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THEMES AND CHALLENGES IN MAKING FREIGHT TRANSPORT SUSTAINABLE

A logistics service providers' perspective

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ABSTRACT

The purpose of this article is to explore themes and challenges in making freight transport sustainable out of a logistics service providers' perspective.

The approach is explorative and the main method for data collection is interviews. The study has a cross sectional design which takes advantage of nine semi-structured interviews from selected logistics service providers operating in the Scandinavian countries.

Our findings illustrate the major themes of sustainable freight transport, by analyses of current as well as future activities, in perspective of nine interviewed logistics service providers. In addition, the patterns of current and probable emerging challenges for developing sustainable freight transport were discovered. It is concluded that there is great need for a holistic perspective where logistics service providers and product owners together analyse and design future freight transport set-ups. The analysis of complex interactions among LSPs and other actors of supply chains provide several opportunities for future research.

The results offered in this paper provide a systematic structure for classifying issues related to sustainable freight transport; something which will be beneficial for managers and policy-makers when they approach sustainable supply chain management challenges. Syntheses and discovery of themes and challenges of making freight transport sustainable are critical for a sustainable society. This paper combines the results from interviews with a thorough review of related articles and homepages. The study ends with research propositions contributing to the further advancement of supply chain sustainability and management.

Keywords: logistics, freight transport, logistics service provider (LSP), third party logistics, sustainability, environment

1. INTRODUCTION

The role of transport in the global societies of today is mandatory but not without negative effects. On the positive side, transport generates accessibility and mobility, which is essential in today's dynamic social life. Without transport, humans/passengers turn to static creatures and products/freight turn to stationary raw materials. Furthermore, transport leads to social as well as economic development. Due to transport, infrastructures are constructed; jobs are created; and new vehicles are generated. Moreover, growth in transport is an inseparable part of growth in economy. Transport is one of the enablers of world trade, globalization, and industrialization. According to European Union (2011), the transport industry directly employs around 10 million people and accounts for about 5% of GDP in the EU.

While being economically and socially feasible, transport and environment have several negative impacts on each other. Natural disasters (like flood, earthquake, volcanic eruption, and tornado); rust, corrosion, sudden temperature changes, shock, and stress are just some negative effects of environment on transport to mention. On the other hand, transport activities have different negative impacts on the environment. Conservation of resources (energy, materials, etc.), pollution, emissions, noise, congestion, and waste disposal are some exemplary negative impacts (World Business Council for Sustainable Development, 2004). Transport activities are some of the main sources of emissions of greenhouse gases (GHG), mostly CO₂. According to IPCC (2007), in 2004, transport sector produced 6.3Gt CO₂ emissions and was responsible for 23% of world energy-related GHG emissions with about three quarters coming from road vehicles. Over the past decade, transport's GHG emissions have increased at a faster rate than any other energy using sector (IPCC, 2007) and is still representing the fastest-growing in the future (Brown, 2005). Transport activities are expected to grow robustly over the next decades. As a result of this growth, in a business as usual scenario, an annually increase of world transport energy use by 2% as well as 80% higher total transport energy use and carbon emissions in 2030 than 2004 levels is predicted (IPCC, 2007). Freight transport has been growing even more rapidly than passenger transport and is expected to continue to do so in the future. In EU, for example, the demand for freight transport is expected to grow on average by 2.7% per year. Globally, freight transport is expected to grow from approximately 15 trillion ton-kilometres in 2000 to around 45 trillion ton-kilometres in 2050 (World Business Council for Sustainable Development, 2004).

Sustainable development of transport calls for developing activities which lead to highest economic and social gains while diminishing the negative environmental losses. However, sustainable development of transport activities in the long term is complex and tied with tremendous challenges, dilemmas, difficulties, and barriers. Governance (McCauley, 2008); migration and internal mobility, aging, urbanization, and globalization are some challenges towards social and economic developments (European Union, 2011). Challenges towards environmentally sustainability may relate to increasing cost, complexity, operationalization, mindset and cultural changes, and uncertainty (Abbasi and Nilsson, 2011) as well as increasing scarcity of fossil fuels and global warming (European Union, 2011).

The purpose of this article is to explore themes and challenges in making freight transport sustainable out of a Logistics Service Providers' (LSPs) perspective. Freight transport services offered by Logistics Service Providers (LSPs) are the main focus of this study. The main reasons to focus on freight instead of passenger transport are higher complexity as well as less research on sustainability promotion and policies (Wigan and Southworth, 2004;

Himanen et al., 2004; Lieb and Lieb, 2010). The main reason for such perspective is increasingly outsourcing of logistical services to LSPs (Wolf and Seuring, 2010).

In the next section, a brief frame of reference is provided to review some previous research on connection of logistics and freight transport to sustainable development as well Logistics Service Providers (LSPs). From this follows the method. The research is mainly based on semi-structured interviews from selected logistics service providers operating in the Scandinavian countries. Emergent themes of sustainable freight transport are thereafter presented, followed by challenges identified from which further discussion are drawn. The paper then ends with concluding remarks and opportunities for future research.

2. SUSTAINABLE DEVELOPMENT AND FREIGHT TRANSPORT

Although there is not a universal definition of concept of sustainable development (Björklund, 2005; Pihl, 1997; Pezzy, 1992), the most popular and widely accepted is that of Brundtland report “*Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs*” (World Commission on Environment and Development, 1987, p.8). According to Björklund (2005), the origin of concept of ‘sustainable development’ dates back to 1970s, when it appeared among professionals in environment and development circles. However, it became widely spread and well-adopted when the United Nations at the Earth Summit in Rio in 1992 quoted Brundtland report’s definition of sustainable development (Anderson et al., 2005).

