

Challenges and Conflicts in Sustainable Supply Chain Management

Evidence from the heavy-vehicle industry

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ABSTRACT

Purpose

The purpose of this paper is to increase the understanding of the challenges and conflicts in sustainable supply chain management through empirical evidence from the heavy-vehicle industry in Sweden and China.

Design/methodology/approach

The theoretical background is based on the literature on sustainable supply chain management in general and in the automotive and logistics industries in particular. An explorative study of the case company's supply chain operating in two countries is conducted for this paper. The major components of the empirical data are interviews with the company's representatives and its downstream supply chain members in Sweden and China, as well as a workshop with the logistics industry's representatives in China.

Findings

The challenges are perceived on the regulatory and organizational levels. The conflicts can be found between several stakeholder groups but the main focus seems to be on environmental and economic aspects. Life-cycle solutions for the vehicles utilization are valuable but there are challenges to employing them, especially in the Chinese context. The results show that intensified international collaboration on environment and traffic safety can help tackle challenges and ease the conflicts in sustainable supply chain management.

Research limitations/implications

The research is limited to two countries and a downstream supply chain of the company. This comparative study may bring understanding of the possible challenges and conflicts within sustainable supply chain management in the industry context on the international level.

Practical implications

Policy makers both in the heavy-vehicle and automotive industries could use the empirical findings of the study for better understanding and managing conflicts and challenges in sustainable supply chain management. The managers of the companies or the business partners could use the results of this study as an illustration of possible conflicts and challenges while managing supply chains in a sustainable way, also applying these issues in the international context since the study is looking at both Swedish and Chinese markets.

Social implications

The use of more sustainable solutions that include life-cycle costs and are sensitive to some of the inherent conflicts between environmental, economic and social goals will also have an impact at the societal level and lead to more sustainable transport systems.

Original/value

The paper contributes to the research within sustainable supply chains in the heavy-vehicle industry with a focus on the downstream supply chain of the case company in Sweden and China as two extreme examples of SSCM implementation.

Keywords: Sustainable supply chain management, conflicts and challenges, automotive industry, heavy vehicle industry, transportation

1. INTRODUCTION

Academic and corporate awareness of sustainable supply chain and logistics issues has increased significantly in recent years (Seuring and Muller, 2008; Pieters et al., 2009). Many practitioners and researchers are discussing efforts of manufacturers, retailers, and carriers to pursue sustainable goals (Lieb and Lieb, 2010). Sustainability is becoming one of the aspects on which the performance of an industry is judged (Pieters et al., 2009). The minimum environmental standards have increased through purchasing contracts or requirements for local and global suppliers in multinational supply chains (Simpson et al., 2007). Environmental and social standards play a central role in supplier evaluation. One of the strategies for sustainable supply chain can be based on sustainable products which usually demand the definition of life-cycle based standards implemented throughout the supply chain (Seuring and Muller, 2008; Simpson et al., 2007).

The heavy-vehicle industry, as part of the automotive industry, sets up a product system that enables economic wealth creation both directly and indirectly as well as affects the human and natural environment through i.e. pollution and safety issues therefore it is challenged to be sustainable (Koplin et al., 2007; Orsato and Wells, 2007; van Hoek, 2001). There are challenges (applying green energy, pursuing ethical and social responsibility, uncertainties and cost increase) that the automotive industry can face in the sustainable development of its supply chains (Xia and Tang, 2011; Abbasi and Nilson, 2012). The pressures for sustainability in the automotive industry may arise from regulation by government and other stakeholders (Orsato and Wells, 2007). It is important to understand what happens when this influence is used to achieve environmental or other sustainability goals and what are the possible conflicts among the members of the sustainable supply chain. The external and internal pressures on the supply chain towards sustainability come from the regulatory,

organizational, media and community stakeholders. This may cause conflicts between the members of supply chain. (ft. Zhu and Sarskis, 2006; Simpson et al., 2007)

SSCM practices are also discussed through life-cycle cost based products or solutions in one of the heavy-vehicle manufacturer's business model. The tendency to focus on life-cycle solutions due to the emphasis of operational efficiency and life-time costs can be applied in the heavy-vehicle industry. Here the combination of optimized specification, full service offerings and driver skills improvements can help increase uptime and vehicle utilization rates as well as add to both customers' and manufacturers' efforts towards greater sustainability, by reducing pollution and increasing traffic safety. Acceptance of such solutions can vary between markets and the comparison between the markets can help to demonstrate the challenges for sustainable development within the supply chain globally. The purpose of the paper is to increase the understanding of the challenges and conflicts in sustainable supply chain management through empirical evidence from the heavy-vehicle industry in Sweden and China.

There are four main parts in this paper, starting with the discussion on sustainable supply chain management in the automotive and logistics industries then continuing with challenges and conflicts in SSCM. The research methods are discussed next. The empirical results of the company and its supply chains are presented in the third part. The analysis forms the fourth section of the paper and it is finished with conclusions and implications for further research.

