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Green Product Design:

Aspects and practices within the
furniture industry

Master's thesis within Business Administration

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Abstract

Purpose - This paper aims to investigate how green product design has been practiced within the Swedish furniture industry. Furthermore, to investigate how green product design can reduce the negative impact on the environment.

Theoretical framework - The literature used to serve as a base for this paper includes some aspects concerning Green Supply Chain Management, but fundamentally concerns green or environmentally conscious design, motivators for designing 'green' products, such as legislation, Corporate Social Responsibility (CSR), internal policy documents and/or green guidelines/certificates, innovation, competitiveness, economic performance, brand image and reputation, and others. Consequently, factors for product design itself were discussed, such as environmentally conscious design, efficient utilization of materials, minimizing waste, time and cost efficiency, types of materials used, etc. Moreover, sustainability aspects are considered vital, namely economic, social and environmental practices, as particular attention is paid to the economic and environmental aspects.

Methodology - For the purpose of this research paper, (multiple) case studies were chosen to be implemented. One face-to-face, two telephone and two Skype/online interviews were conducted based on semi-structured interview questions. The data collected is from four companies, two of them preferred to remain anonymous, i.e. Office Furniture and Office Design, and the other two were Kinnarps and Skandiform.

Findings - The empirical findings gathered for this research comply with the majority of theoretical data provided. A number of the most important and applicable green product design factors, and more specifically the aim of reducing negative environmental impacts, drive companies to implement environmentally conscious design, efficient utilization of materials, minimizing waste, costs associated, types of materials used, product safety, among many others. Furthermore, economic, social and environmental (overall regarded as sustainability for the purpose of this paper) factors are taken into consideration. Economic and environmental issues were mostly discussed and pinpointed as essential.

Conclusions - Green product design should follow a number of important factors in order to reduce the negative impacts on the environment. It is essential to understand a company's motivation for designing green products. Nevertheless, such factors as well as economic aspects regarding green design should be complementing each other.

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I Introduction

This part will introduce different aspects, definitions and information regarding Green Supply Chain Management, green product design and a number of its dimensions. Following, a problem discussion section, purpose, research questions, delimitations and an overall disposition of the paper are presented.

1.1 Background

The environment has become something that people are more aware of and many have realized that it needs to be protected. Furthermore, many companies have started to act on the green pressures with the aim to create sustainable products. If this is thought about when a product is being designed, it can result in higher percentage use of resources and also less negative effects on the environment (Chu, Luh, Li, & Chen, 2009; Tseng, Chang, & Li, 2008).

Furthermore, if green product design is implemented it could also result in higher costs, however companies have to take responsibility regarding the environment and how they are affecting it (Tseng et al., 2008). Nevertheless, companies could undertake responsible planning and regardless of the initial costs, take the moral and economic responsibility to implement green product design. On the contrary, Zhu and Deshmukh (2003) state that if implemented in the design stage life cycle engineering can result in less costs and at the same time reduce the impact on the environment. It is important that the process of making a greener product starts as early as possible when it comes to the design stage (Chu et al., 2009; Tseng et al., 2008).

When designing with the aim of greener products there are a number of aspects to consider namely selecting material for all components, how the product shall be assembled, and in which sequence the assembly will be performed (Chu et al., 2009). Furthermore, designers need to consider end of life alternatives for the products i.e strategies for recycling and how a product can and will be disassembled (Chu et al., 2009).

1.2 Green Supply Chain Management (GSCM)

Supply chain management (SCM) has the purpose to strategically and systematically coordinate and control the supply chain as a whole unity (Zhu & Sarkis, 2004). Since a supply chain also includes transportation of goods/materials between the suppliers and the customers, as well as transportation to the end consumer, all environment effects and aspects (i.e. development of a particular research, manufacturing, storing, transporting, using a product as well as disposing of its waste, etc.) should be taken into serious consideration (Zhu & Sarkis, 2004).

Green, or also called environmental, supply chain management comprises of involvement of activities such as recycling, reduction, reuse and substitution of materials (Zhu & Sarkis, 2004). Furthermore, the authors suggest that a 'green' supply chain refers to innovations in

the supply chain management and industrial purchasing that should be considered as a perspective towards preserving the environment.

Srivastava (2007) claims that nowadays there is a bigger need for environmentally beneficial decisions well integrated within both supply chain management research and practice. Thus, green supply chain management (GSCM) is presented as “integrating environmental thinking into supply-chain management, including product design, material sourcing and selection, manufacturing processes, delivery of the final product to the consumers as well as end-of-life management of the product after its useful life” (Srivastava, 2007, p. 54).

Green SC is also widely discussed to have an impact on environmental enhancement, economic growth and competitiveness (Zhu & Sarkis, 2004; Rao & Holt, 2005). Overall GSCM focuses on enhancing environmental performance through productivity improvement, quality improvement and efficiency improvement, and also on minimizing waste as well as striving for minimal/minimum costs (Rao & Holt, 2005). Furthermore, Zhu and Sarkis (2004) argue that GSCM is rapidly emerging as highly significant for performance improvement, and that in order to be successfully implemented there should be a balance, a clear link established between a supply chain’s enhanced economic, competitive and environmental performance.

Nevertheless, being environmentally friendly, i.e. being concerned for the preservation of the environment, is simply not sufficient. Companies implementing GSCM within their SC practices should furthermore carefully consider and scrutinize whether this implementation is beneficial as well as profitable in their business terms. It is essentially a business value- and profit-driver, rather than a cost driver (Srivastava, 2007; Hu & Hsu, 2010).

1.3 The furniture industry

In the Swedish furniture industry the two largest product families are office furniture and wooden kitchen furniture (Trä & Möbel Företagen website, 2012). Office furniture has about 20% share of the total furniture production in Sweden. In 2011 the export of office furniture from Sweden was 2,4 billion SEK showing 6% growth compared to 2010. During 2011 the import for office furniture to Sweden was 832 million SEK which also was an increase compared to 2010 with 11 percent (Trä & Möbel Företagen website, 2012).

1.4 Product design

As a vital part of the supply chain the product development and, more specifically, product design will represent the basis for this thesis research (Chen, 2001). This area of investigation has been chosen due to the ever-increasing anxiety and concern about protecting the environment nowadays, and thus setting a reliable base for natural resources preservation for the future generations, has also lead to the choice of topic and reasons to initiate and investigate this study (Golden, Subramanian, & Zimmerman, 2011; Johnson, 2009).

Despite the great amount of research done on the topic, and the various theories discussed regarding whether (and to what extent) product design is encompassing environmental

impacts and effects, such impacts are stated to be still a small part of the process of product development (Luttropp & Lagerstedt, 2006; Zhang, Kuo, Lu, & Huang, 1997; Srivastava, 2007; Otegbulu, 2011; Reay, McCool, & Withell, 2011). Thus, this could be considered as a gap in the theory discussed and research done on the topic so far, which would consequently lead to the problem discussion of this thesis.

1.5 Problem discussion

The environment is progressively affected by products with shortening life cycles, i.e. the life-span for many products is decreasing, it is currently not enough to have a passive view on how to deal with resource disposal, for example recycling and garbage classification. Companies should realize the need to bring out the most of their resources and focus on decreasing the effect on the environment. This is something that can be done if taken into consideration as early in the design stage as possible (Tseng et al., 2008). Moreover, fierce market competition is shortening the product life cycle and the passive resource recycling approach can no longer cope with the ever-increasing burden current products have on the the environment.

Therefore, it is important to maximize the usage percentage of resources and minimize the damage to the environment in the early product design stage. In addition, companies aim for high sustainability as well as well-integrated sustainability aspects within the supply chain, i.e. being environmentally conscious and responsible (Srivastava, 2007; Hu & Hsu, 2010; Anker-Rasch & Sjørgard, 2011).

In light of the brief discussion above, it was made clear that there are several factors influencing the development of businesses regarding cost considerations along with more efficient and greener product development; the aim for that was to achieve the goal of potentially more efficient production and positive business ethos. This situation is exemplified with the furniture industry. Hence, leading to the purpose of this thesis research.

1.6 Purpose

This paper aims to investigate how green product design has been practiced within the Swedish furniture industry. Furthermore, to investigate how green product design can reduce the negative impact on the environment.

1.7 Research questions

In light of the Green Supply Chain Management concept, and in particular green product design, being rather modern, innovative and seeking sustainability within companies nowadays, this paper aims to investigate and discuss the possible and prospective outcomes of the 'green' concept through the following research questions:

1. Why should products be designed with environmentally conscious considerations?

2. How can green product design contribute to reducing the negative impact on the environment?

1.8 Delimitations

This study is limited to the aspects and practices of green product design in the furniture industry, in particular the Swedish office furniture, thus it cannot serve as a generalization of green product design in other industries and fields. The choice of companies for this research is restricted to the integration of environmentally conscious features within the companies' product design processes, and the reduction of (negative) impacts on the environment. Hence, only furniture companies incorporating such aspects within their working processes can be taken into consideration for this research. Furthermore, various sustainable and economic aspects are discussed.

1.9 Disposition

With the aim of accommodating the reader better with the structure of this research paper, a disposition section is included briefly presenting the layout of the paper. Firstly, an introduction (the above discussed sections) is presented, introducing the scope of the study. Next, theoretical framework is presented. Following is the methods section along with the empirical findings, gathered for the purpose of this paper. Consequently, analysis section is presented discussing the empirical data gathered. Finally, conclusions are drawn upon the analysis interpreted, and a discussion on the final findings is presented. Recommendations for further research are provided.

2 Theoretical framework

In this section a literature review will be presented discussing various theories and research done on the topic. Green design and its aspects will be discussed, environmentally conscious design, green engineering, sustainability issues and competitiveness will be touched upon, serving as a theoretical base for this research.

Green product design has become a vital concern for many companies, incorporating environmental issues in their product design necessary to meet recent green guidelines. For companies to follow these directives the product development process has to be carried out with special procedures. The structure of a product is considered to be an important factor in the end-of-life of products, since it can reduce the impact on the environment (Chu et al., 2009).

When developing a new product with the aim of environmentally friendly design the green thinking should be incorporated as early as possible in the process. There are several factors that need consideration when designing green products. Selection of material to use for the different components that will be part of the end product is one of the factors. For the construction of the product, assembly method and assembly sequence are the other two factors that should be taken into consideration in the design phase (Chu et al., 2009).

2.1 Green design and its aspects

Green design is claimed to be essentially associated with designing products with further consideration towards the environment, and its preservation (Srivastava, 2007). Above all, green design encompasses the whole life-cycle of a product, including, but not limited to, the process of manufacturing, remanufacturing and disposal activities. Green design is also showed to be one of the significant drivers for the implementation of GSCM (Diabat & Govindan, 2011).

It is argued that the cost of green building materials is nearly as equal as the cost of the traditional manufacturing/product design, as well as that sustainability is very closely related to companies' profitability results, sometimes even equivalent (Wade, 2005). It is concluded that Scandinavian companies are particularly conscious about the product design and production impact on the environment as well as the sustainability issues associated (Wade, 2005).

2.1.1 Environmentally conscious design

In this reasoning, companies and businesses today pay considerable attention to environmentally conscious technologies and design practices that will tolerate manufacturers' minimization of waste and in turn transform waste into a profitable product (Zhang et al., 1997; Srivastava, 2007). This concept further encompasses social and technological aspects of products' design, processing and use in manufacturing. Environmentally conscious design and manufacturing is a proactive approach towards minimizing particular products' impact on the environment during the stages of its

initiation, design and manufacturing, through all the phases of its life cycle, i.e. from raw materials, production, transportation and distribution to re-use, remanufacturing, recycling to final disposal (see Fig. 2.1) (Zhang et al., 1997).

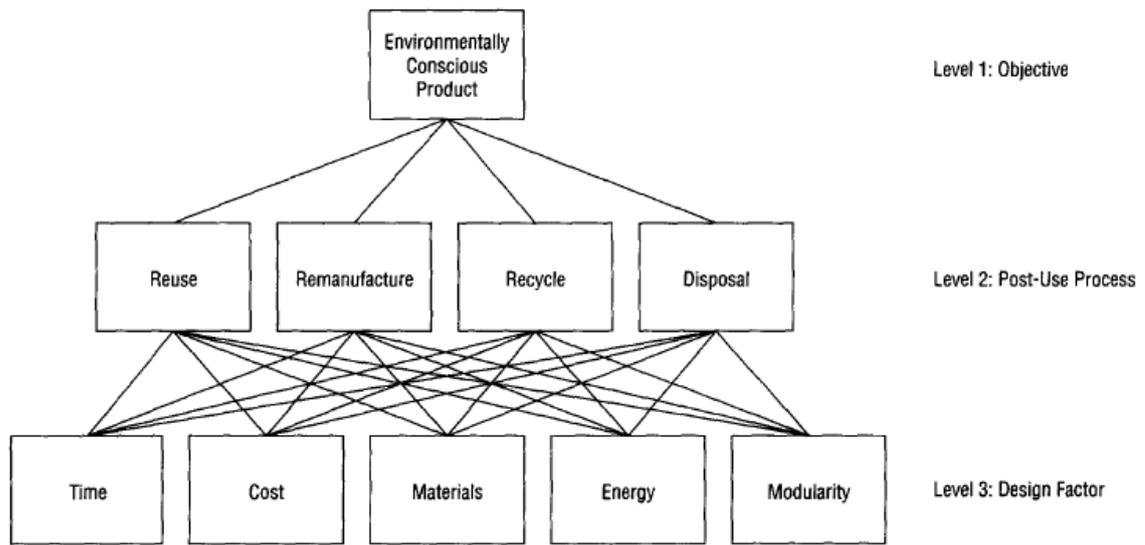


Fig 2.1 Hierarchy for Designing an Environmentally Conscious Product
Source: Zhang, Kuo, Lu, & Huang, 1997, p. 354.