Following the United Nations 2005 World Summit, sustainable development encompasses the interdependent and mutually reinforcing pillars of economic development (Profit), social development (People) and environmental protection (Planet). The three ‘P’s of sustainability are sometimes called the ‘three bottom lines (TBL or 3BL)’. The three bottom lines have begun to appear in the literature of business disciplines, such as management and operations, while adapted by companies (Carter and Rogers, 2008). Jeffers (2010) uses ‘corporate sustainability’ as a similar concept to the three bottom lines and conceptualizes it “*as a dynamic process with the stated aim of allowing business entities to realize economic objectives that potentially can improve the quality of life for its stakeholders, while simultaneously protecting and enhancing the earth’s life support systems*”.

Literature of logistics and supply chain discipline also show an increasing appearance of sustainable development where all its three pillars (Carter and Rogers, 2008) or just some pillars such as corporate social responsibility (Keating *et al.*, 2008; Dyllick and Hockerts, 2002); environmental logistics (Wu and Dunn, 1995); Green logistics (McKinnon et al., 2010; Abukhader and Jönson, 2004; Aronsson and Hult, 2006) have been presented. However, literature on environmental/green- logistics and supply chains are more dominant than wider sustainable- logistics and supply chains. In addition, phrases such as environmentally-sustainable / friendly / sound / preferable / responsible, eco, and green are found to be widely used synonymously (Abbasi and Nilsson, 2011; Björklund 2005).

Sustainability and freight transport, in more specific than logistics and supply chain, have been discussed in literatures in several ways. Some literatures have modified definitions and aspects of sustainable development in context of transport (Black, 1996; Richardson, 2005). The others have used similar or reflected upon specific concepts such as sustainable mobility (Gudmundsson, 1996; Banister et al. 2000; World Business Council for Sustainable Development, 2004), environmental sustainability (McKinnon et al., 2010), transport and climate change (Chapman, 2007), energy efficiency and emissions (McKinnon, 1993), etc.

Based on principles of division of labor and knowledge, companies are increasingly outsourcing their logistical services to LSPs/3PLs. According to Stefansson (2006), *“the degree of outsourcing varies and the outsourced activities differ greatly in complexity”*. Some examples of activities mentioned in literatures are: transportation, storage, and warehousing (Wolf and Seuring, 2010), packaging, freight forwarding, and inventory management (Liu et al., 2006), cross-docking at terminals or consolidation services at distribution centers (Sternberg, 2008), managerial activities related to flows of goods and production (Fabbe-Costes et al. 2009), and value-added activities such as merge-in-transit setups (Stefansson, 2006).

Although outsourcing activities and role of LSPs in creation of trust and value in supply chain is becoming increasingly important, researched-based studies are evidence that very little attention has been given to sustainability goals and aspects (Lieb and Lieb, 2010; Wolf and Seuring, 2010). According to Wolf and Seuring (2010), transport activities of LSPs are the single largest source of environmental hazards and CO₂ emissions in logistics industry.

3. METHODOLOGY

Researching sustainable development in the context of supply chain management and logistics is not easy due to the many aspects and trade-offs that need consideration. This is also the case in practice. Cruz et al. (2006, p.872) state that sustainable development is *“perhaps one of the most complex and important demands that has occupied managers’ reflection”* and Hall and Vredenburg (2003) report that managers have great difficulties in dealing with sustainable development. Consequently, in researching themes and challenges confronted by logistics service providers (LSPs) in making goods flow sustainable, an explorative and mainly qualitative method was found most appropriate. Inspired by grounded theory (Glasser and Strauss, 1967; Charmaz, 2006) and the way the methodology been used in logistics research (Nilsson, 2006; Flint and Golicic, 2009), the research was designed as a combination of interviews, secondary data from homepages and reports, and literature studies. The interviews have been the main source of data.

3.1 Interview study

The interview study was designed based on the seven stages of a qualitative interview investigation suggested by Kvale and Brinkman (2009), namely: thematizing, designing, interviewing, transcribing, analyzing, verifying, and reporting. Furthermore, in line with the case study procedure suggested by Yin (2003), three documents were created in the design of the interview study; an interview study protocol, an interview study database, and an interview study report, in order to secure high quality research. The interview study protocol has had two major purposes; 1) to document all relevant information in making the process of the interview study as effective and efficient as possible (overall purpose of the study, names, addresses, maps, interview questions etc.), 2) as a log-book where impressions and experiences from each interview and company visit were documented. The interview study database had the purpose of collecting the bulk of material that we investigated. In this database the raw data (company reports, homepage documentation, sound files, transcriptions, presentations, photos etc.) that were used are collected during the research process. With the data and information enwrapped but not interpreted it is beneficial in order to go back to the source when doing the analysis. The final document used in the research is the interview study report. This became in the end an approximately 200 pages report encompassing all the material in an interpreted and analyzed form. Here the results from the coding processes as well as the connections found to previous research are reported.

