construction related industries. 79% of the respondents were material suppliers, 10.5 % were sub-contractors, and the remaining 10.5% were considered to be both. The answers given for the survey were analyzed in thematic bases. The themes were defined based on the structure of the survey as it was conducted so that the questions were separated into three categories: 1) environmental management, 2) environmental capabilities, and 3) environmental cooperation with Green Ltd.

The subsidiaries of the case company in both UK and Sweden are much further with their environmental work concerning their GSCM practices. Thus, the aim in the second stage of the empirical research is to benchmark the existing good GSCM practices the subsidiaries of Green Ltd. and find out if some of those could be utilized in Finland as well. In addition, as the subsidiaries have been working with this issue for longer, barriers and drivers to be expected may be identified through their experiences. The knowledge attainable from the subsidiaries can thus be used when conducting the guidance for Green Ltd. as it can be used for both the target setting and dodging the most likely pitfalls.

This stage of the research was conducted through three semi-structured expert interviews. The questions were reviewed by a case company representative and revised based on the suggestions. The questions are listed in appendix 4. The interviews were all conducted and recorded through phone and transcribed afterwards to ensure that the findings did not rely on the recollection of the interviewer of the situation. Furthermore, the employees to be interviewed were also determined together with case company representatives as they had the best knowledge on who would have the best knowledge on the matter of GSCM. Indeed, all of the interviewees work closely with both traditional SCM and with the green aspect connected with it. However, each of the interviewees come from slightly different standing points giving a holistic view of the

matter. The interviewees and the basic information of them are summarized in table 4. Furthermore, in the research itself, the interviewees are addressed according to the names presented in table 4.

Table 4: The interviewees in the 2nd stage of the research

Name of the interviewee	Position	Country	For how long has worked for Green Ltd.
Interviewee A	Director of Procurement and Supply Chain	United Kingdom	14 years
Interviewee B	Green Business Developer	Sweden	6,5 years
Interviewee C	Portfolio Manager	Sweden	7,5 years

The interviews lasted from 45 minutes to little over one hour. The question list was sent to the interviewees beforehand so they had an opportunity to get acquainted with the questions and prepare their answers before the actual interview. However, as typical for semi-structured interviews, free commenting and additional questions emerging throughout the interviews were more than welcome and a possibility for open discussion was purposely remained.

Some of the most typical analysis methods for qualitative researches are thematic analysis, typification, discourse analysis and grounded theory (Hirsjärvi et al. 2007, 224). In this research, the data and materials were analyzed through the thematic analysis. Thematic analysis is a valid tool for analyzing the qualitative data, when the aim is to identify relevant areas of information from the whole body of gathered data, so the set research questions could be answered (University of Jyväskylä 2009). The themes are usually conducted based on the used material, and a common way for forming the themes is identifying the commonly arising topics in the interviews (Hirsjärvi et al. 2007, 224). Indeed the themes were mainly formed based on the question list and the three different areas of consideration in it, and thus the three themes of the research ended up to be 1) drivers for GSCM implementation in the subsidiaries, 2) stepping-stones for the implementation of GSCM, and 3) best practices of GSCM in the subsidiaries. These themes are further divided into smaller sub-themes that are discussed throughout the empirical research.

3.5 1st STAGE OF THE EMPIRICAL STUDY: Analysis on the current environmental awareness in the supplier base

In the following sections of this chapter, the results of the survey research are being analyzed. The goal is to determine the current level of environmental awareness and capabilities among Green Ltd.'s framework agreement suppliers. The current situation may be reflected on the opportunities of Green Ltd. for introducing new, more environment centered SCM practices. The answers are analyzed based on the different areas of interest that were addressed in the survey: 1) environmental management, 2) environmental capabilities and values, and 3) environmental cooperation with Green Ltd.

3.5.1 Environmental management

The first area of consideration in the research is related to the currently existing environmental management practices used by Green Ltd.'s suppliers. In total, the utilization of 16 different environmental practices was investigated. The practices to be examined were mainly determined based on the previously presented theoretical findings on most commonly used supplier selection criteria. Furthermore, the identified "hot topics" of Finnish construction industry, Life Cycle Assessments and carbon footprinting, were also included. By discovering the commonness of these practices in Green Ltd.'s supplier base, the level of environmental awareness and the applicability of the most used practices for example as supplier selection criteria for Green Ltd. could be determined. In the following chapter, the top-five and bottom-three environmental practices applied by Green Ltd.'s suppliers are discussed. The total results and the popularity of the assessed practices are identified in figure 10.

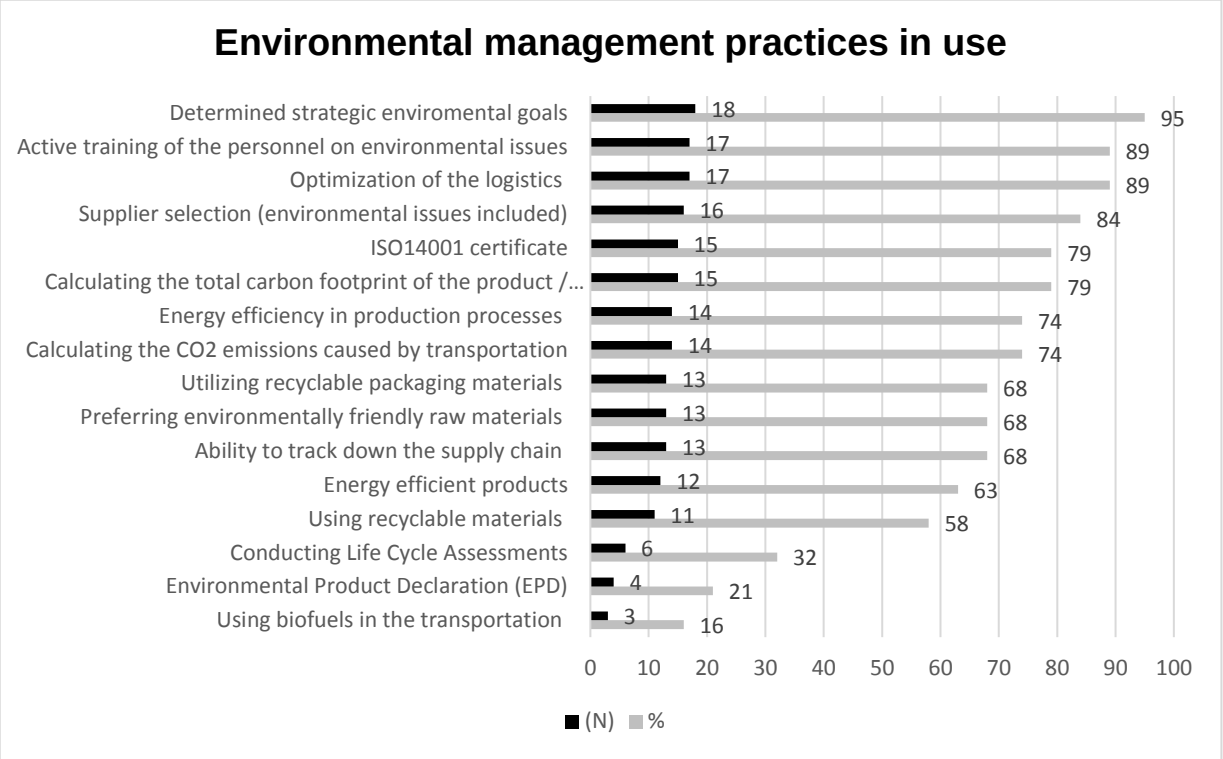

Figure 10. The current environmental practices in use

Firstly, one can state that it is rather common to have environmental management practices in use among the FWA suppliers of Green Ltd. Thirteen out of sixteen environmental practices that were addressed in the survey are applied by more than 50 % of the companies. Furthermore, as illustrated in figure 11, in average eleven of the proposed practices were already in use in the supplier companies, which represents 69 % of all the asked practices in total. Supplier 4 has the most environmental management practices in place as it utilizes as much as fifteen of them. On the other hand, supplier 8 is the least invested in environmental management by utilizing only four of the proposed practices. Importantly, there is no suppliers that would not have any of these environmental practices in place.

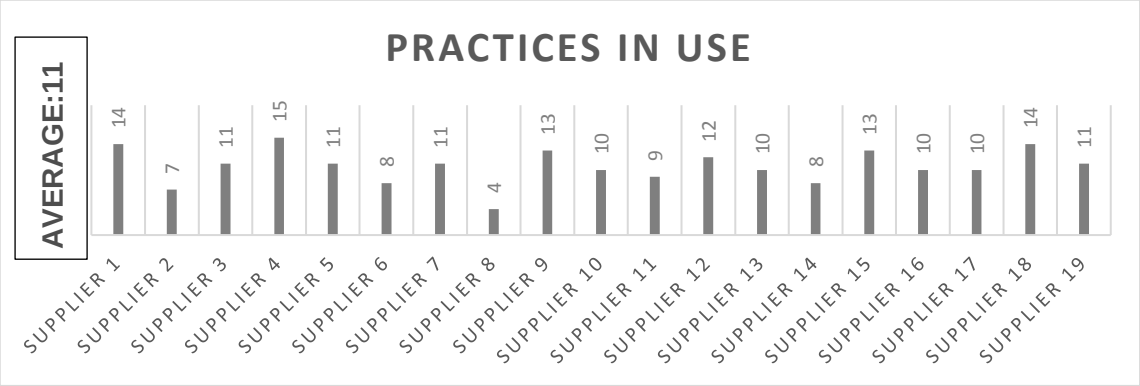

Figure 11. Deviation of the environmental management practices among the suppliers

Moreover, it can be seen from figure 10 that the most common environmental management practice among Green Ltd.'s suppliers is having determined strategic environmental goals for the company. Indeed, 95% of the respondents have some sort of strategic goals in place. The more detailed descriptions of the goals are listed in appendix 5. It is still vital to emphasize that even though it seems that it is very common to have strategic environmental goals among the suppliers, the quality of those targets differ significantly between the companies. Based on the descriptions of the goals, one can state that especially suppliers 1, 5, 9, 14 and 19 have determined rather extensive goals for their organizations, which would indicate that the environmental issues are highly appreciated within these companies. For example, supplier 1 highlights the fact that environmental issues have been a part of their business practices for decades and thus, they have become a significant area of consideration in their strategic goals as well. Furthermore, for example supplier 5 offered a list of the concrete environmental goals, consisting of practices such as implementing a Code of Conduct, conducting a model for tracking the emissions caused by their transport suppliers, and calculating their own carbon footprint and aiming to reduce it based on the results. On the contrary, an example of less detailed or extensive goals was offered by supplier 18, which clarified that their strategic environmental goals are as general as "*sustainable development and recycling"* and supplier 2, who stated that their goals are *"choosing less environmentally intense products and installation methods".*

In addition, it seems that most of the suppliers aim to increase their environmental knowledge though educating their personnel on environmental issues, as 89% of the companies suggested that they actively hold such trainings for their employees. Another as widely used environmental management practice, as the environmental education, seems to be the optimization of logistics. This is not surprising as it simultaneously

offers an opportunity to gain cost savings as well as to decrease the environmental effects of the company's operations.

Furthermore, it seems that it is rather common for the suppliers of Green Ltd. to execute selection processes on their own suppliers and sub-contractors, as 84% of the suppliers have a supplier selection process in place. Moreover, it seems that the suppliers are interested in managing the environmental issues in their own supply chains as well, as all of the suppliers with such processes have also included environmental aspects to it. Furthermore, nowadays ISO14001 certificate can often be considered as a solid part of environmental management systems in organizations. The commonness of the ISO14001 certificate as a tool for environmental management can also be seen from the suppliers of Green Ltd., as 79 % of the suppliers who answered the survey were granted with the certificate.

In the report conducted by the Finnish Environment Institute (2012), it was suggested that one of the future trends in Finnish construction industry would be the conduction of carbon footprinting calculations. In order to gain an overview of the total footprint of construction projects, the emissions produced throughout the process and supply chain must be considered, and thus calculations would be needed in the suppliers' end as well. Even though the Finnish law does not currently obligate companies to conduct carbon footprint calculations (Bionova 2017), still 79% of the respondents state to perform the carbon footprinting measurements for their products and services. However, it is essential to add that when further information of the measurements were asked, many of the suppliers elaborated that often the measurements are conducted for only some of their product or service categories.

The least used practice for managing the environmental issues among the suppliers is the usage of bio-fuels in transportations as it was a used practice in only three of the supplier companies. The next two least used tools actually bind together. EPD is an independently verified document, which offers comparable and transparent information about the environmental impact of products during their whole life cycle (EPD International 2017). Thus, it is a tool that can be used in the LCA calculations that according to Kuittinen and le Roux (2017) can also be seen as future trend for construction projects. However, it seems that both of these more extensive environmental management practices are currently not very widely applied by Green

Ltd.'s suppliers. Only 21 % of the suppliers that responded had defined EPDs and also only 32 % stated to conduct the LCAs for their products or services. This, however, is not that surprising, as it is known that many organizations may lack the knowledge to conduct practices such as LCA calculations due to their complex nature.

3.5.2 Environmental values and capabilities

The second section of this research concentrates on determining how environmental values are generally appreciated among Green Ltd.'s suppliers. Furthermore, their existing capabilities are evaluated through their own perceptions on their current level of knowledge on green issues. This information may be utilized when evaluating how the suppliers could react to more precise and demanding environmental requirements Green Ltd. might set in the future. The environmental values and capabilities of the suppliers are investigated through the answers got from the six self-assessment questions where the response options were set between totally agree and totally disagree. The results of the self-assessments are presented in figures 12-14.

One of the barriers for GSCM implementation that were identified in the theory chapter is the differing value bases of the suppliers and the buying organization on environmental issues. As can be seen from figure 12, it seems that this is not a major issue in Green Ltd.'s supplier base. The results of the survey give a very positive picture of how the suppliers of Green Ltd. currently consider their environmental capabilities and values. The majority of the suppliers answered that environmental issues already are a solid part of their business practices and can thus be actively seen in their actions. Only one of the suppliers felt that environmental aspects consider neither them nor their business operations. Furthermore, even more suppliers saw that including the environmental aspects in their practices is indeed important and also a part of their corporate value base, as 89% of the respondent totally agreed with this statement.

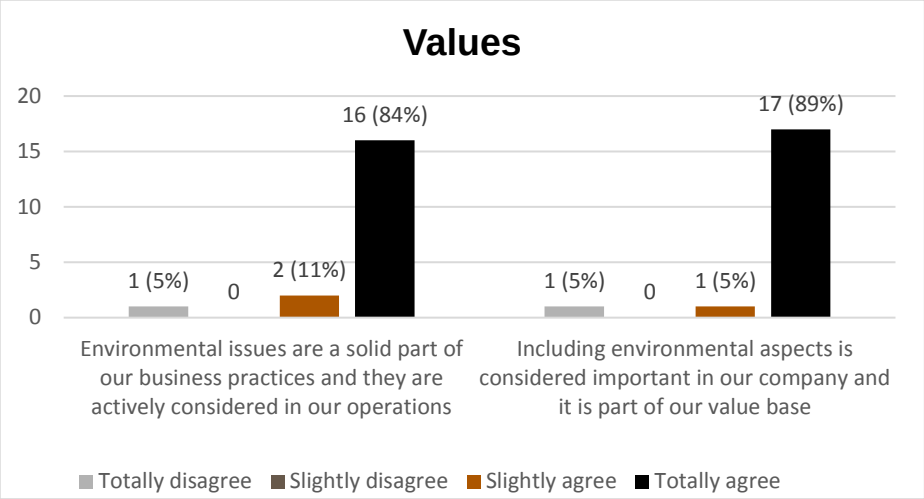

Figure 12. Suppliers' environmental values

As environmental issues can often be regarded as rather complex entities in some cases the suppliers might not have the knowledge on what greening their operations requires or what are the benefits that can be gained through such actions. This might become a severe obstacle for GSCM implementation. However, Green Ltd.'s suppliers seem to have quite good a level of knowledge on environmental aspects of their businesses. As can be seen from figure 13, in total, 53 % of the respondents slightly agreed and 37 % totally agreed with the statement that their personnel has a strong level of knowledge in environmental issues. Thus, only 10 % of the respondents thought that their company basically has no or low level of knowledge on environmental issues.

