Coordination to manage dependencies between logistics service providers and shippers: An environmental perspective

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COORDINATION TO MANAGE DEPENDENCIES BETWEEN LOGISTICS SERVICE PROVIDERS AND SHIPPERS - AN ENVIRONMENTAL PERSPECTIVE

ABSTRACT

PURPOSE

Although it has been suggested that shippers' demands regarding environmental practices appear to have an impact on the environmental work of LSPs, limited attention has been given to environmental practices in the relationships between LSPs and shippers. The purpose of this paper is to explore how dependencies between LSPs and shippers can influence the way in which environmental practices are coordinated in the relationships between them.

DESIGN/METHODOLOGY/APPROACH

Four dyadic case studies, each consisting of one LSP and one shipper, provide the empirical basis for this paper.

FINDINGS

Two types of dependencies are suggested as having an influence over the coordination of environmental practices in LSP-shipper relationships: 1) dependence between LSPs and shippers as such, and 2) dependence with regard to specific environmental practices. In addition, the environmental ambition of the actors is found to be of relevance when LSPs and shippers coordinate environmental practices between them. Based on these parameters, different coordination mechanisms for environmental practices in LSP-shipper relationships are discussed.

RESEARCH LIMITATIONS/IMPLICATIONS

The research is limited to four cases in a Swedish context. Additional cases might provide other insights into LSP-shipper relationships and thereby lead to modifications of the proposed conceptual framework.

PRACTICAL IMPLICATIONS

The results can help both LSPs and shippers improve their work with environmental practices through the use of the appropriate coordination mechanisms in their inter-organisational relationships.

ORIGINAL/VALUE

Contrary to previous research, which mainly takes one party's perspective, this paper takes a dyadic approach and thereby adds valuable knowledge to the inter-organisational aspects of LSPs' environmental work.

Keywords: Coordination mechanisms, dependencies, logistics service providers, shippers, environmental practices, inter-organisational relationships.

INTRODUCTION

It is widely recognised that logistics and transport operations have a substantial negative impact on the natural environment (see for example EEA, 2014; EU, 2011) and that they affect things such as local air quality, noise and vibration, accidents and global warming (McKinnon, 2010). While research into the environmental work of logistics service providers (LSPs) has long been given surprisingly little attention (see e.g. Marchet et al., 2014), it is encouraging that research into this area has increased substantially during recent years. One important area of research in this context is LSPs' environmental practices (see e.g. Lieb and Lieb, 2010; Marchet et al., 2014; Perotti et al., 2012), which refer to initiatives taken as a means to work towards environmental sustainability (Colicchia et al., 2013). Within the context of LSPs, the focus of these environmental practices has to date been largely on the perspective of LSPs (Colicchia et al., 2013; Lieb and Lieb, 2010; Perotti et al., 2012).

Although these studies make an important contribution to the greening of LSPs, to a large extent they exclude their customers, i.e. the shippers. In relation to this, Roth and Kåberger (2002) as well as Wolf and Seuring (2010) suggest that shippers' demands regarding environmental practices appear to have an impact on the environmental practices of LSPs. For example, based on their study of both LSPs and shippers, Wolf and Seuring (2010, p. 85) note that: *".../ a decisive part of the options for environmental actions seems to lie with the transport buying company, as it is this actor who makes the choices on where and how locations are set up and also chooses the service providers, whereas the 3PL is more bound to adapt his services to related customer demands."* The citation illustrates the shippers' influence over environmental practices included in their relationships with LSPs. However, at the same time it is important to note that LSPs play a vital role for shippers who strive to decrease their environmental impact from logistics. Shippers who have outsourced their logistics and transport functions are, at least to some extent, in the hands of the LSPs with regard to logistics expertise and therefore rely on them for environmental practices. As supported by the citation of Wolf and Seuring (2010) above, LSPs are at the same time to some extent dependent on the input of shippers in order for environmental practices to actually be included in the relationships between LSPs and shippers.

According to the reasoning above, LSPs and shippers appear to be mutually dependent with regard to the inclusion of environmental practices in their relationships. This paper takes a coordination perspective in order to further understand these dependencies and thereby offer insight into how environmental practices can be included in LSP-shipper relationships. Coordination is indeed suggested as a way to manage dependencies between activities (Malone and Crowston, 1994). Thus, given that LSPs and shippers are in various ways dependent on each other for decreasing environmental impact from logistics, further focus on these dependencies is of interest. The purpose of this paper is to explore how dependencies between LSPs and shippers can influence the way in which environmental practices are coordinated in the relationships between them. By addressing this issue, the paper addresses a gap in the research that includes 1) the interface between LSPs and shippers, for which research has been called for by, for example, Marchet et al. (2014), and 2) coordination for the purposes of greening supply chains, which is noted as an unexplored area of research by Swami and Shah (2013).

The remainder of this paper is organised as follows: The literature review begins by addressing the question of why coordination is of importance in LSP-shipper relationships, while the following section includes ways in which coordination can be carried out. The final part of the literature review presents what to coordinate, which in this paper is environmental practices. This is followed by the methodology, where the case study approach used for this research is described and case companies presented. The cases are then presented, after which the discussion introduces and elaborates on a

conceptual framework developed from the empirical data. A conclusion sums up the findings of the paper.

LITERATURE REVIEW

WHY COORDINATE?

Although there is no universal definition of coordination, much research appears to rely on the point of view of Malone and Crowston (1994), who argue that coordination can be considered as a means to manage dependencies between entities (Arshinder et al., 2008). This view of coordination corresponds well with the logic of this paper: that LSPs and shippers are mutually dependent when working with environmental practices in their relationships (see e.g. Lun et al., 2015). Most obvious is perhaps the shippers' dependencies on LSPs to perform environmentally sound activities, as LSPs are more likely than shippers to have environmental knowledge within logistics and transportation. However, the dependency situation could also be the reverse, in that the LSPs need shippers' involvement in order to succeed with their work towards decreased environmental impact. For example, changes in a shipper's distribution system could be environmentally beneficial for both a shipper and an LSP in a relationship, but without the shipper's involvement, the LSP would not be able to make any such changes.

Continuing on the matter of dependencies, Malone and Crowston (1994, p. 91) write that *"If coordination is defined as managing dependencies, then further progress should be possible by characterizing different kinds of dependencies and identifying the coordination processes that can be used to manage them"*. Related to this, it is of interest to understand different types of dependencies, and one way to differentiate between them is to separate dependencies from interdependencies and independencies (e.g. Pfeffer and Salancik, 1978). If one actor is highly dependent on another, who in turn has a low dependence on the first, the first actor can be said to be dependent on the second. If both actors were to be dependent on each other, they would instead be interdependent, whereas independency means that neither of the actors is dependent on the other.

Given that various types of dependencies require different types of coordination, it is vital to understand the variety of ways in which coordination can be accomplished. This brings us to the next section of the literature review.

HOW TO COORDINATE?

A variety of coordination mechanisms can be adopted within and between organisations in order to coordinate activities and several authors recognise that different types of coordination mechanisms are suitable for different types of coordination problems (e.g. Danese et al., 2004; Galbraith, 1973; Huiskonen and Pirttilä, 2002; Mintzberg, 1989). Huiskonen and Pirttilä (2002) recognise that high interdependencies between activities require other coordination mechanisms than those with low interdependencies, and, similarly, Galbraith (1973) argues that coordination mechanisms need to change as uncertainty increases. On a more detailed level, Danese et al. (2004) study the relationship between interdependencies in supply networks to the types of coordination adopted. More specifically, Danese et al. (2004) develop a two-dimensional framework which includes 1) characteristics of interdependence and 2) number of units involved. As for the interdependence, the authors make a distinction between one-way and two-way interdependency between entities. As they study supply networks, many actors can be involved and because of this Danese et al. (2004) also make a point of the number of actors involved, i.e. two or more than two. Combined, these two dimensions make up a

matrix of four boxes to which the authors link various types of coordination mechanisms. Although in a different context from the study at hand, the study illustrates that various types of dependencies can indeed affect the way in which the dependencies are coordinated.

