Emerald Supply Chain Management: An International Journal

The Logistics Service Providers in Eco-efficiency innovation: an empirical study

Journal:	*Supply Chain Management: an International Journal*
Manuscript ID:	SCM-02-2012-0053.R4
Manuscript Type:	Original Manuscript
Keywords:	logistics service providers, eco-efficiency, logistics innovation, Sustainable supply chains, logistics and learning capabilities

The Logistics Service Providers in Eco-efficiency innovation: an empirical study

Abstract

Purpose: Sustainability and the search for solutions that are both efficient and ecologically sound (eco-efficient) have become topics of great interest. However, companies seeking to develop supply chain solutions that are eco-efficient are often hampered by their ability to control the wider supply chain and they may need to draw upon external support from logistics service providers (LSPs). This paper aims to explore the innovative strategies undertaken by LSPs in the eco-efficiency arena and the logistics and learning capabilities needed to achieve eco-efficiency in supply chains.

Design/methodology/approach: The insights derived from a Systematic Literature Review approach to identify the most relevant articles to be included in the analysis represented the starting point for building our empirical investigation, based on case studies with in-depth interviews to investigate the phenomenon under consideration and to explore trends and evolving paradigms.

Findings: The Systematic Literature Review enriches the existing literature by drawing upon three bodies of knowledge, i.e. logistics service providers, eco-efficiency and logistics innovation, and putting them into a single framework. The findings from the interviews suggest that although LSPs are well placed to implement innovative initiatives for eco-efficiency there is a range of inhibitors that prevent major change programmes.

Research limitations/implications: The research reported in this paper is exploratory and limited in its scope. It is based on in-depth interviews within six companies. However, it does provide a platform from which more detailed research may be conducted.

Practical implications: The managerial implications arising from the research offer a wide range of current practices in sustainability, from which strategic and operative directions to compete can be derived.

Originality/value: There is little existing literature that addresses the innovative strategies undertaken by LSPs in influencing and moving supply chains towards eco-efficiency and hence the present paper is meant to help fill this gap.

Keywords: Logistics Service Providers, Eco-efficiency, Logistics Innovation, Sustainable supply chain.

Paper type: Research paper

1. Introduction

Sustainability is expected to attract even more managerial attention in the third-party logistics (3PL) industry (Lieb and Lieb, 2010). In fact, with pressure from a variety of stakeholders, including consumers, investors and policy makers, sustainability has become a topic of great interest to organisations in the past few years, especially for transport. For instance, the European Commission (2001) states that its aim is to "disconnect mobility from its adverse effects". Furthermore, many large companies operating in the 3PL industry have increased their commitments to building environmental sustainability programmes as a source of competitive advantage (Lieb and Lieb, 2010). Within the management literature, supply chain sustainability refers to an integration of social, environmental, and economic responsibilities and can be defined as the 'strategic, transparent integration and achievement of an organization's social, environmental and economic goals in the systemic coordination of key inter-organizational business processes for improving the long-term economic performance of the individual company and its supply chain' (Carter and Easton, 2011; Carter and Rogers, 2008).

Moreover, it is now recognised that sustainable practices can often lead to performance improvements and cost reduction simultaneously (Porter and Van der Linde, 1995). Even though many companies have viewed sustainability initiatives as driving additional costs (refer to Abbasi and Nilsson, 2012 for a comprehensive coverage of previous literature), more recent literature would suggest that the adoption of corporate environmental policies could be a new and powerful source of strategic differentiation (Colicchia et al., 2011; Hoffman, 2005; Massaroni and Rossi, 2007).

This theory has been firstly addressed by Schmidheiny and Zorraquin who, in 1996, define eco-efficiency as 'a process of change in which the exploitation of resources, the direction of investments, the orientation of technological development, and corporate change maximise the value added while minimising resource consumption, waste and pollution'. Indeed, eco-efficiency combines the sole environmental and economic dimensions of sustainability (Helminen, 2000) and will represent the focus of the present paper.