Furthermore, the time invested in the process, the costs associated, the materials utilized and energy devoted, and modularity aimed for (i.e. designing a product in a way that it could be still further used after its product life) are the most important design factors affecting the process of product and process design (its manufacturing). As a result, the products' competitiveness among the environmentally conscious companies has increased along with their sustainability awareness and implementation (Zhang et al., 1997; Srivastava, 2007).

Environmentally conscious design and manufacturing is represented by two common approaches, i.e. zero-waste lifecycle approach and the so-called incremental waste control lifecycle (Zhang et al., 1997; Srivastava, 2007).

- The first one assumes that products' lifecycle has a zero impact on the environment, or rather aiming for such. That is, the approach ascertains that the product cycle created is as sustainable as possible – design, production, distribution, usage and disposal have minimal (or zero) environmental damages as well as the product cycle exploits minimum resources applicable, i.e. material and energy.
- The second approach envisions the negative impacts resulting from the current process cycle implemented. It is stated that these or any other negative impacts could be significantly reduced, or completely eliminated, through a certain level of technology improvement or advancement, i.e. incremental waste lifecycle control. Thus, the aim of this approach is to reduce or remove any negative impact of toxic or dangerous materials used in the manufacturing processes, implemented through a

‘clean’ technology; that is, a source reduction or recycling method aimed for elimination or considerable reduction of created/redundant waste.

Furthermore, companies strive for having environmentally friendly products, however there are not many of them who are ready to pay the price for it, i.e. in economic and financial terms (Luttropp & Lagerstedt, 2006). Designers, for example, have several different aspects to consider while designing products. They also have to manage with demands that are versatile and to make sure that the demands are balanced with regards to both time and costs (Luttropp & Lagerstedt, 2006).

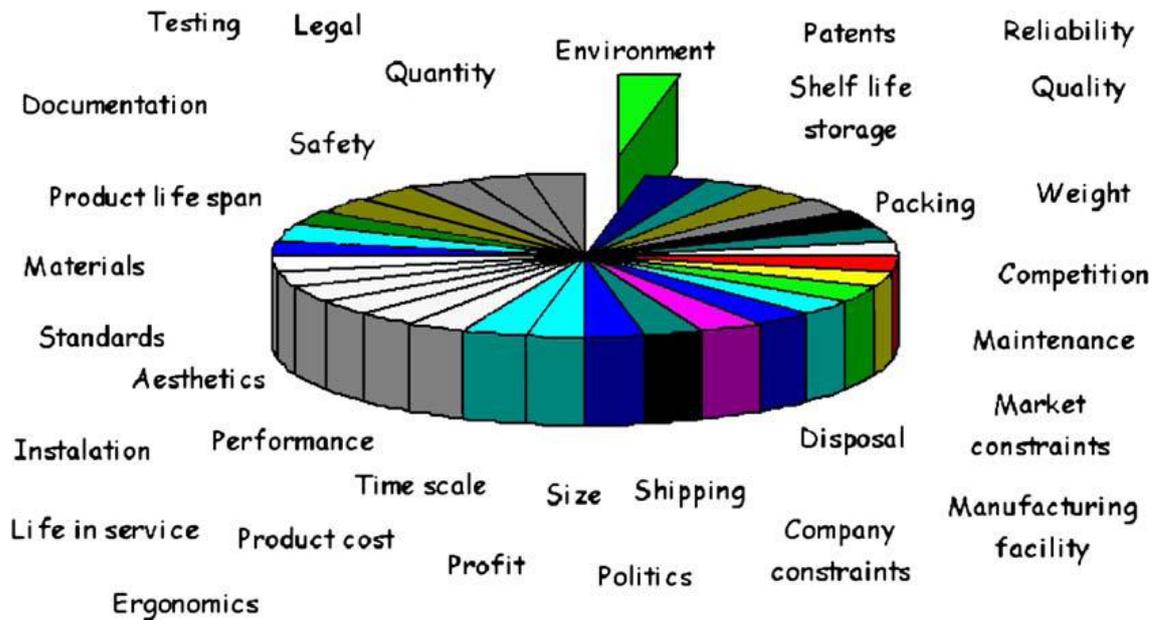


Fig 2.2 – Product development, graphic illustration. Source: Luttropp and Lagerstedt, 2006, p. 1,398.

The authors describe the different aspects to consider when designing a product. Hence, environmentally friendly aspects is just one part of many that need to be incorporated in the design processes (Luttropp & Lagerstedt, 2006). As it can be seen from Figure 2.2, quality, materials, product life span, safety, disposal, profit, product cost, time scale, competition are only a small part of the product development process (Luttropp & Lagerstedt, 2006). Taking into account the purpose of this academic paper, the mentioned aspects in the previous sentence will be taken into particular consideration due to the scope of this research, i.e. not the bio-environmental aspects, toxic substances, etc., but rather the product design stage considering how the negative impacts on the environment can be reduced and minimized.

2.1.2 Eco-design and sustainable design

Reay, McCool and Withell (2011) discuss that in order to demonstrate the growing concern and importance of the social and environmental aspects, concepts like eco-design and sustainable design (both presented below) should be paid their due attention. In this regard, the authors’ Cradle-to-Cradle (C2C) research paper shows that companies are becoming

more and more aware and responsible to the society and the environment nowadays (Reay, McCool, & Withell, 2011).

That being said, eco-design is naturally associated with environmental issues, i.e. reducing the detrimental practices on the environment, incorporated throughout a product's design and thus its development; it further focuses fundamentally on minimizing or decreasing such environmental issues/impacts, in both the design and the process/manufacturing stage of a product's life-cycle (Reay, McCool, & Withell, 2011). It is further stated that eco-design and sustainability, with regards to product design and manufacturing, are merely a part of the aspects playing a significant role on the topic. Besides them, seemingly of high importance are ethical, socio-economic, ecological and innovation-related aspects (Reay, McCool, & Withell, 2011).

In addition, Diegel, Singamneni, Reay and Withell (2010) argue that a sustainable product is one that incorporates economic, socio-economic and ethics dimensions leading to the so-called "triple bottom-line" impact of a product design (see Fig. 2.3) encompassing environmental, economic and social sustainability (p. 69). Furthermore, the authors' understanding of sustainability for the purpose of this paper supports the definition that in order to "[a]chieve societal sustainability we must use holistic, continuous and interrelated phenomena amongst economic, environmental, and social aspects, and that each of our decisions has implications for all of the aspects today and in the future." (Lozano, 2008, p. 1,845).

Therefore, their definition extracted for sustainable design is, "[d]esign which aims to achieve triple-bottom line ideals by striving to produce products that minimize their detriment to the environment while, at the same time, achieving acceptable economic benefits to the company and, wherever possible, having a positive impact on society." (Diegel, Singamneni, Reay, & Withell, 2010, p. 69).



Fig 2.3 Triple Bottom-line Product Design.

Source: Diegel, Singamneni, Reay and Withell, 2010, p. 74.

It becomes visionary clear that all the three aspects play an important role in considering the path of the product design, environmental is inseparable from society and economy (Diegel, Singamneni, Reay, & Withell, 2010). It is also discussed that sustainable design, sustainable development and sustainable practices could bring a product's design or process line both risks and rewards, depending on how well integrated the concept of sustainability is within products' processes (Kenneth, 2010). The author further claims that not only the production line management should be applying environmentally responsible

thinking into their work, but also that management in professional organizations should be the party to encourage and promote to their clients and/or partners that such issues are vital and attention should be paid promptly.

2.1.3 Cradle-to-Cradle approach

Another theoretical practice that is considered important to be discussed is the so-called Cradle-to-Cradle approach (C2C). It describes 'biological' processes of re-use, biodegradable natural recycling as well as the 'human' way of recycling, i.e. technical recycle, re-manufacture, recovery and re-use through many processing cycles in order to maintain the products' material value (Scott, 2006; Reay, McCool, & Withell, 2011). It is crucial that the levels of waste gathered after the utilization of the materials are as minimized as possible, all of the latter should be fully exploited (online source, <http://gdi.ce.cmu.edu/gd/education/gdedintro.pdf>). This approach further addresses problematic aspects such as over-consumption and waste, and argues that 'eco-efficiency' could be regarded as a motivating driver for the development of environmentally conscious products and systems.

2.1.4 Green engineering

Another view on the topic of green product design is presented by Anastas and Zimmerman (2003), who bring up 12 principles of green engineering and how those principles should be applied to green product design. To begin with, these principles can work as guidelines when designing not just products but also materials, processes and systems with the purpose of making them environmentally- and human health friendly. If these principles are used in the design it will bring the product not only to the basic quality and safety standards but even further to include economic, social and environmental elements (Anastas & Zimmerman, 2003). Furthermore, Anastas and Zimmerman (2003) state that it does not matter whether the design concerns molecular architecture, product architecture or urban architecture, the guidelines can be applied. Based on Anastas and Zimmerman (2003) the principles of green engineering most aligned with this thesis are the following:

- When designing it is important to make sure that all materials and the energy that is put in are as harmless as possible, i.s. non-toxic. That is also true for the output of the process.

- If hazardous materials are part of an end product there have to be some kind of strategy for closing the loop. Thus, the hazardous materials will be taken care of in end of life of the product but there are still risks with these products. For instance, when the products are in transportation the risk of an accident and thereby the risk of release is present. Hence, the less usage of hazardous materials and energy, the less risk of release (Anastas & Zimmerman, 2003). This is also supported by Chu et al. (2009), in the product design stage it is important to consider what material to use in every single part of the product. Furthermore, in the manufacturing process avoidance of hazardous substances is important which also should be considered in the product design stage (Chu et al., 2009).

Furthermore this is supported by Luttrupp and Lagerstedt (2006), the authors present ten guidelines for product design, as the first one suggests that there should be no hazardous substances in the products. However, if such substances have to be used this should be done in a closed loop.

- When it comes to waste designers should strive to avoid waste instead of the other option to take care of waste after it has been formed.

- Waste handling does not only take up time but also money and effort, furthermore its hazardous waste will be even more demanding. One significant aspect, which is regularly unseen of the idea of waste, is that there is nothing congenital about material or energy that makes it waste. Instead it is unused material/energy that has not yet been thought through or put into use. Waste can be described as material or energy, which existing practices or processes are not successfully capable to develop for advantageous use (Anastas & Zimmerman, 2003). This is supported by Sarkis (2012), waste streams are costly hence there is a need to minimize them.

In addition, dangerous waste needs constant monitoring and control which results to further investments. It might seem obvious that waste should be avoided whenever and wherever possible, instead there are plenty of examples where waste avoidance is not properly thought through, instead it is thoughtlessly planned into the design.

- The processes of separation and cleansing have to be designed with the purpose to have as little energy and material usage as possible.

- If designers keep separation and cleaning issues in mind at the beginning of the design phase it could result in ease of these processes if and when it comes to reuse and recycling of products. Additionally, energy and material consumption in the two processes are usually high and in several methods that are used for separation there is a need to use hazard solvent (Anastas & Zimmerman, 2003).

Furthermore, some of the separation methods consume a high degree of for example heat, thus energy. To solve this problem the design could be done with properties that allow easier separation and cleansing without hazardous substances. Ultimately, to ease disassembly, hence recovery, recycling and reuse of material designers should incorporate attachments which are designed to be disassembled (Anastas & Zimmerman, 2003). This is supported by Chu et al., (2009), when choosing how to assembly and materials designers should do this with consideration to recycling and reuse. The way products are assembled and which materials they consist of can limit choice of how the product can be disassembled (Chu et al., 2009).

- The designers should aim to maximize energy, space, mass and time efficiency when it comes to products, processes and systems.

- For this principle the main goal is to prevent waste. In this principle waste avoidance is done by the maximization of mass and energy, but also time and space which are not considered as traditional tools with aims of increase efficiency (Anastas & Zimmerman,

2003). This is aligned with one of the guidelines used by Luttrupp and Lagerstedt (2006) which is to household material and energy. Hence in the manufacturing process consumption of resources and energy should be minimized (Luttrupp & Lagerstedt, 2006).

➤ Designers should keep in mind to design for durability and not for immortality.

- The purpose of designing for durability and not immortality is to prevent solid waste. Hence, to avoid waste of materials that are not wanted in the environment it is important to design for a certain lifetime. For designers this principle has to be balanced with the durability, since products still need to function as expected. Additionally, designers should keep in mind that products can have a life after this, for example through reparations (Anastas & Zimmerman, 2003).

➤ Designers should not strive for a solution where unnecessary capability and capacity will be part of it. Hence, one size fits all is not a good way to go.

- For designers it is important to predict how flexible/agile a product or process needs to be. Hence it is also important to remember that there are a lot of costs associated with a 'too flexible' design, unused capacity is not something to strive to. Designers should also keep in mind that products should be designed to meet demands, not over doing it just to be on the safe side. For example, designs that have been done with considerations to worst case scenarios, such designs come with unnecessary waste and work (Anastas & Zimmerman, 2003).

➤ With the purpose to facilitate disassembly and possible value recapture designers should strive to have fewer products with several components and also minimize material variety.