Coordination mechanisms may be on a very specific level or on a more general level (Crowston, 2003). Danese et al. (2004) is one example of a study that takes a wide perspective on coordination mechanisms in order to illuminate which best to adopt under certain circumstances. While they focus on supply networks, Huiskonen and Pirttilä (2002) study the same interface as is of relevance for this paper, i.e. the LSP-shipper interface. Huiskonen and Pirttilä (2002) also focus on several coordination mechanisms, albeit limited to lateral coordination mechanisms (i.e. horizontal mechanisms that can cut across vertical lines of authority). Other researchers focus instead on single coordination mechanisms in their studies. In the context of supply chains, for example, researchers have studied mechanisms such as supply chain contracts (e.g. Cachon, 2003; Cachon and Lariviere, 2005) and information sharing (Cachon and Fisher, 2000; Chan and Chan, 2009; Inderfurth et al., 2013). Studies conducted with an environmental perspective on coordination are also of relevance for this paper, and one such example is Eng-Larsson and Norrman (2014) who focus on contracts and their role for modal shift. In the context of closed loop supply chains, De Giovanni (2014) studies contracts in order to illuminate how this coordination mechanism can affect the benefits of collaborating for environmental purposes. This paper takes a wide perspective on coordination mechanisms in the context of environmental practices in LSP-shipper relationships. To the best of the author's knowledge, very limited, if any, previous research has taken such an approach in the context of environmental considerations in the LSP-shipper interface.

Coordination mechanisms have been studied in both intra- and inter-organisational settings. While inter-organisational coordination mechanisms would seem to be the most useful perspective to take on LSP-shipper relationships, previous studies have successfully applied intra-organisational coordination mechanisms to an inter-organisational setting (e.g. Danese et al., 2004; Huiskonen and Pirttilä, 2002). Taking the intra-organisational perspective, Van De Ven et al. (1976) suggest three coordination mechanisms: impersonal mode, personal channels and group meetings. Impersonal mode includes very little, if any, personal contact; instead, coordination occurs through, for example, plans, policies or standardised information and communication systems. Personal channels refer to coordination through individuals who ensure adaptations via horizontal or vertical communication in an organisation, while group meetings rely on groups that mutually adjust through planned or unplanned meetings. Taking an inter-organisational perspective instead, Arshinder et al. (2008) find in their literature review of supply chain coordination a number of coordination mechanisms studied in previous literature. While many of these are relatively specific, Arshinder et al. (2008) discuss four mechanisms in particular that are of relevance for managing dependencies in supply chains: supply chain contracts, information technology, information sharing and joint decision making. While much of the literature on coordination logistics and supply chain management is concerned with the flow of goods and/or information (Arshinder et al., 2008; Cachon and Fisher, 2000; Romano, 2003; Stank et al., 1999), environmental practices in LSP-shipper relationships are not necessarily connected to the actual goods flow in the same manner. Thus, there is a need for a more general set of coordination mechanisms than those suggested in much of the logistics literature.

This paper applies the coordination mechanisms of Mintzberg (1989), which include six types of mechanisms. This choice is based on the fact that the framework is, in line with Sandberg and Bildsten (2011), one of the most comprehensive with regard to coordination mechanisms. As the mechanisms are also of relatively general character, they are in this paper considered to be suitable for the analysis

of environmental practices. The first of the six coordination mechanisms in Mintzberg's (1989) framework is mutual adjustment, which occurs when individuals or groups adapt to each other in their work process. This often includes informal communication and tends to take place in either very simple or very complex situations (Glouberman and Mintzberg, 2001). In direct supervision, the responsibility of coordination lies with someone who does not actually perform the work, but instead gives directives to those who do. The four remaining coordination mechanisms suggested by Mintzberg (1989) are different forms of standardisation. Standardisation of work means that coordination takes place in the design of the work. When outputs are standardised, on the other hand, coordination is achieved by standardisation of the results. Standardisation of skills and knowledge means that people are trained to know exactly what to expect from each other and thereby coordinate automatically. The final coordination mechanism described by Mintzberg (1989) is standardisation of norms, which implies that common values and norms ensure that people work towards the same goals and expectations. According to Glouberman and Mintzberg (2001), three of the coordination mechanisms (direct supervision, standardisation of work and standardisation of output) are linked to hierarchical situations, in which a level of authority often initiates the coordination.

Although the framework by Mintzberg (1989) was originally developed for intra-organisational coordination, the coordination mechanisms are in this paper considered to be a fruitful way in which to describe how environmental practices can be coordinated. The assumption that this leap from an intra- to an inter-organisational context is reasonable is supported in two ways. First, it is inspired by the success of previous studies that have taken other intra-organisational frameworks and applied them in studies of two or more actors (Danese et al., 2004; Huiskonen and Pirttilä, 2002). Second, and perhaps more importantly, the framework has been applied by Sandberg and Bildsten (2011) in the context of minimising waste in industrial housing projects and they successfully applied the mechanisms for intra-organisational as well as inter-organisational settings.

WHAT TO COORDINATE?

Given the purpose of this paper, it is of interest to pay some attention to the various types of environmental practices that have been discussed in previous literature. This section on environmental practices does not, however, aim to provide an in-depth discussion of all environmental practices identified in the literature but rather to give an overview of what has been mentioned in previous research. One classification of environmental practices commonly referred to is that of Zhu and Sarkis (2004) and (Zhu et al., 2008). The classification includes five categories: *internal environmental management*, *green purchasing*, *customer cooperation with environmental concerns*, *investment recovery* and *eco-design dimensions*. Several other authors have contributed in complementing or extending ways to this categorisation of environmental practices (such as Hu and Hsu, 2010; Vachon and Klassen, 2006). It should be noted that the studies by Zhu and Sarkis (2004); Zhu et al. (2008), Hu and Hsu (2010) and Vachon and Klassen (2006) are conducted in contexts of various types of shippers (i.e. retailers and manufacturers). Although similarities do exist, environmental practices in the context of LSPs deserve specific attention in this paper. A few authors have focused on such environmental practices during recent years (e.g. Colicchia et al., 2013; Lieb and Lieb, 2010; Perotti et al., 2012). One of the most extensive reviews specifically focused on LSPs' environmental practices has been made by Perotti et al. (2012). They rely on the classification of Zhu and Sarkis (2004) and (Zhu et al., 2008) but add three categories of environmental practices in order to adjust the framework to an LSP context: *distribution strategies and transportation execution*, *warehousing and green building*, and *reverse logistics*. This results in a classification of eight categories which in turn can be refined into more specific environmental practices. Table 1 summarises the categorisation suggested by Perotti et al. (2012) and gives some examples of more specific environmental practices within each

category. It should be noted that the table is based on the findings of Perotti et al. (2012), whose categorisation relies on an extensive literature review.

Table 1. Overview of environmental practices in an LSP context (adjusted from Perotti et al., 2012)

Overall category	Specific environmental practices
Green supply	Providing suppliers with design specifications including environmental requirements, environmental management systems of suppliers and environmental audits of suppliers' internal management
Distribution strategies and transportation execution	Use of alternative fuels, less polluting vehicles, consolidation of goods, mode choice, efficient driving
Warehousing and green building	Eco-friendly building design, energy efficiency, material handling equipment and use of alternative energy sources
Reverse logistics	Waste reduction, transport and disposal, materials recycling whenever possible
Cooperation with customers	Helping customers comply with certification programmes and supporting their efforts to attain the "green" goal, as well as cooperation with customers on reverse logistics and recycling programmes.
Investment recovery	Sale of excess inventories, sale of scrap and used materials
Eco-design and packaging	Packaging design to decrease environmental impact, re-cycling or re-use of packaging.
Internal management	Support for environmental practices from managers, environmental management systems, environmental performance measurement and monitoring

With regard to environmental practices in supply chain relationships, some researchers distinguish between monitoring and collaborative practices (Rao, 2002; Vachon and Klassen, 2006). Environmental monitoring encompasses practices initiated by the purchasing company in order to monitor or control the supplier, while environmental collaboration means that the buyer and supplier jointly work towards environmental solutions (Vachon and Klassen, 2006). Both these measures can be adopted at the same time. In the context of companies subject to the European emissions trading system, De Giovanni and Esposito Vinzi (2014), for example, find that monitoring of suppliers does not lead to efficiencies in environmental collaboration. They argue that the underlying reason behind this might be that information sharing and trust in the supply chain makes the chain act as one and the need for monitoring practices is therefore diminished. Finally, the classification into monitoring or collaborative practices is in fact closely related to the coordination of such practices, as the two different types imply the use of diverse coordination mechanisms.