3.1.1 Thematizing and designing

Based on our earlier research and experience of sustainable development in the context of logistics together with a number of discussions and seminars with logistics managers it was found that there are several challenges in making freight transport sustainable. Looking at supply chains, the main actor in freight transport is the logistics service providers (LSP). Hence, in an explorative manner it became natural to get a LSP perspective on the challenges of sustainable freight transport. In order to get a comprehensive and doable sample the research has been focused on LSPs active in Scandinavia. We set out with a list of 30 LSP companies. The list included both small and large LSPs. Then, as a combination of snow ball sampling and earlier contacts at the LSP, we ended up with a list of interviewees. Each potential interviewee was first contacted by an e-mail, in which the purpose of the study, a description of the research area (sustainable freight transport) and an invite to an interview was included. This was then followed up by telephone call in which any extra information was given and dates set for the interview was made. In total we have interviewed twelve logistics and/or sustainability managers from nine LSP companies (DHL, Maersk, Schenker, Green Cargo, Bring, DSV, Transport ledet, SAS Cargo, and Lastbil centralen). The majority of the interviewees had long experience (20 years or more) of sustainability as well as transport and logistics operations. Most of them had a top management position for the regional LSP offices for the Scandinavian market (if the LSP was part of an international organization) or in the management team (for those operating in one nation).

The data collection process ended when saturation was reached. After interview seven, we evaluated the process and got a first feeling that no more significant or new information was really gained for the purpose of our study. To secure the research quality, two more were conducted, from which we then concluded that data saturation was reached. The sample size for this type of research is according to McCracken et al. (1990) eight for homogeneous samples and Carter and Jennings (2002) suggest 12-20 for heterogeneous samples. In this case the companies and interviewees operate in the same geographical regions, working on similar issues. Hence, compared to more global studies or studies in different industries the sample might be regarded as homogeneous.

3.1.2 Interviewing

The interviews were semi-structured, including both open ended questions and a questionnaire at the end. The interviews lasted for about 90 minutes. An interview guideline was created for the open-ended questions divided into three major areas, namely: the current activities for sustainable development, the future activities and trends for sustainable development (till 2050), and the challenges of sustainable development. The discussions focused on these areas for LSPs specifically and for freight transport in general. Prior to each interview an in-depth study of each LSPs home page was made and information about the company in general as well as information about sustainability related activities, statements, reports, etc. were compiled. All relevant information was documented in the interview study database so it could be accessible in alter phases of the analysis.

3.1.3 Transcribing

Every interview was taped and there after transcribed. If there were any possible misinterpretations or question marks found during the transcriptions, follow up contact was made with the interviewee. Interviewees were asked to read the transcribed text and send the reviewed transcription to the authors. Each sound file as well as transcription was then placed in the interview study database.

3.1.4 Analyzing

The principle of grounded theory is that sampling, and data collection and analysis are interrelated and carried out simultaneously (Glasser, 2002; Corbin and Struss, 1990), which has been the case in this research as well. The analysis of the interviews was conducted during the whole process and included the use of secondary material such as reports, homepages, and documentation. The analysis was inspired by principles of discourse analysis suggested by Winther and Phillips (2000). The initial analysis followed the three areas for the interview i.e. the current- and future activities towards sustainable development, and the challenges confronted. This involved a coding process (an open coding) where different themes in each category emerged as well as for the challenges. A second step of the coding, focused coding (Charmaz, 2006) resulted in the major themes being reported in this paper.

3.1.5 Verifying

The results of the analyses of interviews were discussed several times between authors. With help of secondary sources, syntheses of analyzed interviews were conducted. After verification of results by authors, the interviewees were asked to verify their quality; i.e. trustworthiness and authenticity. The verified results were then used as input text for this article.

3.1.6 Reporting

In line with Kvale and Brinkmann's (2009, pp. 272-277) guidelines for structuring an ethical interview report, this article and its structure are embodiment of the task. The results of the analyses are reported from logistics discipline and Meta levels (Nilsson, 2005, pp. 176). The report of this interview study is mainly used for our own research purposes. However, the final report is sent to all the interviewees and used for scientific communication with other researchers.

3.2 Research quality

Two criteria for evaluating quality of our qualitative research are adapted; namely authenticity and trustworthiness (Bryman and Bell, 2007). To increase authenticity of our interview study, different measures were considered. In thematizing and designing phase, comprehensive literature review as well as further discussion with researchers were conducted to be sure that the perspective should be on LSPs and right amount of the right ones should be interviewed. For the interviewing phase, right interviewees were contacted whom interview introduction and guideline were sent in advance. Both the interviewers and interviewees did their best to communicate enthusiastically and use their best conversation and language skills. To increase trustworthiness in interviewing phase, homepage, relevant reports, and documents of each LSP were read in advance. This could decrease the bias from interview protocol as well as mismatch of understanding among interviewers and interviewees. In transcription step, the sound files were reliably saved in the study databases. In other steps of interview, the interviewees were contacted to verify the transcribed texts as well as the synthesized version of the study. For sake of research ethics, the interviews transcriptions are kept confidential.

4. ANALYSIS

After as well as in parallel with data collection, data analysis was run in order to find answers for research questions. The analysis after focused coding can be divided into three sections: current- and future activities as well as challenges in making freight transport sustainable.

4.1 Current activities in making freight transport sustainable

Most of the interviewees have recognized triple bottom lines in the Brundtland Commission's definition of sustainable development. However, ecological/environmental aspects as well as long-term economic sustainability were more explicitly mentioned in interviews than social aspects. This is in accordance with Carter and Rogers' (2008) and Seuring and Müller's (2008) findings. Although all LSPs have plans and objectives for sustainable development, just a few of them have entered such objectives to their mission or vision statements. In addition, just one LSP has designed its business model based on principles of sustainable development especially when it comes to green and environmentally friendly offers.

The analysis of current activities results in eight categories (summarized in table 1). Three of these have been most emphasized by most of the interviewees (primary activities) while the other five have been less emphasized (secondary activities). In this article, just the primary activities are elaborated in details. However, very short exemplary explanations of secondary activities are presented inside parentheses in table 1.