- Reduction of multicomponent products and material variety can lead to ease of disassembly and thereby ease of reuse and recycle. Products that have a wide and long bill of material can be a problem when it comes to disassembly. For example, a car have plastic, metal and glass materials and then the plastic for instant consists of several different chemical, and others (Anastas & Zimmerman, 2003).

➤ Commercial afterlife incorporated in the design.

- Instead of trying to do the best with products at the end of life designers need to incorporate end of life decisions in the design. If products are designed with end of life properties more value will remain. This principle aims to have modular design. Products and or modules can then be used in new product hence the need for new raw material and processing will be less. Bottom line would be design for recovery and re-use (Anastas & Zimmerman, 2003). This is supported by Guide (2000), if products are designed to be disassembled they are less likely to take damage when disassembled hence more materials can be reused. Furthermore, products that have been designed to be disassembled generate less waste since more parts can be reused. Another gain is that less new materials are needed when there is a higher degree of reuse (Guide, 2000).

- Designers should try to use material and energy that as much as possible are renewable.

- The sustainability of products can be affected by what kind of material and energy that is used in it and also where they come from. Usage of renewable or not renewable material and energy can have a long term effect. Furthermore, all usage of finite materials and energy decreases the existing material/energy (Anastas & Zimmerman, 2003). This is supported by Ljungberg (2007), when products are developed it is important to use materials that are renewable. Hence using materials that can be formed again within a short time and that do not affect the environment at all/much (Ljungberg, 2007).

To sum up, several of these principles aim to retrieve value of products that have come to end of life through reuse. One way to close a supply chain is to use remanufacturing which is one way to handle reverse logistics (King, Burgess, Ijomah, & McMahan, 2006). Hence, if a company designs their products with the intention to facilitate remanufacturing it could be argued that it is a form of green product design. There are a number of aspects to consider when designing a product for remanufacturing, it should be easy to disassemble, cleaning of the product when returned, testing of a returned product and ease of reassembling (Zwolinski & Brissaud, 2008). Furthermore, parts should be standardized in order to ease reuse in numerous different end products (Thierry, Salomon, Numen, & Wassenhove, 1995). See Table 2.1 for product properties that ease the process of remanufacturing.

Table 2.1 - Product properties for remanufacturing. Source: Adopted from Sundin, 2004, p. 82

Remanufacturing step Product properties	Inspection	Cleaning	Disassembly	Storage	Reprocess	Reassembly	Testing
Ease of Identification	x		x	x			x
Ease of Verification	x						
Ease of Access	x	x	x		x		x
Ease of Handling			x	x	x	x	
Ease of Separation			x		x		
Ease of Securing						x	
Ease of Alignment						x	
Ease of Stacking				x			
Wear Resistance		x	x		x	x	

The model describes properties that ease remanufacturing and which of the processes in remanufacturing the different properties eases. As stated there are four ways of closing the loop in reverse logistics namely, repair, reconditioning, remanufacturing and recycling.

Remanufacturing is the one that's most complex and needs the most work (King et al. 2006). Based on this it could be argued that the product properties in Table 2.1 will not only ease remanufacturing, but also the three other reverse logistic approaches.

2.2 Sustainability aspects

Despite the research published so far, sustainability is believed to be yet in its early life (Luttropp & Lagerstedt, 2006; Dey, LaGuardia, & Srinivasan, 2011). A number of academics claim that sustainability and supply chains interaction is crucial for companies operations and the environment (Kleindorfer, Singhal, & Van Wassenhove, 2005). Sustainable (product) development in this regard includes and discusses three major aspects, i.e. economic, environmental and social responsibility (Pretty, Ball, Benton, Guivant, Lee, Orr, Pfeffer, & Ward, 2007; Anker-Rasch & Sjørgard, 2011). Moreover, Diegel, Singamneni, Reay and Withell (2010) also argue that sustainability aspects regarding product design are incorporating economic, socio-economic and ethics dimensions.

If, in that sense, sustainability is incorporated within a company's strategy, it thus aims for improvement in all the three areas, economic, socio-economic and ethics dimensions (Golden, Subramanian, & Zimmerman, 2011). In particular, Anker-Rasch and Sjørgard (2011) claim that green supply chain management strives for raising environmental sustainability throughout the whole supply chain, thus including product development and product design (Golden, Subramanian, & Zimmerman, 2011).

It is further stated that GSC, and thus product design, are closely related with the concept of 'sustainable economy', that is, recognizing the significance of environmental issues, and in addition constituting that a company's strategy and vision incorporate these same environmental initiatives (Walton, Handfield, & Melnyk, 1998; Golden, Subramanian, & Zimmerman, 2011). Nevertheless, this positive integration between environmental sustainability within the supply chain still appears to be lacking systematic and thorough adoption (de Brito & van der Laan, 2010).

2.3 Reasons for being 'green' – supply chain and product design

Slightly reversing in retrospect to GSCM, there are a number of reasons in favor of adopting the 'green' aspect within a supply chain, and thus to product design. According to some authors, the most significant ones might be law and regulations enforcement, differentiation among the competitors due to the environmentally-friendly aspect (also Corporate Social Responsibility (CSR) should be considered), and last but not least – remaining competitive towards other business players in the industry, i.e. provided that they have already implemented GSCM (Anker-Rasch & Sjørgard, 2011).

Other academics argue that the adoption of GSCM could be due to ethical motivations and/or commercial drivers (Testa & Iraldo, 2010). That is, manager's values and strategies/goals, for example, and/or the achievement of competitive advantage through showing a company's concern about preserving the environment (Testa & Iraldo, 2010). Ultimately, two of the most important motivators in support of 'greening' a supply chain,

are still the higher profitability outcomes and the cost reduction anticipated (Srivastava, 2007; Fortes, 2009).

In this line of reasoning, it is further argued that both internal drivers, being organizational factors, and external drivers, i.e. regulations, customers, competitors, society as well as suppliers, can be the reasons to accommodate or decide against the implementation of GSCM (Diabat & Govindan, 2011). The research by the two authors does provide evidence in favor of the adoption of GSCM. It nevertheless illustrates a number of managerial challenges for companies due to the complexity of its practices, customer and cost pressures as well as government regulation (Diabat & Govindan, 2011).

Diabat and Govindan (2011) also discuss the aspects of GSCM, presenting a number of so-called drivers, i.e. reasons or motivations for implementing GSCM. Some of these drivers which this paper will look into and consider important for the base of GSCM are environmental collaboration with suppliers, green design, ISO 14001 certification (an internationally recognized environmental management system standard), reusing and recycling materials and packaging, environmental collaboration with customers, reverse logistics, among others (Arimura, Darnall, & Katayama, 2009).

2.3.1 Legal aspects

Considering the legislation factors and policies, western companies are likely to have a strong performance when it comes to environmental and social factors compared to developing countries. This is due to the existing legislations in the western countries regarding human rights, unions with free trade, working conditions, etc. (Mont, Kogg, & Leire, 2010). Furthermore, it is argued that complying with government legislation policies would not only be beneficial for the production processes, but also would prevent future costs to be encountered by neglecting such policies (Johnson, 2009). For instance, accommodating green aspects within the production line of an organization could foster installation of upgraded and thus more efficient production machinery, lighting, applying more sustainable packing, among others (Johnson, 2009).

2.3.2 Reputation and brand image

Stompff (2003) argues that in order to have a well-established brand image on the market it operates in, a company should strive for a well-established relationship between its designers and the company's culture, i.e. "how we do things around here" (p. 31). The author further discusses that products could be perceived as representative agents for a company, a designer themselves or a social group. A good example could be illustrated in the case of Harley Davidson motorcycles, i.e. the product stands for its brand image, and it is (and has been) perceived in a certain, unique, way by the brand's followers (Stompff, 2003). Besides, Johnson (2009) clearly states that, "No company wants a reputation for being a discriminating employer, tolerating unsafe working conditions, or being an environmental polluter.", thus implementing such green aspects within companies' organizational strategies are essential investments for current, and significantly future, growth and development (p. 25).

Furthermore, the customers' perspectives are taken into consideration regarding their choice of product. Griskevicius and Tybur's research (2010) shows that high social status (as a motivator for purchasing green products) leads customers to choosing a green or pro-environmental product, instead of a luxurious but less environmentally friendly product. The authors believe that "A good reputation is more valuable than money.", discussing the pro-social and pro-environmental motives as essential with regards to green product purchasing (Publius Syrus, 100 B.C., cited in Griskevicius & Tybur, 2010, p. 392).

2.3.3 ISO certificates

The International Standards Office (ISO) developed ISO 14000 and its first addition in the form of ISO 14001 in 1996; this being done with the purpose to guide companies' management towards accepting and following technical standards (Chen, 2005; Bansal & Hunter, 2003; Hervani, Helms, & Sarkis, 2005). It is a quality system, which if implemented, is believed to contribute to companies' management parties with creating and fostering competitiveness - through lower costs attached to the process of manufacturing, but also through sustainable development with products that have been designed to be green, and by having a clean production (Chen, 2005).

Furthermore, it is not only believed to help companies gain competitiveness, but also competitive advantages through satisfying both firms and stakeholders by allocation of resources (Chen, 2005). To be an ISO 14001 actor, there are six steps to follow. To start with, companies have to develop an environmental policy and should investigate which of their products/services and activities can be related to the environment. In addition, law requirements and regulations have to be identified. With the purpose to reduce environmental impact, the management needs to determine targets, priorities and objects for the company, as well as to meet goals, such as train personnel and assign responsibilities. Ultimately, adjusting and checking of the environmental management system should be in line (Bansal & Hunter, 2003).

2.3.4 Svanen label

Svanen is an official label that has set requirements regarding green product implementation. Furniture that has received the label of Svanen is among the products that have the least effect on the environment in the category (Svanen website, 2012). The requirements are based on the product life cycle, i.e. manufacturing, use and disposal. Furthermore, the requirements direct companies to use certificated wood, recycled plastics and metal, and to reduce the usage of hazardous substances. If a product gets the Svanen label it should also be possible to recycle it and the product needs to have good durability (Svanen website, Svanenmärkning av Möbler och inredning, 2012).

2.3.5 Möbelfakta label

Möbelfakta is another label with a set of requirements based on three different aspects, namely social responsibility, environment and quality (Möbelfakta website, 2012). If companies meet the requirements from Möbelfakta they will also meet the expectations of the surrounding society, e.g. their customers. The purpose of Möbelfakta is to create a

sustainable development and to provide the furniture producers with a strong start both domestically and internationally (Möbelfakta website, 2012).

2.4 Competitive advantage

Further research states that environmental issues cannot be ignored or overlooked; it also constitutes the notion that companies have been recognizing the need for GSCM and thus green product design implementation, due to its competitive advantage possibilities, in association with acting consciously towards the environment (Walton, Handfield, & Melnyk, 1998; Golden, Subramanian, & Zimmerman, 2011).

The authors also argue that in order for a company to act proactively in its industry and towards the environment, one should strategize and plan effectively through engaging all its activities, throughout the whole supply chain, i.e. from suppliers to end-customers. Green product innovation has also been given its due interest, being recognized as a key factor to achieving growth and environmental sustainability (Dangelico & Pujari, 2010).

In addition, strategies for dealing with environmental issues are suggested; for instance, being proactive would mean that assessment is necessary, society is involved as a responsible party (i.e. just as managers or external consultants might be responsible for various other aspects), the goal of the activity is to create a new vision for the company (Walton, Handfield, & Melnyk, 1998; Golden, Subramanian, & Zimmerman, 2011).

Johnson (2009) argues that competitive advantage could be achieved through sustainability, or going green, which in turn would constitute for better economic performance and profitability for any organization. Hervani, Helms and Sarkis (2005) further constitute that companies nowadays should focus not only on their internal practices and internal considerations for the companies themselves, but rather expand their focus scope towards the external factors and considerations, such as the environment, for example. It is discussed that the environmental impact should be strongly considered on both strategic and operational level, and in that way increase the awareness and growth of the green approach (Hervani, Helms, & Sarkis, 2005; Zhu & Sarkis, 2004).

2.5 Economic aspects

It has been argued that sustainability and Corporate Social Responsibility (CSR) will be gradually becoming more and more important for companies and their strategies in the future (Johnson, 2009). The author claims that factors such as the environment and the sustainability of a company are expected to gain higher awareness over profit maximization and market growth. In addition, being profitable and being green should be implemented in parallel, there should be a tight connection between the two practices, and they should complement each other, instead of having to choose between being profitable and being environmentally conscious (Johnson, 2009).

With regards to implementing green practices within its supply chain, and thus incorporating the green aspect in its product design, a company should take into consideration also factors such as what kind of materials are used and how, costs associated, energy usage, since they are all closely related to the economy and well-being of the company (Hervani, Helms, & Sarkis, 2005). Zhu and Sarkis (2004) further discuss that the green aspect, e.g. eco-design, constitutes an increased economic performance as well as environmental performance. Their study shows that even though there might be a certain increase in investments costs, operational and training costs initially, these costs will be all well-compensated for and improved in the long-run (Zhu & Sarkis, 2004). That is, companies might currently experience an economic slow-down, however this will be reimbursed in the future (Zhu & Sarkis, 2004).