2. THEORETICAL FRAMEWORK

In order to start the discussion on sustainable supply chain management, the sustainable development and sustainable supply chain management (SSCM) definitions are presented in the first section of the theoretical framework followed by discussion on sustainable supply chain management in the automotive and logistics industries. Since the theoretical background of SSCM in the heavy-vehicle industry is limited, the authors are mainly discussing automotive and logistics industries which partly represent the heavy-vehicle industry. The authors also discuss transportation issues which is a part of the business in heavy-vehicle and automotive industries. Further, the challenges and conflicts in SSCM are discussed. The research questions are derived from the theoretical discussion and stated in the third part of the theoretical framework.

Sustainable supply chain management

Many articles refer to one general definition of sustainability and sustainable development given by the Brundtland Commission (World Commission of 1987) which states that: "Sustainable development meets the need of the present without compromising the ability of future generations to meet their own needs" (Pieters et al, 2009, p. 1; Kleindorfer et al., 2005). The principles of sustainable development include social equity, economic growth and environmental protection (Behrend et al., 2008). Although the number of definitions of sustainability varies, these differences are not so significant as most of them incorporate a consideration of at least environmental, economic and social issues while improving the long-term economic performance of the supply chains (Carter and Rogers, 2008). The framework for the sustainable supply chain management is presented by Carter and Rogers (2008) and covers the trade-offs between all three pillars of the sustainability: economic, social and environmental, as well as the domains influenced by the sustainability integration to the supply chain management: strategic planning, risk management, organizational culture and transparency. Sustainable supply chain management is defined as: 'The strategic, transparent integration and achievement of an organization's environmental, social and economic goals in

the systematic co-ordination of key inter-organizational business processes for improving the long-term economic performance of the individual company and its chains' (Carter and Rogers, 2008, p. 368).

Effectiveness and cost reduction have always formed the main focus within logistics, however awareness of demands on sustainability have emerged with an emphasis on transportation (Pieters et al., 2009). It is generally perceived that environmental supply chain management supports efficiency and synergy among actors in supply chain, as well as adds to enhancing environmental performance, minimization of waste and cost savings. The financial performance of the companies in the supply chain is affected by the environmental performance in number of ways: by minimizing hazardous and non-hazardous waste the utilization of natural resources improve, the operating costs are reduced and the productivity is improved. Marketing advantages follow, which leads to improved revenue, increased market share and new market opportunities (Rao and Holt, 2005). Therefore, one of the logistics goals should be decreasing the environmental impact of transport (i.e. improved vehicle utilization). Increasing the efficiency in transport and logistics systems which would lead to both positive environmental effects and decreased costs for the industry should be in focus. The reduction of environmental impacts can be influenced by two general approaches: first, while relying on new, energy efficient technology; second, relying on companies to restructure their processes in a more sustainable way (Aronsson and Brodin, 2006). When incorporating social and environmental issues into a company's corporate behavior the organizational capabilities develop and present potential sources of competitive advantage due to their imperfect imitability by competitors (Gold et al., 2010). Hutchins and Sutherland (2008) mention safety and quality of life as endpoints for higher order needs for the companies wishing to be sustainable and keep focus on social part of the sustainability. Purchasing and distribution have a vital role in improving sustainability of the firm, therefore there is a need for awareness of strategic and tactical decisions' influence on operational outcomes in order to make more sustainable decisions. Strategic decisions have a larger effect on i.e. emissions than operative decisions (Aronsson and Brodin, 2006).

Both government and industry can support the development of sustainability standardization for transportation (Zhu et al., 2006). The government can create more possibilities for industry to reach the goals of de-coupling, modal shift, and improved fill rate by structural means. Another important issue is increasing knowledge about the connection between decision making in logistics and environmental impacts - this knowledge can be spread by education. In this case technology and government may generate possibilities but it is firms that have to realize them. Linton et al. (2007) state that techniques such as life cycle assessment can be used for assisting in the determination of product design and minimization of its environmental impact over its useable life and after it. Resources reduction and environmental impacts are considered in the interface of engineering and product design through cleaner process technologies and quality production techniques. This approach increases the value produced by an individual product. The challenge for the provider of the product is to develop offerings that allow for them to capture more of the product value. Supply chains should be clearly extended to take account of by-products of the supply chain, to assess the total lifecycle of the product, and to optimize the product not only from an existing cost standpoint but also a total cost standpoint. Total cost should include the influence of resource reduction and the generation of by-products that are neither captured nor used (waste and pollutants). The strategy for sustainable products as the definition of life-cycle based standards for the environmental and social performance of products implemented throughout the supply chain is discussed by number of authors. Being a crucial source of competitive advantage, sustainability goals require closer interaction between all supply chain

parts while ensuring economic, environmental and social performance on a product's total life-cycle basis with more performance criteria to be met (Seuring and Muller, 2008; Simpson et al., 2007, Tavasszy et al., 2003; Gold et al., 2010)

Analysis of the operational implications of different policies and integration of sustainability in business is critical, since current legal tendencies will influence many of these changes 'whether or not academe and practice is prepared' (Linton et al., 2007).