It is widely recognised in the literature that supply chain management and logistics could have a significant impact on the environment (Lin and Ho, 2008; Zailani et al., 2011; Sarkis, 2012). Consequently, during the last decade, eco-efficiency within a

supply chain context has become more and more of a concern among both academics and practitioners (Gimenez and Tachizawa, 2012; Seuring and Müller, 2008). Even if performance measurement of eco-efficient initiatives has largely been addressed, still there has been little discussion covering performance and environmental issues related to the practical applications of eco-efficient initiatives in the logistics industry (Venus, 2010). Furthermore, companies seeking to develop supply chain solutions that are eco-efficient are often hampered by their ability to control the wider supply chain and also lack the required specialist capabilities (Svensson, 2007). Consequently they need to draw upon external support, from suppliers, distributors, and logistics service providers (LSPs). However, very little attention has been given to eco-efficiency in the context of the 3PL industry (Lieb and Lieb, 2010). As mentioned by Svensson (2007) the crucial point is that there is insufficient connection and synchronisation between first-, second- and n-order supply chains in building an eco-efficient supply chain. Moreover, the level of interaction and coordination among actors needs to increase considerably with a fragmented supply chain (Bitran et al., 2007; Gimenez and Tachizawa, 2012).

The relationships between LSPs and buyers vary, not only in terms of formalisation and temporal horizon, but also in terms of tactical vs. strategic value deployed (Wolf and Seuring, 2010). In a competitive environment where companies have realised the need for enhancing closer relationships with customers, innovation by LSPs could offer great potential to nurture collaboration among network partners and develop solutions for more eco-efficient supply chains (Flint et al., 2005; Mena et al., 2007; Cozzolino, 2009). A proactive and innovative behaviour towards eco-efficient initiatives are needed but are still missing in both theory and practice (Lin and Ho, 2008; Venus, 2010).

Therefore, this paper aims to provide the results of an empirical study on the adoption of eco-efficient strategies and initiatives in the LSP industry, along with an analysis of the logistics capabilities needed to achieve eco-efficiency in supply chains.

The remainder of this paper is organised as follows. The next section outlines the theoretical background and the research questions. In Section 3 we review the eco-efficiency, LSP and logistics innovation literature to develop a framework for analysing LSPs' commitment toward eco-efficiency and the innovativeness of services provided. The research methodology, based on a cross case study of six LSPs, is described in Section 4. The insights resulting from the case studies analysis are provided in Section 5 and the related discussion in Section 6. The key challenges LSPs are facing to support

and build a more eco-efficient and innovative supply chain are discussed and suggestions for further research are provided in the latter section.

2. Theoretical background and research questions

Green et al. (2012) assert environmental sustainability must first be adopted as a strategic imperative, to be incorporated as a key part of the organisation's mission statement and communicated throughout all levels to enhance organisational performance. The underpinning assumption behind the research is the strategic perspective on supply chain performances developed by Morash (2001). The author describes the cascade effect from the business strategy to supply chain strategy, which can be accomplished through the development of certain capabilities and their combination, and measured through supply chain performance metrics. Esper et al. (2007) provide a comprehensive overview of the logistics capabilities as described in the literature, referring to the Resource Based View paradigm and to Organisational Learning. Although the unit of analysis of the research was the manufacturer, the categories can be reapplied for LSPs. These categories are: Customer-focus, Supply management, Integration, Measurement and Information exchange, and Learning (cultural, relational, structural and temporal) capabilities. Table 1 summarises them.

XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX

Take in Table 1

XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX

As mentioned in the introduction, much remains to be learned on how LSPs are positioning themselves towards eco-efficiency and which capabilities they are developing to support their strategic posture. Hence, this paper explores the following two research questions:

Research question 1: What are the strategies and initiatives currently undertaken by LSPs in the eco-efficiency arena?

Research question 2: How can an LSP deploy capabilities to be creative for the client in creating eco-efficient supply chain solutions?

3. Systematic Literature Review

The Systematic Literature Review approach (Denyer and Tranfield, 2009) allows an evidence-informed approach to identifying, selecting and analysing secondary data (Colicchia and Strozzi, 2012). The first phase is represented by the definition of the scope of the study, in compliance with the objectives and the hypotheses establishing the research itself. In fact a good systematic review is based on a well-formulated, answerable question. Denyer and Tranfield (2009) propose using the acronym CIMO (Context, Intervention, Mechanisms and Outcome) to specify the four critical parts of a well-built systematic review question.

The first phase of our literature review is represented by the application of this logic to the context under study.