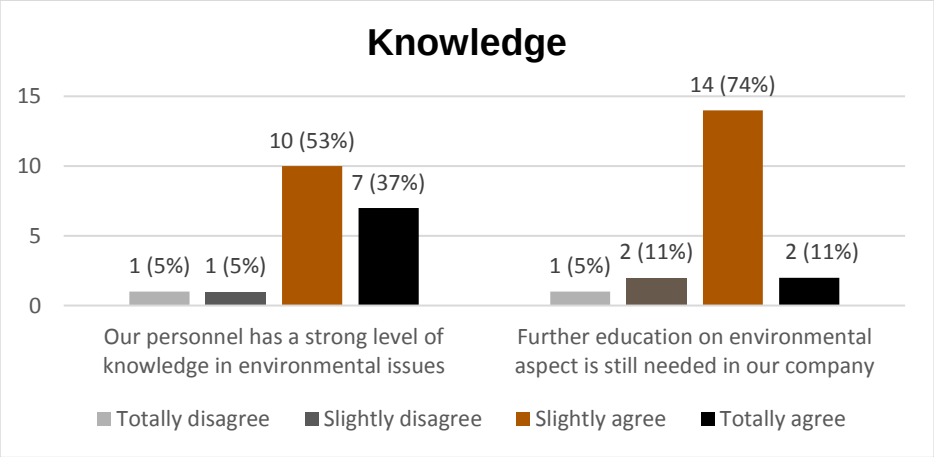

Figure 13. The current knowledge level of suppliers

However, even though it seems that majority of Green Ltd.'s supplier organizations are quite up to date with environmental issues, it is still important to add that in most of the companies there still is more to be done in terms of developing the knowledge level. As

indicated in figure 13, in total 85 % of the respondents slightly or totally agreed that further environmental education is still needed in their companies. Moreover, only 16 % in total thought that no or only little additional training was needed in their organizations.

Furthermore, the results of the survey indicate that the majority of the supplier organizations of Green Ltd. would be interested in further developing their environmental capabilities. As can be seen from figure 14, 79% of the respondents answered that improving the environmental effectiveness is part of their organizational goals. Moreover, the results implicate that the suppliers of Green Ltd. would be rather open for taking the improvements forward through environmental innovativeness, which could enable the utilization of new innovations for Green Ltd. as well. 63 % of the suppliers agreed totally and 32% slightly on the statement that their organizations will aim to improve their environmental effectiveness through innovations. Only one of the suppliers totally disagreed with this statement.

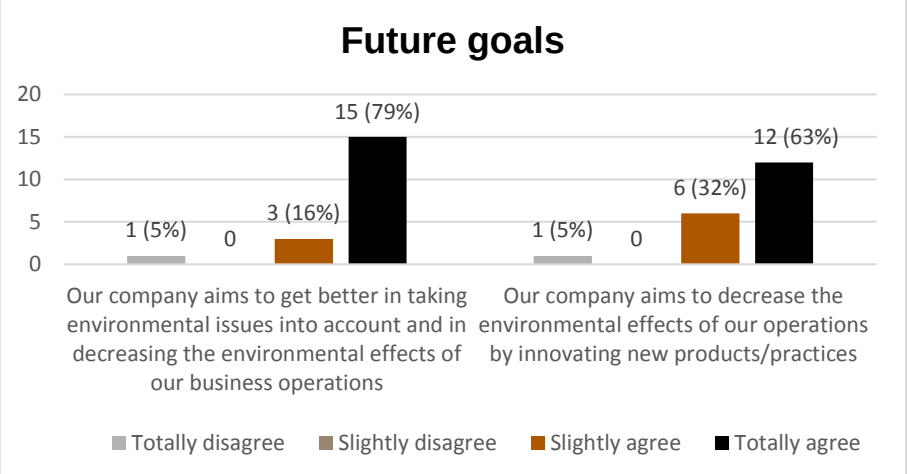

Figure 14. The future goals on environmental improvement

Finally, the section covering the values and capabilities of Green Ltd.'s suppliers was concluded with open-answer questions where the suppliers were asked to give their overviews on both the most significant opportunities and challenges they relate to improving their organization's environmental efficiency. The answers were rather scattered but still a few themes stood out from the responses, as can be further seen from table 5, which summarizes the opportunities and challenges that were pinpointed by several of the respondents. The descriptions of the opportunities and challenges are also listed in appendix 6. Based on the answers, the three main opportunities that the

suppliers connect with environmental improvements are 1) new business opportunities, 2) cost efficiency and 3) optimization of logistics. All of these three opportunities were mentioned by more than three of the suppliers. Moreover, the main challenges that were identified are 1) costs, 2) lack of knowledge, 3) lack of demand, and 4) logistics. These challenges were also raised by more than three suppliers.

Table 5: Summary of the main opportunities and challenges

Opportunities	
Description	**Suppliers**
New business opportunities	4, 5, 6, 7, 11, 17
Cost efficiency	5, 11, 14, 18
Optimization of logistics	1, 8, 17
Challenges	
Description	**Suppliers**
Increasing costs	1, 15, 17, 19
Lack of knowledge	5, 6, 11
Lack of demand	9, 15, 9
Logistics	1, 7, 8, 11

The prospect of ***new business opportunities*** was mentioned by suppliers 4, 5, 6, 7, 11 and 17 making it the most popular environment related opportunity among the suppliers of Green Ltd. The business opportunities may relate to several different things but the suppliers of Green Ltd. especially pinpointed the possibility to develop totally new product concepts, improve collaboration with business partners and identifying new product segments:

"Including environmental issues to our business offers new product concepts and new business opportunities." (Supplier 11)

"The most significant opportunity is related to new collaboration opportunities with business partners." (Supplier 17)

"Renewable diesel is our most radically increasing product segment, which indicates that many business opportunities do relate to the environmental business." (Supplier 4)

As in many cases the GSCM activities are purely initiated by the aim for cost reductions and waste elimination, it is not surprising that the second most common opportunity raised by the suppliers of Green Ltd. is the chance for increasing the ***cost efficiency***. Indeed, suppliers 5, 11, 14 and 18 all identified this as a significant opportunity related

to the improvement of environmental efficiency. Supplier 14 concluded this well in its answer:

"In addition to supply management we see that other important environmental aspects for us are preventing the occurring waste and increasing the energy efficiency. Increasing energy efficiency is linked to lower production costs and thus it leads to improved cost efficiency." (Supplier 14)

Moreover, as it was discussed in the first section of this empirical research, the ***optimization of logistics*** seems to be a rather popular management technique for environmental effects among Green Ltd.'s suppliers. Furthermore, three of the suppliers (suppliers 1, 8 and 17) further stressed the environmental opportunities related to the improvement of their logistical solutions making it the third most common opportunity related to increasing the environmental effectiveness among Green Ltd.'s suppliers. A reason for the popularity of this environmental practice might be the possibility for simultaneous improvement of environmental and economic efficiency as further elaborated by supplier 1:

"We prefer to use Finnish products, so we don't have to deliver them from all around the world. We also aim to optimize our logistics so that larger entities can be delivered at once. These actions are opportunities for us in terms of both lower carbon footprint and better environmental efficiency as well as increased cost efficiency." (Supplier 1)

When it comes to the challenges the suppliers of Green Ltd. relate with improving their environmental efficiency, one can state that the most commonly addressed challenge by the suppliers was related to the fear of ***increasing costs.*** Suppliers 1, 15, 17 and 19 all raised their concerns on the higher costs related to environmental solutions and what the utilization of such options might do to their cost efficiency:

"The biggest challenge is definitely the costs. Customers might not want to pay extra even though they are a result of environmental actions." (Supplier 15)

"We feel that sometimes the cost efficiency might suffer from the environmental decisions." (Supplier 19)

In some of the supplier organizations, the ***lack of knowledge*** seems to be the main obstacle for environmental improvement. Indeed, suppliers 5, 6 and 11 stated that for their organizations, the biggest challenges related to improving the environmental efficiency is in fact the low level of knowledge on environmental issues. Furthermore, it seems that this is the result of too few resources to educate their personnel:

"Increasing the knowledge of the employees is always a challenge in a busy working environment." (Supplier 6)

"The biggest challenge for us is to find the resources to educate and activate the personnel." (Supplier 11)

Furthermore, some of the suppliers questioned extensiveness of the customers' interests towards environmentally effective products and thus named the ***lack of demand*** as one of the main barriers for improving their environmental effectiveness. Especially suppliers 9, 15 and 19 pinpointed the difficulties they have faced with the low demand of the more environmentally friendly products:

"For us the challenge is to figure out how to make customer choose the ecological option." (Supplier 9)

"It seems that the demand for environmental products might not be high enough." (Supplier 19)

Finally, the last challenge raised by several of Green Ltd.'s suppliers is related to improving their ***logistical solutions***. Indeed, suppliers 1, 7, 8 and 11 all stated that for them one of the biggest challenges is finding more environmental ways of executing their logistics. This is interesting, as the optimization of logistics was also identified as one of the main opportunities when it comes to improving the environmental efficiency of the organizations. Thus, it seems that the widely accepted way of developing the environmental aspects of companies might actually be rather demanding and not that easily attainable. Furthermore, especially the global operating environment and the known high price level of Finnish products compared to several other countries is complicating the decision-making when aiming for environmental and optimized logistics processes as companies must constantly balance between the lower purchasing prices and environmental decisions:

"The global market is causing challenges for actually improving the efficiency of logistics. It is known that the Finnish products are more expensive but buying from Finland is more environmentally friendly. So, it is a challenge to find the balance". (Supplier 1)

3.5.3 Environmental cooperation with Green Ltd.

The third section of the first stage in the empirical research concentrates on determining the interests of the suppliers of Green Ltd. towards a closer cooperation or even environmental collaboration. The results are illustrated in figures 15-17. As it was identified earlier, the cooperation with suppliers when aiming for GSCM is vital, as if the suppliers are not fully involved in the greening processes it becomes nearly impossible to produce truly green products and services. Furthermore, it was also pointed out that a common barrier for the development of cooperation is the fact that suppliers often find information regarding their environmental actions confidential. This issue was acknowledged when designing the survey for this research by highlighting the fact that only the researcher had an access to the specified data, and without the supplier's permission, no other person from the case company would see the answers in a form that the respondent could be detected. Deriving from the answers to the question where the permission to use company-specified data was asked, it seems that at least among the respondents of this survey the issue is not that severe: Only three suppliers denied the further utilization of their answers later on in the case company's internal operations.

Even though, the majority of the respondents of this research appeared to be rather open about their companies' environmental information, it is still essential to highlight the importance of developing an open and trustful relationship between the parties. Even lower level environmental cooperation will require a closer relationship than in conventional buyer-supplier relations. Luckily, it seems that the majority of Green Ltd.'s framework suppliers would be rather open-minded about developing the cooperation into closer and more inter-connected direction. This can be indicated form the fact that, as can be seen from figure 15, 74% of the respondents totally agreed when their interests towards developing their environmental capabilities in cooperation with Green Ltd. were asked. Furthermore, also 16 % were slightly interested, meaning that only 10% of the suppliers felt that environmental cooperation would not be of their interest.

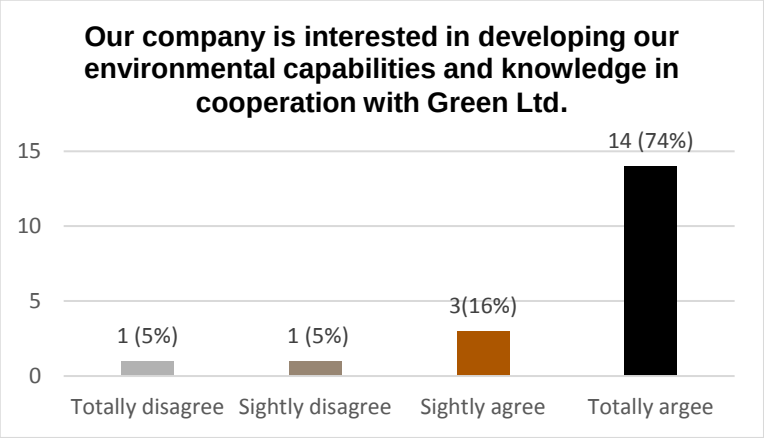

Figure 15. Suppliers' interests towards cooperative development

As stated by Fu et al. (2012) one small step towards closer cooperation or even collaboration may happen through offering guidance for the suppliers when encouraging them to develop into a wanted direction. Due to the restricted resources of the smaller actors in the supply chains, the responsibility to offer guidance is left for the larger parties. Hence, as Green Ltd. is a large player with extensive resources compared to most of its FWA suppliers, it would have the responsibility to help its suppliers in the greening process of their business operations. Furthermore, as presented in the theory chapter, one of the most basic environmental supplier development activities is offering trainings for the suppliers on green issues (Fu et al. 2012; Torielli et al. 2011; Gilbert 2000). Indeed, as can be seen from figure 16, 68% of the suppliers responded that they would be very interested, and 21% slightly interested, to participate if Green Ltd. was to offer such environmental trainings. When combining this with the results presented in the last section of this chapter on the clear need for further education identified by the suppliers themselves, it would indicate that a need for such educative operations still exists among the suppliers. Furthermore, the fact that many of the suppliers already are highly interested and involved in different environmental practices would suggest that such educative cooperation actions could be successful.

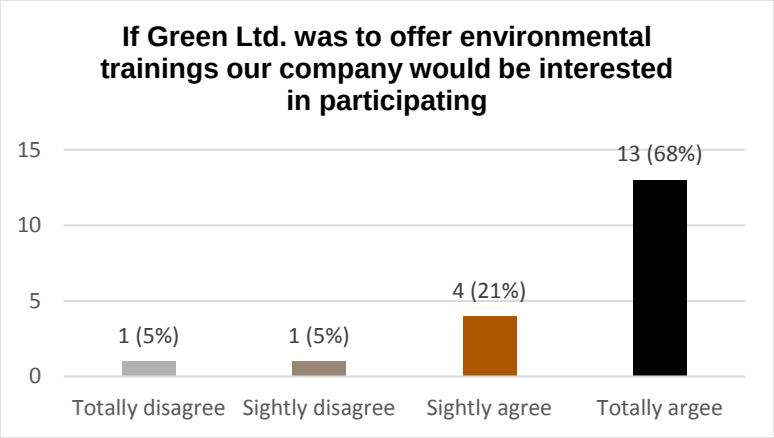

Figure 16. Suppliers' interests towards environmental educations

A common issue related to supplier cooperation is the inevitable increase in the interdependence of the involved parties, since it sometimes causes reluctance among the parties to engage in collaborative supplier relationships (Monczka et al. 1998; Laari et al. 2016). However, as the fact is that the most significant benefits stemming from GSCM are attainable through collaborative actions, the supply chain members must accept this and rather focus on the profits (Mello et al. 2017; Gilbert 2000). It seems that the FWA suppliers of Green Ltd. have also recognized this and are ready to deal with the increasing interdependency, as 79% (see figure 17) of the respondents were eager to establish collaborative relationship with Green Ltd. with goals such as joint innovation development.

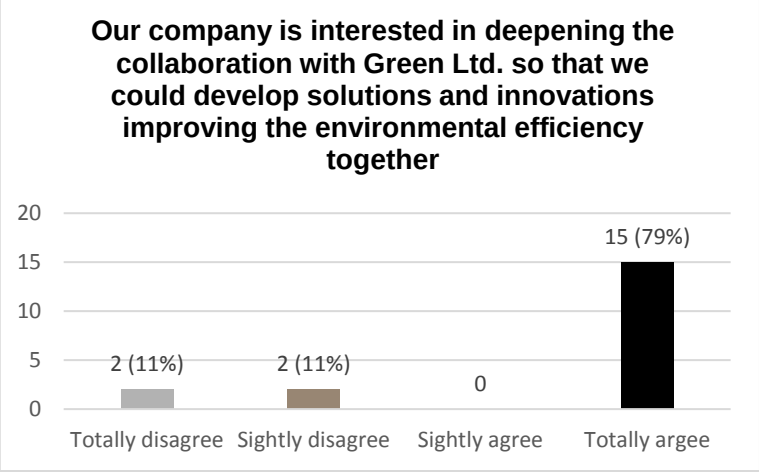

Figure 17. Suppliers' interests towards deep environmental collaboration

However, the fact that all of the organizations that answered the survey have been operating with Green Ltd. for over 5 years, and 95% of the suppliers stated that the cooperation has been very successful, might affect the results in a positive way, since

for many of the suppliers a natural next step would be deepening and developing the cooperation. Furthermore, it is also relevant to highlight the fact that even though the suppliers seem to be rather open about establishing collaboration with Green Ltd., of the three suggested cooperative actions constructing a collaborative supplier relationship was the least popular action as 22% in total were either totally or slightly uninterested of such actions.

3.6 2nd STAGE OF THE EMPIRICAL STUDY: Benchmarking the subsidiaries of the case company

Next, the results of the second stage of the research are introduced. This stage of the research is based on three expert interviews conducted with supply chain and sustainability professionals working in the subsidiaries of Green Ltd. Based on their experiences the greatest stepping-stones that may be expected throughout the implementation process of GSCM can be detected. Furthermore, the existing best practices can be used for benchmarking and identifying those GSCM practices that could also be utilized in Green Ltd. Finland. Before introducing those, the initial reasons for the implementation and the most significant benefits that have resulted from this are presented.

3.6.1 Drivers for GSCM implementation in the subsidiaries

Green Ltd. UK and Sweden have been working with GSCM for several years meaning that they have already established many different tools and practices regarding that. However, the way of working is still evolving in both of these subsidiaries, as GSCM is yet rather recent in them as well. The implementation has happened in the subsidiaries around the same time as according to interviewee A, they first started in UK back in 2009 and according to both interviewees B and C, in Sweden they started to pay more attention to green aspects in SCM somewhere between 2008 and 2010.