2.6 Theoretical framework – summary

This theoretical framework section has been developed to serve as a base for this research. To summarize the theoretical data presented and discussed, green product design and its practices play an important role as a part of the GSCM, particularly in the furniture industry. Aspects such as

- environmentally conscious design (Zhang et al., 1997; Srivastava, 2007; Reay, McCool, & Withell, 2011; Luttrupp & Lagerstedt, 2006),
- sustainability (Diegel, Singamneni, Reay, & Withell, 2010; Lozano, 2008; Golden, Subramanian, & Zimmerman, 2011; Kleindorfer, Singhal, & Van Wassenhove, 2005),
- legislation (Johnson, 2009),
- reputation and brand image (Stomppff, 2003),
- various environmental and quality certificates (Chen, 2005; Bansal & Hunter, 2003; Hervani, Helms, & Sarkis, 2005),
- competitive advantage (Golden, Subramanian, & Zimmerman, 2011; Johnson, 2009; Hervani, Helms, & Sarkis, 2005; Zhu & Sarkis, 2004) and,
- last but not least, the economic benefits (Johnson, 2009; Hervani, Helms, & Sarkis, 2005; Zhu & Sarkis, 2004)

obtained are only part of the big picture (Chu et al., 2009; Srivastava, 2007; Zhang et al., 1997).

3 Methods

This section discusses the approach taken and the research design of the paper, data collection techniques, company selection as well as data analysis approaches. Furthermore, limitations, validity and reliability of the methods are discussed.

3.1 Approach

In order to implement a research on a specific topic, a research approach should be chosen. The two most often implemented and widespread options are qualitative versus quantitative research. One of the main distinctions between the two is that qualitative research data, for example, is based on opinions or meanings motivated by words, while quantitative data is based on numbers and statistics (Saunders, Lewis, & Thornhill, 2007; Malhotra & Birks, 2006). Furthermore, qualitative data or non-standardised data requires classification into categories, while quantitative data results in numerical and standardised data. Last but not least, qualitative data suggests that the data analysis is to be done through conceptualization. On the other hand, quantitative data analysis requires the use of diagrams and statistics (Saunders, Lewis, & Thornhill, 2007).

Another approach that could be considered is a deductive or inductive approach. Deductive is a research approach which is based on existing theory on a particular topic or research area (Saunders, Lewis, & Thornhill, 2007; Malhotra & Birks, 2006). In this approach, the research design is based on previously collected theory and academic research published (i.e. secondary data). On the other hand, inductive approach quite the opposite, i.e. it is one that is based on previous experience, opinions or knowledge about the research area (Saunders, Lewis, & Thornhill, 2007; Malhotra & Birks, 2006).

3.2 Research design

For the purpose of this master thesis, which is to investigate how green product design has been practiced within the Swedish furniture industry, and furthermore to investigate how green product design can reduce the negative impact on the environment, qualitative research approach was implemented, along with a deductive approach applied. Companies were contacted by the telephone, and consequently interview meetings were scheduled. Qualitative research approach was chosen to be applied since it encompasses conducting various kinds of interviews, e.g. in-depth (unstructured) and/or semi-structured, that could be done in accordance with policy documents obtained, for example (Saunders, Lewis, & Thornhill, 2007).

3.2.1 Case studies – reasoning

For the purpose of this research paper, and taking into consideration the methods chosen, the following alternatives are presented and discussed. This sub-section is based on Yin's research about case study research, design and methods (2003; 2009).

Table 3.1 - Relevant research strategies for different situations. Adopted from Yin, 2003, p. 5

Method	Form of research question	Requires control of behavioral events?	Focuses on contemporary events?
Experiment	how, why	Yes	Yes
Survey	who, what, where, how	No	Yes
Case study	how, why	No	Yes
Archival analysis	who, what, where, how	No	Yes/No
History	how, why	No	No

There are a number of factors that have to be considered when it comes to research strategies, which are presented in Table 3.1. To begin with, attention should be paid to the type or form of research questions which will serve as a base for the research of this paper. It was further essential to decide whether the research requires control of behavioral events, i.e. the possibility to control the existing behavior in a particular situation. Last but not least, the third factor reflects upon whether the research field encompasses present or historical events/situations.

Regarding the research questions for this study, Table 3.1 can be used to make a clear distinction between the different method approaches which are applicable for this research (Yin, 2003). To begin with, given that the research questions for this study are ‘how’ and ‘why’ (see section 1.6 Research questions), the scope of the research method was limited to three out of the five options, i.e. implementing an experiment, a case study or history. This is true since the other two options, survey and archival analysis do not comply with the first requirement.

To further limit the options applicable, the second factor was looked upon, i.e. whether control of behavioral events was necessary. In this research paper this is not applicable since the researchers are not required to control the behavior of events regarding the data collection. Thus, two options were left, that is case study research or history research. Consequently, the third option in Table 3.1 was considered, i.e. whether the research topic is a contemporary or current issue to be dealt with. And since this paper aims at investigating the current attitudes and motivators for green product design, this hence leads to the sole choice of conducting a case study (history research does not regard current issues or situations). To sum it up, for the purpose of this research paper case studies were chosen to be conducted due to three reasons. First, the research questions of ‘how’ and ‘why’ qualify for a case study research. Second, no control of behavioral events is required. Last but not least, the research focuses on contemporary or present issues to deal with and investigate, for future implications.

Furthermore, multiple case studies were chosen to serve as the primary information implementation (Yin, 2003). The reasons for that are to explore whether certain research aspects or findings occur in the multiple case studies, and to also aim to generalise the research findings (Yin, 2003; Saunders, Lewis, & Thornhill, 2007). Consequently, recommendations for further research on the topic were made and/or presenting sources of new research area (Saunders, Lewis, & Thornhill, 2007).

All the interviews made were recorded upon agreement. Audio-recording was implemented supporting motives such as allowing for full concentration of both the interviewer and the interviewee on the interview itself, accurate and unbiased answers and information provided, allowing to use direct quotes for empirical data and analysis purposes (Saunders, Lewis, & Thornhill, 2007).

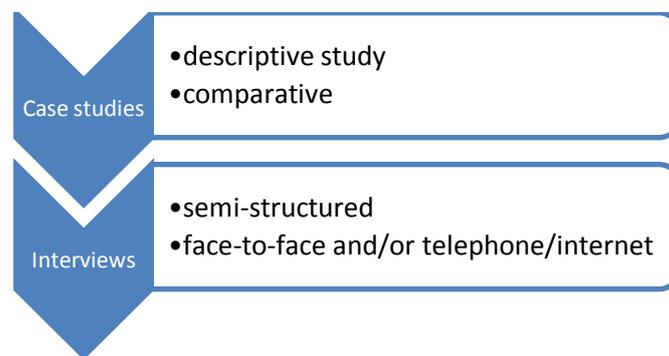


Fig 3.1 – Method selection summary.

Furthermore, as it can be seen in Figure 3.1, it was decided that comparative case studies are most suitable for the purpose, feasibility and time frames of this research paper. Comparative case studies encompass investigating several case units with the intention of providing better understanding of the research field, and further accommodating for a comparative analysis between the case studies at hand (Berg, 2001). In conclusion, the summarized method selection section is presented in Figure 3.1.

3.2.2 Types of interviews - reasoning

Qualitative data in general is conducted through non-standardised approaches, i.e. one-to-one and one-to-many interviews made, which in turn requires classification of the information gathered into categories, according to the concepts and data, facts, records acquired (Saunders, Lewis, & Thornhill, 2007). Through the semi-structured interviews, also referred to as semi-structured questionnaires (Richards & Morse, 2007), varying information could be gathered due to the fact that different questions might be posed (Bailey, 2007). That is to say, even though there were pre-determined questions selected, it was to be expected that more questions could arise during the process of conducting the interviews. Ultimately, all of this contributed further to the case study investigation, deepening the scope of the research and providing the researchers with valuable empirical input for analysis (Berg, 2001; Bailey, 2007).

In addition, semi-structured interviews would accommodate flexibility and open-mindedness about the questions at hand (Bailey, 2007). That is, the interviewee will be able to skip a question if they do not feel confident in answering it or if they think that they cannot provide much input into the research. Furthermore, these factors could contribute to better and more liberal dialogue between the interviewer(s) and the interviewee(s), i.e. complementary information could be provided and come across during the interview as well as further questions might arise.

In particular, the aim of this paper was to conduct face-to-face interviews, and telephone/internet/electronic interviews if necessary, as well as gather any policy documents or company transcript documents, if possible/provided. This was done with the intention of providing more depth to the study plus to present more substantial evidence and verification of the empirical data collected through the interviews, and further giving background information and details (Richards & Morse, 2007).

Furthermore, a number of the advantages of such qualitative interviews could be due to the purpose of the research, the importance of establishing personal contact, the character of the interview questions along with the time-consuming and completeness aspects of the process (Bailey, 2007; Saunders, Lewis, & Thornhill, 2007).

In this line of reasoning, this research paper could qualify for an descriptive study, i.e. the aim will be to investigate the current (specific for this research) processes in the companies selected, and to explore prospective insights into the topic, given that the research/case studies are based on previously conducted theoretical information gathering (Saunders, Lewis, & Thornhill, 2007; Yin, 2009). Last but not least, qualitative interviews were best implemented because it was fundamental to understand and grasp the reasons, attitudes or opinions of the participants regarding this paper's purpose, and thus the base for the interview questions (Berg, 2001; Bailey, 2007).

3.2.3 Interview questions design

The interview questions designed for this study (see Appendix 1) were based on the literature review previously gathered, i.e. why a deductive approach was implemented. The questions were standard interview questions, mostly open-ended, fostering the interviewee's creativity regarding how to answer them; as well as enabling the respondents in identifying and pinpointing trends and company's particular attitudes towards making day-to-day decisions and solutions throughout the product design processes. Furthermore, the questions were aiming at stimulating truthful, unbiased and unaffected answers, i.e. open for individual interpretation based on one's experience and perceptions (Saunders, Lewis, & Thornhill, 2007; Richards & Morse, 2007).

In addition, a couple of closed-ended questions were included in the semi-structured interview design so that they could guide the interviewees' responses in a more focused and specified way regarding the research at hand. Besides, there was one simple ranking question with the intention of enabling a more in-depth analysis of the investigated topic.

3.3 Data collection

With the intention of gathering a reasonable number of participants for this research, fifteen companies within the furniture industry were approached. The companies' selection criteria was based on information available on their websites regarding environmental (and sustainable) aspects.

3.3.1 Company selection

The companies contacted to participate in this research paper were chosen through the relevant information provided on their websites. They were selected for this research due to the application of green aspects and practices within their scope of practices, i.e. product design and product manufacturing within the 'green' reach, environmental consciousness of reflecting impacts as well as sustainability issues associated with these processes.

3.3.2 Collecting the empirical data

This was done via e-mail and/or telephone. The response rate was 26.7% (4 companies participated out of the 15 companies contacted). After having shown interest in participating in this research, the interviewees and interviewers set up a meeting date and time that was suiting both parties. The interview questions (see Appendix 1) were distributed to the interviewees via e-mail in advance, with the intention of convenience and time availability for better preparation. Furthermore, the reason for the online interviews was the inability of both parties to arrange a personal meeting within the time-span of this thesis.

All of the interviews were audio-taped, upon agreement with the interviewee at the actual interview. In addition, the interviewees were asked whether they wanted to be sent the answers extracted from the interviews, with the aim of confirming their appropriateness and truthfulness, and thus approving their release. In addition, the participants were asked whether they preferred keeping themselves as anonymous or simply stating their names and company-employers. The overall process of the data collection took slightly more than one month as it can be seen in Table 3.2 below.

The first interview that took place, with Office Furniture, was a face-to-face interview in the offices of the company, and it took about 1 hour and 10 minutes. After the interview finished, the company representative suggested a tour around the premises, including the the operational level, i.e. the factory and the warehouses, and also the strategic level, i.e. the management offices and work places. The information gathered from this observation is presented in the empirical findings section 4.3.

The second interview was with Skandiform, with the manager of the Product development department. It was a telephone interview, and it took about 50 minutes. The third interview was with Kinnarps, the interviewee was the Design and Brand manager, it took place on Skype (video interview), and it took about 65 minutes. Interview number four, Office Design participating, was implemented via the phone, during two different days. This was done due to the busy schedule of the interviewee. Both of the interviews took about 20-25

minutes/each, resulting in total 45 minutes. Last but certainly not least, interview number five, the second interview with Skandiform, was a Skype (video) interview, and it took approximately 40 minutes.

The average length of the interviews was about 55 minutes. Summarised information regarding the interviews and data collection can be found in Table 3.2 below. The table presents the companies participating, the respective departments, position and name of the interviewee, as well as an interview date, type and length of the interviews.

Table 3.2 - Data Collection Information

<i>Company</i>	Department	Position	Name	Interview date	Type of interview and length
<i>Office Furniture</i>	Anonymous	Anonymous	Respondent 1	29 March 2012	Face-to-face, 70 minutes
<i>Skandiform</i>	Product Development	Product Development Manager	Niklas Dahlman	13 April 2012	Telephone 50 minutes
<i>Kinnarps</i>	Company quarters in London	Design & Brand Manager	Alexander Gifford	26 April 2012	Skype 65 minutes
<i>Office Design</i>	Anonymous	Anonymous	Respondent 2	2 & 3 May 2012	Telephone 45 minutes
<i>Skandiform</i>	Product Development	Product Development	Ann-Louise Zander	7 May 2012	Skype 40 minutes

All the interviews were audio-recorded with the aim of retaining the respondents' answers as truthful and unbiased as possible, as well as for the convenience of being able to deepen the understanding of the answers by listening to them unlimited times, after they were transcribed, which is a characteristic data generation approach for qualitative research (Saunders, Lewis, & Thornhill, 2007; Malhotra & Birks, 2006).