Challenges and Conflicts in SSCM

Challenges, triggers, pressures and difficulties are used as synonyms in this paper referring to a 'demanding or stimulating situation' (dictionary definition) in regards to sustainable supply chain management. The conflicts in the further discussion refer to 'tension between two or several social entities (individual, group or organizations) which arises from incompatibility of actual or desired responses' (Raven and Kruglanski, 1970, p.70) and allow the authors to discuss the diverse trade-offs between the three pillars of sustainability and the tension between various stakeholders.

Abbasi and Nilsson (2012) divide the challenges for SSCM into five major areas: cost increase, operationalization of sustainable development, changing cultures and mindsets, strains in control and management of uncertainties and tradeoffs, and the complexity of problems. Xia and Tang (2011) discuss challenges that the automotive industry can face in the sustainable development of its supply chains and focus on social and ethical responsibility.

While costs and revenues are still the main drivers in the development of supply chain, the majority of the research states that it must pay to be sustainable (Abbasi and Nilsson, 2012). The relationship in the supply chain through collaboration in regards to sustainable goals can actually result in a number of cost-effective activities: collaborative waste reduction, cost-effective and environmentally beneficial solutions to production and services problems, and environmentally sound innovation. The relationship within the supply chain is also an important channel for communicating customer requirements (including the environmental demands) to suppliers (Simpson et al., 2007). Environmental regulation is one of the most effective tools to enable companies within a supply chain to internalize the effects of their activities (Carter and Jennings, 2002). Conversely, compliance with sustainable regulation obliges the supply chain members to implement possibly costly adaptation processes that can affect their competitiveness and profits as much as they transform production/service methods and systems. Therefore, a company's response to fines and penalties for non-compliance can depend on whether the regulatory pressures are seen as opportunities or threats. If they are perceived as opportunities, it can help organizations to concentrate on long-term sustainability and relationship. The actors in a supply chain can manage and share the benefits through contracts, market mechanisms and partnership arrangements, which may result in the increasing efficiency of all partners. In a mature industry, the partners in the supply chain work together in a collaborative way with long-term objectives and are therefore engaged in a win-win strategy. In this situation, sustainable goals have a positive and direct impact on supply chain actors' performance as well as an indirect effect on performance through improved trust and cooperation. The literature also discusses that command-and-control regulations can strangle innovation and that instead, voluntary norms may inspire proactive environmental strategies that lead to competitive advantages for companies (Carter and Jennings, 2002, Lopez-Gomero et al., 2010). Thus, the pressures for sustainability in the automotive industry may arise from regulation by government or through 'socio-technical experiments and normative visioning' (Orsato and Wells, 2007, p. 990).

Operationalization of sustainable development is perceived as a challenge in terms of inertia and interpretation. ‘A fear of change connected to difficulties of interpretation, the complexity involved, and the underlying business logic with its clear focus on financial aspects, all contribute to the inertia in reaching sustainable supply chains’ (Abbasi and Nilsson, 2012, p. 526). Change of mindset and culture at the organizational (top management as well as other employees), national and international levels are other challenges for sustainable supply chain. The change needs to be critical, creative and incorporative of sustainability perspectives and assumptions. The uncertainties related to governmental decisions, consumer demands and competitive advantages and strategies formulated by organizations can be perceived as a challenge to change. The complexity is inherited in the numerous ways in which supply chain processes and logistics influence society and the environment. There are several challenges involved in the choice of fuel, the routing of vehicles, the negotiation of environmental contracts etc. Tradeoffs between environmental effects and delivery times as well as service levels are other challenging issues (Abbasi and Nilsson, 2012).

Multiple areas of conflicts can arise from the stakeholders of sustainable supply chain management. The customer – as one of the major financial stakeholders – has noteworthy potential to force developments of its suppliers’ environmental management practices through the introduction of environmentally sound technologies or services, and collaboration with suppliers within the supply chain for common knowledge and joint development of more sustainable products and processes. However, pressures can come from three sources: from customers - while expecting that some suppliers will be more or less responsive than others; from suppliers – it may include both benefits and difficulties in their attempts to face a new set of environmental performance requirements; from government – this might require more collaboration in working with organizations (Simpson et al., 2007). Many possible conflicts from the external pressures on the supply chain approach towards sustainable responsibilities are considered from the regulatory, organizational, media and community stakeholders (Zhu and Sarskis, 2006).

The possible conflicts for SSCM are also discussed by Walker et al. (2008). The authors argue that cost and customer desire for lower price may inhibit environmental goals. The studies show that cost concerns might be the most serious obstacle for considering environmental factors in the purchasing process in this sense functioning as a barrier in the mindset of ecology versus economy trade-off. In terms of social versus economic performance, the difficulties for the companies can lay in understanding the system and ways of incorporating social issues into economic ones due to the focus on efficiency and governance issues and little experience with broader social demands (Walker et al., 2008). Also, as discussed by Zhu and Sarskis (2006), the reaction of the companies to all these issues can depend on specificities of the industry.