METHODOLOGY

The research for this paper has been exploratory in nature (Yin, 2009) and has used case study research (Ellram, 1996; Yin, 2009) in order to explore how dependencies between LSPs and shippers can influence the way in which environmental practices are coordinated. This is in line with Johnston et al. (1999) who reason that case study research is a suitable method for studying supply chain relationships. A multiple case study was chosen as it was considered important to be able to compare the results of several cases and thus identify patterns of various types (Eisenhardt, 1989). It should be noted that initially the study was broader than the scope of this paper and had a broad aim of gaining initial insight into how environmental work can be included in relationships between LSPs and shippers.

CASE SELECTION

This study takes a dyadic approach in order to study coordination of environmental practices in LSP-shipper relationships. Following the logic of intensity sampling described by Patton (2002), there was, therefore, a need to identify dyads in which environmental practices were an issue. The case selection took its starting point in suitable LSPs, meaning such LSPs that were actively working with environmental practices in one way or another. Two LSPs were chosen and for each of these, two shippers were selected so that in total four LSP-shipper relationships were studied (see Figure 1). All case companies are based in Sweden, although all of them except for LSP A also operate in other countries.

Figure 1. The four studied LSP-shipper relationships

The LSPs were chosen based on two main criteria: 1) environmental practices should be part of their agenda; and 2) they should provide a basis for heterogeneity (Patton, 2002) and therefore differ in, for example, size and market coverage. With regard to the first criterion, LSP A and LSP B both showed much interest in environmental and sustainability issues during discussions prior to the study and their web pages confirmed this interest. As further evidence of their commitment to these types of issues, it can be noted that LSP A has received an award for its sustainability report and LSP B won an IT award in the category “sustainable project of the year” for its emission simulation tool. In terms of heterogeneity, the LSPs differ in several ways. LSP A is a regional company with three business areas. Long-distance and Distribution, which is the focused business area in this paper, is responsible for long-distance transports and distribution of goods. The business area also offers additional services, ranging from handling of incoming goods at a terminal and storage to full 3PL solutions. LSP B differs from LSP A mainly in its size and market coverage as LSP B is much larger than LSP A and operates all over the world. LSP B can offer a wide range of services to customers, from basic transportation needs to multimodal transport solutions to highly individual solutions.

The shippers in the dyads were selected with help from the LSPs. In order for the dyads to be of interest from the perspective of environmental practices, the LSPs were asked to suggest shippers they regarded as being environmentally interested. The homepages of the suggested shippers were checked in order to ensure that they had some interest in the environment. As with the LSPs, it was important that the shippers differed in, for example, size and industry, in order to increase the likelihood of a wide perspective of coordination of environmental practices in the dyads. Two shippers were selected for each of the LSPs. The cases, meaning the dyads, will be labelled A1, A2 and B3, B4. Table 2 presents some key facts about the case companies and illustrates similarities and differences between them. General facts about the cases might also be of interest:

- Case A1: The shipper is the LSP’s largest customer and represents 20% of its turnover. For the shipper, the LSP represents about 5% of transport costs. Even though 5% may seem a small figure, LSP A is the largest transporter of products from the studied shipper site to destinations within Sweden.
- Case A2: The shipper represents about 3% of the LSP’s turnover, which makes them an average customer for the company according to the LSP. For the shipper, LSP A represents

around 4.5% of total transport costs. The LSP is involved in deliveries of almost the whole range of heating and sanitation products and in the smaller deliveries of the electric power products offered by the shipper. Every evening, the LSP sends a truck and trailer to the shipper's central warehouse. The goods are driven to the LSP's terminal, where they are handled and sorted and then distributed the next morning in the distribution vehicles.

- Case B3: The shipper is an important customer for the LSP, and is sometimes the fourth and sometimes the fifth largest customer within the studied business area. The LSP transports a total of approx. 30% of the shipper's total volumes. The LSP often transports large volumes to distribution centres around the world, where another business area, or in some cases regional actors, take over and distribute the separate parcels.
- Case B4: The LSP takes care of about 20% of the inbound flows of the shipper, which corresponds to SEK 150 million. The shipper is a major customer of the LSP and is also very expansive. The LSP does not merely provide sea and air freight, but also has control tower operations which mean that they function as support for the logistics department at the shipper. The LSP is also one of five transporters that take care of the shipper's outbound flows.

Table 2. Case sample

Logistics Service Providers				
	LSP A		LSP B	
Turnover (MSEK)	642		3,200	
No. of employees	95		325	
Market focus	Regional		Global	
Shippers				
	Shipper 1	Shipper 2	Shipper 3	Shipper 4
Turnover (MSEK)	18,071	1,900	4,900	207,000
No. of employees	4,600	300	4,400	82,500
Industry	Producer of paper	Wholesaler for HVAC & electric power products	Producer of cutting tools and related products	Provider of telecommunications equipment and related services
Market focus	Mainly Europe	Sweden	Global	Global

CASE DATA COLLECTION AND ANALYSIS

As is common for case study research (Voss et al., 2002), the case data collection was mainly based on interviews. Three to four in-depth interviews (Yin, 2009) were conducted for each of the cases, each one lasting between one and two hours. The respondents were the individuals involved in the business relationship. In line with Voss et al. (2002), the respondents were sent an overview of the questions in advance so that they had the opportunity to prepare. The interviews consisted of four main topics:

- general information about the company and the respondent
- environmental practices from an intra-organisational perspective
- general information about the specific LSP-shipper relationship studied and
- environmental practices in relation to the specific LSP-shipper relationship studied.

In line with Voss et al. (2002), the information given by the respondents was coded into main subject areas with the aim of compiling case study write-ups for each case. Each respondent's parts of such a write-up were sent for a final check to ensure that all the information had been understood correctly.

The analysis of data followed two main steps, as suggested by Eisenhardt (1989): within-case analysis and cross-case analysis. The former relied to a large extent on detailed case study write-ups, which in essence are pure descriptions of the cases and a recommended way to cope with large volumes of data (Eisenhardt, 1989). This process included merging the respondent data from the respondents of each dyad into one write-up for each case. The write-ups allowed for a deep understanding of each case before attempting to generalise the findings through a cross-case analysis (Eisenhardt, 1989). Each case was analysed separately in an attempt to find patterns within them. One issue that was given much attention in this stage of the research was the causes of the way in which environmental practices were included in each case. The within-case analysis (as well as the subsequent cross-case analysis) followed an iterative research process (Yin, 2009) which allowed the moving back and forth between empirical data and literature. After several iterations, coordination mechanisms were found to be a fruitful path forward to enable an initial understanding of how environmental practices were included in the cases. As described in the literature review, the framework of Mintzberg (1989) was found to include the most suitable coordination mechanisms for the empirical data. The identified environmental practices of each case were analysed based on how they were included in the relationships in which they were found and, based on this, one or more coordination mechanisms were linked to each practice in each relationship.