3.3.3 Types of data

There are two types of data that can be used as a research tool in the academic field, and these are primary and secondary data (Saunders, Lewis, & Thornhill, 2007; Malhotra & Birks, 2006). Primary data is generated by the researchers, i.e. data collected throughout the study, specifically aimed to be used for a particular study or research. It is data concerning a current issue or situation, serving as a base and reliable source of information important for a specific study, and can be obtained through qualitative and/or quantitative method approaches, i.e. interviews, questionnaires, surveys, etc. (Saunders, Lewis, & Thornhill, 2007; Malhotra & Birks, 2006). On the other hand, secondary data can be any kind of

previous research done, i.e. articles, books, brochures, etc., and have no implication or purpose regarding the contemporary study (Malhotra & Birks, 2006).

For the purpose of this study paper, both approaches have been used, as first secondary data was gathered in order to familiarize the researchers more in depth with the topic and the various theories and studies implemented on it. There were various resources used, such as academic search engines, library data, information searched for through the internet. Consequently, this data generated was used to facilitate the process of gathering the primary data itself, i.e. interview questions were designed and thus interviews were made.

3.3.4 Data analysis

For the purpose of this thesis the empirical data gathered was analysed by following the structure of the interview questions designed. The empirical findings were presented in Summary Tables 4.1 and 4.2, after that the most important aspects arisen during the interviews were summarized. Consequently, the empirical data gathered was discussed and analysed in parallel with the relevant theory presented in the theoretical framework section. This was decided upon since the interview questions were based and structured on the theory data provided, thus following a consistent lay out and structure. The aim of doing the analysis this way was to extract possible trends or tendencies regarding the primary data obtained. Consequently, parts of the analysed data was summarized and presented in the conclusions in order to answer the research questions designed for this academic paper.

3.4 Limitations

One of the limitations of the chosen method was that the information gathered might not be able to represent all the aspects and views on the topic researched, i.e. answers to the interviews questions could be interpreted ambiguously or as a result of the interviewee's personal experience and opinions. Furthermore, depending on whether anonymity would be demanded by the interviewees, this could lead to avoidance of trustworthy and extensively answered questions; in the notion that if the respondent was to choose to be presented in the research with their name(s), thus they would be responsible and conscientious towards the answers provided.

3.5 Validity and reliability

Regarding data quality issues and overcoming them, two of these were mentioned. The first one was the validity of a research, and the latter one – reliability. The two issues were meant to support the claim that the method of research employed did not only measure the aspects it was anticipated to encompass, but further implement this in an accurate manner (Saunders, Lewis, & Thornhill, 2007).

Validity is associated with the possibility of assuming a particular (information) meaning, as a result of the flexibility and responsiveness of the semi-structured and in-depth interviews implemented. Therefore, specific topics and research areas can be investigated and explored from different angles and perspectives (Saunders, Lewis, & Thornhill, 2007). On

the other hand, reliability is said to be subject to change, since it is generally anticipated to be applicable and valid at the time of the conducted study, i.e. reliability's aspects are complex and dynamic.

To ensure validity and reliability of this paper, a number of questions in various aspects of green design, environmentally conscious and product life-cycle (within the furniture industry with respect to manufacturing) as well as sustainability with regards to these aspects, were made and structured. The validity of this research encompasses the contemporary situation and practices of the chosen company participants.

To conclude with, this research was based on the information gathered through the conducted interviews, any supplementary documents provided by the company-participants, as well as on information provided on the companies' websites. This was done in order to substantiate the data gathering, its validity and reliability.

3.6 Overview of the methods section

In order to make it easy for the reader to follow and be in line with the methodological and overall process and structure of this thesis, the above discussed approaches and aspects are summarized. For the purpose of this research paper, qualitative research approach was implemented.

Qualitative research approach, in particular case studies research (Yin, 2003), was chosen to be applied since it encompasses conducting in-depth semi-structured interviews as well as gathering any policy documents. This was done with the intention of providing more depth to the study plus to present more substantial evidence and verification of the empirical data collected through the interviews, and further giving background information and details (Saunders, Lewis, & Thornhill, 2007; Richards & Morse, 2007). Face-to-face, telephone and Skype/online interviews were conducted. All the interviews were audio-recorded with the aim of retaining the respondents' answers as truthful and unbiased as possible.

4 Empirical findings

The following sections present the empirical data collected from the conducted interviews as research means for this thesis. The information provided is a combination of the participants' answers, observation, experience and understanding of the research area, as well as website information gathered online, and policy documents obtained through the interviews. The results are presented in two tables.

4.1 Office Furniture

Office Furniture offers “Quality Office” stylish furniture designed by selected and gifted architects and designers from different parts of Scandinavia. Its furniture products are manufactured in its own factory, exclusively designed and often customized furniture with “cutting-edge design, quality and ergonomics” (Office Furniture website, 2012). All the company’s brands and design products are own-developed and manufactured following strict guidelines and company’s policies.

This in turn contributes to managing every aspect of the working process such as design, ergonomics, aesthetics, functionality, manufacturing and service (Office Furniture website, 2012). As a result, the company can offer “rationally manufactured and price-efficient “Quality Office” furniture for almost every need” (Office Furniture website, 2012). It has been granted and highly acknowledged with various awards and diplomas for its professionalism and quality work (Office Furniture website, Awards, 2012).

4.2 Kinnarps

Kinnarps is a Swedish office furniture company offering workspace interior solutions and it also controls its entire supply chain, starting from sourcing of raw materials, production, logistics services and deliveries to installation and after-sales service (Kinnarps website, 2012). Its own logistics services are well-known and respected for the efficiency and environmental thinking, e.g. goods and products are shipped in special environmentally adapted trucks (Kinnarps website, Company facts/Production & logistics, 2012). The company provides interior design solutions for both offices and public settings, striving for and symbolizing “high quality and low environmental impact mark” (Kinnarps website, Company facts/Operations, 2012).

The company provides flexible, sustainable and ergonomic workplaces with the aim of “making life better at work” (Kinnarps website, Company facts/Mission, 2012). Furthermore, the company’s sustainability philosophy “Think Green. Save Money” simply illustrates the company’s aspiration to “waste as little as possible and to care for resources so that they support long-term development, something that is a natural to Kinnarps” (Kinnarps website, Sustainability, 2012). Kinnarps has also been awarded with the prestigious “Outstanding Green Supplier” award from the Swedish Environmental Management Council (MSR) (Kinnarps website, Sustainability, 2012).

4.3 Empirical findings – Office Furniture and Kinnarps

Following are the results presented from the interviews with Office Furniture and Kinnarps, presented in Table 4.1, and the most relevant and important features are summarized after that.

Table 4.1 – Summary of Empirical Findings, Office Furniture and Kinnarps

Aspects	Office Furniture	Kinnarps
<i>Attitudes towards being 'green'</i>	<ul style="list-style-type: none"> - everybody talks about it - above all, you have to be profitable 	<ul style="list-style-type: none"> - we are environmental not because of political reasons, but because it makes business sense and it is the right thing to do - being environmental is not about marketing strategies, it is the only way things should be done - in the future this is will be the only way to do things, have a positive attitude towards it
<i>Internal green policies/ guidelines</i>	<ul style="list-style-type: none"> - not so strictly used, having a 'green mindset' is more important than papers - working on getting Svanen (Nordic label) 	<ul style="list-style-type: none"> - Nordic swan eco-label, FSC, PEFC, and own internal environmental policies as well - if nothing bad goes in, nothing bad will come out (as production) - you need to be organic
<i>Factors motivating companies to be 'green'</i>	<ul style="list-style-type: none"> - regulations - good working conditions (CSR) - competitors' pressure - economic benefits - saving costs by energy reduction - 'green' reputation/ image/ awareness - innovation 	<ul style="list-style-type: none"> - government/ social/ legal policies are drivers for change (universal regulations suggested) - Corporate Social Responsibility (CSR) and very good employment laws - being pro-active/ innovative in the way materials and production processes are used; in new ways and techniques - competitors'/global markets' pressure can be connected to innovation - economic/ business performance, green products should not be more costly - competitive edge/ advantage - improve a product offering/ brand image, should be part of everyday life - authenticity - rethink consumption - continuously re-use products - refurbishment
<i>'Green' certificates</i>	<ul style="list-style-type: none"> - no specific certificate acknowledgements - 'green' papers do not always prove 'green' thinking 	<ul style="list-style-type: none"> - ISO certificates, Nordic swan, Euro flowers, others - problematic, they might be contrary to each other

Aspects	Office Furniture	Kinnarps
<i>Product design process</i>	<ul style="list-style-type: none"> - customer request - function and design importance 	<ul style="list-style-type: none"> - starts with trend analysis workshop (i.e. internal staff, external trend researchers and an external consultant cooperate to bring it together) - external designers contacted - internal development and engineering - prototype workshops to test and present the product, and receive feedback
<i>Supply chain stages</i>	<ul style="list-style-type: none"> - transportation (truck space) 	<ul style="list-style-type: none"> - transportation (product flexibility/ practical space utilization)
<i>Supplier selection</i>	<ul style="list-style-type: none"> - not included in the product design 	<ul style="list-style-type: none"> - yes and no; it is taken into consideration - own the knowledge of how things should be done, and products produced
<i>Motivators for green product design processes</i>	<ul style="list-style-type: none"> - environmentally conscious design (4) - efficient utilization of materials (4) - minimizing waste (4) - time efficiency (1) - costs associated (3) - materials used (re-use, dispose) (4) - energy usage (5) - modularity, i.e. use parts after life cycle (1) - product safety (4) - durability/long life cycle - easy disassembly - transportation - packaging 	<ul style="list-style-type: none"> - environmentally conscious design (5) - efficient utilization of materials (5) - minimizing waste (5) - time efficiency (3) - costs associated (4) - materials used (re-use, dispose) (4) - energy usage (4) - modularity, i.e. use parts after life cycle (4) - product safety (4)
<i>End-of-life cycle</i>	<ul style="list-style-type: none"> - recycling - easy disassembly - proper disposal (e.g. wood) 	<ul style="list-style-type: none"> - re-use - recycle, very important - dispose - waste management
<i>Economic, social and environmental aspects</i>	<ul style="list-style-type: none"> - most important is economic (profit-driven) - all of them are important 	<ul style="list-style-type: none"> - most important is economic, the other will follow - all three overlap, should serve as a guideline for companies
<i>Sustainability</i>	<ul style="list-style-type: none"> - people will be willing to pay more in the future with respect to the environment 	<ul style="list-style-type: none"> - part of the company's culture - efficient practices serve as environmentally friendly - economical benefits

<i>Aspects</i>	Office Furniture	Kinnarps
<i>Evaluation processes</i>	- none	- impact analysis under customers' request - product life cycle calculations, when needed - if products are done the right way from the very beginning, evaluations should not be needed
<i>Customers' feedback</i>	- most important influence for product design	- having representatives for the target markets, with the aim of having close relationships with the customers to understand their needs - it is essential to listen to and understand the customers' needs as well as to be innovative
<i>Additional comments</i>	- none	- from a design perspective, it is important to know the basics, where things come from, i.e. the engineering and manufacturing processes - having an understanding about form, design, human interaction, i.e. it is all a cooperation, a marriage

The empirical findings summarized in Table 4.1 present the companies' practices and views on the topics and sub-sections included in the interview questions. Overall it could be stated that incorporating the 'green' aspect within a company's product design processes is important due to the environmental awareness and concern of the businesses and society at large, i.e. it is of great value what attitudes the management has towards the impacts caused on the environment. It is also of great importance (for Kinnarps more important than for Office Furniture 1) that companies follow specific guidelines and policies (including their own internal policies), such as ISO 14000, ISO 140001, FSC and others, when designing green.

With regards to the motivators for designing 'green', all of the listed factors in the interview questions (see Appendix 1, q. 3) were considered important. Nevertheless, significant emphasis was put mostly on economic performance, innovation, CSR practices. Regarding the motivators or drivers for green product design, environmentally conscious design, efficient utilization of materials, minimizing waste, types of materials used and energy usage were the highest ranked factors. In addition, transportation was considered of great importance as a major stage of an efficient supply chain. Moreover, the observation session at Office Furniture further supported various aspects from the conducted interview, namely: good working conditions, saving costs by energy reduction, considering transportation (truck space), minimizing waste and packaging (Observation, 29 March, 2012). Considering the end-of-life cycle, the following aspects were pinpointed as essential: recycling, easy disassembly and proper disposal. Last but not least, economic performance was identified as most important when it comes to sustainability factors; society and the environment were also given their due attention.

4.4 Skandiform

Skandiform is one of the leading suppliers for office furniture in Scandinavia. Its products are well-known for their high quality, function and design, due to its traditions, high competence and reliable deliveries, as well we importantly - personal service (Skandiform, Environment/Quality, 2012). The company works with the belief that good quality has a positive impact on the environment, with the aim of being “as environmentally responsible as it is possible to be (Skandiform, Environment/Quality, 2012). Thus, it is considered a long-term and serious commitment for improvement. In addition to that, Skandiform strives for using as pure materials as possible in order to be able to recycle its products and components. The company further tries to influence this thinking on its suppliers when it comes to choice of raw materials, for example. The management believes that, “Furniture that combines a timeless appeal with high quality is long-lasting furniture. This, too, promotes sustainability and serves the interests of what we all need to take care of - our environment.” (Skandiform, Environment/Quality, 2012).