Table 1 – Current activities in making freight transport sustainable from LSPs' perspective

Primary activities	Secondary activities
Resources efficiency, effectiveness, and utilization	Taking initiatives (<i>UN Global Compact, UN Development Program (UNDP), Logistics Emergency Teams (LET)</i>)
Environmentally/sustainability cautious behavior	Compliance with legislations and standards (<i>ISO 14001, EMAS certification, Sulfur emission- and Ballast water legislations by IMO</i>)
Measurement and assessment	Efficient utilization of transport infrastructure (<i>Single sky, Coordinated air traffic control</i>)
	Well-connected information and goods flows (<i>By implementing 'Intelligent Transport'- or 'Track and Trace' systems</i>)
	Vertical and horizontal collaboration (<i>Collaboration and Lobby work with other LSPs, authorities, and stakeholders</i>)

Resources efficiency, effectiveness, and utilization

These are the efforts which aim to increase efficiency, effectiveness, as well as utilization of logistical (including transport) resources. Effectiveness means doing the right things while efficiency is defined as doing things right (Nilsson, 2005). The resources considered by interviewees are just the physical ones (Magnusson, 2008) which can be movable or static.

A) Efficient- and effective- movable resources

From LSPs point of view, resources' effectiveness – which means using the right resources – as well as their efficiency – which means using the resources right – can contribute to sustainable freight transport. The most common activities to increase effectiveness and efficiency of freight transport resources are as follow:

- Right mode of transport (intermodality): These are related to efforts which aim to find the right combination of available modes which may fulfill the transport demand with the right cost at the right time with lowest negative environmental effects. All LSPs take advantage of several modes of transport in their operations and aim to continuously improve efficiency of each mode.
- Using environmentally friendly vehicles like Electrical trains and EU 5.0 trucks with the lowest energy/fuel consumptions.

B) Efficient static resources

Several LSPs have started to be energy- and eco-efficient by acting more responsible with/in their static resources like terminals, hubs, distribution centers, warehouses, offices, etc. Some exemplary parameters are reducing electricity consumption by using low energy lamps, decreasing waste of energy by using light and temperature sensors, recycling as well as reducing consumption of paper and plastic. One of the interviewees adds: *“It is also very important to visualize energy- and eco-efficiency and letting all personnel to access it. This can make the staffs more responsible with consumption of resources”*.

C) Higher resource utilization

To increase the utilization of movable and static resources is another effort of LSPs towards sustainable freight transport. Higher resource utilization may increase load factor, fill-rate, efficiency, as well as economic benefits (in line with findings from McKinnon et al., 2010). On the other hand, it may decrease fuel/energy consumption and GHGs emissions per ton -, volume -, or TEU (Twenty foot Equivalent Unit) - km. According to one of the LSPs with core competence in sea transport, *“the fill-rate is a very important factor of making the consumption per transported unit lower but also to improve the income. In order to increase the fill-rate, we do triangulation and try to decrease imbalances in goods flows. However, we can still increase the fill-rate inside each unit load, like container, if we collaborate directly with our customers while they fill the unit loads/ containers”*.

Environmentally/sustainability cautious behavior

LSPs have started programs which aim to make the behavior of stakeholders more environmentally/sustainable cautious. Some examples are:

- Educating all personnel about ethical and environmental operations; like ‘GoGreen’ and ‘GoTeach’ programs started by DHL.
- Training all fleet personnel for ‘eco-driving’ in road and rail transport, ‘eco-sailing’ in sea transport, and ‘green- take off and approach’ in air transport.
- Responsible sourcing/ procurement in order to scan all suppliers to assure that they fulfill social and environmental (corporate social responsibility) requirements. One of the interviews elaborates further by mentioning: *“What we do is that we make risk assessment on each supplier and if we find that there is a risk connected to that supplier, we work further with the supplier until we have either decided that there is not any risk or irresponsible behavior”*.

Measurement and assessment

Measurement and assessment are inseparable activities of LSPs towards sustainable development. As one of the interviewees mentions: *“We have developed an internal standard as well as scorecards regarding how to collect and measure different kinds of parameters connected to sustainability”*. Some LSPs have taken advantage of independently verifying authorities for execution of such activities. One of the interviewees emphasizes: *“we would like that all measures and figures be checked by independent parts. For example, we have made sure that our, [as start] CO₂ emissions, figures are independently verified by Lloyds-registered quality assurance [...] we are also asking our clients to ask for similar independently-verification for our competitors’ figures... so, the figures are really accurate and possible to use in real benchmarking ... because we believe that we have figures that you can trust and can be used for your procurement process and that will also drive performance. So, that’s one of our ideas on how to bring the whole industry towards more sustainable shipping”*.

All LSPs collaborate actively with other stakeholders to increase validity and reliability of their emissions calculations. Four out of nine interviewed LSPs offer online platform for calculation of GHG emissions from transport operations.

Furthermore, eight out of nine interviewees publish annual sustainability reports which are openly available for customers/clients and other stakeholders.

4.2. Future activities in making freight transport sustainable

All the interviewees agreed upon tremendous difficulty and uncertainty in design of future sustainability-related activities and strategies for freight transport in a long-term perspective like 40 years from now (till 2050). However, they took a shorter perspective (till 2020) to elaborate on future activities and strategies.