The drivers for implementation processes can be stated to consist of the initial reasons that force the organization to make changes in its operations as well as of the identified benefits the implementation may make attainable. Next, the reasoning behind the implementation and the most significant benefits that have resulted of the implementation in the subsidiaries are discussed.

Reasons behind GSCM

Several different reasons the subsidiaries of Green Ltd. had when deciding to introduce green as a part of the SCM practices were identified throughout the interviews. They are summarized in figure 18 and further discussed in this chapter.

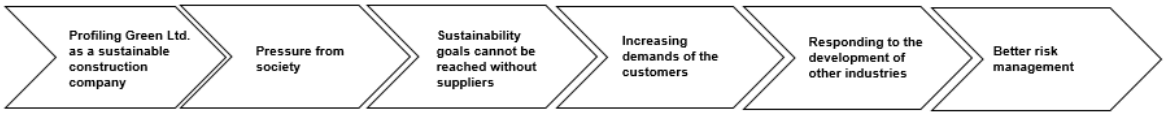

Figure 18. The reasons of GSCM implementation in Green Ltd.'s subsidiaries

The most highlighted driver for implementation was the ***possibility of profiling Green Ltd. as a sustainable construction company***. All of the interviewees pointed this driver out at some point. According to interviewee A, it was recognized in Green Ltd. UK that the sustainability aspects could become a significant and positive part of Green Ltd.'s brand, and indeed the realization of this has brought multiple different benefits from attracting capable employees to winning work due to the sustainability label.

According to interviewee C, the brand aspects however were not the initial reason in Sweden to engage in GSCM but rather the changes in the environment that basically forced them to do something. Furthermore, as the governments of both UK and Sweden have set national environmental regulations, reacting to ***pressure from society*** has definitely been a significant trigger in engaging in GSCM. However, interviewee C further added that an upfront reaction to these regulations has also benefitted Green Ltd. Sweden brand-wise as they have now been selected as one of the drivers in the Swedish construction sector when it comes to reaching the carbon targets set by the government of Sweden.

However, as stated by Krause et al. (2009), the ultimate level of sustainability simply cannot be reached without also concerning the suppliers and supply chains. Hence, as Green Ltd. has strongly identified itself as a green construction company both in UK and in Sweden, it has been forced to act within its supply chains as well. Indeed, interviewees A and B strongly agreed with these arguments and stated that one of the key drivers for them was the fact that the ***sustainability goals could not be reached without the suppliers***:

"For sure, it is about wanting to be a sustainable business, bearing in mind that 80% of our turnover is spent through the supply chain. We have to have supply chains that align with these aspirations of being sustainable so that is the driver really…We can't just stand there and say we are sustainable if our supply chains aren't." (Interviewee A)

"We see a great need to work with our suppliers to support our greener projects, for example those having high LEED or BREEAM ambitions. So to be able to deliver those projects we need our suppliers to help with that." (Interviewee B)

One of the clear reasons behind the decision to include green in the traditional SCM practices in the subsidiaries of Green Ltd. was also the significant ***increase in demands of the customers*** in terms of environmental issues. Interviewee B pointed out that nowadays many of the Swedish customers are willing to pay more for environmentally produced products, which is making green a clear priority for them. Moreover, interviewee A stated that this is also the case in UK and the change in the demand has happened quite radically, which has made it one of the main drivers of GSCM in Green Ltd. UK:

"Our customers have become more forward in what they want in these [green] areas. So what they are asking for now compared to what they were asking 10 years ago is completely different." (Interviewee A)

Interviewee C also pointed out that in general the construction industry is significantly lagging behind when it comes to ensuring the green aspects in the supply chains compared to other manufacturing industries. Thus, at least in Sweden, that has led to one of the reasons for GSCM implementation being the need to ***respond to the development of other industries***. Moreover, interviewee C stated that the late response compared to other industries is not all negative as Green Ltd. is still a forerunner in environmental aspects in the Swedish construction sector and it can now look for inspiration from the already existing practices developed in other industries.

Finally, according to interviewee B, one of the great influencer to the development of more environmentally aware mind-set in Green Ltd. Sweden, stems from an environmental accident that occurred in their site back in mid-1990s. After that, it has been realized that SCM practices can be used for avoiding further environmental breaches. Thus, interviewee B states that one of the main reasons for the implementation of GSCM has indeed been the possibility to ***manage the risks*** better:

"One driver is of course managing the environmental risks… We must focus on the risks as they are always there. We are trying to do that through ensuring at least the lowest level of environmental aspects within our supply chain." (Interviewee B)

Gained benefits

When asking the interviewees about the main benefits Green Ltd. has gained after including green into their traditional SCM practices, three distinctive options emerged. They are presented in figure 19.

Figure 19. Gained benefits in the subsidiaries

Firstly, all of the interviewees pinpointed that the overall ***risk management has improved*** significantly after the implementation of GSCM ideologies. Interviewee C highlighted the fact that Green Ltd. Sweden now has considerably better control over its spend and it is now known that the majority of the suppliers used in its projects comply with the company specific requirements. Furthermore, interviewee B argued that especially after implementing the pre-qualification tool for identifying the usable suppliers, Green Ltd. Sweden has been able to make supplier base reductions, which also aids in controlling from where the materials and services are actually acquired to Green Ltd.'s projects:

"It is kind of a Wild West in the construction sector in Sweden, and since we have these Green Supply Chain Management tools it makes it easier to identify the suppliers with whom we want to work with and who we want to rule out." (Interviewee B)

Thus, for example the usage of hazard and risky suppliers has been successfully minimized, which in turn has significantly lowered the risks Green Ltd. faces throughout its construction projects. Interviewee A concluded this well in his statement:

"So, you know, if you cut corners and just go on price and cost as the only element of making your purchasing decision, then that will backfire at some point." (Interviewee A)

Secondly, both interviewees A and B brought up that one of the gained benefits is related to ***improvements in cost efficiency***. The cost efficiency is often related to the

fact that inclusion of green to the production usually leads to minimizing the waste and other excess in the processes (Gilbert 200; Walker et al. 2008). Indeed, interviewee B pointed out that when carefully planning the actions made in the construction sites, it straightforwardly leads to improvements in both performance and environmental efficiency:

"If you plan for the waste, you can actually plan for not producing waste. That means that you will buy fewer materials in the first place, which saves both money and the environment. Also, if you sort your waste well you can actually get paid or at least pay less for the handlers to pick the waste up. Also, using low-consuming vehicles are at the same time decreasing your carbon footprint and the fuel costs." (Interviewee B)

Furthermore, the high maturity level in terms of environmental aspects in these subsidiaries can be indicated from the fact that the long-term perspective needed for realizing the attainable cost benefits of GSCM company are understood both in Green Ltd. UK and Sweden:

"Usually, when it comes to building green it adds the costs and the total price in the end will be more expensive. But, we also see that the customer, especially in housing and offices, can count that money back from few years of running that house because the green solutions have significantly decreased the energy consumption. That's why they can pay a little more for the building in the first place." (Interviewee B)

Thirdly, a clear benefit the subsidiaries of Green Ltd. have gained in Sweden and in UK is ***increased competitive advantage***. As the competition is constantly accelerating in the current business environment, finding sources for competitive advantage is becoming increasingly important (Cosimato & Troisi 2015; Tseng 2014). According to interviewee A, Green Ltd. UK is trying to exploit its forerunner position in being able to respond to the tightening environmental requirements of customers, as it is something that is differentiating Green Ltd. UK from its competitors:

"Green Ltd. UK is seen as a leading construction firm in green. So, for us the benefits are about, I guess, winning work. Our clients now know that we are really good at doing things around sustainability, so they are more willing to give us work rather than our competitors." (Interviewee A)

Moreover, interviewees B and C state that for Green Ltd. Sweden the implementation of GSCM practices has helped in gaining competitive advantage through making it easier to identify the most environmentally capable suppliers that can help Green Ltd. in going forward with its environmental ambitions. Furthermore, it is evident that Green

Ltd. Sweden is loudly profiling itself as an environmental construction company in Sweden, as it has engaged in both the governmental and organizational carbon reduction targets. These actions, when operated successfully, will bring a lot of publicity and even competitive advantage to the company. However, according to interviewee B these high profile carbon reduction targets cannot be reached without cooperation with the environmentally capable suppliers, meaning that the suppliers are an essential enabler of the attainable competitive advantage.

3.6.2 Stepping-stones for the implementation of GSCM

In the interviews, it became quite clear that during the implementation of GSCM approach to purchasing, some barriers would most likely appear. In total seven different themes regarding the barriers arouse and they are summarized in figure 20. Next, these most significant barriers raised by the interviewees are presented and discussed. Furthermore, a list of pitfalls to be avoided based on the experiences of the interviewees is presented in the latter section of this chapter.

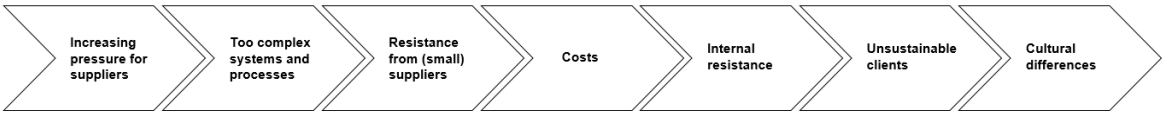

Figure 20. Barriers of GSCM implementation identified in the subsidiaries of Green Ltd.

Barriers

The interviews revealed that one of the most highlighted barriers of GSCM implementation is the ***increasing pressure it causes for the suppliers***. All of the interviewees stressed the fact that suppliers are already facing multiple demands from several stakeholders, which requires a lot of effort from them. Furthermore, it can be expected that the pressure will only increase in the future as more and more companies start to engage in environmental practices. Thus, as interviewee B pondered, there is much to do in terms of developing the processes for GSCM in a way that decreases the pressure directed towards suppliers. He even suggested that some of the development initiatives should be taken to the construction sector level:

"The suppliers face requirements from all over. How do we make it easy enough for them and find good ways to cooperate? Could there be an open source business tool for the whole construction sector, which could then be complemented with our own tools?" (Interviewee B)

Furthermore, both interviewees B and C pointed out that some of the barriers for the implementation have been caused by Green Ltd. Sweden itself, as it has created ***too complex systems and processes*** that both the suppliers and the employees of Green Ltd. Sweden are struggling with:

"I think for us, the main barrier is the system we are using for pre-qualifying our suppliers. It's slow, it's complicated even for us and the suppliers." (Interviewee C)

Furthermore, according to interviewee B, the complexity of the systems and processes can also cause problems when the company is forced to use the limited resources for ensuring the basic functionality of the tools, which then restricts further development of GSCM practices. Moreover, if the suppliers do not understand the reasoning behind all al the new processes and requirements that can also endanger the implementation:

"Often the suppliers need help to understand what the requirements mean for us just to understand what to do with them. Also if they are too complex, they sometimes question their necessity". (Interviewee B)

In general, all of the interviewees thought that resistance from the suppliers after Green Ltd. has started to increase the environmental aspects in its SCM practices has not been a major issue. Especially the larger organizations, who have the resources to flex and who, in many cases, are in a journey towards sustainable business practices themselves, have had no issues with the greener approach to business, interviewee A stated. Furthermore, both interviewees B and C agreed that the Swedish suppliers seem to be very talented and mature when it cost to sustainability issues:

"I think a lot of our suppliers are really good [in green issues]. They are very mature in their sector." (Interviewee B)

However, each of the interviewees stated that the problem with ***resistance from suppliers*** does still exist among the smaller suppliers with fewer resources. According to interviewee A, this is however quite natural, because in some cases those suppliers have very scarce resources meaning that they would have to do trade-offs between different business aspects if they wanted to fulfill all the new requirements:

"If you go to the smaller suppliers and ask who are their health and safety resources, or ethics resources, or their environmental resources, they will say it is the one and same person for all of those actions. So when you try to give something extra to do

they don't have that extra half a person or person to develop their business."
(Interviewee A)

However, interviewee C points out that Green Ltd. should not work with too small suppliers in the first place as they do not have the competence to work in a level that is suitable for Green Ltd. Sweden. Indeed, also interviewee B pointed this out when stating that eventually Green Ltd. Sweden will not be working with the suppliers who do not have the environmental competence or the interest towards developing that, as they have realized that those same suppliers often lag behind in other areas as well, since they are refusing to evolve.

Furthermore, interviewees A and B both stated that the barriers related to the ***costs*** cannot be dismissed when discussing GSCM. When starting from scratch, the implementation of green perspectives might indeed be an expensive process for the suppliers (Giunipero et al. 2012; Luthra et al. 2011), which according to A can cause hesitation among the suppliers as they may be worried that their profits might decrease. However, interviewee A argued that the worry of decreasing profitability is often only a result of too short a time-perspective, as the monetary benefits of green often take longer to get realized. Furthermore, interviewee B added that as in Sweden many of the customers are more and more willing to pay extra for environmental solutions, the increasing production costs should not become an issue.

Another barrier that came up throughout the interviews was ***internal resistance****,* as according to interviewee A, in UK the procurement team has nearly 140 persons and it is clear that not everybody see the green aspects in their procurement work as important. Furthermore, interviewee A stated that Green Ltd. UK has to struggle with ***unsustainable clients*****.** According to Green et al. (1996) a grave barrier for implementation of GSCM is if the customers do not see the benefits of the green initiatives. Indeed, interviewee A states that even though they have a lot of green-appreciative clients, especially in private sector there are some who are still totally cost-centered and excluding the environmental thinking totally. According to interviewee A, this leads to the question of whether Green Ltd. is willing to leave those customers for the competitors whose aspirations align with those clients.

Furthermore, interviewee B wanted to stress the barriers that could emerge due to ***cultural differences in different countries***. Indeed, Walker et al. (2008) states that

the market situation and the number of potential environmentally aware suppliers vary significantly depending on the country and business context. Interviewee B further argued that the difference between Finland and Sweden might be quite significant:

"Sometimes cultural aspects are restraining the implementation of green. My opinion is that Sweden has had a lot of help from the fact that the Swedish market is rather mature… And we have customers that are willing to pay more. I think this might not be the case in Finland. What works for Sweden might not work for Finland in the same way." (Interviewee B)

Admittedly, the cultural aspects have a great role in whether the implementation of GSCM will be successful. Interviewees A and C also stress the fact that the practices should be developed with the business context in mind so the company does not end up excluding too many of the suppliers, and disrupting the supply chain as proposed by Beske and Seuring (2014).

Altogether, based on the three expert interviews one can state that several difficulties can be expected when aiming for implementation of GSCM. A statement made by interviewee B concludes this well:

"This is a difficult area to work with because you can have a determined process but every supplier is different and every situation is different. So it is very hard to figure out how detailed should the processes be and how much flexibility to preserve." (Interviewee B)

Pit-falls to be avoided

As presented in the previous section of this chapter, there are several barriers that can be expected throughout the implementation of GSCM. As the subsidiaries both in UK and in Sweden have already started the implementation several years ago and have faced some of the barriers, the interviewees had many suggestions for how Green Ltd. Finland could avoid at least some of the pitfalls. Next, these pit-falls are briefly presented.

1) Not having a mandate for the GSCM from the highest management

According to interviewee A, one of the main pitfalls for the implementation of GSCM is if the business unit fails to get a mandate for the greener approaches from the top management, as the support is critical in all kinds of strategic projects. This is because

if you do not have the mandate you most likely will not get the resources needed for the implementation, interviewee A added.

2) Trying to do too much at once

Interviewee A, further pointed out that for Green Ltd. UK a significant difficulty has been the fact that at some point they were trying to do too much at once:

"Do a few things very well each year rather than trying to do 15 things and then fail because you haven't got the time to do it. So, just try to move the business gradually over the years. Of course, you are trying to make a change and an impact on things but sometimes the business can't change that quickly." (Interviewee A)

Furthermore, as discussed earlier, the increasing amount of demands directed to suppliers is setting barriers for the implementation. Thus, if Green Ltd. was to suddenly make significant changes in the requirement levels, this barrier might be realized in an insurmountable way.

3) Not including green as a part of the other existing SCM practices

According to interviewee B, it is important not to try to build a separate management system for the green aspects in supply chain and supplier management. Indeed, in many cases GSCM should be seen as an extension to the traditional SCM practices, which basically happens through including the green aspects to be a part of the existing management practices (Beske & Seuring 2014; Svensson 2007). Interviewee B further elaborates that this is also good from the costs perspective, as in many cases there is no need to build new and expensive systems or processes:

"As you know, costs are always an issue but if you have a management system for the supply chain or suppliers then you can always add in the green. That is very cost efficient. It would be even strange to have a separate green supplier management system." (Interviewee B)

4) Not elaborating the benefits to the projects

Furthermore, interviewee C stressed the importance of elaborating the attainable benefits for Green Ltd. in the project level. If the benefits are not clear and visualized, it is difficult to get the people who actually implement these practices on board, interviewee C added.