4.5 Office Design

Office Design has been rapidly growing into a major furniture manufacturer on the striving for recognition for its ambitious design on an international level. The company believes in “qualitative, innovative and sustainable design”, and also that Corporate Social Responsibility (CSR) has the same importance as design and quality (Office Design website, 2012). Since the production development processes are focal for the company, the choice of materials, energy, logistics and transportation are of high importance. Thus, Office Design aims at improving the sustainability of its products by ensuring their quality as well as the minimization of all negative impacts on the environment, i.e., “We are continuously searching for innovative solutions that open up new ways for creativity.” (Office Design website, Products/Quality, 2012).

4.6 Empirical findings – Office Design and Skandiform

Following are the results presented from the interviews with Office Design and Skandiform. They are presented in Table 4.1, and the most important features are summarized after that.

Table 4.2 – Summary of Empirical findings, Office Design and Skandiform

Aspects	Office Design	Skandiform
Attitudes towards being ‘green’	- not only being profitable, but also sustainable, responsible towards the environment	<ul style="list-style-type: none"> - becoming more and more important - communication with manufacturers and suppliers is very important - we use sub-contractors for everything, communication is vital, also all parties should be sustainable and responsible - sometimes being productive should be prioritized than being environmental

Aspects	Office Design	Skandiform
<i>Internal green policies/ guidelines</i>	<ul style="list-style-type: none"> - yes - most importantly, you should do the right thing 	<ul style="list-style-type: none"> - currently working on Svanen labeling, FSC mark - suppliers are demanded to also use them, one should be green throughout the whole supply chain - even though it takes both time and money, it is a win-win situation for both the company and the environment, we must be responsible - this will be a future ‘must’ - incorporating the environmental aspect in every decision made
<i>Factors motivating companies to be ‘green’</i>	<ul style="list-style-type: none"> - Corporate Social Responsibility (CSR) - being innovative - global markets’ pressure - economic/ business performance, if a company strives to be sustainable, it needs to be profitable - competitive edge/ advantage - improve a product offering/ brand image, very important - important that customers are on board, discussions - top level support - motivators for designing ‘green’ can sometimes be in conflict, i.e. you should think first in economic terms - sort out and dispose of plastics by burning them, government included 	<ul style="list-style-type: none"> - government/ social/ legal policies, very important and must be followed; media, the government, and others are questioning what you are doing; one should be a step ahead - Corporate Social Responsibility (CSR), all our sub-contractors must also follow these - being pro-active/ innovative, very important, being one step ahead of the competition; also gives good PR - competitors’ and global markets’ pressure, yes, you cannot fall behind the other players in the market - economic/ business performance, very important; however, it will provide profits in the future, not now - competitive edge/ advantage, good for the economy of the company - improve a product offering/ brand image, striving for being seen as an environmental company
<i>‘Green’ certificates</i>	<ul style="list-style-type: none"> - Nordic eco-label - The EU flower label, FSC label for forest 	<ul style="list-style-type: none"> - Svanen (not labeled yet), also FSC marking on wood - ISO 14000 and ISO 14001
<i>Product design process</i>	<ul style="list-style-type: none"> - worldwide designers send proposals - proposal must be aligned with company’s strategies - proposals are chosen by the design council - a prototype is built 	<ul style="list-style-type: none"> - the marketing department as well as the product development department are involved, and the process includes information briefings, prototypes development, testing, etc. - since we use sub-contractors, we give a task to a designer, and he and his team design the products; it is, however, a team project we are both involved in - also, it is important to take a step back and elaborate on what do you really aim to do

Aspects	Office Design	Skandiform
<i>Supply chain stages</i>	<ul style="list-style-type: none"> - manufacturing, transportation and re-use (end-of-life cycle) 	<ul style="list-style-type: none"> - we try to involve the manufacturers as early as possible, they have knowledge of the material, construction, etc. - location of our sub-contractors with regards to transportation (quite expensive), also for storage and assembly - recyclable materials
<i>Supplier selection</i>	<ul style="list-style-type: none"> - the purpose is to know where materials are sourced and where things are produced 	<ul style="list-style-type: none"> - it is essential; contacts are established very early in the process - we choose who the manufacturer will be
<i>Motivators for green product design processes</i>	<ul style="list-style-type: none"> - environmentally conscious design (5) - efficient utilization of materials (5) - minimizing waste (4) - time efficiency (4) - costs associated (4) - materials used (re-use, dispose) (3) unfortunately lack of good recycling channels; difficult to find re-usable materials - energy usage (3) - modularity, i.e. use parts after life cycle (3) - product safety (5) - disassembly 	<ul style="list-style-type: none"> - environmentally conscious design (5), we visit the factories to make sure conditions are good; a check-point for us - efficient utilization of materials (4), it costs less, it weighs less and also it impacts the environment less; everybody gains, the product is cheaper, lighter transport is easier and cheaper; less material used; working with different materials - minimizing waste (5), waste is not worth anything; use the materials in the best way, best in economic terms and in environment terms - time efficiency (4) - costs associated (4), less materials costs less, less weight costs less, more profit in the future - materials used (re-use, dispose) (5), using a lot of steel, different fabrics; recyclable, reusable, disposable - energy usage, plays a big role; if we do good for the environment, costs will be less eventually; if you use less energy – less costs (3) - modularity (3), applicable in some cases - product safety (5), guarantee and reputation
<i>End-of-life cycle</i>	<ul style="list-style-type: none"> - re-use is of interest, but it is still on a discussion level - recycle - waste management, following recycling guidelines, disassembly, assortment 	<ul style="list-style-type: none"> - recycle, what happens to a product after its used), dispose as well - how long a product lasts, durability, time-line of a product; environmentally friendly compared to durability – lasting longer is better and more economical. - easy disassembly
<i>Economic, social and environmental aspects</i>	<ul style="list-style-type: none"> - economic is very important, needed to run the company - overall all of them play an important role 	<ul style="list-style-type: none"> - economic should be most essential; everything is very important, it is hard to prioritize them; however, the company must be profitable; social and environmental are equally important; we

		<p>have to make a difference for our workers</p> <ul style="list-style-type: none"> - the environmental aspects are very important in the design process; CSR has its importance in the manufacturing stage, but not in the design process
Aspects	Office Design	Skandiform
<i>Sustainability</i>	<ul style="list-style-type: none"> - get rid of harmful substances - control where materials are sourced (e.g. woods) - recyclable materials - end-of-life cycle, disassembly - part of a package, pay for good design and good quality, as well as good environmental properties - usually customers are willing to pay extra, if there is additional service/aspect provided - social aspects, cutting trees, being sustainable and responsible - keep up the good reputation and brand image 	<ul style="list-style-type: none"> - now we have a policy that all New furniture should be branded with Svanen - it is very important to be in the front line, selling more by doing the right things - do good for the environment, get our brand name out more, sell more and consequently earn more; selling products with environmental properties is a win-win for us - no company wants to be associated with child labor, for example; establishing personal contact with your workers is very important - we visit all our partners to make sure they are sustainable enough to cooperate with - suppliers must have the right materials from the right places
<i>Evaluation processes</i>	<ul style="list-style-type: none"> - ISO 14001 and internal objectives - increasing the products with Nordic eco-label - keep control of all processes 	<ul style="list-style-type: none"> - sub-contractors must also fulfill ISO 14001, for example; all processes must be following certain guidelines; it is about working with people and partners you trust
<i>Customers' feedback</i>	<ul style="list-style-type: none"> - very important - today a product can be developed together with the customer, and even added to our product assortment 	<ul style="list-style-type: none"> - after the product has been finished, we try to offer a solution to their demands and needs; not at the design stage; we do not show half finished products
<i>Additional comments</i>	<ul style="list-style-type: none"> - none 	<ul style="list-style-type: none"> - none

The empirical findings summarized in Table 4.2 present Office Design and Skandiform's practices and attitudes on the topic of green product design. Both companies firmly believe that being sustainable and responsible towards the environment is a rapidly increasing issue concerning all participants in the industry. Furthermore, both of them follow internal policies and various guidelines regarding green practices, and Skandiform requires following such guidelines from its suppliers as well; for example, the Euro flower, FSC, ISO 14000, ISO 14001 and others.

With regards to what motivates the companies to incorporate the 'green' aspect, most commonly highlighted as important are the CSR practices, being pro-active/innovative, and naturally the economic performance of the company. Furthermore, both of the

companies state that supplier selection is of high importance when it comes to 'green' practices, and thus green product design; one should know how and where materials are sourced, for example.

When it comes to motivators for designing green products, the two companies highlighted as most important the following factors: the environmentally conscious design, the efficient utilization of materials, minimizing waste, time efficiency, costs associated, materials used and product safety. End-of-life cycle aspects, such as recycling and disassembly were considered most significant.

Touching upon the sustainability aspects, economic performance is naturally seen to be most essential factor for the companies, and consequently, social and environmental factors are equally important. With regard to sustainability, various aspects are very important, however both companies state that keeping the good brand image and reputation are essential, doing the right thing, being sustainable and responsible.

5 Analysis

This section presents the analysis of the empirical findings gathered throughout this research. In this section, the results obtained through the interviews are compared and analysed simultaneously.

5.1 Attitudes towards being ‘green’

The perception of being ‘green’ according to Office Furniture as well as Skandiform is that “everybody talks about it”, and above all, profitability is the major reason for companies to exist, and thus be able to design green (Srivastava, 2007; Hu & Hsu, 2010). On the contrary, Office Design constitutes that a company nowadays should not only be profitable, but it should furthermore be sustainable and responsible towards the environment (Diegel, Singamneni, Reay, & Withell, 2010; Golden, Subramanian, & Zimmerman, 2011).

Kinnarps state that it incorporates the environmental aspect not because of political urges or reasons, but rather, simply because “it makes business sense and it is the right thing to do” (Kinnarps respondent, 2012). In addition to that, the company believes that being environmental is not about marketing strategies, for instance; it is simply the only way things should be done. Hence, this will be the future of how things should be done, as Lozano (2008) suggests, i.e. to have a positive attitude towards the green product design - this is what Kinnarps stands for.

Skandiform also believes that this issue is gaining more and higher importance within the furniture industry. The interviewee states that the communication dialogue with manufacturers and suppliers has a significant role in the working process, especially due to the fact that the company uses sub-contractors for all of its processes. As a result, communication is vital, as well as sustainability and responsibility (Golden, Subramanian, & Zimmerman, 2011).

5.2 Internal green policies/ guidelines

In order to be granted with ISO 14001 certificate a company needs to develop an environmental policy (Bansal & Hunter, 2003). Office Furniture has internal policy documents but it does not necessarily follow them strictly and at all times; instead it has “a green mindset” which is the driver for their ‘green’ implementation. Hence, Office Furniture’s case internal policy documents are not considered as drivers. For Skandiform, Office Design and Kinnarps, on the other hand, their internal policies are considered as drivers and are also used throughout the companies. Furthermore, the entire Kinnarps organization acknowledges that the core of their policy is that “if nothing bad goes in to the product, nothing bad will come out of it”.

The majority of the case companies are driven by their internal policies and guidelines, Office Furniture is the only one who is not. A reason for that might be that Office Furniture is the smallest among the companies, hence might not have as worked through

policies. Furthermore, Office Furniture works with a green mindset which might be considered as a policy.

5.3 Factors motivating companies to be 'green'

In western countries there are more existing legislations regarding human rights, working conditions and etc than in developing countries (Mont et al., 2010; Johnson, 2009). Hence, companies in western countries often show stronger performance regarding environmental aspects (Mont et al., 2010). Office Furniture does agree that legislation has been and is a driver for them in terms of incorporating 'green' in their business and product design. Skandiform also agrees that these are things necessary to be followed, however legislations might not be the strongest driver, rather something that has to be followed. Office Design is in line with Skandiform, hence legislation is seen as helpful but not an aspects that drives Office Design to incorporate environmental thinking in its product design.

In the case of Kinnarps, this is considered a driver for all companies to undertake the same actions towards the environment. However, it is not the strongest driver and it can also cause problems for the companies, than rather assist them in evolving. Every country has its own legal policies and some of them can be in conflict with each other, which in turn prevents and causes difficulties for international companies to follow all of them. Furthermore, the respondent at Kinnarps highlights the fact that many companies find ways to go around the different policies. Thus, if there were universal policies, there would be more positive impacts for all the parties involved.

When it comes to drivers for being green, some of the most significant ones might be law and regulations (Anker-Rasch & Sjørgard, 2011). Based on the companies in this study laws and regulations might be seen more as a basic start point, something everyone has to follow and not as a driver for being green. The only company in this study that considers laws and regulations as a driver for environmentally friendly products is Office Furniture. The other three companies claim that naturally it is important to follow such laws, however this is not what drives them in their strive to be environmentally friendly.

Corporate Social Responsibility (CSR) can be considered as a driver for engaging in environmentally friendly practices (Anker-Rasch & Sjørgard, 2011). In this aspect all the case companies are aligned, and CSR is considered to be of high importance to all of them. However, the respondent at Kinnarps considers CSR as an aspect that many companies cut back on, if and when they experience economic or other issues. To sum up, based on theory and the case companies' insights, CSR and internal policy documents are drivers for being green. Legislation and regulation do not count as a driver in the three largest cases in this research, but they do in the smallest company. Hence, it could be argued that legislation can be a driver in the initial phases of developing environmental practices for companies. This is also supported by the three larger case companies which view this as a basic level that everyone has to follow.