Analyzing these challenges and conflicts can add to logistics sustainability and allow companies to improve their approach to sustainable supply chain management (Abbasi and Nilsson, 2012).

Research questions

Sustainable supply chain management can be analyzed from several dimensions depending on the actors of the supply chain and the sustainability issues in diverse industries, therefore the first research questions is:

1 RQ: What are the conflicts and challenges for the sustainable supply chain management in the heavy-vehicle industry?

As the situation in different markets in regards to the issues mentioned above might be different and collaboration and comparison in between countries can actually help for identifying the areas to focus on, the second research question is:

2 RQ: How is the perception of the sustainable issues different for diverse actors in the heavy-vehicle industry in Sweden and China?

As one of the sustainable issues in the heavy-vehicle and transportation industries today is actually the employment of the life-cycle cost based solutions the third research question is:

3 RQ: How can life-cycle cost based solution help achieve sustainable goals of the supply chain?

3. RESEARCH METHODS

The present paper is based on an explorative qualitative study. The strength of such a study lies in the deep focus on the particular situation and works at delving into social complexities in order to truly investigate and understand the meaning for a participant and the context of his actions within such situations (Maxwell, 2005; O’Leary, 2010).

Data collection and analysis

The unique opportunity of the data gathering and collaboration with The Manufacturer’s (this label will be used for the case company) downstream supply chain and transportation industry’s representatives allowed us to decide for qualitative approach and a case study research strategy with the data collection through interviews and communication with the actors in the company’s supply chain during the workshop.

The primary data collection was made through the conducted interviews with The Manufacturer and its downstream supply chain (Dealers and Customers) in Sweden and China as well as workshop with them and industry’s representatives in China (see Table 1) in 2012-2013. The workshop lasted a full day. The form of the workshop was the presentation and open discussion between the workshop members. All the discussions were recorded and transcribed. Interviews with The Manufacturer representatives, dealers and customers were conducted in Sweden as well as China. The number of the interviews with The Manufacturer representatives in Sweden is a major part of all interviews since the knowledge and understanding of the company’s business and situation in the markets primarily came from the Head Office. In total there were 25 interviews out of which 20 were conducted in Sweden. The interview questions were semi-structured and referred to diverse aspects company’s business. By coding the interview transcripts, the empirical material was subsequently reviewed for indications regarding sustainability issues throughout supply chain. Further, company’s representative received more detailed questions on challenges and conflicts in sustainable supply chain management in both countries for clarification. Typically, interviews lasted for 1-1.5 hrs. All were transcribed verbatim.

NR of interviews/	Sweden	China (interviews)	China (workshop)
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Country			
Company's representatives	13	1	6
Dealers	4	planned	2
Customers	2	4	6
Other (associations, authorities, media)	1		6

Table 1. The primary data

The secondary data includes information from the meetings protocols, company's reports, regulatory reports, external and internal promotional material.

The analysis process focused on several issues and partly overlapping phases. Firstly, a general understanding of The Manufacturer's supply chain statements and positions in regards to sustainability issues was presented, secondly the overlapping challenges and conflicts of SSCM were discussed. Multiply perspectives from several company representatives, dealers and customers allowed us to generate a broad overview of the phenomenon. Misunderstandings were reduced as multiple interviewers (2-4 researchers) were present at each interview and all of the interviewers participated in the workshop.

Trustworthiness

In our attempt to find relevant challenges and conflicts for the sustainable supply chain management in the heavy-vehicle/automotive industry in Sweden and China we have together with the company gathered and interviewed key representatives not only from the different parties of the supply chain but also parties in the wider context (i.e. journalists, governmental representatives). Based on a triangulation of the literature review, secondary material workshops and interviews our intention has been to develop high credibility and dependability in the study.

4. EMPIRICAL FINDINGS

The main researched entity is a European manufacturer of heavy trucks (this label will be used for the case company) and one of its offered solutions. Other interviewed actors in the supply chain are dealers and customers of The Manufacturer. This study is focused on two markets where The Manufacturer is operating and it is a comparison of two sets of challenges and conflicts in SSCM in the Swedish and Chinese markets respectively.

The Manufacturer's life-cycle cost model (solution) is applied in most markets. With it, the customers and The Manufacturer co-evolve. The relationship is seen as a strategic partnership. The sales process focuses not only on a product but also on added services for the transportation task, letting the customer take care of its business and The Manufacturer takes care of all activities connected to trucks. Thus, sustainable aspects which are included in the life-cycle cost solution are affecting the whole supply chain with the continuous demands for decreased fuel consumption and improved efficiency as well as training for the drivers, which increase the safety of both drivers and society around. The Manufacturer's offered solution includes four pieces: the vehicle, which is specified according to the customer operations; maintenance - inspection points: checking tire pressure, lowest possible fuel consumption; driver training - checking the driver performance once per month for keeping the level

achieved in the beginning; coaching of the drivers in order to keep the results of the training ongoing. The concept is based on the life-cycle cost thinking.