5) <u>Having too short a time scale</u>

Finally, it was brought up by interviewees A and B that when discussing the barrier of costs related to GSCM, in many cases the barrier is caused by too short a time scale. Moreover, they both further stressed this as a pit-fall that could easily be avoided. When trying to see the attained benefits too quickly, it is sure to kill the motivation of both the employees of Green Ltd. and its suppliers, as the results are not showing in a way that was expected. According to Carter and Dresner (2001) tackling this issue is just a matter of educating all the involved parties of the fact that the realization of many of the benefits will take more time than in usual development projects.

3.6.3 Best Practices of GSCM in the subsidiaries

It is evident that the GSCM practices are much further especially in Green Ltd. UK, but also in Green Ltd. Sweden when comparing to the existing methods utilized in Finland (see table 3, p. 62). All of the interviewees gave several examples of very mature ways of working in terms of green procurement. The identified best practices are summarized in figure 21, and in the next sections of this chapter, those actions are discussed. As the practices differ from each other quite significantly, they are discussed separately, starting with the ones identified from Green Ltd. Sweden.

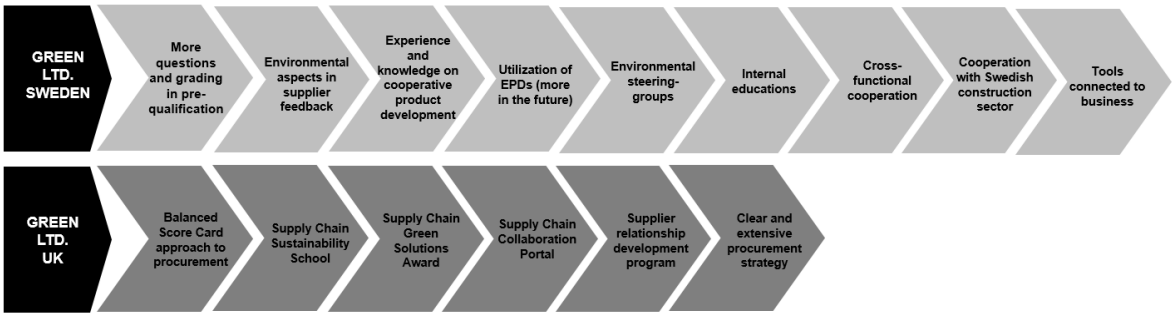

Figure 21. The best GSCM practices of Green Ltd. Sweden and UK

Best practices from Green Ltd. Sweden

One of the main findings from the interviews conducted with the representatives of Green Ltd. Sweden is the fact that the Swedish subsidiary is indeed further with some of the environmental practices when comparing to Green Ltd. Finland. To a large extent, this is a result of the rather mature market situation in Sweden when it comes to environmental issues. However, the maturity of the practices is not substantially higher, which means that majority of the actions could be rather easily adopted in Finland as well.

Firstly, just as in Finland, Green Ltd. Sweden is also utilizing the supplier pre-qualification process to screen and select those suppliers as business partners who comply with the organizational and legal requirements. Especially interviewee C stressed the importance of the pre-qualification in environmental management through positioning it as the main practice Green Ltd. Sweden is currently applying for GSCM. According to interviewee B, similar to Finland, the process is also used as a tool for introducing the key areas of interest in terms of environment, safety and ethics to all actors who wish to cooperate with Green Ltd. Sweden. However, the process and the environmental section of it are more advanced than in Finland. In Sweden, there are more questions on environmental aspects. For example, the suppliers' capabilities on LEED and BREEAM projects are mapped and their tendency to conduct green risk assessments are asked. However, the major difference is related to the categorization based on the answers. Whereas in Finland, a supplier can get a status of either "accepted" or "not approved", in Sweden the tool is used for sorting the suppliers into four separate categories. All of the environmental questions are valued so high that if the supplier does not meet even one of the requirements, it will not be considered as an acceptably prequalified supplier. Furthermore, a supplier can get a special marking to its company details in the procurement system, if it gets a high grading in the environmental questions:

"The idea is to identify the best suppliers [in green], which can for example help us to win the LEED projects or other projects that want to go further with environmental aspects. Initially the idea would be that we could really filter the suppliers based on the environmental questions, promote the best ones, and in the end lift them as our preferred or key suppliers. We might not be there yet but that is the direction."
(Interviewee B)

Certainly, the features included in the pre-qualification tool of Green Ltd. Sweden have made it significantly easier to manage the green issues of suppliers. Furthermore, as the tool is even used for excluding the underperformers, it meets the definition of Govindan et al. (2015) on green supplier selection as they state that it is a tool used for screening and selecting those suppliers as business partners who have the capability and competence to operate within the organization-specific environmental requirements.

Secondly, as presented in the case company description, Green Ltd. Finland is currently applying different supplier development tools. Of these, the supplier audits and the

process for collecting supplier feedback from the projects are the most significant ones. The data collected from these practices is used for supplier development, improving supplier cooperation and spotting the performance deviations at the company's construction sites and supplier base. Green Ltd. Sweden has very similar practices in place and especially the process for audits is basically identical. However, the process for supplier development through giving feedback is more developed in terms of green aspects in Green Ltd. Sweden. According to interviewee B, in Green Ltd. Sweden, they have included an environment specific question to their supplier feedback form, where they ask the projects to evaluate the supplier's overall capabilities in environmental aspects (e.g. recycling, material decisions, environmental risk management). In Finland, the environment point of view is basically lacking totally from the supplier feedback and development process. Thus, the formalized process Green Ltd. has set up for supplier development basically neglects the environmental development completely whereas in Sweden, the green aspects are risen alongside the other development areas.

According to interviewee B, another existing best practice is the fact that Green Ltd. Sweden has already gained some experience in developing mutual environmental product innovations with the suppliers. Furthermore, he stated that in the future these development projects would become even more common, as for example the carbon targets cannot not be reached without the suppliers' input. Thus, to name some, Green Ltd. Sweden is currently working with cement suppliers to find a low-carbon cement and with window suppliers to come up with more energy efficient solutions. Furthermore, interviewee B elaborated the reasoning for the increasing interest towards supplier development:

"We do development with suppliers quite a lot in some areas because we see that we are kind of in the hands of our suppliers. So, if we want to develop our product to be greener, we need to control the material flow. We can do that by finding a new supplier and maybe even import the product from somewhere in the world and the product still might not be good in the end. Or we can work together with suppliers we already have and together find ways of having a better product. That might even be cheap as the product is built based on our requirements but the development costs are on the supplier." (Interviewee B)

Furthermore, an essential aspect highlighted by interviewee B is the fact that this kind of supplier development and collaboration enables a true win-win situation, as Green

Ltd. Sweden with its early desires for green products drives the suppliers to engage in a forerunner product development. At the development phase, the supplier gets a clear customer from Green Ltd. Sweden, and in the end, the development work will position them as a leader in green in their own sector. Thus, this kind of a setup should be used as a base for a deeper supplier collaboration and development.

Interviewee C also pinpointed that one of the current aspirations of Green Ltd. Sweden is to find a better way of utilizing the Environmental Product Declarations (EPDs). Thus, the usage of those might not yet be a fully implemented best practice, but according to interviewee C, it should become one during the upcoming years:

"It is a good tool but we still need to get a better understanding how we can use it because now it is still a little here and there." (Interviewee C)

Both interviewees B and C further elaborated that Green Ltd. Sweden also has several internal best practices that help in taking the GSCM initiatives forward. Interviewee C stressed the importance of different steering groups that are used for developing the different green goals. Furthermore, he mentioned the internal educations on environmental issues that are held even in the project level, as a key aspect to the implementation of the green value base in the organization. Furthermore, interviewee B highlighted the close cross-functional collaboration Green Ltd. Sweden is deploying. According to interviewee B, the good relations between the procurement unit and the green team is highly beneficial as the professionals of both sectors can combine their knowledge and thus come up with ideas that consider both the supply chain and the green aspects in a realistic way. Additionally, interviewee B stated that in order to become and preserve a leader position in GSCM, it is important to form good relations to the national construction sector, as it gives the insights on what to prioritize and what can be expected in terms of green:

"To be able to put the right things and aspects to the tools, we need to do our homework and actually have a dialogue with the Swedish construction sector. That helps in prioritizing and defining the areas that should be developed and to see what is needed in a bigger scope and not just by Green Ltd. Sweden. Also, we cannot do everything alone, so that's why it is important to communicate with other big builders." (Interviewee B)

Finally, interviewee B concluded that in the end the success of the GSCM depends heavily on how well the organization succeeds in connecting the tools with the business

and contract requirements. He further stated that in Sweden Green Ltd. has managed well with finding this kind of a linkage. The importance of connecting the GSCM practices with other business requirements comes from the fact that if the tools seem separate to the suppliers they will see them as just extra work that brings no additional value. According to interviewee B, at that point even the high quality of the tool might not lead to successful implementation:

"Even the best tools might flop if you fail to connect them with the business."
(Interviewee B)

Best practices from Green Ltd. UK

During the interview conducted with the director of procurement and supply chain of Green Ltd. UK, it became obvious that they have several innovative and advanced GSCM practices in place. Indeed, interviewee A himself pointed out that out of all subsidiaries of Green Ltd., the one located in UK is a clear forerunner in green procurement practices. Thus, it is evident that they utilize the similar pre-qualification and supplier development tools that are used in Sweden and in Finland. Furthermore, their leader position in green means that the environmental aspects are naturally considered in them. Hence, these more generic tools are not discussed in this section of the chapter. Rather, this section is used for discussing the more distinctive and advanced practices for finding true inspiration for Green Ltd. Finland.

The first best practice identified from the interview with interviewee A, is the Balanced Scorecard approach to procurement Green Ltd. UK is currently applying in some of the purchases. In short, interviewee A described it as having a weighting to the sustainability factors when making procurement decisions. Basically, it means that in the tendering phase the suppliers' proven environmental capabilities are truly included in the decision-making process by giving them a scoring that together with the price will form the ultimate markings for the suppliers. The weighting and the areas to be weighted can be determined based on the customer demands and other requirements needed in different situations. Thus, when making the purchasing decision, the comparison between the suppliers will not be based purely on price as the comparable scorings include other aspects as well:

"If you have got key factors, make sure that there is a weighting for those. Then it is not just looking for the rock bottom price but rather including our sustainability values to our procurement." (Interviewee A)

So, in a sense Green Ltd. UK is utilizing to separate processes for Green Supplier Selection as it has the pre-qualification process to ensure that the company specific and legal requirements are met by all of the used suppliers, and the more specific needs are ensured through the balanced scorecard approach.

The second best practice from Green Ltd. UK is an education program directed to the suppliers called the Supply Chain Sustainability School. According to interviewee A, it is basically an extensive competence development tool that was founded in 2012. Currently, the tool is run by 65 partner members who pay around 10 000 pound a year to keep the school going. The starting point for the school is a self-assessment on 10 different sustainability themes the suppliers are asked to do. Those assessments are then used in determining the starting level for the suppliers' capabilities and giving a modified action plan that aids them in moving forward with the sustainability aspects. The actual school consists of different free contents that the suppliers can use when aiming to upskill their competences. Furthermore, the SCSS is not all about e-learning as Green Ltd. UK also organizes different kinds of sustainability seminars every year. Interviewee A, himself stressed this practice as one of the main GSCM tools they are currently applying in Green Ltd. UK:

"This is a great tool as it is a carrot rather than a stick. It is also totally voluntary for the suppliers and it is supplier driven, meaning that they can develop at their own pace. I think this has been one of the reasons for the popularity – we have 24 000 supply chain members with an access to the school every year." (Interviewee A)

Interviewee A further stressed that one of the main benefits the utilization of the SCSS tool has revealed is its great potential in developing the smaller organizations with fewer resources. Interviewee A stated that the education process has also revealed that sometimes the fear of resistance from the smaller suppliers is actually totally unnecessary as they may have significant prospects in developing their operations within a very short time-frame when just giving them the chance:

"What we have actually found is if an organization that only got 10 people, wants to change from being a traditional business into a sustainable business and they want to

use the school to change that, the owner of that company can decide to do that and they can start their journey towards sustainability the next day." (Interviewee A)

The third identified best practice from Green Ltd. UK is related to finding innovative suppliers with whom a closer collaboration could be considered. As stated by Schiele et al. (2012), collaboration is one of the best ways of gaining an access to the supplier innovations. According to interviewee A, this has been recognized in Green Ltd. UK and some years ago, they created a so-called Supply Chain Green Solutions Award system:

"Basically through this we get 50 to 60 innovative products put forward through our supply chain and then we pick a winner for the award. What it does is that it highlights some of the green or carbon efficient products that are out there that we could actually use. Also, not only the winner products are used but the best ones can be communicated to our projects. This also generates good energy in the supply chain as there is some competition that often pushes the organizations to go further." (Interviewee A)

Furthermore, interviewee A elaborated that these innovative products are archived in the Intranet of Green Ltd., so they can be accessed by all employees of the organization. Thus, if properly marketed within Green Ltd., the innovations can be used by a wide selection of Green Ltd. employees. Furthermore, interviewee A stated that the award has been a great way of spotting the suppliers who show potential in innovativeness. Hence, a closer collaboration with those suppliers can be considered with a longer timeframe in mind.

According to interviewee A, Green Ltd. UK has also a few other tools that they are developing for improving the process of supplier collaboration and development. The other tool is a so-called Supply Chain Collaboration Portal, which basically is an interactive group page in the Intranet of Green Ltd. The page is used for sharing information around, for example, tenders and new collaboration initiatives so the employees of Green Ltd. could discuss best practices with each other. The other tool is still at the development phase but the basic idea behind it is to create a more structured way for developing the supplier relationships. According to interviewee A, the idea is to build more functioning cooperative supplier relationships than there currently are:

"The idea is that you should meet with the selected suppliers at least every quarter and create a formal relationship plan with them. This aids our procurement people to expand their relationship thinking to be longer, even from 3 to 5 years. Also, the idea

is that the suppliers feel special because we are investing so much time in them. That could help in developing the relationships to be closer." (Interviewee A)

Finally, interviewee A concluded that the GSCM tools are a good way of guiding the sustainability work within the procurement operations. However, he stressed that in the end the successfulness of the implementation depends heavily on how well the organization succeeds in forming a clear procurement strategy on these areas and connecting these aspects to the other business requirements in the eyes of the suppliers. Hence, according to interviewee A the fact that they have succeeded in this quite well should definitely be accounted as one of their best practices, as it has been one of the factors enabling the implementation of GSCM, since the incoherency and illegibility of organizational strategies are known to be some of the main barriers for successful GSCM implementation in organizations (Berns et al. 2009; Giunipero et al. 2012). Altogether, interviewee A concluded this well in his statement:

"So, the first thing is to make sure that you have a procurement strategy for every bid or window of opportunity and to every operational project from the perspective of procurement. That's the way of going forward with GSCM as it is how you get an acceptance for your green initiatives." (Interviewee A)

4 CONCLUSIONS AND DISCUSSION

The importance of GSCM in construction industry was recognized early on during this research process, and indeed the great role of construction companies, when aiming to respond to the constantly tightening global and national environmental requirements as well as to the increasing environmental demands stemming from customers, was one of the great motives of this research. Furthermore, as the fact that the project-based construction companies have traditionally faced issues when aiming to improve control over their supply chains (Lönggren et al. 2010; Kim et al. 2016) was identified and combined with the issue of lack of tangible frameworks on GSCM (Ashby et al. 2012), a clear research gap was determined. In order to fulfil and find answers to this particular research gap, the main research question was formulated as follows:

RQ: "How can a Finnish construction company develop its Green Supply Chain Management practices?"

In general, it was found that the shift from traditional SCM towards GSCM starts with leaving behind the purely economic approach to business and procurement, as in GSCM the green aspects are risen alongside the financial ones and are appreciated highly when making different business decisions (Beske & Seuring 2014; Svensson 2007). However, many researchers further stress that the idea in GSCM is still not to neglect the economic aspects in organizational decision-making, as in the end the idea is to find solutions from the supply chains that simultaneously comply with environmental, economic and quality requirements of organizations (Igarashi et al. 2013; Zimmer et al. 2016; Govindan et al. 2015; Lu et al. 2007; Handfield et al. 2002). In a practical level, it was found that the development of GSCM in its most basic happens through including new, environment related aspects to the existing supply management tools and practices (Beske & Seuring 2014). Beske and Seuring (2014) even referred GSCM as "SCM-plus", whereas Igarashi et al. (2013) pointed out that a pure add-on approach would not be sufficient, as a successful implementation would also require significant efforts in including green as a solid part of the whole value base and organizational culture of the company. Thus, purely external practices would not be enough to ensure the implementation, meaning that some company's internal actions would also be needed.

In practice, the answer to the first research question is the conducted step-wise guidance for a Finnish construction company on how it could implement GSCM into its procurement operations. The guidance and its different steps are presented and summarized in table 6. The frame for the guidance is mainly based on the GSCM tools that were identified in the theory chapter. It is further complemented with the benchmarked actions the subsidiaries of the case company have taken within the frame of these commonly used GSCM tools. The guidance is completed with a possible supplier response that could be expected if the case company was to take the same tools and practices into use. Furthermore, as it was identified in the second stage of the empirical research that a pitfall that should be avoided when implementing GSCM is trying to do too much at once, the actions are divided into short-, medium-, and long-term development initiatives based on how easily they could be implemented.