The subsequent cross-case analysis sought to find common patterns that would help explain differences in coordination of environmental practices in the cases. In line with Eisenhardt (1989), the cross-case analysis was used as a means to move from initial insights from the separate cases to more generalisable results. The analysis also opened up for parameters that were not necessarily suggested by literature, but rather a result of the cases combined. An iterative approach (Yin, 2009) was taken in order to find explanations for the adoption of coordination mechanisms identified in the within-case analysis. With the in-depth understanding of the separate cases as a basis, one construct (dependencies between actors) from the literature was found to help explain the differences in how environmental practices were coordinated in the cases. An additional parameter emerged from the empirical data and included the environmental ambition of the actors involved in the relationships. This term refers to the willingness of shippers and LSPs to include environmental practices in their relationships now and in the future.

CREDIBILITY, DEPENDABILITY AND CONFIRMABILITY

According to Bryman and Bell (2011) and Halldórsson and Aastrup (2003), qualitative research can be judged by four aspects of trustworthiness: credibility, transferability, dependability and confirmability. *Transferability* will be discussed in the concluding section and will therefore not be addressed here. *Credibility* refers to how well the research corresponds with reality (Halldórsson and Aastrup, 2003). In order to guarantee a correct level of information and thereby strengthen credibility, all interviews were recorded and transcribed and the respondents were given the opportunity to reflect and comment on the transcriptions (Bryman and Bell, 2011). *Dependability* refers to the extent to which the study is repeatable and the same results could be drawn by other researchers (Bryman and Bell, 2011). To increase dependability, the interviews were based on an interview guide with mainly open-ended questions. Finally, *confirmability* addresses the extent to which the findings are objective and thus are not a result of the researcher's biases (Halldórsson and Aastrup, 2003). In order to increase confirmability, the results of the analysis as well as earlier drafts of this paper have been reviewed by colleagues familiar with green logistics and green supply chain management.

COORDINATION IN THE STUDIED CASES

In this section the four cases are presented, with a focus on the coordination of environmental practices in each of them. Thus, the section includes both case presentations and the results of the within-case analysis of which coordination mechanisms are adopted in each case. Table 3 summarises the results for each coordination mechanism of the Mintzberg (1989) framework. Additional empirical support for the analysis of some of the coordination mechanisms can be found in Appendix 1.

CASE A1

Both companies involved in relationship A1 appear to agree that very few environmental practices are present in the relationship. The LSP does, however, perceive the work with high load rates as an environmental practice. High load rates are required by the shipper, who also keeps track of the results. In relation to coordination mechanisms, it appears that direct supervision is adopted in this situation. Further, high load rates correspond to a type of output sought by the shipper, and the coordination mechanism standardisation of output therefore also appears to be in play.

It is interesting to note that the shipper never talks about the fill rates in environmental terms; the practice conducted to reach high fill rates is undertaken for financial reasons. The work with fill rates is made easier since LSP takes care of both inbound and outbound transports for the shipper and both “sides” (inbound and outbound) were present at the same time during the previous negotiation.

CASE A2

Environmental issues were not mentioned during the negotiations between the LSP and the shipper in relationship A2, and according to the LSP, the focus was on on-time deliveries and price. Although the environmental factors were not explicitly addressed during the negotiation process, some environmentally related issues in relationship A2 are of interest. According to the shipper, one of its requirements was that the LSP should have environmentally high-quality vehicles. Further, the fact that LSP A is certified according to the ISO 14001 standard is another important requirement for the shipper. The requirement of high-quality vehicles as well as that of ISO 14001 appears to be coordinated through direct supervision, as the shipper leaves the responsibility of the practices to the LSP.

CASE B3

For the shipper in case B3, environmental work is one of the criteria to be considered when suppliers are chosen. LSP B confirms that environmental issues are a part of the relationship and clearly states that it does not have the same substantial environmental discussion with all customers:

Two people are primarily responsible for relationship B3 and together they have worked with different environmental projects during the last few years. One of these projects concerned the shipper’s distribution centre (DC) in Brussels and the aim was to see if it was possible to reduce the number of trucks that picked up goods from the DC. The two company representatives tried to calculate the time at which the goods had to be picked up in order to arrive at the customer on time and their calculations resulted in a reduction in the number of trucks from fifteen to eight. Two other, not yet implemented, changes were discussed in the relationship, both of which aimed to decrease the environmental impact of distribution. Taking a coordination perspective on the changes, it appears that all three examples aim at finding an improved way to perform certain activities and are therefore closely related to the coordination mechanism standardisation of work. Another mechanism that it is suggested might be adopted in these examples is mutual adjustment, as one person from each company work together to come up with possible new solutions that are suitable for both companies.

According to the environmental manager at the LSP, the shipper is one of the few customers who have asked for help to calculate more advanced environmental data. The shipper, in turn, states that many of the environmental services performed by the LSP are not standard products. Consequently, the LSP's environmental manager has had to work hard to provide the shipper with the data they require. The shipper believes that the LSP has an advantage because of the work that the environmental manager conducts. Because there is an environmental manager at the LSP, the shipper knows who to turn to in connection with specific questions about environmental work. In terms of coordination mechanism, it appears as though standardisation of skills and knowledge is adopted in this specific example.

Finally, the shipper requires emission reports of CO₂ emissions from LSP B, implying that environmental practices in the relationship are coordinated by standardisation of output. Moreover, the requirement for emission reports is closely related to the coordination mechanism direct supervision.

CASE B4

Case B4 provides several examples of coordination of environmental practices. Initially, the environmental aspects of relationship B4 concerned emission reports. Since there is no standard regarding how these emissions should be measured, there was a discussion about how it should be done. The shipper now requires the LSP to report environmental data every month, following a specific format that the shipper has decided. Three coordination mechanisms are suggested for adoption in relationship B4 with regard to emission reports. Firstly, the two companies have jointly agreed on a specific way – i.e. standardised the work – to measure emissions and can thus measure the possible changes that their environmental work affects. Further, the fact that the environmental practices are focused on emissions implies that standardisation of output is in play. The requirement for environmental reports also indicates that direct supervision is of relevance in the environmental work in this relationship.

Another aspect of the environmental practices in relationship B4 is the Clean Shipping project. This project provides an index in which shipping companies can report their environmental impact. The shipper wants the LSP to buy shipping services from companies that are included in the Clean Shipping database. This environmental practice appears to be enabled through direct supervision as well as standardisation of work, in that the shipper requires the standardised procedure from the LSP.

Moreover, the shipper wants all LSPs to conduct an environmental project every year. This has been written into the contract and the project should be something that is beneficial to both companies. As the environmental project as such is a requirement from the shipper it is closely linked to direct supervision. In 2009, the LSP and the shipper ran one project that concerned eco-driving on a specific route in Sweden, a project which resulted in lower fuel consumption. In 2010, the LSP was in charge of one environmental project in which a milk run was initiated. Prior to the change, different sites were responsible for sending their goods to the central warehouse, which meant that each site used several transporters which, in turn, added up to many transports to the site that ordered the goods, and the central warehouse had to deal with many transporters. The milk run means that trucks go from one production site to the next to pick up goods. The trucks follow a timetable, in the same way as buses, and employees at the sites know when the trucks are scheduled to arrive. The project has resulted in high fill rates and low emissions per tonne-km. Both the eco-driving and the milk run examples of the environmental project illustrate coordination through standardisation of work.

Traditionally, there has been a focus on cost and lead times when the shipper has worked with LSPs. The shipper has, however, tried to integrate the environmental dimension into part of their communication with LSP B and the shipper has now encouraged their employees to ask for the

environmental dimension, as well as cost and lead time, when they deal with LSP B. Simultaneously, the shipper has encouraged the LSP to automatically include environmental impact in every such report, even though the shipper might not necessarily have asked for it. In order for the environmental dimension to become a natural part of the communication between the shipper and the LSP, an attempt at standardisation of work appears to be applied both when the shipper contacts the LSP and when the LSP reports to the shipper. Further, the continuous communication regarding environmental work presented at the shipper's different sites could possibly lead to standardisation of norms.