As The Manufacturer's Executive Director notes: *Our overall perception of SSCM is as the pursuit of continuous improvements in the whole supply chain with the aim of reducing negative social and environmental impact of its daily core activities. This entails increasing its efficiency and thus reducing life-cycle costs. 'There should be no difference between various industries in regards to the principles of SSCM'.*

The two following parts of the empirical part will be structured in accordance with the respondents (data from The Manufacturer, Dealers and Customers)

Challenges and Conflicts in Sweden

There is an established and still growing awareness with regards to sustainable issues among all stakeholders in Sweden.

While discussing the drivers for sustainability from a The Manufacturer's perspective, there are several issues mentioned by its representatives. First, the requirements must come from the customer. If the company tries to market something which is not based on the needs and requirements from the customer, it may not succeed. The demands for sustainability are growing from two aspects, from the pressure of consumers and from politicians. The pressure is not coming from the trucking firms, which are mostly limited in size. Rather, it is their customers, such as the larger freight forwarding firms and customers' customers or final customers that have it as a priority. The large freight forwarding firms are often aware of the sustainability issues and are gradually increasing their sustainability. The dilemma is that the final customer seldom wants to pay for a more expensive transport service.

When realizing that it is possible to achieve both environmental and economic benefits with defensive driver training, coaching and higher capacity utilization, the customers acknowledge that it is possible to reduce the cost at the same time as reducing CO₂ emissions and effectiveness of this solution. As Regional Sales and Service Management Director states *'It is simple: when you burn fuel you produce CO₂, if you burn less fuel you will produce less CO₂: that link of understanding is unquestionable. The good thing with sustainability is that it goes hand in hand with fuel consumption and all customers are interested in that'.* A part of The Manufacturer's customers are truly interested in the environment, also influenced by demands from their customers in driving alternative fuels and in showing a smaller carbon footprint from transports. The company sees a growing interest for its services where they can present figures for carbon footprints for these customers. Most initiatives regarding environmental issues are seen from European companies' - in Sweden as in any European country.

When discussing environmental-economic issues, The Manufacturer's Executive Director discusses if Sweden has the right taxation structure to encourage even better alignment between environmental and economic interests. With regards to social-environmental considerations, also in Sweden, there is a problem with limited awareness of the right choices in consumption behaviors. This leads to overconsumption of global resources.

One of The Dealers also notes that *there are several ways for sustainability: the customer's customers are the ones who actually require it. There are also environmental regulations and even responsible transporters who provides such requirements.* Also, The Manufacturer's dealer states: *'It's the customer's customer that has put demands on the tenders. We have different "Euro-classes" of engines that can run in different environmental zones. The focus now in regards to the environment is on getting down the fuel consumption, partly due to the cost aspect, and if it consumes less fuel it releases less CO₂ emissions. Nobody thought of this*

5 years ago, now you enter programs/applications and measure RPM and Load. You need this so you can lower your fuel consumption and emissions". We have a program so we can run and simulate, the program which allows to monitor the driving patterns. I find this to be the biggest development in terms of the environment, because you're focused and you want to save money and at the same time there is an effort for the environment too.'

One of the Customers discusses the sustainability issues as a competitive advantage for his company in comparison to other transportation companies. Also, he notes that the final customer is usually the one who demands the sustainable transportation but the carriers and distributors nowadays are also very much aware of these issues as well as about life –cycle cost based concept. Other Customer specifically states that usually on the personal level you want to be environmentally friendly since this has an impact on your own kids/next generations, but you also have to think about the business aspect.

Challenges and Conflicts in China

As The Manufacturer's Executive Director notices: *'In overall there is a surprising negligence about the transportation part of SSCM from all stakeholders in China, including foreign companies in their various roles in the supply chain. The attitude seems to be that "this is China - I don't care" and/or "this is China and things have to be done in the Chinese (wrong) way here. For transportation the biggest change would come if foreign stakeholders begin to apply the same basic standards as they do in other markets: not to accept "illegal" overloading, too long working hours and substandard equipment, also deficient manual loading and unloading of precious goods should not be accepted. Moreover, foreign stakeholders need to insist on one standard for loading pallets, since it drives the efficiency of the whole supply chain. Another argument from The Manufacturer in regards to the Chinese supply chain is that China is not as developed in terms of environmental and safety awareness as Sweden. In Sweden it is part of the common consciousness. In China, on the general level, the community is aware of this, but the reactions are quite behind.*

In the workshop one of the common reflections was that there is a great focus on short term costs in China. Without taking a wider responsibility for how the supply chain transportation is managed in each part, sustainable cost reductions are not possible. Instead, suppliers of transport services are forced into severely "cutting corners" in order to survive. This includes both trucking firms as well as most of the freight forwarders. In many cases, there is a concrete demand for the sustainability from government. It is very much a legal issue about being more environmental and socially responsible. The demand is coming from governmental regulations and to some extent the manufacturing companies of high end brands. The Chinese customer is not that keen, but many foreign companies entering the market have another agenda, however they also have to adapt and be pragmatic. They build up this step by step – as reflected in the discussions from the workshop.