Context: Logistics service providers and the environment. It is widely acknowledged that the transportation process, i.e. distribution of goods, has a great impact on supply chain sustainability (Roth and Kaberger, 2002), since it is one of the major sources of environmental problems (European Commission, 2001). In this context, LSPs can assume a critical role towards eco-efficiency, having the required specialist capabilities to develop eco-efficiently.

Intervention: Eco-efficiency. The area of interest is an increasing awareness of the so-called "Triple Bottom Line" (Elkington, 1994) – i.e. the need to pursue objectives that take not only an economic perspective, but reflect the impact on ecology and society as well. In particular eco-efficiency combines the environmental and economic dimensions of sustainability.

Mechanisms: Logistics innovation. Nevertheless, the adoption of eco-efficient initiatives is still in its infancy and thus it can be considered as an innovative process for an LSP (Lin and Ho, 2008). Furthermore it is recognised that innovation plays an important part in providing supply chain competitive advantage (Flint et al., 2005). As far as the necessary mechanisms are concerned, it is important to underline that LSPs are able to increase their expertise to provide logistics services more effectively and at a better price than producers, distributors, retailers, or consumers could do on their own (Hugos, 2003), thanks to the economies of knowledge and scale they have developed. Thus new opportunities for business emerge for those providers able to realise a strategy of "scope extension" of their activity, offering highly-integrated and innovative

services and expanding their variety in response to market demand and competition (Rao and Young, 1994; Cozzolino, 2009).

Outcome: Competitive advantage. In order to handle the above mentioned environmental issues, LSPs should include them in their strategies, to gain competitive advantage (Esty and Winston, 2009; Mahler, 2007).

Hence, on the basis of the application of the CIMO logic, as reported above, and considering the research questions of the present study, three main areas, and the overlaps between them, were investigated:

1. Logistics service providers and the environment,
2. Eco-efficiency,
3. Logistics innovation.

A number of keywords were first identified in each area of interest, moving from the idea that the objective of the review is represented by focusing on the overlaps between the key themes. Secondly, these were further discussed and refined until a reasonable list of terms was deemed sufficient (resulting in approximately 40 relevant research strings to be applied to the search of the databases). To refine the keywords, a team composed of three academics and two systematic literature review experts was constituted in order to give the search a sound validity, ratifying the process and the research strings. We collected citation data from the EBSCO Database and the Science Citation Index (SCI) compiled by the Institute for Scientific Information (ISI).

The following criteria have been considered to include/exclude papers:

- Papers presenting a high relevance to the themes under consideration were included, i.e. ensure substantive relevance by requiring that selected articles contain at least one keyword in their title or abstract.
- The analysis was aimed at papers in peer-reviewed scientific journals in English.
- The papers were selected according to the journal scope, i.e. supply chain management. However, if the papers were published in journals not related to management, they should be about supply chain or logistics exclusively.

The search process returned the most relevant 128 articles published between 1990 and 2011.

The main objective of the literature review is to build upon three bodies of knowledge (i.e. LSPs and the environment, logistics innovation and eco-efficiency) by putting them into a single framework that will constitute the basis for the case analysis. It was made possible through a systematic analysis of the collected papers for each topic. The reliability was addressed by having this step conducted by two researchers, as suggested by Seuring and Müller (2008). A database was built up with relevant topics that arose in the references by each of the researchers. Discrepancies and different judgements were resolved among the researchers. Within this step, as indicated by the SLR methodology, papers were evaluated according to a paper review protocol intended to assess the significance of each paper related to the focus of the research.

In the following paragraphs we report some highlights for the most relevant contributions, i.e. those papers which obtained the best scores in the paper review protocol, analysed according to the above-mentioned main areas.

Logistics service providers and the environment

The service sectors are traditionally assumed to have a much smaller environmental impact. The firms most likely to formulate environmental plans are likely to be those in the manufacturing sector which may consume more natural resources and generate more contaminants, while firms in the service sector are less likely to do so. However, the operation of logistics services often leads to several negative impacts on the natural environment, including air pollutants, hazardous waste disposal, solid waste disposal, fuel consumption, and other effects (Lieb and Lieb, 2008; Murphy et al., 1994; Rondinelli and Berry, 2000; Wolf and Seuring, 2010). The logistics industry may be more polluting than other service sectors (Skjoett-Larsen, 2000; Wu and Dunn, 1995).