Table 3. Coordination mechanisms adopted in the four cases

	Case A1	Case A2	Case B3	Case B4
Mutual adjustment			Change in pick-up system Change in distribution (to Asia) Change in distribution (to Nordic region)	
Direct supervision	High load rates	Type of vehicles ISO 14001	Emission reports	Clean Shipping project Emission reports Environmental project
Standardisation of work			Change in pick-up system Change in distribution (to Asia) Change in distribution (to Nordic region)	Milk-run project Eco-driving Environmental factors as part of all communication between LSP and shipper Emission reports Clean Shipping project
Standardisation of output	High load rates		Emission reports	Emission reports
Standardisation of skills and knowledge			Environmental competence at LSP important for the relationship	
Standardisation of norms				Environmental factors as part of all communication between LSP and shipper

DISCUSSION

Given that coordination can be viewed as a means to manage dependencies between entities (Malone and Crowston, 1994), it is not surprising that the case data actually reveals different types of dependencies. However, what is interesting with regard to the empirical data is that two types of dependencies emerge: general dependency between LSPs and shipper, and dependency related to environmental practices. An additional parameter is also suggested to be of importance for gaining deeper insight into how dependencies influence the way in which LSPs and shippers can coordinate environmental practices between them, namely environmental ambition. The term is defined in this paper as the willingness of shippers and LSPs to include environmental practices in their relationships

now and in the future. Both types of dependencies as well as environmental ambition will be further operationalised below, starting with general dependency. This refers to dependencies between LSPs and shippers as such, without the specific environmental practices taken into account. That is to say, who is the more dependent actor in a relationship between an LSP who performs various logistics activities for a shipper, and the shipper who outsources logistics activities to a particular LSP? According to the empirical data, the four cases represent relationships in which the LSPs are to a large extent in a position of dependency towards the shippers. The dependency situation between LSPs and shippers can be illustrated by Shipper 2 in Case A2: *"After all, we are the ones who are in charge of whether or not we want them [LSP A] to transport [goods]; they are not the ones who decide if they want to transport our goods"*. A similar statement was given by Shipper 3 in Case B3: *"If [LSP B] does not have the best balance between price, lead time and accuracy and cannot show environmental data that is correct, well, then they won't get the deal"*. Previous literature also supports the suggested dependency in LSP-shipper relationships. In the context of environmental buying criteria set by shippers for LSP services, Wolf and Seuring (2010) note that a hierarchical relationship appears to be common between LSPs and shippers, with the dependency being on the part of the LSP. The identified dependency relationship is also in line with previous research in which it has been suggested that suppliers are more dependent on customers than the other way around (Kähkönen and Lintukangas, 2010; Simpson et al., 2007). The general dependency of LSPs on shippers identified in the empirical data appears to influence coordination in the relationships studied in that shippers set the conditions for the coordination of environmental practices in their relationships with the LSPs. However, the dependencies of LSPs on shippers found in the cases are likely to be related to the case sample. More specifically, the services of the LSPs offered in the relationships studied are of a general nature and do not represent unique services that are difficult to find elsewhere. Thus, although the empirical data presented here merely represents situations in which the LSPs are more dependent on the shipper than the other way round, there are likely to be situations where the opposite dependency exists. However, the remainder of this discussion will focus on the situation which the empirical data supports.

The other type of dependency that emerged from the empirical data is directly related to the environmental practices. There appear to be some such practices that LSPs can be relied on to perform with little or no involvement from the shipper. Although the LSP is the party responsible for the practice, the shipper is dependent on the LSP in order to succeed with such an environmental practice. There are several examples of this in the empirical data, one of which can be found in Case A2, in which the shipper wants the LSP to have ISO 14 001 certification. Other environmental practices require both the LSP and the shipper in a relationship to be involved, which thus leads to interdependency between the actors for such a practice. An example of this can be found in Case B4, when the shipper wants to include environmental factors as a part of the communication between the shipper and the LSP. This requires the shipper's employees to include the environmental dimension in their enquiries to the LSP, as well as the LSP to automatically include the environmental dimension in every report, regardless of whether the shipper has asked for it.

These dependencies, in turn, are related to the second parameter identified as important for gaining deeper insight into how LSPs and shippers can coordinate environmental practices between them, i.e. environmental ambition. According to the empirical data, there appear to be LSP-shipper relationships in which there is a correlation between the involved LSP and shipper regarding environmental ambition (B3 and B4 in the case sample). The other two cases (A1 and A2) were instead found to illustrate divergent views of environmental ambition. In both the latter cases, the empirical results pointed to a higher environmental ambition for the LSP than for the shippers. Despite this ambition on the part of the LSP, the number of environmental practices was relatively low in these relationships.

This indicates that the environmental content in the relationship is highly influenced by the shipper. Even in the two relationships where the results suggest corresponding environmental ambition, the shippers appear to exert the main influence over the environmental content.

According to the reasoning above, the empirical results indicate that there are different ways in which to coordinate environmental practices in LSP-shipper relationships depending on the combined evaluation for a specific relationship of, on the one hand, the environmental ambitions of, and on the other hand the dependencies between, an LSP and a shipper. Figure 2 illustrates the four types of situations in which LSPs and shippers can find themselves with regard to environmental ambition, whereas the general dependency of the LSPs on the shippers is an underlying assumption of the matrix illustrated. Each of the four categories depicted in Figure 2 will be discussed in the following sections and the second type of dependency, which is related to the environmental practices, will be further elaborated on for each of the categories.

Ambitions for environmental exchange in LSP-shipper relationships

LSP	High	Category B: Direct supervision* Standardisation of output* Standardisation of norms *If seen from a financial perspective by shipper	Category C: Mutual adjustment Direct supervision Standardisation of work Standardisation of output Standardisation of skills and knowledge Standardisation of norms
	Low	Category A: Coordination of environmental practices unlikely	Category D: Direct supervision Standardisation of work Standardisation of output
		Low	High
		Shipper	

Figure 2. Possible coordination mechanisms depending on environmental ambition when general dependency is in favour of the shipper.

CATEGORY A

In category A, none of the actors involved in the relationship has any interest in a decrease in environmental impact from their logistics activities. It is therefore far-fetched to think that they would include environmental practices in their relationship and this in turn makes a discussion of the coordination of the same irrelevant. In sum, no coordination of environmental practices is likely to be needed in a context where neither the LSP nor the shipper has any interest in environmental issues for logistics.

CATEGORY B

Category B, however, is more interesting from a coordination perspective. It represents a situation in which the LSP has a relatively high environmental ambition for a specific relationship whereas the shipper's environmental ambition for the same is low. Given that the LSP is in a dependency position towards the shipper, the LSP with a high environmental ambition finds itself in a difficult position, in that it is difficult to influence the shipper in terms of environmental practices, and as a consequence also the coordination of such practices. Both researched cases A1 and A2 can be said to belong to category B and support this view. Given the imbalance in ambition, this should mean that there is large potential for additional environmental practices if only the LSP could somehow influence the shipper. Is that possible, given the dependency situation of the LSP? Kogg (2003) offers hope in this

matter when she writes “*greening the supply chain is not the prerogative of the big and powerful*” (p. 55).

With regard to coordination, it would at first appear that three coordination mechanisms in particular suggested by Mintzberg (1989) would be unsuitable to attempt from an LSP perspective in category B, namely those that are linked to hierarchical situations, i.e. direct supervision and standardisation of work as well as output (see Glouberman and Mintzberg, 2001). Nonetheless, both direct supervision and standardisation of output are found in cases A1 and A2. However, despite the low environmental ambition of the shippers, the initiatives in fact come from them. In the example of high fill rates, the shipper’s initiative stems from financial, as opposed to environmental, motives. In line with this, the coordination of environmental practices in category B would most likely benefit from the LSP promoting that such practices often go hand in hand with financial benefits (Oglethorpe and Heron, 2010). With regard to dependencies in the context of environmental practices, it is unlikely that shippers in category B would be willing to participate in environmental practices. In line with the empirical findings, environmental practices are instead likely to be included in LSP-shipper relationships if performed by the LSP, thus making the shipper dependent on the LSP’s execution of the practices.