The analysis of future activities results in seven categories (summarized in table 2). Three of these have been most emphasized by most of the interviewees (primary activities) while the other four have been less emphasized (secondary activities). In this article, just the primary activities are elaborated in details. However, very short exemplary explanations of secondary activities are presented inside parentheses in table 2. Worth mentioning that all LSPs are going to continue their current activities in making freight transport sustainable mentioned in section 4.1.

Table 2 – Future activities in making freight transport sustainable from LSPs' perspective

Primary activities	Secondary activities
Innovation and research	Technological development (<i>Development or adaptation of 'Transport Management System's (TMS), 'Intelligent Transport Systems' (ITS), 'Enterprise resource Planning' (ERP)</i>)
Energy/fuel efficiency	Design for sustainability (<i>Better design of supply chain statics like number and arrangement of terminals, hubs, distribution centers, etc.)</i>)
Increasing awareness	Adaptation to future policies and corporate governance (<i>Collaboration with authorities and policy makers regarding coming policies and directives</i>)
	Taking supply/ value chain view (<i>Collaboration with products' producers/manufacturers and consumers as well as passenger carriers</i>)

Innovation and research

Innovation is going to be on the agenda for sustainable development all the time. LSPs are going to be always open to innovative solutions, strategies, out of the box ideas, and business models which may develop sustainability of their businesses in both short- and long-terms.

In addition, they are going to invest heavily in research and collaboration with researchers and advisory councils. Research may smooth the path towards innovation. As an example, one of the LSPs with core competency in sea transport elaborates on role of innovation and research on energy consumption of vessels by stating: *"long-term investments in research, technical developments, and innovation are behind our strategies towards reduction of [total] energy consumption [...] we would like to be pioneer, prime mover, in reduction of emissions"*.

Energy efficiency

Energy will be an inseparable part of transport. Based on principles of *peak oil* (Chapman, 2007); oil production will begin to fall during the coming years. With regard to this, finding proper replacement of energy produced from renewable sources as well as taking plans for higher energy efficiency in transport sector is a must. LSPs show the path to this trend by reflecting upon one or some of the following issues:

- To energize and utilize resources like vehicles and facilities which are fed by non-fossil/renewable while economic fuels.
- Collaboration with vehicle manufacturers - Volvo and Scania were oftentimes mentioned - in order to design more environmentally friendly trucks, trains, vessels, and aircrafts which, for example, are lighter and more aerodynamic, have more efficient engines, emit zero GHG emissions.
- To move towards zero emission from energy production and consumption. In this regard, LSPs are going to collaborate with base industries, like energy producers, to find alternative fuels which are produced without using raw material from food sources or endangering forests or the biodiversity. As one of the interviewees signifies: *“It is very important that renewable energies be globally and ethically produced in way which does not increase GHG emissions. One of the LSPs with core competency in sea transport adds: “we do not believe in substitution of fossil fuel to bio-fuel on a short term basis because we believe that, in the short perspective, it is impossible to change/ switch such a huge amount of energy that is used in shipping [...]but we would like to be prepared in the future; we would like to be sure that when we switch or start switching, we have fuel that is sustainable [...] so, it is not that we discover after a year or two that we killed the possibility for people of this part of the World, to have food or we have cut down rainforest, or whatever things that can happen. [...] To find fossil-free fuel which can be produced in enough quantity without other external negative effects is very tricky... So, I don’t believe that we can switch on short-term base but on the long-term base. So, we are preparing and trying to find”.*
- To benchmark energy efficiency with other businesses as well as investment on innovation, research, and technical development for less and higher energy consumption and efficiency, respectively were also lifted by several interviewees.

Increasing awareness

Awareness makes the path towards adaptation of new solutions and policies as well as change of behavior smooth. LSPs are going to work with other stockholders in organizational, national, and international levels to increase awareness of new generations about dimensions and importance of sustainable freight transport/logistics. According to one of the interviewees, *“In general, we have been much more aware of sustainable development after Al Gore and IPCC Nobel peace prize in 2007. In fact a new world has been opened. I think that future generations will be still more aware when it comes to energy resources, climate change, environment, ethical trade, and so on.”*

Lifting awareness of suppliers and customers (Shippers and receivers/ Consignors and consignees) as well as carriers, forwarders, and logistics service intermediaries were elaborated by LSPs several times during the interviews. They also emphasized the significance of change of customers’ behavior and outlook when it comes to purchasing sustainable freight transport services. At the moment, cost and time are much more preferred than environmentally friendliness.

4.3 Challenges in making freight transport sustainable

The third part of our interviews focused on the challenges the LSP’s perceived in making their operations more sustainable. The following five categories emerged from the analysis:

Business complexity

Finding cooperative ways to develop sustainable solutions is recognized as a major challenge due to the fragmented nature of logistics industry. While all LSPs offer freight transport services by all modes of transport, they typically contract with several logistics service intermediaries (LSIs) (Stefansson, 2006), forwarders and carriers to fulfill their services.