Innovation in green product design has been pointed out as one of the key factors to achieve growth and environmental sustainability (Dangelico & Pujari, 2010). Innovation

has not been a driver for Office Furniture, for the fact that its customers are mostly price-driven. On the contrary, Skandiform and Office Design have the intention to use green product design in order to be innovative. In the case of Kinnarps the innovation lies in how materials and production processes are used. There is no direct link between innovation and the actual product design at Kinnarps. However, the importance of coming up with new ways and techniques to carry out the green product design is considered innovative. Hence, two of the case companies are fully aligned with the theory, one partly and one not at all.

On the other hand, global markets and competitors' pressure can drive companies to take environmentally conscious actions (Diabat & Govindan, 2011; Anker-Rasch & Sjørgard, 2011; Johnson, 2009). Office Furniture feels that pressure from competitors in the Swedish market drives them to strive for greener products. However, Office Design does not perceive the global market as a driver, since the Swedish market is already more developed with regards to environmental practices. Skandiform regards competitors' pressure as a driver; however, they also do what feels right for them. Furthermore, the respondent at Skandiform is uncertain if they consider global market pressure which aligns Kinnarps with Office Furniture's opinion in that aspect.

Office Design, on the other hand, has the opposite viewpoint, which is that the global market pressure is important and that competitors' pressure is of less importance. Kinnarps considers both competitors and the global market pressure important. Furthermore, this is why the respondent believes that they need to be innovative and strive to come up with new production processes as an example. Hence, there is a conflicting opinion in this aspect from the companies as two of them consider competitors' pressure important while two do not. Furthermore, the same proportions apply for the global markets' pressure.

Companies that implement GSCM, thus green product design, can gain competitive advantages through striving to be environmentally conscious (Walton, Handfield, & Melnyk, 1998; Golden, Subramanian, & Zimmerman, 2011). Office Furniture does not aim to be green in order to get competitive advantages, because it believes that it is possible in theory but not in its practice. That is applicable in the case of Office Furniture, since most of its competitors are on the same level and additionally they use the same suppliers' suppliers and the same base material. However, Office Furniture thinks that competitive advantages can be gained in the future if the customers are prepared to pay more for an environmental product.

On the other hand, Skandiform and Office Design consider competitive advantages as a driver for environmentally friendly products. Kinnarps has a different opinion being that first innovation is what creates competitive advantages, and second it is important to be innovative in environmental terms. However, aligned with Office Furniture's opinion Kinnarps also argues that this is something that should be implemented by all companies. Hence, three of the companies see competitive advantages as an important factor with regards to environmentally friendly products. Office Furniture though believes that this will have an impact in the future.

Zhu and Sarkis (2004) argue that GSCM is rapidly emerging as highly significant for performance improvement, and that in order to be successfully implemented there should be a balance, a clear link established between a supply chain's enhanced economic, competitive and environmental performance. Office Furniture does not consider that green product design creates economical or performance benefits at the moment, however it assumes that it might happen in the future, and that customers will be prepared to pay more for environmentally friendly products. Skandiform already considers green product design to give less cost, and further that by doing good for the environment, costs can also be reduced.

Another aspect from Skandiform is that if the brand is associated with green design, sales will consequently increase, and thus will the company's profit. In this respect, Office Design is aligned with Skandiform. Furthermore, in Office Design's opinion customers are prepared to pay more for products that are of good quality, design and with environmental properties. Kinnarps also agree that economical benefits are to be found, especially since green is the only way it has worked, it is hard to estimate such benefits' amount. Hence, three of the case companies are aligned with the theory that companies can get economical and performance benefits from being green. Office Furniture is the only company that has some reservations at the moment.

If a company strives to be green and takes actions towards being environmentally conscious, its brand image can be strengthened (Johnson, 2009). Office Furniture believes that brands can be strengthened from green reputation in the future but for now most of the companies in the Swedish office furniture industry are on equal level. Kinnarps, on the other hand, thinks that if the company does provide environmentally friendly products in a special way, this can strengthen the brand.

Furthermore, that it will not be like that in the future because then all companies will have an equal level. Both Office Design and Skandiform align with the theory, claiming that green reputation can strengthen the brand image, furthermore considering it as an important aspect. Hence, three of the companies believe that green reputation can have a positive impact on companies' branding nowadays. Office Furniture believes that this will happen in the future, while Kinnarps on the contrary believes that this will not matter in the future, regarding a company's brand image.

5.4 'Green' certificates

There are a number of different certificates and labels for companies that produce green products, such as ISO certificates, Svanen and Möbelfakta (Chen, 2005; Bansal & Hunter, 2003; Svanen website, 2012; Möbelfakta website, 2012). Office Furniture is in the progress of receiving the Svanen label for its products, however its management does not believe in just having labels. Having green certificates/labels is not a proof for being green, Office Furniture has experienced that the criteria can be compromised. Furthermore, Office Furniture has the opinion that it is better to be and to try be green rather to have labels for it. Skandiform also is in the process of being granted the Svanen label; they also have ISO 14001 and 14000 certificates, as well as FSC label for wood.

Office Design has the Nordic eco-label which according to the respondent is aligned with the Euro flower and FSC label. Kinnarps has a number of different labels, for example, ISO, Nordic swan, Euro flower and others. Its management believes that having certificates and labels is important so that its green reputation is not seen as just another marketing strategy. Furthermore, Kinnarps, also as Office Furniture, thinks that there are too many different labels, and that some of them have conflicting criteria. Instead, Kinnarps thinks that it would be better to have international standards.

All companies participating in this research have green labels/certificates, however, one of the companies states that it is possible to find ways around the labels criteria and also to get dispensation on some of the criteria. Furthermore, conflicting criteria between labels have been brought up which could lead to an argument that it is impossible for a company to follow or have all the labels. The empirical findings also point out that there are a number of labels from different countries which can be seen as further evidence that companies cannot incorporate all existing labels.

5.5 Product design process

With regards to the initiation process of product design, the participating companies seem to have different approaches. At Office Furniture a product design process starts when a customer request is received, while at Kinnarps the process starts with a trend analysis workshop, i.e. workshop cooperation between the internal staff, external trend researchers and an external consultant, all working together with the aim of creating a start-up point of a particular product design. On the other hand, Office Design product design processes are initiated when designers worldwide send their proposals for a product's implementation. Nevertheless, Skandiform designing scheme is yet different from all the other companies, i.e. the company gives a task to a designer and their team, and they collectively design the product (this is so because Skandiform uses sub-contractors for all processes, and cooperation and excellent communication are crucial). It also involves the marketing department as well as the product development department, the process includes information briefings, prototypes development, testing, etc.

Consequently, Office furniture emphasizes on functions and design during its product design processes, in support of what Reay, McCool, and Withell (2011) discuss. In the mean time, Kinnarps contacts its external designers and the process of internal development and engineering begins, following prototype workshops aiming to test and present the final product, and ultimately to receive feedback. Similarly, the next step at Office Design is that the received proposals must be aligned with the company's strategies and policies. In addition, the best proposals are elected for implementation by the design council, and eventually a prototype is built.

5.6 Supply chain stages

Regarding the supply chain stages included to a certain extent in the product design processes, transportation, and in particular truck space efficiency is essential for Office Furniture. In parallel, transportation in terms of product flexibility during shipping as well

as practical utilization of space is most significant for Kinnarps in this field. Office Design also constitutes transportation as important with regards to supply chain stages involvement, further adding manufacturing and re-use after end-of-life cycle. Last but certainly not least, Skandiform believes that manufacturers should be involved within the process as early as possible because of their competence in materials, construction, etc. A similarity to the other companies is that transportation is major as well. Ultimately, when it comes to supply chain stages included in the product design, implementing the products with recyclable materials is significant (Srivastava, 2007; Hu & Hsu, 2010; Zhang et al., 1997).

5.7 Supplier selection

Office Furniture does not incorporate supplier selection processes within the product design itself. On the other hand, Kinnarps takes that into consideration, stating that it should own the knowledge of how things are to be done, and thus products produced. Hence, in this regard, supplier selection process is considered important and part of the product design (Diabat & Govindan, 2011; Zhu & Sarkis, 2004). Accordingly, Office Design includes the supplier selection with the purpose of having information about the source of the materials as well as the location of the production processes. In line with that, Skandiform considers the supplier selection essential stating that contacts should be established as early as possible in the design process, with the intention of choosing the most appropriate manufacturer for the production. Hence, three of the participating companies are aligned with the theory, supplier selection is included in the product design processes in these companies.

5.8 Motivators for green product design processes

In the theory section a number of aspects that are important for green product design were pinpointed. These aspects are environmentally conscious design, efficient and effective material utilization, types of materials used, minimizing waste, time efficiency, cost associated and energy usage (Zhang et al., 1997; Srivastava, 2007).

All companies graded these aspects from 1 to 5, where 5 is most important and 1 is least important.

➤ Environmentally conscious design

Office Furniture (4), Skandiform (5), Office Design (5), Kinnarps (5). Average (4,75)

Skandiform regards this as a factor of high importance as well as one of the reasons why Skandiform visits its new partners or sub-contractors' factories before it starts working with them. Kinnarps and Office Design also consider this as very important.

➤ Efficient and effective utilization of the materials

Office Furniture (4), Skandiform (4), Office Design (5), Kinnarps (5). Average (4,5)

For Skandiform this aspect is of high importance, however hard to manage due to the possible combinations of many different materials. Furthermore, this is an aspect that is always discussed in Skandiform, along with their suppliers. Office Furniture also considers this as important; it uses machines that calculate minimum material usage for given forms (parts of products), hence it can be argued to be more of a production aspect at Office Furniture. Office Design and Kinnarps also consider efficient and effective utilization of materials of high importance.

➤ Minimizing waste

Office Furniture (4), Skandiform (5), Office Design (4), Kinnarps (5). Average (4,5)

Office Furniture views this as a concern for the production and not for product design itself. However, products are not design with the aim of using unnecessary materials. Kinnarps and Skandiform think that this is of high importance, and Skandiform includes this aspect in the efficient and effective utilization of materials. Office Design thinks that it is important as well, nevertheless not among the most important factors.

➤ Time efficiency

Office Furniture (1), Skandiform (4), Office Design (4), Kinnarps (3). Average (3)

Skandiform and Office Design regard this aspect as important, however not among the most important ones. Kinnarps thinks that it is important, but it would not compromise environmental factors with time factors since designing 'green' is more important than cutting production time (Luttropp & Lagerstedt, 2006).

➤ Costs associated

Office Furniture (3), Skandiform (4), Office Design (4), Kinnarps (4). Average (3,75)

Skandiform thinks that this is important as well due to the possibility that costs for green product design can be higher than regular products, however the company believes that developing green products will pay off in time (Luttropp & Lagerstedt, 2006). Furthermore, if less materials are used this leads to less costs, and less materials will constitute less weight that in the end will also give less costs. Office Design and Kinnarps also regard this as important, since nowadays the competition is very strong and thus costs are always taken into a serious consideration for the businesses.

➤ Materials used (re-usable, disposable)

Office Furniture (4), Skandiform (5), Office Design (3), Kinnarps (4). Average (4)

Skandiform has been working with this issue for a long time and it finds it of high importance; as an example, the last alternative for disposing of materials, which is to burn them, and that is not good enough for Skandiform. Office Furniture, on the other hand, burns materials and considers this as a good way of disposal since they use the energy generated to heat up the factory. Office Design thinks that this is very important, however that there is a lack of good recycling channels in Sweden and that it is hard to find reusable

materials for its products. In addition, Kinnarps regards this as highly important, and it works a lot with product end-of-life decisions, taking into consideration that all materials are reusable.

➤ Energy usage

Office Furniture (5), Skandiform (3), Office Design (4), Kinnarps (3). Average (3,75)

This is the most important factor according to Office Furniture. Office Design also thinks that this is important, nevertheless hard to measure. Skandiform does not prioritize this aspect.

➤ Modularity (ability to use (parts of) the product after its life-cycle)

Office Furniture (1), Skandiform (3), Office Design (3), Kinnarps (4). Average (2,75)

Office Design does not regard this as important to their product design processes since there are a number of different designers used. Skandiform is in the process of developing legs with such an intention, i.e. modularity; however it is not something they take into consideration for every product. Furthermore, Skandiform finds this an interesting aspect. Kinnarps thinks that this is something essential for the future, hence the ability to refurbish products.

➤ Risk assessment/product safety:

Office Furniture (4), Skandiform (5), Office Design (5), Kinnarps (4). Average (4,5)

Kinnarps, Skandiform and Office Design think that this is of high importance. Nonetheless, Kinnarps does not consider this as part of green product design. For Skandiform this is of high importance due to customers' safety, economic concerns as well as reputation. Furthermore, all Skandiform furniture goes to Kinnarps laboratory to be checked.

➤ Other aspects considered important

When it comes to green product design one of the most important product attributes for Office Furniture is durability which is in line with the theory, durability is an important factor to consider for green product design (Anastas & Zimmerman, 2003). Products should be designed to be used a long time, to prevent waste and unnecessary energy and material used in the production process. Office Furniture further discussed transportation and packaging. Office Design pinpointed disassembly.

Efficient and effective utilization of materials and minimizing waste are seen as production concerns, not something to include in the product design stage at Office Furniture. Since this is a small company this might be because it is not as developed (with regards to in green product design) as the other participating companies. Furthermore, having less resource to allocate to the product design might lead to the need for prioritizing more.