1) Green Supplier Selection

One can state that the actions related to improving the GSS of the case company are the most important steps towards GSCM. Many researchers (e.g. Igarashi et al. 2013; Govindan et al. 2015; Lu et al. 2007; Handfield et al. 2002; Zimmer et al. 2016) have highlighted the importance and easiness of GSS in improving and ensuring the basic level of environmental efficiency in the supply chains. Furthermore, it was also identified as the main GSCM tool in the Swedish subsidiary. Thus, developing the GSS practices is something the case company should definitely pursue in short-term basis. The easiest step the case company could take is introducing more environment related questions in its existing pre-qualification survey as well as pinpointing some of those questions as the criteria effecting the pre-qualification status. The new questions could be benchmarked from the subsidiaries or from the extensive framework presented by Humphreys et al. (2003). A good starting point could be increasing the importance of ISO14001 certificate in the used selection criteria. Requiring the possession of the ISO14001 certificate is the most used GSS criterion (Torielli et al. 2011; Giunipero et al. 2012; Handfield et al. 2002) due to its easy integration to the other existing criteria and the basic level of environmental consideration it offers (Jabbour & Jabbour 2009). Furthermore, according to the survey results, it is already very common to have the certificate, which would indicate that even if more value were given to this criterion, the pre-qualification would not become too exclusive.

Table 6: The guidance for GSCM implementation (GSCM practices)

GSCM Practice	Short-term development	Medium-term development	Long-term development	Supplier response?
1) Green Supplier Selection	More environment driven questions			
	Including green in the selection criteria / pre-qualification status			e.g. 95% had determined strategic environmental goals/ 79% has ISO14001 certificate
		Rating based on environmental capabilities		*Look above*
		BSC approach		e.g. 79% calculated the carbon footprint / 84% conducted their own GSS
			Including EPDs	Only 21% of the suppliers had these
2) Environmental segmentation			Implementation	
3) Supplier development	Including green in supplier feedback process			95% aim to improve environmental efficiency/ 90% interested in cooperative development
		Supply Chain Sustainability School		85% felt that further training is needed / 90% were interested in joining Green Ltd.'s trainings
			Investment and resource transfer	
			Management and organizational practices	90% interested in cooperative development
4) Supplier collaboration	Supplier relationship development program			90% interested in cooperative development / 79% interested in deep collaboration,
	Supply Chain Green Solutions Award			95% of the suppliers aim to improve environmental efficiency through innovations
			Collaborative green product development / innovations	79% interested in deep collaboration, 21% not interested
5) Other (internal practices)	Internal education			-
	Utilization of cross-functional knowledge			-
	SC Collaboration portal			-
	Developing the cooperation in the construction sector			-
	Procurement strategy with environmental agenda and clear link to the business requirements			-

Expanding the ratings of the suppliers in the e-procurement system based on their capabilities determined in the pre-qualification, the same way as in Green Ltd. Sweden, is also something that should definitely be pursued in the GSS development. However, as it might require some alterations in the systems, it is defined as a medium-term development initiative. Furthermore, the Balanced Score Card approach to procurement utilized in Green Ltd. UK is also a great development initiative. For example, the tool could be used for improving the carbon footprinting of the projects,

which is an upcoming trend in Finnish construction industry (Finnish Environment Institute 2012), through increasing the utilization of suppliers who track down their carbon emissions. The survey research indicated that at least among the FWA suppliers it is already rather common to conduct carbon footprintings, which would indicate that potential suppliers would be available even with this kind of a stricter selection method. However, as setting up the process for giving scores for such environmental practices and implementing the practices and the ideology behind it might take a while, this is considered a medium-term development initiative.

Finally, it seems that the goal of Green Ltd. Sweden in better utilizing the EPDs is currently not as applicable development area in Finland, as it seems to be rather rare to have those declarations. However, due to the holistic overview that the declaration offers on the environmental aspects of the suppliers' products, the utilization should not be dismissed. Hence, the declaration could be easily included as a new question to the pre-qualification survey, but in the short-term the information should not be used as an aspect influencing the suppliers' pre-qualification status, since that approach could be too exclusive.

2) Environment driven supplier segmentation

Supplier segmentation is not a new concept in the case company as they have a piloting project regarding that going on. Also the subsidiaries of Green Ltd. have similar segmentation activities in place. However, these models cannot be considered as similar environmental segmentation tools that were presented in the theory chapter by Pagell et al. (2010) or Krause et al. (2009). As the implementation of even the traditional segmentation model is still at the piloting phase in Green Ltd., the implementation of an environmental one should be considered as a long-term development initiative. As it seems that the subsidiaries cannot be benchmarked in terms of this tool, inspiration should be sought from the existing academic research when the implementation becomes topical.

Even though, the implementation of environmental segmentation might not be one of the first GSCM development areas at Green Ltd., it definitely should not be neglected nor forgotten. The importance of the tool is related to the fact that the one-size-fits-all approach should also be avoided when constructing GSCM strategies, as according to Keating et al. (2008) it is a waste of resources when using significant amount of resources in greening the business practices of incompetent suppliers.

3) Environmental supplier development

Several development areas in terms of improving the environmental supplier development practices of Green Ltd. were identified throughout this study. The clearest step is to include environmental aspects in Green Ltd.'s supplier feedback process in a similar way as in its subsidiaries in Sweden and in UK. According to Fu et al. (2012) and Wagner and Krause (2008), performance assessments and formal processes for both giving feedback and setting improvement targets are an important area of environmental supplier development, and just by adding in the environmental question in the feedback process, both of these aspects would be initiated. Furthermore, one can state that it seems that the suppliers would also be very interested in hearing about their environmental performance and further developing it based on the feedback given by Green Ltd., as 95% of the responded suppliers had goals for improving their environmental performance and 90% were interested in executing the improvement in cooperation with Green Ltd.

As it was stated by Fu et al. (2012) and Keating et al. (2008) not all potential suppliers are able to improve their environmental performance on their own as embracing GSCM may represent a significant change in the supplier's business practices. Thus, a medium-term development initiative in terms of environmental supplier development tools could be the implementation of Supply Chain Sustainability School benchmarked from Green Ltd. UK. Offering free education prospects for the smaller suppliers is just what Fu et al. (2012) proposed when stating that the larger actors in the supply chains should offer support and get involved in developing the green capabilities of those suppliers. The interest and need of suppliers towards such tool is clear, as 85% of the suppliers felt that additional training in environmental issues is still needed in their organizations and 90% of the suppliers were interested in participating if Green Ltd. was to offer environmental such education programs. However, one must state that the implementation of the tool in the same extent as in Green Ltd. UK is unlikely, as acquiring as extensive a collaboration partner network requires significant amount of resources and takes a lot of time. However, as Green Ltd. Finland already has an existing tool for e-schools directed to suppliers, the implementation of the tool in a smaller scale could be done rather easily and even in quite short a time frame.

Furthermore, it should be noted that even in the subsidiaries, that were benchmarked due to their maturity in terms of GSCM, all the environmental supplier development practices are related to the first category of supplier development (*green knowledge transfer and communication*) identified by Fu et al. (2012) and Dou et al. (2015). Thus, the implementation of the supplier development actions in the two following categories (*investment and resource transfer & management and organizational practices)* seems quite far away. However, practices from these categories such as developing an incentive system for suppliers to improve in environmental efficiency or conducting long-term contracts with environmental targets (Dou et al. 2015; Fu et al. 2012) should not be forgotten even though they are not implemented in the subsidiaries. This is because ideally an organization with fully implemented GSCM toolbox, would use practices from all of the above-mentioned categories as together they offer the most effective supplier development results in the supply chains. Furthermore, the high interest of suppliers in cooperative development (90%) would back up the successful implementation of the more demanding development practices.

4) Environmental collaboration

It was found in the research that regardless of the difficult implementation of supplier collaboration (Whipple & Frankel 2000; Torielli et al. 2011) it should definitely be pursued by organizations, as it is the most significant enabler of the benefits attainable through GSCM (Mello et al. 2017, Vachon & Klassen 2008; Laari et al. 2016; Gilbert 2000). An easy step towards developing the environmental collaboration at Green Ltd. would be the implementation of a similar supplier relationship development program that has been initiated in Green Ltd. UK. In a project-based construction industry, an essential success factor of different SCM practices is developing ways to lengthen the time perspective of the supplier relationships that otherwise would be short term (Kim et al. 2016; Bemelmans et al. 2012), which is not an optimal base for supplier collaboration. Thus, the main benefit of the development program is the initial starting point for the supplier relationship as there are at least three to five years to build up the collaboration. Furthermore, the regular meetings and clear goals set for the development of the relationship are all practices that are in line with the supplier collaboration success factors presented by Whipple and Frankel (2000). Thus, an implementation of such development program could positively influence the success of the collaboration and decrease the risk of failure, which indeed is as high as 70 to 80 percent (Whipple & Frankel 2000; Kumar 2012). Furthermore, it seems that this kind of

a supplier development program could interest the suppliers of Green Ltd. as 79% of the respondents were interested in developing an environmental collaboration with Green Ltd.

The second rather easily implementable GSCM development practice related to supplier collaboration would be initiating the Supply Chain Green Solutions Award benchmarked from Green Ltd. UK. The suppliers that responded the survey showed high interest towards environmental innovativeness as 95% of the respondents stated that they aim to improve their environmental performance through innovations. This would indicate that the suppliers might be interested in participating in such a competition, which could inspire them to go further with their environmental innovativeness. Furthermore, as the idea behind the award is that Green Ltd. implements at least the best solution at its projects, the practice follows nicely the preferable supplier cooperation setup presented by the representative of Green Ltd. Sweden, where the supplier gets a clear customer out of Green Ltd. while simultaneously developing itself towards a market leader position in its own sector. The implementation of this practice could also be an easy step towards identifying potential collaboration partners. Moreover, the yearly environment weeks held at Green Ltd. Finland could offer a great, already existing forum for such awarding competition.

Finally, as one of the main benefits supplier collaboration may enable in terms of GSCM is the access to environmental supplier innovations (Schiele 2012; Nidumolu et al. 2009), it would be essential for Green Ltd. to familiarize itself with the successful green product development and innovation processes Green Ltd. Sweden has already completed. By learning from their successful collaborative product development cases, it could be easier to copy the same operational model for Finland as well. A concern related to the applicability of the Swedish practices in the Finnish context was raised in one of the interviews due to the differing maturity levels of suppliers in green. Indeed, partner compatibility is one of the success factors of supplier collaboration (Whipple & Frankel 2000), and if the high environmental ambitions of Green Ltd. would not align with the maturity level of the Finnish suppliers, it might mean that collaborative green product development would not be attainable straight away in Finland. However, the results of the survey research would indicate that the majority of Green Ltd.'s FWA suppliers would align with these environmental ambitions as 89% of the respondents stated that environmental issues are highly appreciated in their corporate values.

Furthermore, 53% of the respondents had a good knowledge level and 37 % an excellent knowledge level on environmental issues, indicating that capabilities for such collaborative development work could already exist.

5) Other (internal practices)

As said, according to Igarashi et al. (2013) and Beske and Seuring (2014), the implementation of GSCM cannot be executed purely by just adding on the green perspectives to the already existing SCM practices, but rather some internal actions must also be taken to ensure the implementation of the whole ideology in the organizational level. Indeed, both subsidiaries that were benchmarked named some of these internal practices as their best practices in GSCM. Especially the importance of internal educations on GSCM and its benefits was highlighted, which aligns with the arguments made by Berns et al. (2009) who state that if the strategy and the concept of GSCM as a whole is unclear, the implementation may be endangered, as the employees do not understand their role on the process, which then decreases the motivation of the actual implementation. Furthermore, the utilization of both cross-functional and cross-sector collaboration was highlighted. Finally, a highly pinpointed internal practice that takes the implementation of GSCM forward was conducting a clear procurement strategy for all the actions to be taken and ensuring that they are closely linked with the other business requirements. This decreases the incoherency of the green strategies, which in turn supports the successful implementation process (Giunipero et al. 2012).

SQ1) Why should companies engage in GSCM practices?

The aim of the first sub-question was to ensure that the drivers for the implementation of the guidance presented earlier would be identified. It is clear that the implementation of the guidance will require significant allocation of resources making it vital to understand why that is beneficial and worth the efforts. Furthermore, it was also important to see why the suppliers thought the green approach would be beneficial for them. The drivers were first investigated from the existing academic literature and based on the findings they were divided into five categories (monetary benefits, society, customers, competition and suppliers). Then, they were further addressed the empirical research. The identified drivers are summarized in table 7. As the drivers were identified from both the point of Green Ltd.'s subsidiaries as well as Green Ltd.'s suppliers, the

point of view is further elaborated in the table. In addition, the alignment of the drivers to the academic literature that was presented in the theory chapter is further illustrated in the table.

As can be seen from table 7, there are several drivers that would encourage Green Ltd. to implement the GSCM guidance. Furthermore, table 7 further indicates that the drivers identified in the empirical research align strongly with the theoretical findings of this research. Moreover, in the subsidiaries of Green Ltd., different drivers are identified from all of the categories that were determined in the theory. This kind of a holistic point of view to the attainable benefits should be embraced in Finland throughout the implementation process as well, as only then is the big picture of all the gains of GSCM out in the open.

Table 7: The drivers of GSCM implementation from the empirical research

#	Driver	In accordance with	Point of view
		Monetary benefits	
1	Profiling as a sustainable organization	*Pil & Rothenberg (2003); Walker et al. (2008)*	Green Ltd.
2	Cost efficiency	*Handfield et al. (1997); Gilbert (2000); Walker et al. (2008); Carter & Dresner (2001); Green et al. (1996); Hervani et al. (2005)*	Green Ltd. / Suppliers
3	New business opportunities	*Gilbert (2000)*	Suppliers / Green Ltd.
4	Optimization of logistics	*Azevedo et al. (2012)*	Suppliers
5	Better risk management	*Jabbour & Jabbour (2009)*	Green Ltd.
		Society	
6	Pressure from society	*Giunipero et al. (2012); Berns et al. (2009); Handfield et al. (1997; Green et al. (1996)*	Green Ltd.
		Customers	
7	Increasing demands of the customers	*Seuring & Müller (2008); Walker et al. (2008) Green et al. (1996); New et al. (2000)*	Green Ltd. / Suppliers
		Competition	
8	Competitive advantage	*Zhu et al. (2008); Walker et al. (2008); Gonzales-Benito & Gonzales-Benito (2005); Cosimato & Troisi (2015); Tseng (2014); Al-Abdallah et al. (2014)*	Green Ltd.
9	Responding to development of other industries	*Walker et al.(2008); Giunipero et al. (2012)*	Green Ltd.
		Suppliers	
10	Green goals unreachable without suppliers	*Krause et al. (2009); Seuring & Müller (2008); Kim et al. (2016)*	Green Ltd.

Furthermore, most of the drivers identified at the subsidiaries of Green Ltd. are related to the monetary benefits of GSCM, which is not very surprising as it aligns with the statements of Giunipero et al. (2012) on economic aspects being the most critical driver for the implementation of sustainable procurement practices. Moreover, also almost all of the main benefits that the suppliers themselves related with environmental improvement were related to gaining positive economic profits as a result. However,

this would indicate that the FWA suppliers of Green Ltd. lack the big picture of the attainable benefits. Additionally, GSCM as a tool for gaining competitive advantage in relation to the competitors was highly appreciated in the subsidiaries of Green Ltd., and indeed as stated by Zhu et al. (2008) in today's environmentally aware business environment GSCM should be considered as a very potential source of competiveness. Finally, Carter and Dresner (2001) state that often the role of suppliers as a GSCM driver is not that important but they rather act as a supportive influencer for the implementation. However, the role of suppliers as a driver for GSCM was seen from a bit different point of view in the subsidiaries: As in many cases, the goals and targets set for the green procurement practices are completely unreachable if the environmentally aware suppliers cannot be identified or the potential ones cannot be developed, one can actually state that the suppliers are one of the key drivers of GSCM.

SQ2) What are the barriers for the implementation of GSCM?

As a certain complexity of GSCM was recognized early on during this research process, it became clear that an essential part of the guidance as a whole would also be recognizing the barriers Green Ltd. could face during the implementation process. Furthermore, it was also acknowledged that it would be beneficial to understand what are the main barriers Green Ltd.'s suppliers link with developing their business operations into a greener direction. The investigation process for the barriers was the same as the one with the drivers. It started with an extensive assessment of the current literature on the topic, based on which the barriers were categorized into six groups (lack of consistency on the corporate strategy, costs, lack of knowledge, lack of supplier cooperation, fear of image risks, and industry/context specific barriers). The barriers were further addressed the empirical research. The identified barriers are listed in table 8, and again their alignment with the researched academic literature, and the point of view (Green Ltd. / suppliers) are further indicated in the same table.