Consequently, management of all LSIs, forwarders, and carriers are challenging, especially when it comes to all pillars of sustainable development. For example, some of the global LSPs complain that it is difficult to follow that all carriers use environmentally friendly trucks like Euro 5.0 class or measure their sustainability performance. Another challenge is that competence of different modes is distributed, something that both have positive and negative effects. For example, one of the LSPs with core competency in rail transport complains that several technical problems by electrical or hybrid trucks have influenced whole of their business brand. Finally, as all interviewees put forward, the sustainability interest of the customers is essential in order to develop and deliver more sustainable solutions. All LSPs put forward that the customers had rather low interest in prioritizing more sustainable transport solutions. Furthermore, the competences related to transport effects on the environment or socially of their customers were also found very fragmented. One interviewee stated that *“Sometimes they have their own environmental departments or groups in their companies, but we have found that they do not speak to each other internally about the importance of environmentally friendly transport.”*

Time and cost

“The challenges are mostly about time and price!”(Interviewee number 4). Some LSPs emphasize that today, customers’ behavior are in opposite of environmentally cautiousness. Customers usually look at transport as a non-value added activity where it must be fulfilled with the lowest time and price. As a consequence, fill-rates and resource utilization of LSPs are sacrificed. In addition it usually leads to higher emissions and negative environmental impacts. As one of the interviewees claims: *“In conclusion, it is very difficult to balance the cost, time, environmentally friendliness, and at the same time competition with other LSPs.”* Consequently, there is great challenge in finding ways to overcome the economically driven solutions. As explained by one interviewee *“...it is not the environmental friendly solutions that should be costly. The non-environmentally solutions should be more costly”* However, as another explained *“we have an eco-friendly solution [...] which is actually cheaper but then we need more time to plan the transport. But it is not many companies using [the eco-friendly solution] even if it is cheaper; Because of time limits”*. Hence, the market needs of timely deliveries are also a challenge to consider.

Managerial complexity

Developing sustainable freight transport services is tied with several managerial challenges. One dimension is difficulties in measurement and assessment. For example, different LSPs use different standards, methods, and platforms for measuring GHG emissions or for assessing environmental impacts of freight transport operations. One of the interviewees from air sector states: *“Together with IATA and Star Alliance, we work with issues like global Emissions Trading Scheme (ETS)... This is an absolute challenge to reach the goals and I do not know if we can succeed!”* Another dimension is different customers’ demand in different markets. Working with different types of industries calls for high flexibility of transport system. For example, in some occasions resources are restricted by volume (cubic meter) and in some by weight (ton). Furthermore, change and adaptation take time and in some occasions this is very expensive. All the interviewees highlight the complexity of implementation i.e. it takes long time and is expensive to change the fleet to newer more environmentally ones, adapt to new sustainability legislations, synchronize internal thinking about environment, inform all actors of a global supply chain and sometimes the politicians and decision makers about importance of all aspects of sustainability, get the suppliers to adapt to sustainability criteria, change customers’ behavior, etc.

Network imbalance

To balance the goods and resources flows in the network is another identified challenge.

Imbalances in goods flows are mostly due to restrictions in the system like delivery at an exact sharp time; daily, and usually diverse, load and unload (pick and delivery) operations; etc. Geographical positions may lead to both imbalances in goods and resources flows. For example, one of the interviewees from rail sector says: *“if you look at long geographical position of Sweden, there are huge amount of goods from Göteborg/Skåne till Stockholm but there are little from Stockholm till Göteborg or from north to south. This can also lead to empty running or imbalance in flows of trucks”*. Network imbalances deteriorate fill-rates as well as resources utilization which means higher emissions and negative environmental impacts. The scenario becomes worse when it comes to network imbalances in international markets. Globalization, exports, and fair trade can all lead to imbalances in freight transport network. One of the interviewees from a global LSP company with core competency in sea transport highlights that: *“if you look at global commerce – it is very easy to say that everything should be locally sourced ... but you should have in mind that no country has ever got from extreme poverty to developed country without a very heavy commerce with other countries.”*

Uncertainties

Uncertainties about future fossil-free fuels and infrastructural changes for production of such fuels, especially in global markets, are very challenging. One of the interviewees states: *“My guess is that finding a fossil-free fuel for the future is not easy [...] so, if we can cut the consumption, that is really very good but to take it to the very far end to find fossil-free fuel that be produced in enough quantity without other external negative effects is very tricky*. Other dimensions of uncertainties are related to future changes in transport infrastructure. Taking initiatives like investment in new infrastructures or combination of passenger and goods transport infrastructure, for example transport in city by rail, are tied with tremendous uncertainties. Uncertainty in legislation and regulations is also a challenge emphasized by the interviewees. Without clear and long-term directions from regulators the willingness in the LSP industry to take risks in increasing transports by train, go for bio-fuel alternatives, etc. are low. As explained by one interviewee *“regulators and governments must create concrete strategies and stay with these”*.

5. DISCUSSION

In order to tackle the challenges in making freight transport sustainable, there is a great need for holistic models together with long term perspectives in which comprehension, not elimination or reduction, of the emergent complexity that sustainability represents is explored. Without such perspective, the decision- and policy making will be suboptimal. By analogy, LSPs must also take a holistic perspective to whole of the supply chain in order to avoid suboptimal and isolated decisions for sustainable development of freight transport. A future step may be the analysis and design of future freight transport set-ups in collaboration with products' producers/manufacturers, end- tiers consumers, and passenger carriers.

In addition, there are just few LSPs who have taken part in sustainability initiatives. A more proactive approach to such initiatives may lead to bottom-up changes towards sustainability and increase the chance of operationalization of bottom lines of sustainable development.

The identified themes, the current and future activities, also represent the importance of an integrative perspective. It is clear that sustainable freight transport can never emerge by just

one activity or operation. There is great need for developing a packet of solutions with different activities which do not have conflicting goals or effects on each other. The solutions for making freight transport sustainable can be classified in three major areas: Adaptation, Reduction, and Optimization. These three areas may be considered as macro solutions towards sustainable supply chains and be used by decision- and policy makers.