Although not supported by the empirical data, another mechanism that it could be of relevance for LSPs to work with in category B is that of standardisation of norms. In their study of LSPs’ green offerings, Isaksson and Høge-Brodin (2013) find that there are differences in rationale behind such offerings. While all the LSPs studied in their paper could be said to have a high environmental ambition, Isaksson and Høge-Brodin note that some LSPs treat environmental practices offered to customers as integrated in the complete offering, instead of a complement to a more basic offering. Some also offer their environmental services to all customers, as opposed to others who focus these services on a smaller group of shippers. By including environmental practices as a part of the general offering and thereby offering them to all potential customers, LSPs could have the possibility to influence shippers with a low environmental ambition. This would again be an example of where the shipper would be dependent on the LSPs for the coordination of environmental practices in their mutual relationships.

CATEGORY C

In category C both the shipper and the LSP have high environmental ambitions for their relationship. As the empirical data illustrates, this creates several opportunities for coordination of environmental practices in LSP-shipper relationships. As in category B, the dependency situation that LSPs find themselves in appears to limit their possibilities of initiating coordination of environmental practices in their relationships with shippers. Interestingly, the empirical results of cases B3 and B4 indicate that the shippers would have liked the LSPs to come up with more suggestions for environmental activities than they have done so far. Shipper 4 of Case B4 says: “*They have done the [environmental] things we’ve said we want. But there might be other things possible that we don’t know about.*”

Thus, as for all other categories, the shippers appear to set the conditions for the coordination of environmental practices in their relationships with the LSPs. In line with the empirical data, all six of Mintzberg’s (1989) coordination mechanisms can be adopted in relationships belonging to category C. What is interesting in this category is that shippers can choose different paths for how they wish to coordinate environmental practices. More specifically, it appears they can choose the dependency situation they want to find themselves in with regard to environmental practices, a direct result of the fact that both actors involved have a high environmental ambition. Case B3 illustrates several examples where the shipper and the LSP are interdependent in their work with environmental

practices, whereas Case B4 to a larger degree illustrates a situation where the shipper depends on the LSP to perform the environmental practices. For example, similar practices such as changes in a pick-up system (B3) and implementation of a milk run (B4) were approached in two ways in the empirical data: in Case B3 the LSP and the shipper depended on each other in order for the pick-up system to result in standardisation of work, whereas work was standardised by the LSP alone in Case B4. The differences in these two examples highlight the fact that the shippers have a choice with regard to what degree they want to be involved themselves and to what degree they want the LSPs to take responsibility for the environmental practices. The latter is naturally convenient for shippers, but at the same time there might be some potential if the shippers are a part of some of the environmental practices, thus making the actors interdependent with regard to those practices. For example, the statement by Case B4 earlier in this section might not have been made if the shipper had been willing to actively take part in the environmental work in its relationship with LSP B, as ideas might have come up during the work with other environmental practices.

CATEGORY D

In category D the shipper has a relatively high environmental ambition whereas the LSP's ambition is low. Given a situation in which the LSP is dependent on the shipper, the shipper inevitably needs to initiate environmental practices in the relationships with LSPs. Due to the sampling of cases for this research, where LSPs were chosen in the first hand because of their environmental interests, the empirical data does not support category D. Nonetheless, a brief discussion of this category is still in order. As the shipper is the party with high environmental ambition and the LSP is in a dependency situation towards the shippers, the shipper could initiate coordination in several ways. Based on the assumption that the coordination mechanisms direct supervision and standardisation of work as well as output can be linked to hierarchical situations (Glouberman and Mintzberg, 2001), these mechanisms are of specific interest in category D. Although the cases do not fit into category D, the identified environmental practices and the way in which they are coordinated offer some examples of how this can be conducted. Direct supervision could, for example, include requirements for the LSP to have ISO 14 001 certification (Case A2), use vehicles of high environmental standards (Case A2) or conduct a relationship-specific environmental project each year (Case B4). There are also examples of standardisation of work and of output in cases B3 and B4 that could be applicable in category D. However, coordination through the three suggested mechanisms requires the LSPs to be able to conduct the environmental practices asked of them. Given their low environmental ambition, this might prove to be a challenge in these relationships. With regard to dependencies related to environmental practices in this category, shippers could therefore initiate practices that require both actors to be involved and thus create interdependencies between them. This could be one way for shippers to ensure that the LSPs conduct what is required in terms of environmental practices. It should be noted that for LSPs in category D there is a risk of shippers switching to LSPs with higher environmental ambition.

CONCLUSIONS

This paper set out to explore how dependencies between LSPs and shippers can influence the way in which environmental practices are coordinated in the relationships between them. Two types of dependencies were found to have an influence on the coordination of environmental practices: 1) dependence between LSPs and shippers as such, and 2) dependence with regard to specific environmental practices. In addition, another parameter was found to be of relevance when LSPs and shippers coordinate environmental practices between them, namely environmental ambition of the actors. A conceptual framework was developed based on the assumption that LSPs have a general

dependency on shippers (see Figure 2). The framework includes four categories of environmental ambition of LSPs and shippers. It was suggested that each of the four categories set different conditions for the coordination of environmental practices and that different coordination mechanisms were possible depending on whether shippers are dependent on LSPs to perform the environmental practices alone or if the shippers are a part of the environmental practices (interdependence).

THEORETICAL IMPLICATIONS

This research confirms the findings of Wolf and Seuring (2010), who suggest that LSPs are often “*in a henchman’s position towards their customers*” (p. 99). The paper at hand takes this insight further as it attempts to illustrate how the position of LSPs influences the coordination of environmental practices in LSP-shipper relationships. An important academic contribution of this paper therefore lies in the framework presented in Figure 2 and its four categories. Moreover, the recognition that the environmental ambition of the actors involved influences environmental practices in LSP-shipper relationships also brings more clarity to the findings of Wolf and Seuring (2010).

Further, the paper takes a wider perspective on coordination of environmental practices than, to the best of the author’s knowledge, has been done in previous research into interfaces in the area of environmental supply chains. More specifically, whereas previous studies have focused primarily on specific coordination mechanisms such as contracts (e.g. De Giovanni, 2014; Eng-Larsson and Norrman, 2014), this paper instead takes its starting point in environmental practices, and highlights the fact that different characteristics of supply chain relationships set boundaries and open up possibilities for different types of coordination mechanisms.

This research might also offer some explanation for the findings of Martinsen and Björklund (2012). They conclude that there appears to be a gap between LSPs’ green offerings and shippers’ perceptions of such offerings in terms of environmental practices. The results presented here illustrate that even though an LSP can be considered to be “green”, shippers who have a low environmental ambition fail to perceive the environmental practices that the LSP can offer. It is suggested that this is a result of the dependency situation that LSPs are found to be in in their relationships with shippers.

Finally, the research has implications for the coordination literature in that it illustrates that the coordination mechanisms suggested by Mintzberg (1989) can be applied to an inter-organisational context. Huiskonen and Pirttilä (2002) argue that in inter-organisational relationships, there is no single authority that can make decisions for both involved actors. Although they also apply intra-organisational coordination mechanisms in an inter-organisational context, they therefore focus on lateral coordination mechanisms which cut across hierarchical lines of authority. Despite their argumentation, the Mintzberg framework applied in the paper at hand includes three coordination mechanisms that are related to hierarchical levels of authority (Glouberman and Mintzberg, 2001). The findings show that due to dependencies of LSPs on shippers, the shippers are in fact able to initiate environmental practices by means of all three of these coordination mechanisms (direct supervision and standardisation of work as well as output). As such, these findings confirm the comprehensiveness (suggested by Sandberg and Bildsten, 2011) of the Mintzberg framework and illustrate to a larger degree than Sandberg and Bildsten that the framework is applicable to an inter-organisational context.