To conclude, based on the average ranking for the different aspects it can be argued that environmentally conscious design is the most important factor (4,75) and close after that come efficient and effective utilization of the materials (4,5), minimizing waste (4,5) and product safety (4,5). After that are materials used (re-usable, disposable) with an average score of 4, and then energy usage and costs associated (both having 3,75). Next in line comes time efficiency (3) and ultimately modularity (2,75). All aspects have been mentioned as important; however, the rankings point out which aspects are prioritized highest at the participating companies.

5.9 End-of-life cycle

Product end-of-life options were found in the theory as re-use, dispose, remanufacture, recycle and waste management (Zhang et al., 1997; Reay, McCool, & Withell, 2011). Office Furniture implements recycling and disposal. To make this easier Office Furniture includes disassembly properties in the product design stage. Skandiform incorporates recycling, disposal and waste management in their product design. To ease those processes considerations to disassemble are taken in the design stage. Office Design takes recycling and waste management into consideration in the product design stage. Furthermore, disassembly has a role in the design process. Kinnarps implements re-using, recycling, disposal and waste management in the product design. In addition, Kinnarps thinks and believes that in the future it will incorporate remanufacturing as well. This is possible already, however not used yet.

Hence, all four companies incorporate recycling in their product design, three of them also consider disposal. Furthermore, the three larger companies have waste management practices. Kinnarps implements four of the options at the moment but thinks that remanufacturing might come to more use in the future.

5.10 Economic, social and environmental aspects

There are three important issues regarding product design, namely: economic, social and environmental aspects (Reay, McCool, & Withell, 2011; Diegel, Singamneni, Reay, & Withell, 2010; Johnson, 2009; Hervani, Helms, & Sarkis, 2005; Zhu & Sarkis, 2004).

Office Furniture puts the economy as most important since without profit the company will not be able to exist (Srivastava, 2007; Hu & Hsu, 2010). But all three of them play a big role for the company, striving to be environmentally friendly and considering the social aspect as an important part. Skandiform agrees that the economic is the most important factor, but also that everything is very important, it is hard to prioritize them. Furthermore, if the company is not profitable, it will not be existent according to Srivastava (2007) and Hu and Hsu (2010). Social and environmental aspect is considered to have equal importance. Making working conditions better for employees are viewed as an obligation in Skandiform and the only way to make a difference. Office Design further agrees that the economic factor is the most important, necessary to run the company, and that all of them play an important role as well.

Kinnarps opinions are aligned with the other companies. The economic aspect is most important, and the other two will follow it. However, all of them are imperative and they overlap each other. Besides, there is a model including all three aspects. And it should serve as a guideline for companies to follow. It is vital to try to be in the center of the model, i.e. in the middle, encompassing all three aspects simultaneously, as it has been discussed and argued by Diegel, Singamneni, Reay and Withell (2010). However, as a manufacturing company within the furniture industry, one should start with the economic aspect. All participating companies believe that economic aspects are the most important among the three issues.

5.11 Sustainability

Companies strive to have a high level of sustainability and a sustainable product should have economic, socio-economic and ethical dimensions. Hence, environmental, economic and social sustainability should be incorporated in the product design (Srivastava, 2007; Hu & Hsu, 2010; Anker-Rasch & Sørgard, 2011; Diegel, Singamneni, Reay, & Withell, 2010).

The sustainability of a product can be affected by the material and energy in the product (Anastas & Zimmerman, 2003). Office Design discusses harmful substances, where materials are sourced, assuring that materials are recyclable with practical end-of-life options. Skandiform investigates where its suppliers source the materials, as the materials have to come from the right places, how products will be transported and make a revision on its old products. All of these aspects are included in the company's product design stage. Kinnarps believe in its bottom-line policy, i.e. if good things go in then good products will come out. Furthermore, doing things in the most efficient way is often also the most environmentally friendly way. Kinnarps provides an example for this, which is that using reusable packaging (blankets) will reduce the negative impacts on the environment as well as save money to the company.

Considering the economic benefits, companies profitability is closely linked to sustainability and it can be regarded as an equivalent (Wade, 2005). Office Furniture believes that economic benefits will be better in the future when customers are prepared to spend more money in order to get environmentally friendly products. Kinnarps and Office Design both think that there are economic benefits from green product design while Skandiform and Office Furniture rather think that this will happen in the future, and thus companies will be more profitable in the long run. On the other hand, Office Design thinks that green products are part of a package where customers are already prepared to pay for good design, quality and implemented environmental practices. However, Skandiform states that this is only true for some customers, since normally customers demand to receive something extra in order to pay more. Kinnarps believes that if a company performs well in one area, then it is likely to perform well in other areas as well, hence economic benefits are perceived from implementing green product design.

With regards to brand image, trustworthiness and ethical consideration, both Office Design and Skandiform agree that brand image can be strengthened. Skandiform also thinks that trustworthiness and ethical consideration can be gained. Skandiform further discusses how

important it is that companies make sure to not be part of exploiting child labor, and to make sure that working conditions throughout the whole supply chain are good and sustainable.

5.12 Evaluation processes

Office Furniture does not apply any evaluation programs, on the contrary though the three other companies implement some form of evaluation of their products. Kinnarps does impact analysis when customers have asked for that; product life cycle calculations have also been used. However, Kinnarps thinks that these types of programs are time – consuming, and if the product is done in the right way from the start then there will be no need to investigate that later. Office Design is doing this in line with ISO 14001 and the Nordic eco-label. Office Design is working on getting the Nordic eco-label for a greater number of its product line, and in this work it needs to evaluate the product design impact on the environment. Skandiform performs routines for product evaluation; nevertheless the routines are not completely finished and thus can be improved. Furthermore, Skandiform admits that such processes have a lot to do with sourcing as well, and hence it is essential to evaluate the suppliers, making sure that suppliers can be trusted to follow the green guidelines as well.

5.13 Customers' feedback

It is important to consider customers' opinions in the product design regarding green products (Griskevicius & Tybur, 2010). Office Furniture believes that a customer's opinion is always the most important aspect in a product design process. Office Design also regards customers' opinions as highly important, sharing that products are even often developed together with the customer. Skandiform takes customers' opinions into consideration and some of its products can be customized; however for new products customers' opinions are collected after the product has been made. Kinnarps has representatives from every target market who work to get close to the customers and figure out what they want. Furthermore, Kinnarps believes that it is important to take into consideration what the customers need, not only what they want.

5.14 Additional comments

Only one of the companies, Kinnarps, had additional comments to add. Taking into consideration the design perspective, it is important to know the basics, where things come from, i.e. the engineering and manufacturing processes. This statement is well aligned with the theory discussed by Anastas and Zimmerman (2003), and Dangelico and Pujari (2010). Furthermore, Kinnarps believes that it is essential to have an understanding about the form, design, human interaction; it regards the process of designing products as a cooperation, a marriage.

6 Conclusions

This section focuses on answering the research questions of this academic paper, and thus concluding the most significant findings. The aim is to ensure that the research purpose and objectives have been fully investigated.

With the aim of concluding the most significant findings of this academic paper the research questions are answered below.

- Why should products be designed with environmentally conscious considerations?

This question is related to the reasons for companies to design green products, i.e. implementing the ‘green’ aspect. First of all, companies should be aligned with existing legislations and regulations, as this has been pointed out to lead to the most basic level of green product design implementation in this research. Companies should have certificates and labels, both green and internal, not exclusively green. Nonetheless, companies should create trustworthiness towards their customers’, proving to customers that such green practices are not just a marketing strategy. Internal policies and guidelines are important as well, and obligatory in order to receive some of the certificates in particular. In order to strengthen brand image companies should work with green product design. Furthermore, companies should design green products in order to be aligned with CSR. Economic benefits that can come out of green product design are also a reason for companies to design green products. And last but not least, innovation is a very important feature for companies to be one step ahead, pro-active, in order to get competitive advantages, thus being innovative with regards to designing green products is also essential.

- How can green product design contribute to reducing the negative impact on the environment?

Green product design can contribute to reducing the negative impact on the environment in a number of ways. After analyzing the different motivators for designing green, it could be concluded that if companies design environmentally conscious products, utilize the materials they use in the most efficient and effective way, and further minimize waste, thus the impact on the environment should be reduced. This is true since the average rank of the three factors is as follows: 4.75, 4.5 and 4.5 (out of 5). The argument is that, if materials are utilized efficiently, this will not only cost less for the company, but will further impact the environment less. In addition, if waste is well-managed and minimized as much as possible, thus will the environment be impacted less negatively. Materials used and product safety also are considered of highest importance, materials should be recyclable and disposable. Furthermore in the product design stage it is important to consider transportation properties as well as end-of-life cycle options. Last but not least, product safety is essential.

6.1 Practical findings

During the empirical data collection it has become perceptible that certificates and labels are considered important in order to receive customers' trust. Nevertheless, it was further clear that it is impossible to have or follow all certificates/labels due to their large number (from different countries); furthermore, the fact that some criteria from different labels are conflicting with each other.

Another finding regarding the certificates/labels is that it could be possible for companies to go around the criteria. Moreover, it is possible for companies to apply for dispensation from the labels and thus avoid fulfilling the criteria.

Economic benefits are also considered significant with regards to green product design. Environmental and economic factors should be complementing each other, both the businesses and the impacts on the environment should exist and practiced in balance.

Laws and regulations are seen as a basic requirement in reality and thus companies have to take more responsibilities in this direction.

6.2 Future research

Since the participating companies in this thesis are within the Swedish furniture industry, it could be interesting to further investigate whether the findings are applicable in different countries. Moreover, to find out if the findings would be the same for furniture companies that do not work strictly with office furniture, hence investigate all kinds of furniture production for the Swedish furniture industry. Another interesting aspect for future research on the topic could be the customers' willingness to pay more for green products, further investigating what the customers' perceptions and attitudes are towards green products, what impacts green product design will have in the future.

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Appendix I, Interview questions

Green Product Design: Aspects and practices within the furniture industry

Environmentally conscious design is claimed to be essentially associated with designing products with further consideration towards the environment, and its preservation. It is connected to the whole life-cycle of a product, including (but not limited to) the process of manufacturing, remanufacturing and disposal activities.

Company:

Department:

Position:

Name:

Anonymity (Please put a cross 'x'): Yes No

.....

The authors would kindly ask you to answer the following questions.

1. Can a Green (Environmental) Supply Chain be considered a Modern supply chain nowadays? (not only being productive, profitable, but also sustainable, responsible towards the environment, being pro-active?)
2. Do you have any company policies/guidelines regarding reducing environmental impacts?
 - if yes, how successful have their implementation been, and
 - how do you measure its success? (i.e. profits, self-content that you're doing the good thing, following legal policies, etc.)
 - what are the primary components of these policies/guidelines?
 - are suppliers included? If yes, in what way, and to what extent?
3. Which one(s) of these do you consider important factors for motivating companies to design environmentally conscious products?
 - government/ social/ legal policies
 - Corporate Social Responsibility (CSR)
 - being pro-active/innovative

Appendices

- competitors' pressure
 - global markets' pressure
 - economic/ business performance
 - giving competitive edge/ advantage
 - to improve a product offering/brand image
 - others (please specify)
4. Are there any special certificates you are required to obtain/own in order to be 'green', i.e. to be able to brand yourself as designing eco-friendly products? (for example, ISO 14001 certificate)
- If yes, what changes were necessary to make in order to be granted with such certificate(s)?

Product Design Implementation Questions

1. How do you start the product design? Planning, considering different strategies, consulting with specialists, etc.
2. What stages of the supply chain does it include? (manufacturing, transport; reuse, recycle?)
3. Does it include end-customers' opinions?
4. Is the suppliers' selection process involved in the product design? Please elaborate why, why not.
5. Which of the following aspects do you consider significant for your company, and the product design processes? How important are they with regards to (green) product design:
 - Environmentally conscious design
 - Efficient and effective utilization of the materials
 - Minimizing waste
 - Time efficiency
 - Costs associated
 - Materials used (re-usable, disposable)
 - Energy usage

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- Modularity (ability to use (parts of) the product after its life-cycle)
- Risk assessment/product safety
- Others (please specify).....

Please rate them from 1-5; 1 being of lowest importance, 5 being of highest importance.

6. Are there any particular steps in designing an environmentally conscious/eco-design product? Please elaborate.
7. Which of the following processes are incorporated in your product design when it comes to end-of-life-cycle?
 - Re-use
 - Remanufacture
 - Recycle
 - Dispose
 - Waste management
 - Other (please specify)
8. Please explain in detail how these processes are implemented/ put into practice.

Aspects associated with Environmentally Conscious Design

1. If we consider 3 important product design issues, namely: Economic, Social and Environmental aspects
 - Which of these would you regard as most important for your company?
 - Do all of them play an important role for you product design processes?
2. How big is the role of sustainability in your company, when it comes to product design and product implementation?
 - What are the environmental aspects included? (i.e. lessen the impacts imposed)
 - Are there economic benefits as a result? (if yes, what are they)
 - Are there positive impacts on the society, and if yes, in what ways? (i.e. brand imaging, trustworthiness, ethical consideration, etc.)

Appendices

3. Are there any evaluation programs or practices your company performs in order to assess its product design processes and their impact (on the economy, society, environment)? Please elaborate.
4. Do you take into consideration customers opinions/responses/reactions to your products and their design? If yes, how do they influence your future product design?
5. Is there something else you would like to add or elaborate on from your personal experience?