As the Manufacturer's representative in China claims: *'We have to be clear that we are doing what we are expected to do but we don't know exactly what we are expected to do. So it is the way of trials and errors. And this is a problem for most of the foreign investments in the country'. Meanwhile, the life-cycle cost based concept in China cannot be sold to many companies. The customers have to be picked. As The Manufacturer in China mentions 'You have to understand the customers, the customers' customers, their demand and requirements, you have to understand its business in order to see: What are their challenges, How are they earning money.'* Though, the tendency is more and more towards life-cycle cost based solution over the time. The Manufacturer's Executive Director in China discusses that *'in China sub optimization occurs in all three relations of sustainability due to the fact that China is still run by a mix of market forces and with big state involvement. The complexity of*

the issues makes the knowledge to introduce correct laws, standards and regulations to encourage a healthy long-term development extremely difficult. Due to the Chinese political structure and cultural traits, decision-makers are not aware about the lack of proper knowledge for decisions on sustainability. The transportation sector has low status and generally low knowledge on management levels and is often poorly paid. In the country with high unemployment this breeds poor environmental awareness of the connection between their own behaviors and its impact on macro problems (social-environmental issues). In the fight between short and long term interests, short term economic gain wins while eroding both the long term sustainability of the economy and of the environment. This conflict needs to be addressed from the very top and a fundamental shift in mindset is imperative. The issue of norms and values in society lies at the heart of this conflict.'

The approach when inviting customers to the seminar (educating) should be continued since it is an implementation process. 'How do we turn around something traditional?' Instead of marketing and going to the customers, by inviting trucking firms as well as other logistics firms to the seminars and helping them to understand what is going on in the transport business. Then it's a different approach. *'I would gladly take that thinking and concept to many other countries and do the same because it is the way how to approach a customer, nothing to do with the product'* - The Manufacturer's Executive Director in China claims.

The Manufacturer's Sales Director explains the environmental issues can come into importance with recognition of its economic benefits, but customers' customers have more demands for this; therefore, life-cycle cost based concept will take time to be implemented. The change in China will come mainly from customers. If looking at calculations and understanding operational cost, it will make a difference for customers' bottom line. *'We also need to understand the customer's business more, we need to understand the problems of the customers in their operations'*. It is a start of the relationship and building the trust, which is the most important.

The government in China is working in the same direction but since China is so large, even though the government is quick in many aspects, it cannot control the whole country in regards to this direction. One of The Dealers claims: *Even though they say "we have the rules" then who is securing that the rules are being followed? When a high brand company is entering the country and building their first captive workshop, it wants to fulfill the legislation, but it comes clear that there is no legislation ready for this. The private Chinese companies manage to go around the rules and procedures in a way that for example a Swedish company cannot do partly due to the awareness of CSR and sustainability.*

The transportation industry representatives in China (from the workshop discussion) see some of the main challenges and conflicts in the market as lack of interest for sustainability domestically. Furthermore, transportation is seldom included in sustainability of supply chains neither for Chinese nor for international firms since transportation is harder to control with the exception of dangerous goods. The customer requirements for companies are rather on trucks and their condition. To fulfill the requirements it might be a solution to buy a better truck. Trucking firms do not care about the environment if governments do not have demands. However, the new government talks about beautiful China and highlight environmental issues.

Standardization and national policy are very important (it can be very different in different areas of China). The penalty on overweight has a quick effect with automatic weighing. It can be more difficult to go for low price with new regulations. Trucking firms control the drivers' consumption of fuel, detours also become more difficult due to the black box. The drivers cannot claim a breakdown especially not when you have an life-cycle solution. When thinking

about total life cycle, the unit cost of a good truck is lower. The total service and maintenance fee would be lower as well. Using better trucks can also be a trigger to improved management – for a better truck the importance of better control is higher. As to security and environment protection, security is an economic behaviour. All benefits will make no sense unless security is guaranteed. Environmental protection belongs to social responsibilities and means the increase of investment and cost as well as the loss in driving forces of enterprises; therefore, the government should implement environmental protection compulsorily when necessary. What customers care about is that whether their goods are delivered safely, but not the issue of environmental protection.

The perception and adoption of sustainability (environmental issues) is faster in China - in the sense of reaction. The sustainable practices are more advanced in Sweden but the reaction to new developments is slower. On the other hand, the developing countries are accepting the changes in this regard much faster. There is a high demand for environmental activities: some of the customers are mature enough to adopt life-cycle cost based model: they see that it is profitable after the calculation. Some companies are mature and highly advanced to take on such concepts and work with it. *'It is the matter of implementation process.'*- one of The Customers in China claims. Another Customer presented criteria and calculations for their purchasing decisions and mentioned the life-cycle cost and fuel consumption as few of the important factors. The customer further claims that their customers *'require on time delivery, high service quality and safety. In most of the cases, price is not the most importance factor. Therefore, when we market our services, we often emphasize safety and cost performance.'*

5. ANALYSIS

In order to answer RQ1 and RQ2 the two following tables were developed:

The concern with sustainable issues differs between the different stakeholders involved in the supply chain. An initial categorization is shown in table 1.