MANAGERIAL IMPLICATIONS

From a managerial perspective, the identification of the six different coordination mechanisms in relation to various environmental practices can be helpful when companies strive to become greener. This is valid both for LSPs and for shippers, but in different ways. Starting with shippers, the results can be used as guidance as to what type of coordination mechanisms to apply in which relationship

context. Different coordination mechanisms might be suitable depending on whether the shippers are willing to delegate all responsibility for the environmental practices to the LSP or if they want to be involved in the work with the practices (in particular, see category C of the proposed framework). For LSPs, the results showed that they might have very little to say in the matter of whether, and if so how, to coordinate environmental practices. While discouraging, this insight might lead to LSPs gaining a better understanding of their customers and thereby finding new ways to approach them with regard to environmental concerns. Although initiation of actual coordination of environmental practices might be difficult, the actors could, for example, promote such practices that are financially beneficial (see e.g. Oglethorpe and Heron, 2010) in order to include environmental practices in their relationships with shippers.

LIMITATIONS AND AVENUES FOR FURTHER RESEARCH

This paper is based on four specific LSP-shipper dyads, and the dependencies and environmental practices suggested are a result of the four cases. It is therefore possible that more cases might offer additional insight into how dependencies can influence the way in which environmental practices are coordinated. Additional cases could, for example, provide examples of coordination in relationships where the dependency situation is in favour of the LSPs instead of, as in this paper, the shippers. Further, the findings of this paper are mainly based on interviews with the separate companies, while the cases are relationships that each include two actors. This has made triangulation via, for example, sustainability reports, difficult, as these typically focus on one particular company. Following this, there is an opportunity for future studies to focus more on relationship-specific documentation in order to further illuminate how dependencies can influence the way in which environmental practices are coordinated. Moreover, the sampling of cases was based on a wish to identify “green” LSP-shipper relationships. As implied by Table 3, two of the cases included less environmental work than anticipated. Nonetheless, without the differences between cases, the suggested LSP dependency on shippers would perhaps not have been identified. Another limitation of this research is that of transferability (Halldórsson and Aastrup, 2003). The cases represent companies active on the Swedish market and Sweden is generally seen as an environmentally conscious country. For this reason, it would be bold to claim the findings are transferable to all LSP-shipper dyads.

This paper has focused on the coordination of environmental practices in a particular supply chain interface, namely that between LSPs and shippers. However, as supply chain coordination in general aims to improve the performance of entire supply chains (Cachon, 2003), this study could be extended to include more supply chain actors and investigate environmental, as well as financial, performance effects on entire supply chains. Finally, there is also the aspect of measuring the “greenness” of LSP-shipper relationships. In other words, what determines if such a relationship is green or not? The results from the research presented here show some examples of this, but more research is needed to establish what truly determines whether or not an LSP-shipper relationship is green.

Appendix 1: Empirical data to support the coordination mechanisms

	Case A1	Case A2	Case B3	Case B4
Mutual adjustment			Change in pick-up system Change in distribution (to Asia) Change in distribution (to Nordic region)	

			LSP B: “With regard to environmental work, we have a very good dialog with [the shipper] in particular.”	
Direct supervision	High load rates	Type of vehicles Shipper 2, in response to which environmental practices are included in the relationship with LSP A: “One part is the wish that they should have high-quality vehicles. Environmentally, that is.” ISO 14001 Shipper 2: “I would probably not have chosen [LSP A] if they weren’t certified.”	Emission reports Shipper 3: “What we need is basic [environmental] data, which should be of high enough quality and we should understand how it was calculated.”	Clean shipping project LSP B: “What they have required are environmental reports and that we do an environmental project each year, plus that we have to use shipping companies that are included in the Clean Shipping project.” Emission reports LSP B: “They also [in addition to the environmental project] require that we report CO₂ emissions every month.” Environmental project LSP B: “It [an environmental project] is a part of their requirements, that [LSP B] each year should be a part of a project.” Milk-run project LSP B: “...we’ve taken over all of their [Shipper 4’s] flows that have gone between the factories and put up a system where a truck arrives at 10 a.m.. If there is nothing on the loading platform, the truck leaves at 10.30 a.m., period. There is no time to wait [for goods to arrive], because it comes back again at 2 p.m. and leaves at 2.30 p.m. So, it goes in loops like that.”
Standardisation of work			Change in pick-up system LSP B’s evaluation of the change in pick-up system which originally included fifteen trucks: “We did pretty well. We managed to get down to eight [trucks].” Change in distribution (to Asia) Change in distribution (to Nordic region)	Eco-driving LSP B: “We introduced eco-driving to the drivers and they managed to reduce the [fuel] consumption by 5%.” Environmental factors as part of all communication between LSP and shipper Emission reports LSP B, in relation to the requirements from Shipper 4 to report emissions every month: “In a certain way, with certain emission factors that they have decided.” Clean Shipping project
Standardisation of output	High load rates		Emission reports The environmental data that	Emission reports

	LSP A: "We hardly ever have half-filled trucks [for the shipper]; we make use of the loading possibilities to 100%, at least with regard to weight limits."		Shipper 3 requires is CO2 emissions, partially because "CO ₂ emissions are the specific indicator for which an international standard has started to be developed. We have to start somewhere."	
Standardisation of skills and knowledge			Environmental competence at LSP important for the relationship Shipper 3: "The specific supplier, no matter who, that has [the environmental manager at the LSP] as their environmental manager, has an advantage over the others. I have never met a person more devoted to environmental issues."	
Standardisation of norms				Environmental factors as part of all communication between LSP and shipper

REFERENCES

- Arshinder, Kanda, A. & Deshmukh, S. G. (2008). "Supply Chain Coordination: Perspectives, Empirical Studies and Research Directions". *International Journal of Production Economics*, Vol. 115, No. 2, pp. 316-335.
- Bryman, A. & Bell, E. (2011). *Business Research Methods*, Oxford University Press, New York.
- Cachon, G. P. (2003), "Supply Chain Coordination with Contracts". In: De Kok, A. G. & Graves, S. C. (eds.) *Supply Chain Management: Design, Coordination and Operation*. Elsevier, Amsterdam, The Netherlands.
- Cachon, G. P. & Fisher, M. (2000). "Supply Chain Inventory Management and the Value of Shared Information". *Management Science*, Vol. 46, No. 8, pp. 1032.
- Cachon, G. P. & Lariviere, M. (2005). "Supply Chain Coordination with Revenue-Sharing Contracts: Strengths and Limitations". *Management Science*, Vol. 51, No. 1, pp. 30-44.
- Chan, H. K. & Chan, F. T. S. (2009). "Effect of Information Sharing in Supply Chains with Flexibility". *International Journal of Production Research*, Vol. 47, No. 1, pp. 213-232.
- Colicchia, C., Marchet, G., Melacini, M. & Perotti, S. (2013). "Building Environmental Sustainability: Empirical Evidence from Logistics Service Providers". *Journal of Cleaner Production*, Vol. 59, No. pp. 197-209.
- Crowston, K. (2003), "A Taxonomy of Organizational Dependencies and Coordination Mechanisms". In: Malone, T. W., Crowston, K. & Herman, G. A. (eds.) *Organizing business knowledge: The MIT Process Handbook*. Cambridge and London: MIT Press.
- Danese, P., Romano, P. & Vinelli, A. (2004). "Managing Business Processes across Supply Networks: The Role of Coordination Mechanisms". *Journal of Purchasing and Supply Management*, Vol. 10, No. pp. 165-177.
- De Giovanni, P. (2014). "Environmental Collaboration in a Closed-Loop Supply Chain with a Reverse Revenue Sharing Contract". *Annals of Operations Research*, Vol. 220, No. 1, pp. 135-157.