As can be seen from table 8, there are even more identified barriers than drivers for GSCM, which gives some indication of the complex nature of green procurement operations. Furthermore, just as the drivers, also the identified barriers highly align with the researched literature. However, there was a bit more variation between the theory and the empirical research as some of the barriers were only identified in the empirical

research. On the other hand, the barrier related to the fear of image risks was pinpointed by none of the interviewees nor the suppliers.

As specified in table 8, the majority of the identified barriers are located in the group of lack of consistency in corporate strategy, which would indicate of the importance of corporate planning when it comes to implementing GSCM practices. In addition, the barrier related to costs was highlighted by both the subsidiaries of Green Ltd. as well as the FWA suppliers, which is not surprising as cost efficiency has been a traditional indicator of performance (Luthra et al. 2011) and it is logical to see the inevitable implementation costs and probable higher raw material prices (Giunipero et al. 2012; Luthra et al. 2011) as a threat to this measurement practice. However, in accordance with Hervani et al. (2005) and Walker et al. (2008) the too short a time-scale, which can be stated to be one of the main sources of this barrier, was recognized at least by the subsidiaries of Green Ltd.

Table 8: Barriers of GSCM implementation from the empirical research

#	Barrier	In accordance with	Point of view
Lack of consistency in corporate strategy			
1	Lack of mandate from top management	*Luthra et al. (2014); Giunipero et al. (2012); Berns et al. (2009); Min & Galle (2001); Luthra et al. (2011)*	Green Ltd.
2	Not including green as a part of the existing SCM	*Beske & Seuring (2014); Svensson (2007)*	Green Ltd.
3	Trying to do too much at once		Green Ltd.
4	Too short a time scale	*Hervani et al. (2005); Carter & Dresner (2001); Giunipero et al. (2012); Walker et al. (2008)*	Green Ltd.
Costs			
5	Increasing costs	*Luthra et al. (2014); Walker et al. (2008); Giunipero et al. (2012); Min & Galle (2001); Luthra et al. (2011)*	Green Ltd. / Suppliers
6	Too short a time scale	*Hervani et al. (2005); Carter & Dresner (2001); Giunipero et al. (2012); Walker et al. (2008)*	Green Ltd.
7	Logistics		Suppliers
Lack of knowledge			
8	Lack of knowledge on environmental aspects in the company	*Luthra et al. (2014); Gilbert (2000); Walker et al. (2008); Carter & Dresner (2001)*	Suppliers
9	Benefits unclear for the projects	*Berns et al. (2009)*	Green Ltd.
10	Internal resistance		Green Ltd.
Lack of supplier cooperation			
11	Resistance from (small) suppliers	*Fu et al. (2012)*	Green Ltd.
12	Too complex systems and processes		Green Ltd.
13	Increasing pressure caused for the suppliers	*Walker et al. (2008); Fu et al. (2012)*	Green Ltd.
Industry and context specific barriers			
14	Cultural differences	*Walker et al. (2008)*	Green Ltd.
15	Unsustainable clients / Lack of demand	*Green et al. (1996); Walker et al. (2008); Zhu & Sarkis (2006); Luthra et al. 2011)*	Green Ltd. / Suppliers

Furthermore, most deviations between the findings in the theory and in the empirical research are found from the barrier related to the lack of supplier cooperation. Igarashi et al. (2013) and Walker et al. (2008) state that in many cases suppliers might consider their environmental information as confidential and would therefore be reluctant to cooperate. However, at least the majority of supplier respondents of the survey for this research were very open about their environmental practices and values. Furthermore, the results of the survey research also indicated that the different value bases (Mudgal et al. 2010; Luthra et al. 2011) would not be causing significant reluctance towards environmental cooperation, at least with the FWA suppliers, as the suppliers also seemed to value the environmental aspects of their business very high. On the other hand, in the theory the increasing pressure the growing interest in environmental issues is causing for the suppliers was not that highly stressed, whereas the interviewees stressed this as one of the main barriers of GSCM, as it might easily cause reluctance towards the environmental cooperation. Furthermore, it was highlighted that the design of the systems and process should be seriously considered when developing the GSCM practices, as Green Ltd. should try to help in decreasing the workload caused by the increasing pressure towards suppliers, not making the situation more difficult.

Finally, the barrier caused by the lack of knowledge should not be underestimated. Both suppliers and the subsidiaries of Green Ltd. brought this up in some level, and so did Luthra et al. (2014), Gilbert (2000) and Walker et al. (2008). Furthermore, even though one of the drivers of GSCM identified by the suppliers was the monetary benefits it might bring, in the end only a few of the suppliers who responded the survey truly had the knowledge on the financial possibilities of GSCM. Thus, education should be offered to both the employees of Green Ltd. as well as the suppliers at least on the monetary benefits and the longer time perspective needed for their realization, as in the end the financial aspects are currently the most significant aspect encouraging companies and its suppliers to engage in GSCM (Giunipero et al. 2012).

4.1 Reliability, validity and limitations of the research

To a large extent, the quality of a research can be determined based on its reliability and validity (Hirsjärvi et al. 2007). Reliability refers to the extent to which the research may be repeated with the same outcome (Stuart et al. 2002). According to Stuart et al. (2002), reliability of a case study can be enhanced in two ways: 1) by using a case study protocol and 2) by maintaining a case study database, from which the notes may be

easily retrieved, which would allow another researcher to repeat the research. The reliability can also be increased by triangulation, which refers to combining different methods and point of views in the research (Tuomi & Sarajärvi 2002, 141-142). Validity of a research can be separated into external and internal validity, where the former one refers to the generalizability of the research and the latter one to the fact whether the research measures what was intended (Metsämuuronen 2003, 86).

The external validity and generalizability of this research are negatively affected by the initial decision of choosing the case study as the research method, as the nature of the method leads to low generalizability. Furthermore, the fact that all of the suppliers that responded the survey have a FWA with Green Ltd. means that the results cannot be straightforwardly applied in the whole supplier base. Moreover, regardless of the efforts to increase the response rate, it still remained 38% meaning that the supplier point of view should be considered with a certain reservation as it is based on only 19 responses. However, as the total amount of FWA suppliers is only around 50, those 19 give somewhat good representation of that scope of suppliers. Finally, it should also be considered that Green Ltd. is a significant client for the FWA suppliers, which might have influenced their responses to be more positive, as it can be expected that they would like to be seen as a potential partner when pursuing the green ambitions.

The internal validity of the research is better. As the initial aim of a case study is not to find wide generalizable results but rather deeply understand the case, it can be stated that that goal is reached in this study. The deep understanding is attained through the extensive theoretical base, the high expertise of the interviewees as well as through the wide approach gained by including the supplier point of view as well. Furthermore, as the FWA suppliers often are the target in all kinds of piloting projects initiated within the centralized procurement unit, at this point the lack of generalizability to the rest of the supplier base is not an issue. Finally, as the main goal of this study was to produce a practical and usable implementation model, the goal can be stated to be reached as the inspiration for the practices were sought from already successfully implemented actions from subsidiaries where the values and strategy are similar to the case company’s.

The reliability of this research can be stated to be in a good level. The interviews were all recorded and transcribed, meaning that the results of those are not based on the recollection of the researcher. Furthermore, the transcriptions and data from the survey

are all archived, so it would be possible to redo the research. Lastly, the possibility for anonymity in the survey research also increases the reliability as an option for total honesty was offered.

4.2 Managerial implications and suggestions for further research

The results of this research have significant managerial implications for the case company. As the case company currently does not have a mature way of working with GSCM, a step-wise model for the implementation will help substantially in the process and will make the transition from traditional SCM into GSCM easier. Furthermore, as the pressure in the whole construction sector in Finland towards environmental effectiveness is already significant but will expectedly increase in the near future, it is clear that the demands will start to rise internally as well, as the procurement unit does have a clear role in the greening process of Green Ltd. as an organization. Hence, the fact that the procurement unit now has an existing guidance, which can be used as a base for a more environmentally centered supply strategy, will significantly aid it in responding to the internal requirements and demands on environmental efficiency.

The research process also brought up some potential areas for future research. First of all, for the case company it would be beneficial to expand the research in a way that the environmental capabilities in the whole supplier base could be detected. Furthermore, after the implementation of the guidance it would be interesting to research which of the barriers ended up to become the most severe ones and which of the drivers had the biggest role in taking the implementation forward. Finally, in terms of finding a better way of further prioritizing the implementation of the GSCM practices, it would be valuable to find out, which of the tools are truly the most effective in the greening process of the supply chains and why.

4.3 Conclusive summary

In this study, a practical step-wise guidance was conducted for a Finnish construction company on how it could implement GSCM practices into its procurement operations. The supplier point of view was included by assessing the current capabilities and values of the FWA suppliers on environmental issues, which aided in better fitting the guidance into its implementation context. The applicable GSCM practices were investigated in the theory chapter and further inspiration was sought from the subsidiaries of the case

company were the green aspects have already been included to the SCM operations. Furthermore, as the guidance can be considered to consist of both the suggested actions as well as the different aspects that should be taken into consideration, an extensive research on the drivers and barriers of the implementation was conducted.

Overall, it seems that the case company has a great opportunity for successful GSCM implementation, as the change from their existing SCM practices is not that dramatic and the suppliers would seem to be highly interested and capable in moving towards the more environmentally concentrated direction. Furthermore, several of the suggested practices can be implemented in short-term basis meaning that the change towards GSCM can be initiated quite rapidly. However, in the long run also the more demanding practices should be pursued and implemented, as they are the way to reach the more significant improvements in the environmental effectiveness of the procurement unit. The implementation should be driven by highlighting the economic benefits and business opportunities it offers together with pinpointing the need to respond to the increasing demands stemming from different stakeholders. Furthermore, it should be ensured that enough education is offered to both the suppliers and the employees of the company especially on the longer timeframe needed for the realization of GSCM benefits. Moreover, the strategy for GSCM must be conducted carefully so that it connects the practices into other aspects of the business and clearly clarifies the roles of each party. Altogether, by following the proposed guidance, the Finnish construction company has a true possibility to respond to its evident environmental responsibility and thus lead the change within the Finnish construction sector.

REFERENCES

Adetunji, I., Price, A. & Fleming, P. (2008) Achieving sustainability in the construction supply chain. *Proceedings of the ICE – Engineering Sustainability,* 161, 3, 161-172.

Al-Abdallah, G., Abdallah, A. & Hamdan, K. (2012) The Impact of supplier relation management on competitive performance of manufacturing firms. *International Journal of Business and Management,* 9, 2, 192-202

Ashby, A., Leat, M. & Hudson-Smith, M. (2012) Making connections: a review of supply chain management and sustainability literature. Supply Chain Management: An International Journal, 17, 5, 497-516.

Azevedo, S., Carvalho, H., Duarte, S. & Cruz-Machado V. (2012) Influence of Green and Lean upstream supply chain management practices on business sustainability. *IEEE Transactions in Engineering Management*, 59, 4, 753-765.

Bemelmans, J., Voordijk, H., Vos, B. & Buter, J. (2012) Assessing buyer-supplier relationship management: Multiple case-study in the Dutch construction industry. Journal of Construction Engineering and Management, 138, 1, 163-176.

Berns, M., Townend, A., Khayat, Z., Balagopal, B., Reeves, M., Hopkins, M. & Kruschwitz, N. (2009). The business of sustainability. *MIT Sloan Management Review*, 1–82.

Beske, P., & Seuring, S. (2014) Putting sustainability into supply chain management. *Supply Chain Management: an international journal*, 19, 3, 322-331.

Betoni (2012) Vihreä betoni voi puolittaa betonin hiilidiksidipäästöt. [www document]. [Accessed 22.12.2017]. Available: http://betoni.com/wp-content/uploads/2015/09/BET1204_54-55.pdf

Bionova (2017) Tiekartta rakennuksen elinkaaren hiilijalanjäljen huomioimiseksi rakentamisen ohjauksessa. [www document]. [Accessed 13.12.2017]. Available: http://www.ym.fi/download/noname/%7B4B3172BC-4F20-43AB-AA62-A09DA890AE6D%7D/129197

Bowen, F. (2000) Environmental visibility: a trigger for organizational response? *Business Strategy and the Environment,* 9, 92–107.

Bresnen, M. & Marshall, N. (2000) Partnering in construction: A critical review of issues, problems and dilemmas. *Construction Management and Economics* 18, 229-237.

Caniëls, M. & Gelderman, C. (2005) Power and interdependence in buyer supplier relationships: A purchasing portfolio approach. *Industrial Marketing Management* 36, 219-229.

Carter, C. & Dresner, M. (2001) Purchasing's role in environmental management: cross-functional development of grounded theory. *Supply Chain Management*, 37, 3, 12–26.

Cox, A. & Thompson, I. (1997) 'Fit for purpose' contractual relations: determining a theoretical framework for construction projects. European Journal of Purchasing and Supply Management, 3, 3, 127-135.

Cosimato, S. & Troisi, O. (2015) Green supply chain management – Practices and tools for logistics competitiveness and sustainability. *The TQM Journal,* 27, 2, 256-276.

Dadhich, P., Genovese, A., Kumar, N. & Acquaye, A. (2015) Developing sustainable supply chains in the UK construction industry: A case study. *International Journal of Production Economics,* 164, 271-284.

Deng, M. & Xu, W. (2010) A conflict measure model and its application to supplier evaluation under environmental uncertainty. *International Journal of Environment and Pollution*, 42, 359–370.

Dou, Y., Zhu, Q. & Sarkis, J. (2015) Integrating strategic carbon management into formal evaluation of environmental supplier development programs. *Business Strategy and the Environment,* 24, 873-891.

Dubois, A. & Gadde, L. (2000) Supply strategy and network effects – Purchasing behavior in the construction industry. European Journal of Purchasing and Supply Management 6, 207-2015.

Dubois, A., & Pedersen, A. C. (2002). Why relationships do not fit into purchasing portfolio models: a comparison between the portfolio and industrial network approaches. *European Journal of Purchasing & Supply Management*, 8,1, 35-42.

Dyer, J., Cho, D. & Chu, W. (1998) Strategic supplier segmentation: The next "Best Practice" in supply chain management. *California Management Review* 40, 2, 57-77.

EPD International (2017) What is an EPD? [www document]. [Accessed 11.1.2018]. Available: http://www.environdec.com/en/What-is-an-EPD/

Elkington, J. (1997). Cannibals with forks - the triple bottom line of 21s century business. Oxford, Capstone.

European Comission (2017) Nearly zero-energy buildings. [www document]. [Accessed 13.12.2017]. Available: https://ec.europa.eu/energy/en/topics/energy-efficiency/buildings/nearly-zero-energy-buildings

Fahimnia, B., Sarkis, J. & Davarzani, H. (2015) Green supply chain management: A review and bibliometric analysis. International Journal of Production Economics, 162, 101-114.

The Finnish Environment Institute (2012) Elinkaarimenetelmät yrityksen päätöksenteon tukena. *Suomen ympäristö,* 10, 3-90.

The Finnish Ministry of Environment (2017a) Vihreän julkisen talonrakentamisen opas lausunnolle. [www document]. [Accessed 7.7.2017]. Available: http://www.ym.fi/fi-FI/Ajankohtaista/Tiedotteet/Vihrean_julkisen_talonrakentamisen_opas_(43120)

The Finnish Ministry of Environment (2017b) Vihreä julkinen rakentaminen – Suositukset vähähiilisen rakentamisen kriteereiksi. [www document]. [Accesse 13.12.2017]. Available: http://www.ym.fi/download/noname/%7B860FE81D-D521-44CD-B725-FE5E088FF2AB%7D/127996

The Finnish Ministry of Environment (2017c) Kysymyksiä ja vastauksia vähähiilisestä rakentamisesta. [www document]. [Accessed 20.12.2017]. Available: http://www.ym.fi/fi-FI/Maankaytto_ja_rakentaminen/Rakentamisen_ohjaus/Vahahiilinen_rakentaminen/Kysymyksia_ja_vastauksia

Finnish Council of State (2017) Selvitys rakennusten hiilijalanjäljen vähentämisestä valmis. [www document]. [Accessed 7.7.2017]. Available: http://valtioneuvosto.fi/artikkeli/-/asset_publisher/selvitys-rakennusten-hiilijalanjaljen-vahentamisesta-valmis

Fu, X., Zhu, Q., & Sarkis, J. (2012). Evaluating green supplier development programs at a telecommunications systems provider. *International Journal of Production Economics*, 140, 1, 357-367.

Gadde, L.-E. & Dubois, A. (2010) Partnering in the construction industry: problems and opportunities. Journal of Purchasing and Supply Management,16, 4, 254- 263.

Ganguly, I., Bowers, T., Eastin, I. & Cantrell, R. (2013) Role of green building programs in Enhancing the usage of environmentally certified wood in the U.S. residential construction industry. International Journal of Construction Education and Research, 9, 3, 183-202.

Giesekam, J., Barret, J. & Taylor, P. (2016) Construction sector views on low carbon building materials. Building Research and Information, 44, 4, 423-444.

Gilbert, S. (2000) Top forum on green productivity: An integrated summary. *International Green Productivity Association*, 1-6.

Giunipero, L., Hooker, R. & Denslow, D (2012) Purchasing and supply management sustainability: Drivers and barriers. *Journal of Purchasing & Supply Management,* 18, 258-269.