SCM actors/stakeholders	Sweden	China
Truck manufacturers	Considerable concern with sustainability issues	Some concern with sustainability issues
Industrial companies (retailers and dealers, trucking firms, LSPs)	Some concern with sustainability issues	Almost no concern with sustainability issues
Consumers	Considerable concern with sustainability issues	Some concern with sustainability issues
Authorities	Considerable concern with sustainability issues	Some concern (increasing) with sustainability issues

Table 1: Sustainable focus of main stakeholders

The main challenges and conflicts for SSCM in the two markets are presented in the table 2.

SSCM	Main challenges	Main conflicts
Sweden	The final customers still seldom want to pay	

	for the more expensive sustainable service	
	Right taxation structure to encourage even better alignment between environmental and economic interests	
China	Low-cost focus (suppliers of transport services are forced into severely "cutting corners" in order to survive)	The conflict between short and long term interests (short term economic gain wins while eroding both the long term sustainability of the economy and of the environment) - the issue of norms and values in society lies at the heart of this conflict.
	The operationalization of governmental regulations (how to securing that the rules to be followed)	Between international companies entering market and lack of governmental legislations for this.
	Negligence about the SSCM from all stakeholders in China (further change in mindset and organizational culture is needed)	Conflict between customers' focus on fast and safe deliveries and transportation company's perception of sustainable transportation
	In understanding the system and ways of incorporating social issues into economic ones due to the focus on efficiency and governance issues and little experience with broader social demands (reflects strains in control and management of uncertainties and tradeoffs)	
	The situation with the transportation industry and lack of educated and permanent drivers (as well as small salaries) leads to the negligence of strategic long-term goals and therefore less sustainable focus (complexity of problems)	

Table 2. The main challenges and conflicts in SSCM in Sweden and China

The answer for research question 3 lies in the discussion of the life-cycle cost based solution offered by The Manufacturer. The offered life-cycle solution can provide several positive outcomes for companies in the supply chain. Low CO₂ numbers equals low fuel consumption and since fuel is 1/3 of the lifetime cost (*The Manufacturer's report*), it has tremendous influence on cost which can bring economic benefit to a company. As also mentioned in the theory, the cost are still playing a big role in supply chain formation therefore the cost of the fuel is a very important aspect (Abbasi and Nilsson, 2012). Further, drivers' training helps to reduce traffic accidents with heavy vehicles included, which is positive for society. For the company, trained drivers mean less fuel consumption, which means more profit. This is one of the ways for SSCM also discussed by Rao and Holt (2005), while the operating costs are reduced and the productivity is enlarged. Marketing advantages can also follow both for The Manufacturer and its customers.

The life-cycle cost based solution for The Manufacturer in this case means less repairs and also less services (since the vehicle is driven in more efficient way). As stated by Aronsson and Brodin (2006), one of the logistics goals actually should be decreasing the environmental impact of transport through improved vehicle utilization. The customer, the manufacturer and society benefit while adding sustainable performance to the whole supply chain.

6. CONCLUSIONS

The situation for the supply chains of The Manufacturer in the two countries studied show some similarities but many very significant contrasts.

The great focus on short-term cost in China means that the authorities and end-consumers are the only actors which are really concerned with sustainable outcomes. These two types of actors are however increasingly worried about the development and heavy environmental impact of the transportation sector and by implication heavy vehicle manufacturers. Since most supply chain members are focused on the economic outcomes, it becomes very hard for individual firms to make significant changes that create improved sustainable results. To create changes, the government must necessarily define new standards and environmental and social requirements, measure these and ensure enforcement. At the system level a challenge for the government is the complexity involved in measuring environmental impact in a setting with very high growth and vast numbers of vehicles and limited interest by the organizations.

In Sweden the government is highly aware of sustainability issues, but is working far more with changing attitudes and voluntary changes. This may be related to the fact that both consumers and firms in the supply chain are more accepting of environmental and social requirements. However, there is still a significant conflict between environmental and economic issues, not least seen in terms of the significant cost disadvantage of Swedish transporters compared to other European competitors. This also affects social outcomes in terms of unemployment. For Sweden an increasing challenge is that many of the “low-hanging fruits” in terms of cleaner fuel and better engines have already been taken to some extent. Further improvements are becoming increasingly costly and painful for the firms to bear.

Comparatively, an advantage for the Chinese government is that the ability to force through changes is considerable and it can be expected that government policy change has immediate impact, whereas the Swedish government typically is not able to exert the same direct pressure. It seems however that the life-cycle cost based solutions is one of the ways for companies in both countries to deal with the trade-off between economic, social and environmental requirements. This can lead to benefits for the firm in terms of CSR and efficiency, and creates benefits for society in terms of lower emissions, reduced environmental impact and improved traffic safety.

7. LIMITATIONS AND FURTHER RESEARCH

This paper seeks to contribute to the discussion on SSCM in heavy-vehicle and automotive industries as well as add to the comparison of two diverse markets. The research is limited to two countries, however it is a contrast example of two extremes whereas Sweden is doing relatively well in terms of SSCM and China is still struggling with it. The empirical material is based on the downstream supply chain of The Manufacturer in both countries therefore it is limited to this part of the whole supply chain of the company.