Adaptation: Adaptation refers to those types of solutions which seek opportunities for changing the supply chain actors' behaviours in both short- and long-terms. Taking initiatives, compliance with legislations and standards, sustainability cautious behaviour, collaboration, and innovation can all be classified under solutions towards adaptation.

Reduction: It relates to efforts which aim to reduce consumption of materials and resources of the Earth. The simple equation behind this solution is that by reducing demand, supply will be reduced as well. Less demand means less consumption of natural materials, products, packages, energy, transport, resources, and so and so forth. Less consumption may decrease the amount of green-house-gases (GHG) emissions.

Optimization: An obvious conclusion from the last section is that although consumption of materials and resources of the Earth can be reduced, they can never be completely omitted. To imagine a world without demand for materials, foods, packages, energy, and transport sounds even impossible. Optimization relates to those solutions which aim to find opportunities for optimizing consumption of materials and resources of the Earth. The result will be finally less consumption and green-house-gases (GHG) emissions.

A very dominant pre-assumption in developing sustainable transport is that more environmentally friendly modes should be used. This may be true in the short-term but the standpoint made from our analysis is that it will not solve the problem in the long-term. The transport system must be developed in a resilient way. This means that in case of peak loads for one mode, the other modes must be ready to be replaced. Peaks can happen due to natural disasters, weather conditions, risk and security reasons, terrorist attacks, etc. In addition, optimal competition among transporters, and modes of transport, may decrease the price of transport service for the customers.

Some interviewees raise another dimension which is related to geographical restrictions or distribution of the resources of the world in a way which is impossible to reach by all modes or can be reaching by just one mode. For example, one interviewee states: *"There are not so much rail opportunities in Denmark in compare to Sweden and that is mostly related to how its geography looks like"*. Another one with core competency in air transport mentions: *"In north parts of Norway, the only mode of transportation is either by car or the aircraft. So, if we do not fly, then the society there will almost stop"*.

6. CONCLUSIONS

In this paper we have explored major themes as well as pattern of current and emerging challenges for developing sustainable freight transport out of a LSPs perspective. A major conclusion drawn from the findings is that sustainability issues out of a LSP perspective have a strong tendency towards economic/profit related issues followed by environmental concerns and thereafter social/people related. It is also a conclusion that the LSPs recognise cost and time to be of major importance to their customers and most of them feel that their efforts in providing more environmental solutions do not pay off since it is not prioritized if it is in conflict with either cost or time. Furthermore, there are a number of uncertainties that restrain LSPs such as uncertainty in technological development, regulations and legislations, and the

movement of their customers. Further research is needed in understanding the interrelationship between LSPs and their customers in the development of sustainable logistics solutions as well as the role and importance governments have in reaching the goals of 90% CO₂ reductions before 2050.

REFERENCES

- Abbasi, M., and F. Nilsson. "Themes and challenges in making supply chains environmentally sustainable." *Supply Chain Management: An International journal*, Accepted for publication (2011).
- Abukhader, S., and G. Jönson. "Logistics and the environment: Is it an established subject?." *International Journal of Logistics* 7 (2), (2004):137-149.
- Anderson, S., J. Allen, and M. Browne. "Urban logistics – how can it meet policy makers' sustainability objectives?." *Journal of Transport Geography* 13 (1), (2005): 71-81.
- Aronsson, H., and M. Huge Brodin "The environmental impact of changing logistics structures." *International Journal of Logistics Management* 17 (3), (2006): 394-415.
- Banister, D, K. Dreborg, L. Hedberg, S. Hunhammar, P. Steen, and J. Åkerman. "Transport Policy scenarios for the EU: 2020 Images of the Future." *Innovation* 13 (1), (2000): 27-45.
- Björklund, M. "Purchasing Practices of Environmentally Preferable Transport Services – Guidance to increased shipper consideration." Dissertation (Ph. D). Lund University, Lund, Sweden, 2005.
- Black, W.R. "Sustainable transportation: a US perspective." *Journal of Transport Geography*, 4, (1996):151–159.
- Brown, M. "Special Issue Introduction: Transport Energy Use and Sustainability." *Transport Reviews*, 25 (6), (2005): 643-645.
- Bryman, A., and E. Bell. *Business research methods*. Oxford University Press Inc, New York, 2007.
- Carter, C.R. and M.M. Jennings. "Social responsibility and supply chain relationships." *Transportation Research Part E: Logistics and Transportation Review* 38 (1), (2002): 37-52.
- Carter, C.R. and D.S. Rogers. "A framework for sustainable supply chain management: moving toward new theory." *International Journal of Physical Distribution & Logistics Management* 38 (5), (2008): 360-387.
- Chapman, L. "Transport and climate change: a review.", *Journal of Transport Geography* 15, (2007): 354-367.
- Charmaz, K. *Constructing grounded theory: a practical guide through qualitative research*. Sage Publications, Inc., 2006.
- Corbin, J.M. and A.L. Strauss. *Basics of qualitative research: techniques and procedures for developing grounded theory*. Sage Publications, Inc. LA., 1990.
- Cruz, L.B., E.A. Pedrozoand, and V. de Fátima Barros Estivaleta. "Towards sustainable development strategies – A complex view following the contribution of Edgar Morin." *Management Decision* 44 (7), (2006): 871-891.
- Dyllick, T. and K. Hockerts. "Beyond the business case for corporate sustainability." *Business strategy and the Environment* 11(2), (2002): 130-141.