Glass, J. (2012) Engaging small firms in sustainable supply chains: responsible sourcing practices in UK construction industry. *International Journal of Agile Systems and Management,* 5, 1, 29-58.

Gonzalez-Benito, J. & Gonzalez-Benito, O. (2005). Environmental proactivity and business performance: an empirical analysis. *Omega International Journal of Management Science,* 33, 1, 1–15.

Govindan, K., Rajendran, S., Sarkis, J., & Murugesan, P. (2015) Multi criteria decision making approaches for green supplier evaluation and selection: a literature review. *Journal of Cleaner Production*, 98, 66-83.

Green Building Council Finland (2011) Betoni vai puu rakennusmateriaalina? [www document]. [Accessed 21.12.2017]. Available: http://figbc.fi/betoni-vai-puu-rakennusmateriaalina/

Green, K., Morton, B. & New, S. (1996) Purchasing and environmental management: Interactions, policies and opportunities. *Business Strategy and the Environment,* 5, 188-197.

Gualandris, J. & Kalchschmidt, M. (2016) Developing environmental and social performance: The role of suppliers' sustainability and buyer-supplier trust. *International Journal of Production Research,* 54, 8, 2470-2486.

Hall, J. (2001) Environmental supply chain innovation*. Greener Management International*, 35, 105–119.

Handfield, R., Walton, S. V., Seegers, L. & Melnyk, S. A. (1997) Green value chain practices in the furniture industry. *Journal of Operations Management,* 15, 4, 293-315.

Handfield, R., Walton, S. V., Sroufe, R., & Melnyk, S. A. (2002) Applying environmental criteria to supplier assessment: A study in the application of the Analytical Hierarchy Process. *European Journal of Operational Research*, 141, 1, 70-87.

Hernandez, P. & Kenny, P. (2011) Development of a methodology for life cycle building energy ratings. *Energy Policy*, 39, 2779–3788.

Hermawan, A., Marzuki, P., Abduh, M. & Driejana, R. (2017) The sustainable infrastructure through the construction supply chain carbon footprint approach. Procedia Engineering, 171, 312-322.

Hervani, A., Helms, M. & Sarkis, J. (2005) Performance measurement for green supply chain management. *Benchmarking: An International Journal,* 12, 4, 330-353.

Hetterich, J.; Bonnemeier, S.; Pritzke, M. & Georgiadis, A. (2012) Ecological sustainability – a customer requirement? Evidence from the automotive industry. Journal of Environmental Planning and Mnagement, 55, 9, 1111-1133.

Hirsjärvi, S. & Hurme, H. (1985) Teemahaastattelu. 3rd Edition. Helsinki, Kyriiri Oy.

Hirsjärvi, S., Remes, P. & Sajavaara, P. (2007) Tutki ja kirjoita. 13. painos.
Helsinki: Tammi.

Humphreys, P.K., Wong, Y.K. & Chan, F.T.S. (2003) Integrating environmental criteria into the supplier selection process. *Journal of Materials Processing Technology,* 138, 349-356.

Igarashi, M., Boer, L. & Fet, A. (2013) What is required for greener supplier selection? A literature review and conceptual model development. *Journal of Purchasing and Supply Management* 19, 247-263.

Iloranta, K. & Pajunen-Muhonen, H. (2012) Hankintojen johtaminen: Ostamisesta toimittajamarkkinoiden hallintaan. Jyväskylä, Gummerus.

Jabbour, A. B. L., & Jabbour, C. J. (2009) Are supplier selection criteria going green? Case studies of companies in Brazil. *Industrial Management & Data Systems*, 109, 4, 477-495.

Jansen, H. (2010) The logic of qualitative survey research and its position in the field of social research methods. [www document]. [Accessed 29.12.2017]. Available: http://www.qualitative-research.net/index.php/fqs/article/view/1450/2946

Keating, B., Quazi, A., Kriz, A. & Coltman, T. (2008) In pursuit of a sustainable supply chain: insights from Westpac Banking Corporation. *Supply Chain Management: An International Journal,* 13, 3, 175-179.

Kim, M., Woo, C., Rho, J. & Chung, Y. (2016) Environmental capabilities of suppliers for green supply chain management in construction projects. Sustainability, 8, 82, 1-17.

Kiwa Inspecta (2017) Ympäristöjärjestelmän sertifiointi (ISO 14001). [www document]. [Accessed 30.11.2017]. Available: https://www.inspecta.fi/_pdf/fi/ff54717d-6669-4378-9ced-f8392f5b5870/Ymp%C3%A4rist%C3%B6j%C3%A4rjestelm%C3%A4n%20sertifiointi%20%28ISO%2014001%29%20-%20Kiwa%20Inspecta.pdf

Klassen, R. & Vachon, S. (2003) Collaboration and evaluation in the supply chain: The impact on plant-level environmental investment. *Production & Operations Management,* 12, 3, 336–352.

Kovács, G. (2004) Framing a demand network for sustainability. Progress in Industrial Ecology, 1, 4, 397-410.

Kraljic, P. (1983). Purchasing must become supply management. *Harvard Business Review,* 61, 5, 109-117.

Krause, D., Vachon, S. & Klassen, R. (2009) Special topic forum on sustainable supply chain management: Introduction and reflections on the role of purchasing management. Journal of Supply Management, 45, 4, 18-25.

Krausmann, F., Gingrich, S., Eisenmenger, N., Erb, K.-H., Haberl, H., & Fischer-Kowalski, M. (2009). Growth in global materials use, GDP and population during the 20th century. Ecological Economics, 68, 10, 2696–2705.

Kuittinen, M. & le Roux, S. (2017) Vähähiilisen rakentamisen hankintakriteerit. [www document]. [Accessed 18.12.2017]. Available: http://julkaisut.valtioneuvosto.fi/bitstream/handle/10024/80654/YO_2017_Vahahiilisen_rakentamisen_hankintakriteerit.pdf?sequence=1&isAllowed=y

Kumar, T. (2012) Collaborative strategy – The way forward in alliances and joint ventures: A concept note. *The IUP Journal of Business Strategy,* 9, 2, 31-43.

Laari, S., Töyli, J., Solakivi, T. & Ojala, L. (2016) Firm performance and customer-driven supply chain management. *Journal of Cleaner Production,* 112, 1960-1970.

Lintukangas, K., Kähkönen, A-K. & Ritala, P. (2016) Supply risks as drivers of green supply management adoption. Journal of Cleaner Production, 112, 1901-1909.

Lu, L. Y., Wu, C. H., & Kuo, T. C. (2007) Environmental principles applicable to green supplier evaluation by using multi-objective decision analysis. *International Journal of Production Research*, 45, 18-19, 4317-4331.

Luthra, S., Garg, D. & Haleem, A. (2014) Green supply chain management: Implementation and performance – a literature review and some issues. *Journal of Advances in Management Research,* 11, 1, 20-46.

Luthra, S., Kumar, V., Kumar, S. & Haleem, A. (2011) Barriers to implement green supply chain management in automobile industry using interpretive structural modeling technique – An Indian perspective. *Journal of Industrial Engineering and Management,* 4, 2, 231-257.

Lönngren, H.-M., Rosenkrauz, C. & Kolbe, H. (2010) Aggregated construction supply chains: success factors in implementation of strategic partnerships. Supply Chain Management: An international Journal,15, 5, 404-411.

Mello, T., Eckhardt, D. & Leiras, A. (2017) Sustainable procurement portfolio management: a case study in a mining company. *Production,* 27, 1-15.

Metsämuuronen, J. (2003) Tutkimuksen tekemisen perusteet ihmistieteissä. 2nd Edition. Jyväskylä, Gummerus.

Min, H., & Galle, W. P. (2001). Green purchasing practices of US firms. *International Journal of Operations & Production Management*, *21*, 9, 1222-1238.

Min H. & Galle, WP. (1997) Green purchasing strategies: trends and implications. Journal of Supply Chain Management, 33, 3, 10–17.

Min, H. & Kim, I. (2012) Green supply chain research: past, present, and future. *Logistics Research,* 4, 1-2, 39-47.

Moeller, S., Fassnacht, M. & Klose, S. (2006) A framework for supplier relationship management (SRM). Journal of Business-to-Business Marketing, 13, 4, 70-71.

Monczka, R. M., Petersen, K. J., Handfield, R. B., & Ragatz, G. L. (1998) Success factors in strategic supplier alliances: the buying company perspective. *Decision Sciences*, 29, 3, 553-577.

Mudgal, R.K., Shankar, R., Talib, P., & Raj, T. (2010). Modeling the barriers of green supply chain practices: an Indian perspective. *International Journal of Logistics Systems and Management*, 7, 1, 81-107.

Nasir, M., Genovese, A., Acquaye, A., Koh, S. & Yamoah, F. (2017) Comparing linear and circular economy supply chains: A case study from the construction industry. International Journal of Production Economics, 183, 443-457.

New, S., Green, K., Morton, B. (2000) Buying the environment: The multiple meanings of green supply. In: Fineman, S. (Ed.), The Business of Greening. Routledge, London.

Nidumolu, R., Prahalad, C.K., Rangaswami, M.R. (2009) Why sustainability is now the key driver of innovation. *Harvard Business Review*, 9, 57–64.

Nielsen, I. E., Banaeian, N., Golińska, P., Mobli, H., & Omid, M. (2014) Green supplier selection criteria: from a literature review to a flexible framework for determination of suitable criteria. *Logistics operations, supply chain management and sustainability*, 79-99. Springer International Publishing.

Nyaga, G., Whipple, J. & Lynch D. (2010) Examining supply chain relationships: do buyer and supplier perspectives on collaborative relations differ? Journal of Operations Management, 28, 101-114.

Olsen, R. & Ellram, L. (1997) A Portfolio approach to supplier relationships. *Industrial Marketing Management* 26, 101-113.

O'Neall, C. & Haraburda, S. (2017) Balanced scorecards for supply chain management. *Defense AT&L,* 2-6*.*

Pagell. M., Wu, Z. & Wasserman (2010) Thinking differently about purchasing portfolios: An assessment of sustainable sourcing. *Journal of Supply Chain Management,* 46, 1, 57-73.

Pasanen, P., Korteniemi, J. & Sipari, A. (2011) Passiivitason asuinkerrostalon elinkaaren hiilijalanjälki. [www document]. [Accessed 21.12.2017]. Available: https://media.sitra.fi/2011/12/19145441/Selvityksia63.pdf

Pil, F. & Rothenberg, S. (2003) Environmental performance as a driver of superior quality. *Production & Operations Management,* 12, 3, 404–415.

Preuss, L. (2002) Green light for greener supply. *Business Ethics: A European Review,* 11, 308–317.

Rajeev, A., Pati, R., Padhi, S. & Govindan, K. (2017) Evolution of sustainability in supply chain management: A literature review. Journal of Cleaner Production, 162, 299-314.

Rakennusteollisuus (2011) Rakennuksen hiilijalanjäljen ratkaisee energiapihiys. [www document]. [Accessed 21.12.2017]. Available: https://www.epressi.com/tiedotteet/rakentaminen/rakennuksen-hiilijalanjaljen-ratkaisee-energiapihiys.html

Reid, A. & Plank, R. (2000) Business marketing comes of age: A comprehensive review of literature. *Journal of Business-to-Business Marketing,* 7, 2, 9-185.

Rudus Oy (2017) Vihreä betoni – ympäristön hyväksi. [www document]. [Accessed 22.12.2017]. Available: http://www.rudus.fi/tuotteet/betoni/vihrea-betoni

Ruuska, A. & Häkkinen, T. (2014) Material efficiency of building construction. *Buildings,* 4, 266-294.

Saaranen-Kauppinen, A. & Puusniekka, A. (2006) Aineiston rajaaminen. [www document]. [Accessed 11.10.2017]. Available: http://www.fsd.uta.fi/menetelmaopetus/kvali/L6_2_1.html

Sarkis, J. (1995) Supply chain management and environmentally conscious design and manufacturing. International Journal of Environmentally Conscious Design and Manufacturing, 4, 2, 43–52.

Sarkis, J., Zhu, Q., Lai, K.-H. (2011) An organizational theoretic review of green supply chain management literature. *International Journal of Production Economics*, 130, 1-15.

Sartori, I. & Hestnes, A.G. (2007) Energy use in the life cycle of conventional and low-energy buildings: A review article. *Energy Build*, 39, 249–257.

Schiele, H. (2012) Accessing supplier innovation by being their preferred customer. *Research-Technology Management* 1, 44-50.

Schneider, L. & Wallenburg, C. (2012) Implementing sustainable sourcing – Does purchasing need to change? Journal of Purchasing and Supply Management, 18, 243-257.

Segerstedt, A. & Olofsson, T. (2010) Supply chains in the construction industry. Supply Chain Management: An International Journal, 15, 5, 347 – 353.

Seuring, S. & Müller, M. (2008) From literature review to a conceptual framework for sustainable supply chain management. Journal of Cleaner Production, 16, 1699-1710.

Simpson, D.F & Power, D. (2005) Use the supply relationship to develop lean and green suppliers. Supply Chain Management: An International Journal,
10, 60-68.

Sitra (2011) Puukerrostalolla on pienempi hiilijalanjälki. [www document]. [Accessed 21.12.2017]. Available: https://www.sitra.fi/uutiset/puukerrostalolla-pienempi-hiilijalanjalki/

Spekman, R., Kamauff, J. & Myhr, N. (1998) An empirical investigation into supply chain management: A perspective on partnerships. *Supply Chain Management*, 3, 53-67.

Stuart, I., McCutcheon, D., Handfield, R., McLachilin, R. & Samson, D. (2002) Effective case research in operations management: a process perspective. *Journal of Operations Management,* 20, 419-433.

Svensson, G. (2007) Aspects of sustainable supply chain management (SSCM): conceptual framework and empirical example. *Supply Chain Management: An International Journal,* 12, 4, 262-266.

Tang, Z. & Ng, S. (2014) Sustainable building development in China – A system thinking study. Procedia Engineering, 85, 493-500

Taticchi, P., Tonelli, F. & Pasqualino, R. (2013) Performance measurement of sustainable supply chains: A literature review and a research agenda. International Journal of Production Performance Management, 62, 782–804.

Torielli. R., Abrahams, R., Smillie, R. & Voigt, R. (2011) Using lean methodologies for economically and environmentally sustainable foundries. *China Foundry,* 8, 1, 74-88.

Tseng, S-M. (2014) The impact of knowledge management capabilities and supplier relationship management on corporate performance. *International Journal of Production Economics* 154, 39-47.

Tuomi, J. & Sarajärvi, A. (2002) Laadullinen tutkimus ja sisällönanalyysi. 2nd edition, Helsinki, Tammi.

United Nations (2017) Paris Agreement – Status of ratification. [www document]. [Accessed 2.10.2017]. Available: http://unfccc.int/paris_agreement/items/9444.php

United Nations (2013) Global Corporate Sustainability Report. United Nations Global Compact, New York, USA.

United Nations (2014a) First steps to a safer future: Introducing the United Nations Framework on Climate Change. [www document]. [Accessed 25.10.2017]. Available: http://unfccc.int/essential_background/convention/items/6036.php

United Nations (2014b) Kyoto Protocol. [www document]. [Accessed 25.10.2017]. Available: http://unfccc.int/kyoto_protocol/items/2830.php

United Nations (2014c) The Paris Agreement. [www document]. [Accessed 25.10.2017]. Available: http://unfccc.int/paris_agreement/items/9485.php

University of Jyväskylä (2009) Graduaineiston analysointi. [www document]. [Accessed 29.12.2017]. Available: http://www.mit.jyu.fi/OPE/kurssit/Graduryhma/PDFt/aineiston_analysointi.pdf

Vachon, S. & Klassen, R. (2008) Environmental and manufacturing performance: The role of collaboration in the supply chain. *International Journal of Production Economics,* 111, 299-315.

van Lakerveld, A. & van Tulder, R. (2017) Managing the transition to sustainable supply chain management practices: Evidence from Dutch leader firms in Sub-Saharan Africa. *Review of Social Economy,* 75, 3, 255-279.

Vitasek, K. & Manrodt, K. (2012) Vested outsourcing: A flexible framework for collaborative outsourcing. *Stretegic Outsourcing: An International Journal,* 5, 1, 4-14.

VTT (2012) Puurakentaminen Euroopassa – LeanWOOD. [www document]. [Accessed 21.12.2017]. Available: http://www.vtt.fi/inf/pdf/technology/2017/T297.pdf

Waddock, S., Graves, S. (1997) The corporate social performance: financial performance link. *Strategic Management Journal,* 18, 303–319.

Wagner, S. & Krause, D. (2009) Supplier development: communication approaches, activities and goals. *International Journal of Production Research,* 47, 12, 3161-3177.

Walker, H., Di Sisto, L. & McBain, D. (2008) Drivers and barriers to environmental supply chain management practices: Lessons from the public and private sectors. *Journal of Purcahsing & Supply Management,* 14, 69-85.