- De Giovanni, P. & Esposito Vinzi, V. (2014). "The Benefits of a Monitoring Strategy for Firms Subject to the Emissions Trading System". *Transportation Research Part D: Transport and Environment*, Vol. 33, No. pp. 220-233.
- EEA. 2014. *Trends and projections in Europe 2014 - Tracking progress towards Europe's climate and energy targets for 2020* [Online]. Available: <http://www.eea.europa.eu/publications/trends-and-projections-in-europe-2014> [Accessed 18 November 2014].
- Eisenhardt, K. M. (1989). "Building Theories from Case Study Research". *Academy of Management Review*, Vol. 14, No. 4, pp. 532-550.
- Ellram, L. M. (1996). "The Use of the Case Study Method in Logistics Research". *Journal of Business Logistics*, Vol. 17, No. 2, pp. 93-138.
- Eng-Larsson, F. & Norrman, A. (2014). "Modal Shift for Greener Logistics - Exploring the Role of the Contract". *International Journal of Physical Distribution & Logistics Management*, Vol. 44, No. 10, pp. 721.
- EU. 2011. *Roadmap to a Single European Transport Area – Towards a competitive and resource efficient transport system* [Online]. Available: <http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52011DC0144&from=EN> [Accessed 18 November 2014].
- Galbraith, J. (1973). *Designing Complex Organisations*, Addison-Wesley Publilshin Company, USA.
- Glouberman, S. & Mintzberg, H. (2001). "Managing the Care of Health and the Cure of Disease - Part II: Integration". *Health Care Management Review*, Vol. 26, No. 1, pp. 70-84.
- Halldórsson, A. & Aastrup, J. (2003). "Quality Criteria for Qualitative Inquiries in Logistics". *European Journal of Operational Research*, Vol. 144, No. 2, pp. 321-332.
- Hu, A. H. & Hsu, C.-W. (2010). "Critical Factors for Implementing Green Supply Chain Management Practice: An Empirical Study of Electrical and Electronics Industries in Taiwan". *Management Research Review*, Vol. 33, No. 6, pp. 586-608.
- Huiskonen, J. & Pirttilä, T. (2002). "Lateral Coordination in a Logistics Outsourcing Relationship". *International Journal of Production Economics*, Vol. 78, No. 2, pp. 177-185.
- Inderfurth, K., Sadrieh, A. & Voigt, G. (2013). "The Impact of Information Sharing on Supply Chain Performance under Asymmetric Information". *Production & Operations Management*, Vol. 22, No. 2, pp. 410-425.
- Isaksson, K. & Huge-Brodin, M. (2013). "Understanding Efficiencies Behind Logistics Service Providers' Green Offerings". *Management Research Review*, Vol. 36, No. 3, pp. 216-238.
- Johnston, W. J., Leach, M. P. & Liu, A. H. (1999). "Theory Testing Using Case Studies in Business-to-Business Research". *Industrial Marketing Management*, Vol. 28, No. 3, pp. 201-213.
- Kogg, B. (2003). "Greening a Cotton-textile Supply Chain". *Greener Management International*, Vol., No. 43, pp. 53-64.
- Kähkönen, A.-K. & Lintukangas, K. (2010). "Dyadic Relationships and Power within a Supply Chain Network Context". *Operations and Supply Chain Management*, Vol. 3, No. 2, pp. 59-69.
- Lieb, K. J. & Lieb, R. C. (2010). "Environmental Sustainability in the Third-Party Logistics (3PL) Industry". *International Journal of Physical Distribution & Logistics Management*, Vol. 40, No. 7, pp. 524-533.
- Lun, Y. H. V., Lai, K.-H., Wong, C. W. Y. & Cheng, T. C. E. (2015). "Greening Propensity and Performance Implications for Logistics Service Providers". *Transportation Research Part E*, Vol. 74, No. pp. 50-62.
- Malone, T. W. & Crowston, K. (1994). "The Interdisciplinary Study of Coordination". *ACM Computing Surveys*, Vol. 26, No. 1, pp. 87-120.
- Marchet, G., Melacini, M. & Perotti, S. (2014). "Environmental Sustainability in Logistics and Freight Transportation - A Literature Review and Research Agenda". *Journal of Manufacturing Technology Management*, Vol. 25, No. 6, pp. 775-811.
- Martinsen, U. & Björklund, M. (2012). "Matches and Gaps in the Green Logistics Market". *International Journal of Physical Distribution & Logistics Management*, Vol. 42, No. 6, pp. 562-583.
- McKinnon, A. C. (2010). "Environmental Sustainability - A new Priority for Logistics Managers". In: McKinnon, A., Cullinane, S., Browne, M. & Whiteing, A. (eds.) *Green Logistics - Improving the Environmental Sustainability of Logistics*. Kogan Page Limited, London.

- Mintzberg, H. (1989). *Mintzberg on Management: Inside our Strange World of Organizations*, The Free Press, New York.
- Oglethorpe, D. & Heron, G. (2010). "Sensible Operational Choices for the Climate Change Agenda". *International Journal of Logistics Management*, Vol. 21, No. 3, pp. 538-557.
- Patton, M. Q. (2002). *Qualitative Research & Evaluation Methods*, Sage Publications, USA.
- Perotti, S., Zorzini, M., Cagno, E. & Micheli, G. J. L. (2012). "Green Supply Chain Practices and Company Performance: The Case of 3PLs in Italy". *International Journal of Physical Distribution & Logistics Management*, Vol. 42, No. 7, pp. 640-672.
- Pfeffer, J. & Salancik, G. R. (1978). *The External Control of Organizations: A Resource Dependence Perspective*, Harper & Row, New York.
- Rao, P. (2002). "Greening the Supply Chain: A New Initiative in South East Asia". *International Journal of Operations & Production Management*, Vol. 22, No. 5, pp. 631-655.
- Romano, P. (2003). "Co-ordination and Integration Mechanisms to Manage Logistics Processes across Supply Networks". *Journal of Purchasing & Supply Management*, Vol. 9, No. 3, pp. 119.
- Roth, A. & Kåberger, T. (2002). "Making Transport Systems Sustainable". *Journal of Cleaner Production*, Vol. 10, No. 4, pp. 361-371.
- Sandberg, E. & Bildsten, L. (2011). "Coordination and Waste in Industrialised Housing". *Construction Innovation*, Vol. 11, No. 1, pp. 77-91.
- 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.
- Stank, T., Crum, M. & Arango, M. (1999). "Benefits of Interfirm Coordination in Food Industry Supply Chains". *Journal of Business Logistics*, Vol. 20, No. 2, pp. 21-42.
- Swami, S. & Shah, J. (2013). "Channel Coordination in Green Supply Chain Management". *Journal of the Operational Research Society*, Vol. 64, No. 3, pp. 336-351.
- Vachon, S. & Klassen, R. D. (2006). "Extending Green Practices Across the Supply Chain - The impact of Upstream and Downstream Integration". *International Journal of Operations & Production Management*, Vol. 26, No. 7, pp. 795-821.
- Van De Ven, A. H., Delbecq, A. L. & Koenig, R. (1976). "Determinants of Coordination Modes within Organizations". *American Sociological Review*, Vol. 41, No. 2, pp. 322-338.
- Wolf, C. & Seuring, S. (2010). "Environmental Impacts as Buying Criteria for Third Party Logistical Services". *International Journal of Physical Distribution & Logistics Management*, Vol. 40, No. 1, pp. 84-102.
- Voss, C., Tsikriktsis, N. & Frohlich, M. (2002). "Case Research in Operations Management". *International Journal of Operations & Production Management*, Vol. 22, No. 2, pp. 195.
- Yin, R. (2009). *Case Study Research: Design and Methods*, Sage Publications, London.
- Zhu, Q. & Sarkis, J. (2004). "Relationships Between Operational Practices and Performance Among Early Adopters of Green Supply Chain Management Practices in Chinese Manufacturing Enterprises". *Journal of Operations Management*, Vol. 22, No. 3, pp. 265-289.
- Zhu, Q., Sarkis, J. & Lai, K.-h. (2008). "Green Supply Chain Management Implications for "Closing the Loop"". *Transportation Research: Part E*, Vol. 44, No. 1, pp. 1-18.