Further research can investigate the possibilities for transferring lessons between the two countries, in particular in terms of the effects of previous changes in Sweden. Furthermore, the findings of this study could be transferable to other studies of sustainable supply chain management in similar industries. Policy makers both in the heavy-vehicle and automotive industries could use the study for better understanding of conflicts and challenges in sustainable supply chain management. The managers of the companies or the business partners could use the results of this study as an illustration of possible conflicts and challenges while managing supply chains in a sustainable way, also applying these issues in the international context since the study is looking at both Swedish and Chinese markets.

REFERENCES

- Abbasi, M., Nilsson, F. (2012) Themes and challenges in making supply chains environmentally sustainable. *Supply Chain Management: An International Journal*. Vol. 17, No. 5, pp. 517-530
- Aronsson, H., Brodin, M. H. (2006) The environmental impact of changing logistics structures. *The International Journal of Logistics Management*. Vol. 17, No. 3, pp. 394-415
- Carter, C. R., Jennings, M. M. (2011) Logistics social responsibility. An integrative framework. *Journal of Business Logistics*. Vol. 23, No. 1, pp. 145-180
- Gold, S., Seuring, S., Beske, P (2010) Sustainable Supply Chain Management and Inter-Organizational Resources: A Literature Review. *Corporate Social Responsibility and Environmental Management*. Vol. 17, pp. 230–245
- Hutchins, J., Sutherland, J. W. (2008) An exploration of measures of social sustainability and their application to supply chain decisions. *Journal of Cleaner Production*, Vol. 16, pp. 1688-1698
- Koplin, J., Seuring, S., Mesterharm, M. (2007) Incorporating sustainability into supply Management in the automotive industry: the case of the Volkswagen AG. *Journal of Cleaner Production*, Vol. 15, pp.1053-1062.
- Klendorfer P, R., Singhal, K., Van Wassenhovel L, N. (2005) Sustainable Operations Management. *Production and Operation Management*.14 (4), 482-492
- Lieb, K. J., Lieb, R. C. (2010) Environmental sustainability in the third-party logistics (3PL) industry. *International Journal of Physical Distribution and Logistics Management*, Vol. 40, No. 7, pp. 524-533
- Linton, J. D., Klassen, R, Jayaraman, V. (2007) Sustainable supply chains: an introduction. *Journal of operations managemen*, Vo.l. 25, pp. 1075-1082
- Lopez-Gomero, M.D., Molina-Azorin, J.F., Claver-Cortes, E. (2010) The potential of environmental regulation to change managerial perception, environmental management, competitiveness and financial performance. *Journal of Cleaner Production*, Vol. 18, pp. 963-974
- Maxwell, J. A. (2005). *Qualitative research design: an interactive approach*. SAGE publications, London 2nd edition
- Orsato, R. J., Wells, P. (2007). The automobile industry and sustainability. Introduction. *Journal of Cleaner Production* Vol. 15, pp. 989-993
- Pieters, R., Gloeckner, H. H., Weijers, S.J.C.M (2009) Sustainability in logistics practice. University of Arnhem and Nijmegen, 1-9

- Rao, P., Hold, D. (2005) Do green supply chains lead to competitiveness and economic performance? *International Journal of Operations & Production Management*, Vol. 25, pp. 898-916
- Raven, B. H., & Kruglanski, A. W. (1970). Conflict and power. In P. Swingle (Ed.), *The structure of conflict* (pp. 69–109). New York: Academic Press.
- Seuring, S., Müller, M. (2008) From a literature review to a conceptual framework for sustainable supply chain management. *Journal of Cleaner Production* Vol. 16, No. 15, pp. 1699-1710
- Simpson, D., Power, D., Samson, D. (2007) Greening the automotive supply chain: a relationship perspective. *International Journal of Operations & Production Management*, Vol. 27, No. 1, pp. 28-48
- Tavasszy, L. A., Ruijgrok, C.J., Thissen, M.J.P.M (2003) Emerging Global Logistics Networks: Implications for Transport Systems and Policies. *Growth and Change*, Vol. 34, No. 4, pp. 456-472
- Van Hoek, R. (2001) Case studies of greening the automotive supply chain through technology and operations. *Environmental Technology and Management*, 1 (1/2), 140-163
- Zhu, Q., Sarskis, J. (2006) An inter-sectoral comparison of green supply chain management in China: Drivers and Practices. *Journal of Cleaner Production*. Vol. 14, pp. 472-486
- Zhu, Q., Sarskis, J., Lai, K. (2007) Green supply chain management: pressures, practices and performance within the Chinese automobile industry. *Journal of Cleaner Production*, Vol. 15, pp. 1041-1052
- Xia, Y., Tang, T. L-P. (2011) Sustainability in Supply Chain Management: Suggestions for the auto industry. *Management Decision*, Vol. 49, No. 4, pp. 495-512