- European Union. *European Communities, A sustainable future for transport*, 2011.
- Fabbe-Costes, N., M. Jahre, and C. Roussat. "Supply chain integration: the role of logistics service providers." *International Journal of Productivity and Performance Management* 58 (1), (2009): 71-91.
- Flint, D.J. and S.L. Golicic. "Searching for competitive advantage through sustainability - A qualitative study in the New Zealand wine industry." *International Journal of Physical Distribution & Logistics Management* 39 (10), (2009): 841-860.
- Glaser, B.G. "Conceptualization: on theory and theorizing using grounded theory." *International Journal of Qualitative Methods* 1(2), (2002).
- Glaser B.G. and A.L. Strauss. *The Discovery of Grounded Theory - Strategies for qualitative research*. Aldine Publishing Company, Chicago, 1967.
- Gudmundsson, H. and M. Höjer. "Sustainable development principles and their implications for transport." *Ecological Economics* 19, (1996): 269-282.
- Hall, J. and H. Vredenburg. "The challenge of innovating for sustainable development" *MIT Sloan Management Review*, (2003): 61-80.
- Himanen, V., M. Lee-Gosselin, and A. Perrels. "Impacts of Transport on Sustainability: Towards an Integrated Transatlantic Evidence Base." *Transport Reviews* 24 (6), (2004): 691-705.
- IPCC / Intergovernmental Panel on Climate Change/. IPCC Forth Assessment Report, *Climate Change 2007 (AR4) – Working Group III Report: Mitigation of Climate Change*, 2007.
- Jeffers, P.J. "Embracing sustainability: Information technology and the strategic leveraging of operations in third-party logistics." *International Journal of Operations & Production Management* 30 (3), (2010): 260-287.
- Keating, B., A.Q. Quazi, A. Kriz, and T. Coltman. "In pursuit of a sustainable supply chain: insights from Westpac Banking Corporation." *Supply Chain Management: An International Journal* 13 (3), (2008): 175-179.
- Kvale, S., and S. Brinkmann. *InterViews: Learning the craft of qualitative research interviewing*, SAGE Publications Ltd., USA, 2009.
- Lieb, K.J., and R.C. Lieb. "Environmental sustainability in the third-party logistics (3PL) industry." *International Journal of Physical Distribution & Logistics Management* 40 (7), (2010): 524-533.
- Liu, X., D.B. Grant, A.C. McKinnon, and Y. Feng. "An empirical examination of the contribution of capabilities to the competitiveness of logistics service providers." *International Journal of Physical Distribution & Logistics Management* 40 (10), (2006): 847-866.
- Magnusson, M. *Introduction to Strategy*. Chalmers University of Technology, Göteborg, Sweden., 2008.
- McCauley, D. "Sustainable Development and the 'Governance Challenge': the French Experience with Natura 2000." *European Environment* 18, (2008): 152-167.
- McCracken, G., B. Pfaffenberger, D. Morgan, and A. Bryman. "The Long Interview." *Contemporary Sociology: An International Journal of Reviews* 19 (3), (1990): 485-486.

- McKinnon, A.C., I. Stirling, and J. Kirkhope. "Improving the fuel efficiency of road freight operations." *International Journal of Physical Distribution & Logistics Management* 23 (9), (1993): 3-11.
- McKinnon, A., S. Cullinane, M. Browne, and A. Whiteing. *Green Logistics: Improving the environmental sustainability of logistics*, Kogan Page Limited, UK, 2010.
- Nilsson, F. "Adaptive Logistics – using complexity theory to facilitate increased effectiveness in logistics." Dissertation (Ph. D). Lund University, Sweden, 2005.
- Nilsson, F. "Toward theories of complex logistics." *The International Journal of Logistics Management* 17 (1), (2006): 38-54.
- Pezzy, J. *Sustainable Development Concepts, An Economic Analysis*. World Bank, Washington, D.C., USA., 1992.
- Pihl, H. *Miljöekonomi: För en hållbar utveckling*, SNS-Förlag, Stockholm, Sweden., 1997.
- Richardson, B. "Sustainable transport: analysis frameworks." *Journal of Transport Geography* 13, (2005): 29-39
- Seuring, S. and M. Müller. "From a literature review to a conceptual framework for sustainable supply chain management." *Journal of Cleaner Production* 16 (15), (2008): 1699-1710.
- Stefansson, G. "Collaborative logistics management and the role of third-party service providers" *International Journal of Physical Distribution & Logistics Management* 36 (2), (2006): 76-92.
- Sternberg, H. "Freight Transport Operations and Information sharing." Dissertation (Licentiate), Chalmers, Göteborg, Sweden, 2008.
- Wigan, M. and F. Southworth. "Movement of goods, services and people: entanglements with sustainability implications." *STELLA FG4 meeting*, Brussels, Belgium, 2004.
- Winther, W.J. and L. Philips. *Diskursanalys som teori och metod*. Studentlitteratur: Lund., 2000.
- Wolf, C., and S. Seuring. "Environmental impacts as buying criteria for third party logistical services." *International Journal of Physical Distribution & Logistics Management* 40 (1/2), (2010): 84-102.
- World Business Council for Sustainable Development, *Mobility 2030: Meeting the challenges to sustainability*, 2004.
- World Commission on Environment and Development, *Our Common Future*, Oxford University Press, 1987.
- Wu, H. and S. Dunn. "Environmentally responsible logistics systems." *International Journal of Physical Distribution & Logistics Management* 25 (2), (1995): 20-38.
- Yin, R.K. *Case Study Research: Design and Methods*. Thousands Oaks, Sage Publications., 2003.
- http://www.movingtheworld.org/logistics_emergency_teams
- <http://www.undp.org/>
- <http://www.unglobalcompact.org/>