Walton S., Handfield R. & Melnyk, S. (1998) The green supply chain: Integrating suppliers into environmental management processes*. Journal of Supply Chain Management*, 34, 2, 2–11.

Whipple, J. & Frankel, R. (2000) Strategic alliance success factors. *Journal of Supply Management,* 36, 3, 21-28.

Wilhelm, M. & Kohlbacher, F. (2011) Co-opetition in Japanese supplier-networks: The case of Toyota. *Asian Business & Mangement,* 10, 1, 66-86.

Wilson, J. (2015) The triple bottom line: Undertaking an economic, social, and environmental retail sustainability strategy. International Journal of Retail and Distribution Management, 43, 4, 432-447.

Wolf, C. & Seuring, S. (2010) Environmental impacts as buying criteria for third party logistical services. *International Journal of Physical Distribution and Logistics Management,* 40, 84–102.

The World Bank Group (2017) GDP (Current US$). [www document]. [Accessed 4.10.2017].Available:https://data.worldbank.org/indicator/NY.GDP.MKTP.CD?end=2016&locations=KR-FI-GB&start=1960

Wu, Z. & Pagell, M. (2011) Balancing priorities: Decision-making in sustainable supply chain management. Journal of Operations Management, 29, 577-590.

Xi, F., Davis, S., Ciais, P., Crawford-Brown D., Guam, D. Pade, C., Shi, T., Syddal, M., Lv, J., Bing, L., Wang, J., Wei, W., Yang, K., Lagerblad, B., Galan, I., Andrade, C. Zhang, Y. & Liu, Z. (2016) Substantial global carbon uptake by cement carbonation. *Nature Geoscience,* 9, 880-883.

Yin, R. (2009) Case Study Research. 4th edition. Los Angeles, SAGE Publications.

Ympäristöhallinto (2016) Tiekartta rakennusmateriallien hiilijalanjäljen vähentämiseksi valmisteilla. [www document]. [Accessed 13.12.2017]. Available: http://www.ymparisto.fi/fi-FI/Rakentaminen/Tiekartta_rakennusmateriaalien_hiilijala(40813)

Zhu, Q., Sarkis, J. & Lai, K. (2008) Confirmation of a measurement model for green supply chain management practices implementation. *International Journal of Production Economies,* 111, 261-273.

Zhu, Q.H. & Sarkis, J. (2006) An inter-sectoral comparison of green supply chain management in China: drivers and practices. *Journal of Cleaner Production*, 14, 5, 472–486.

Zimmer, K., Fröhling, M., & Schultmann, F. (2016) Sustainable supplier management–a review of models supporting sustainable supplier selection, monitoring and development. *International Journal of Production Research*, *54*, 5, 1412-1442.

APPENDICES

APPENDIX 1: Description of the ISO14001 certificate

The environmental ISO 14001 certificate offers tools for continuous improvement while simultaneously indicating to the stakeholders that the certified company is considering the environmental issues seriously. The ISO14001 standard is designed to help the organizations to reach the targets they have set for their environmental programs and to produce additional value for both the environment and the organization and its stakeholders. The three main goals of the standards are to 1) improve the level of environmental protection, 2) meeting the binding obligations, and 3) reaching the environmental targets. In order for a company to gain the ISO14001 certificate, it is required to identify the environmental risks and opportunities of it operations, to set goals for improving the environmental issues, and to commit to continuous improvement. The environmental program will help the organization to improve its processes. A key element to the certification are also the audit held in yearly basis. (Kiwa Inspecta 2017)

APPENDIX 2: The survey for the FWA suppliers

COMPANY INFORMATION

1. **Do you give a permission to utilize your answers internally at Green Ltd?**
   - **a.** Yes
   - **b.** No
2. **Basic information**
   - **a.** Organization
   - **b.** The name of the respondent
   - **c.** The position of the respondent in the organization
   - **d.** e-mail
   - **e.** Phone number
3. **Our company's branch of industry**
4. **We are**
   - **a.** Sub-contractor
   - **b.** Material supplier
   - **c.** Both

ENVIRONMENTAL MANAGEMENT

5. **Does your company have strategic environmental goals?**
6. **Please, describe these goals**
7. **Does your company have**
   - **a.** ISO14001 certificate
   - **b.** EPD (environmental product declaration)
   - **c.** Neither of the above mentioned
   - **d.** Something else, what?
8. **Does your company actively educate its personnel on environmental issues?**
9. **Does your company have a supplier selection process?**
   - **a.** Yes
   - **b.** No
10. **Does the supplier selection process consider environmental capabilities of the suppliers?**
11. **Please, select the environmental management practices your organization already utilizes from the following list:**
    - **a.** Energy efficiency in the production process
    - **b.** Production of energy efficient products
    - **c.** Optimization of logistics
    - **d.** Recyclable packaging materials
    - **e.** Preferring the environmentally friendly raw materials
    - **f.** Bio fuels in transportations
    - **g.** Calculating the carbon emissions caused by the transportations
    - **h.** Calculating the carbon footprint of the products / services: How extensively?
    - **i.** Recycled raw materials: How big a portion of all used raw materials? (%)
    - **j.** Conducting Life Cycle Assessments (LCAs) of the products / services
    - **k.** Something else, what?

SELF-ASSESSMENT

12. **Environmental issues are a solid part of our business practices and are actively considered in our operations**
    - **a.** Totally agree
    - **b.** Slightly agree
    - **c.** Slightly disagree
    - **d.** Totally disagree
13. **Including environmental aspects in our operations is considered important in our company and it is part of our value base**
    - **a.** Totally agree
    - **b.** Slightly agree
    - **c.** Slightly disagree
    - **d.** Totally disagree
14. **Our personnel has a strong level of knowledge in environmental issues**
    - **a.** Totally agree
    - **b.** Slightly agree
    - **c.** Slightly disagree
    - **d.** Totally disagree
15. **Further education on environmental aspects is still needed in our company**
    - **a.** Totally agree
    - **b.** Slightly agree
    - **c.** Slightly disagree
    - **d.** Totally disagree
16. **Our company aims to get better in taking environmental issues into account and in decreasing the environmental effects of our business operations**
    - **a.** Totally agree
    - **b.** Slightly agree
    - **c.** Slightly disagree
    - **d.** Totally disagree
17. **Our company aims to decrease the environmental effects of our operations by innovating new products / practices**
    - **a.** Totally agree
    - **b.** Slightly agree
    - **c.** Slightly disagree

d. Totally disagree

18. From our company's point of view, the biggest challenges related to improving environmental efficiency are:

19. From our company's point of view, the greatest opportunities related to improving environmental efficiency are:

COOPERATION WITH GREEN LTD.

20. How long have cooperated with Green Ltd.?

21. How has the cooperation gone?

- **a.** Well
- **b.** Quite well
- **c.** Quite poorly
- **d.** Poorly

22. If Green Ltd. was to offer environmental educations, our company would be interested to join

- **a.** Totally agree
- **b.** Slightly agree
- **c.** Slightly disagree
- **d.** Totally disagree

23. Our company is interested in developing our environmental knowledge and capabilities in cooperation with Green Ltd.

- **a.** Totally agree
- **b.** Slightly agree
- **c.** Slightly disagree
- **d.** Totally disagree

24. Our company is interested in deepening the collaboration with Green Ltd. so that in the future it would be possible to develop environmental solutions and innovations together

- **a.** Totally agree
- **b.** Slightly agree
- **c.** Slightly disagree
- **d.** Totally disagree

APPENDIX 3: The survey respondents

Supplier	Industry	Sub-contractor/material supplier/both
Supplier 1	HVAC	Material supplier
Supplier 2	Lath and door installations	Sub-contractor
Supplier 3	Materials for infrastructural building	Both
Supplier 4	Energy	Material supplier
Supplier 5	Waste management & facilities management	Sub-contractor
Supplier 6	Energy	Material supplier
Supplier 7	Concrete, stone materials, concrete materials and concrete disposal	Material supplier
Supplier 8	HVAC	Material supplier
Supplier 9	Heavy equipment rental	Both
Supplier 10	Carpentry	Material supplier
Supplier 11	HVAC	Material supplier
Supplier 12	Flooring	Material supplier
Supplier 13	Kitchen producer	Material supplier
Supplier 14	Builders hardware wholesaler	Material supplier
Supplier 15	Power tools	Material supplier
Supplier 16	Kitchen whitegoods	Material supplier
Supplier 17	Electrical materials	Material supplier
Supplier 18	Building materials (especially plasterboards)	Material supplier
Supplier 19	Building materials (especially heat insulation)	Material supplier

APPENDIX 4: The interview questions

Basic information

Name of the interviewee:
Working title:
How long have you worked at Green Ltd.?
Does your work relate closely with Supply Chain Management?

Background questions on the GSCM practices in Green Ltd. Sweden / UK

1. For how long has *Green Ltd. Sweden / UK* included environmental aspects to its Supply Chain Management?

2. What were the initial drivers for such development?

3. What kind of GSCM tools and practices are currently applied at *Green Ltd. Sweden / UK*? How long have you utilized them? How do they differ from the conventional tools that did not include the environmental aspects?

4. What are the most significant benefits *Green Ltd. Sweden / UK* has gained through implementing GSCM?

Barriers for GSCM implementation

5. What were the main barriers for GSCM implementation?

6. Did you face resistance from suppliers when Green Ltd. started to increase the environmental requirements?

7. Learning from your experience: what are the biggest stepping-stones that Green Ltd. Finland could avoid when aiming for greener SCM?

Best practices and future development areas

8. What would you state are the best GSCM practices you are currently applying and would recommend for Green Ltd. Finland?

9. Are you planning to develop them in the near future? If yes, how?

10. What are the next big development areas on GSCM in which *Green Ltd. Sweden / UK* will engage in?

Other free comments:

APPENDIX 5: Description of the strategic environmental goals

Supplier	Description of the goals
Supplier 1	- Sustainable development has been part of our identity for decades and they are a significant part of our business: It benefits environment, society, customers, business partners, employees and shareholders at the same time - Examples of our environmental goals are: new logistical solutions, energy efficient production facilities and sustainability education
Supplier 2	- Choosing less environment intense products and installation methods
Supplier 3	- Our goal is to be able to offer even more solutions and knowledge for structures, in which the environmental aspects are becoming more and more important - Utilizing renewable/recycled materials in the structures - Offering tools for comparing the environmental effects of the available solutions - We constantly aim to offer the best technology with the environment in mind and we are also developing the industry instruction on this
Supplier 4	- Global increase in the renewable fuels - Low sulfur fuels in the area of Baltic Sea
Supplier 5	- Implementing the Code of Conduct - Ensuring that the products are in line with the requirements - Controlling the risks - Improving the internal environmental capabilities - Calculating the carbon footprint of the services - Decreasing the emissions - Energy efficiency of the facilities - Conducting a model for tracking the emissions of transport suppliers - Sustainable supply chain - Brand management
Supplier 6	- We follow the CO2 emissions caused by our business and our strategic goals are focused on decreasing those emissions
Supplier 7	- Climate change - Preserving the diversity of nature - Circular economy - Efficient resource usage - Stakeholders
Supplier 8	- All of the packaging waste are sorted and recycled - All the haulaging firms we utilize are using new equipment - We partly utilize solar energy in heating our storages
Supplier 9	- When renting machines and equipment from us, the customers should be ensured that they are doing an excellent decision on environmental bases. - We are determined to minimize all the environmental disruption from our side - We have certified quality and environment systems - We aim to use haulagers that are able to help us in decreasing the environmental effects of our operations - We take good care of our machinery in order to ensure the long working life - We decrease the environmental effects by optimizing our logistics and by utilizing our office network: the goal is to transport as many machinery at the same time as possible via the shortest route.
Supplier 10	- Decreasing the amount of waste - Decreasing the energy usage - Conducting LCAs - EN15804 environmental card
Supplier 11	- Developing the logistics - Energy efficiency - Waste management
Supplier 12	- Decreasing the carbon footprint - Improving efficiency in material usage, transportations and energy usage - Decrease the amount of utilized fossil fuels
Supplier 13	- Decreasing the VOC-emissions - Decreasing the usage of electricity - Decreasing the heating emissions

Supplier 14	- The aim is to offer environmentally friendly products and services, so we especially concentrate on the origin and quality of the solutions we offer - We engage in sustainable business practices in all of our actions - Our key sustainability themes are: health, safety, environment, people, responsible business and communality. these themes support our business strategy - In procurement we prefer the suppliers who are able to offer products and services that are safe, origin certified and have known environmental effects
Supplier 15	*Not public*
Supplier 16	-
Supplier 17	- Decreasing the amount of packaging materials - Decreasing the amount of transports - Ensuring the energy efficiency of the office - Increasing the knowledge on environmental issues
Supplier 18	- Sustainable development - Recycling
Supplier 19	- Delimiting the emissions - Energy efficiency in production - Renewable and recyclable materials in production - Developing bio-based raw materials & end products

APPENDIX 6: The most significant opportunities related to improving environmental efficiency

Supplier	The most significant opportunities related to improving environmental efficiency
Supplier 1	The opportunities are actually at the same time the challenges. We prefer to use Finnish products, so we don't have to deliver them from all around the world. We also aim to optimize our logistics so that larger entities can be delivered at once. These actions are opportunities for us in terms of both lower carbon footprint and better environmental efficiency as well as increased cost efficiency
Supplier 2	Regardless of the challenges, replacing plastic as a packaging material is one of our best opportunities related to improving the environmental efficiency.
Supplier 3	Utilizing the reusable materials in construction, optimizing the total carbon footprint and the additional environmental effects of the structures. The carbon footprint is currently calculated to only some of the products, in the future this could be expanded.
Supplier 4	New solutions for producing plastic. Expanding the LCA analysis, currently they are conducted more for some products and less for some. Renewable diesel is our most radically increasing product segment, which indicates that many business opportunities do relate to the environmental business.
Supplier 5	Development of the legal aspects, business opportunities that environmental efficieny can bring, increasing cost efficiency.
Supplier 6	We sell renewable electicity and the increasing awareness among the Finnish customers has been significant. For us almost the only way of decreasing the environmental effects of our operations is to utilize technology even more (e.g. no more paper bills)
Supplier 7	Our biggest opportunity is related to increasing the wize usage of resouces. Furthermore, another aspect is related to expanding the environmental thinking to more product categories as it has shown potential.
Supplier 8	Packaging and logistics
Supplier 9	Digitalization and the increasing commonnees of shared economy
Supplier 10	Aiming for a long life cycle of the products
Supplier 11	Cost efficiency, decreasing costs. Including environmental issues to our business offers new product concepts and new business opportunities. New energy solutions and their marketing.
Supplier 12	More environmentally friendly operations
Supplier 13	Heating and transportation emissions
Supplier 14	In addition to supply management we see that other important environmental aspects for us are preventing the occurring waste and increasing the energy efficiency. Increasing energy efficiency is linked to lower production costs and thus it leads to improved cost efficiency. We also separate the waste caused by our operations.
Supplier 15	The change in the attitudes.
Supplier 16	-
Supplier 17	The most significant opportunity is related to new collaboration opportunities with business partners. Also increasing opportunities for developing our logistics
Supplier 18	Cost savings in addition to highlighting the environmental values.
Supplier 19	Usage of renewable ja recycled materials, developing bio-based raw materials and end products.

APPENDIX 7: The biggest challenges related to improving environmental efficiency

Supplier	The biggest challenges related to improving environmental efficiency
Supplier 1	The global market is causing challenges for actually improving the efficiency of logistics. It is known that the Finnish products are more expensive but buying from Finland is more environmentally friendly. So, it is a challenge to find the balance
Supplier 2	Decreasing the amount of plastic in packages that should dure moisture.
Supplier 3	Including environmental aspects to the public procurement processes.
Supplier 4	Expanding the usage of raw materials that are currently only used for recycable products
Supplier 5	Legal challenges, slow permision processes, attitude issues (both employees and customers)
Supplier 6	Tracking down the whole supply chain efficiently is very difficult. Increasing the knowledge of the employees is always a challenge in a busy working environment. The most significant emissions of our operations emerge "far away" from us, so it might feel distant for our employees to act on those.
Supplier 7	Material transportations, energy consumption
Supplier 8	Packaging and logistics
Supplier 9	For us the challenge is to figure out how to make customer choose the ecological option
Supplier 10	Decreasing the amount of waste
Supplier 11	The biggest challenge for us is to educate and activate the personnel. Also developing the logistics is a challenge.
Supplier 12	The global operating environment is causing the biggest difficulties.
Supplier 13	Decreasing the VOC emissions.
Supplier 14	We follow our own Code of Conduct and we expect our material suppliers and business partners to commit to the code and act upon the requirements and standards. Sometimes it is difficult to ensure this.
Supplier 15	The biggest challenge is definitely the costs. Customers might not want to pay extra even though they are a result of environmental actions
Supplier 16	-
Supplier 17	The influence of business partners, partly the price level of environmentally efficient solutions.
Supplier 18	The accessanbility of the recyclable materials is a challenge.
Supplier 19	We feel that sometimes the cost efficiency might suffer from the environmental decisions. Also it seems that the demand for environmental products might not be high enough