This suggests that it is necessary to study environmental issues in the logistics industry, but only a limited number of contributions have focused on eco-efficiency issues in the logistics industry in the past decade (Lieb and Lieb, 2010; Lin and Ho, 2008).

While some of these studies in the logistics industry merely argue the importance of environmental issues for the logistics industry (Rodrigue et al., 2001; Rondinelli and Berry, 2000), others explore environmental practices, such as recycling materials, reducing consumption, reusing materials and environmental audits (Perotti et al., 2012; Murphy and Poist, 2000; 2003), simultaneously meeting cost and efficiency objectives (Wu and Dunn, 1995). Wong and Fryxell (2004) conducted an empirical study on the

influences of stakeholder pressures on the adoption of environmental management practices for fleet companies. Other contributions focus on reverse logistics as a driver for LSP selection (Wolf and Seuring, 2010).

Logistics could be considered as the "missing link" in providing environmentally sustainable outputs to customers (Wu and Dunn, 1995). But even if companies are discovering that sustainable outputs will be more sustainable if value adding logistics activities become sustainable themselves (Wu and Dunn, 1995), much remains to be learned empirically about the adoption of environmental practices for LSPs (Lin and Ho, 2008), especially in the transportation activities of LSPs, as they are the largest source of CO_2 emissions in the logistics industry (Wolf and Seuring, 2010).

The existing literature seems not to properly cover the evolution experienced by LSPs in the eco-efficiency domain. However, it is going to become more and more relevant in managerial terms (Lieb and Lieb, 2010; Cozzolino, 2009). The need emerges to explore what practices LSPs have developed recently towards eco-efficiency.

In order to better interpret the current situation it is also important to investigate the factors that drive or inhibit companies to adopt eco-efficient initiatives.

The study by Lin and Ho (2008) examines six factors that will influence the intention to adopt green innovations for LSPs: explicitness and accumulation of green practices, organisational encouragement, quality of human resources, environmental uncertainty and governmental support.

The research by Wolf and Seuring (2010) aims at analysing how and if companies buying services from LSPs take up environmental issues, and explore how environmental issues might be integrated into non-financial measures.

Lieb and Lieb (2010) explain the extent to which large 3PL companies have committed themselves to environmental sustainability objectives. In pursuing sustainability goals, 'many of the 3PL have closely worked with customers, transportation companies, trade associations, non-governmental organizations, and government agencies. Interestingly, in many instances, their efforts have resulted in significant cost savings for the companies' (Lieb and Lieb, 2010 p. 532).

Building upon the above cited references and the other papers included in our literature review, we can derive the main drivers to the adoption of eco-efficient initiatives. Internal drivers include personal commitment of leaders, middle management involvement, reduced costs, improved quality (Carter and Dresner, 2001; Green et al.,

1996; Handfield et al., 1997; New et al., 2000); externally, drivers of green supply chain practices can be classified into five major groups, i.e. regulation, customers, competitors, marketing and staff attracting (Carter and Dresner, 2001; Green et al., 1996; Handfield et al., 1997; Porter and Van der Linde, 1995).

In the literature, besides the drivers, the inhibitors that prevent companies from implementing environmental initiatives are also investigated: internally to the organisation, there are three main inhibitors: cost, poor commitment and lack of legitimacy (Carter and Dresner, 2001; Min and Galle, 1997; Walker and Jones, 2012); externally, regulation, poor supplier commitment and industry specific barriers are the main inhibitors of environmental management adoption (Trowbridge, 2001; Walker et al., 2008; Walton et al., 1998; Walker and Jones, 2012).

Therefore, a key consideration is the need to embed the environmental strategy into the corporate one, defining appropriate roles and responsibilities, but to what extent eco-efficiency culture and organisation is managed by companies is still not clear and we aim to fill this gap.

Eco-efficiency

Eco-efficiency is defined as the 'Reduction of resource intensity and minimisation of environmental impacts of production and products/services, together with value creation by continuous incremental improvement' (Dias-Sardinha and Reijnders, 2001). Helminen (2000) utilises the ratio shown in equation (1) to measure eco-efficiency in the pulp and paper industry and states that 'the ratio has not been operationalised by specifying the content of the numerator and the denominator' (p. 198):

$$\textit{Eco-efficiency} = \frac{\text{Value added}}{\text{Environmental impact}} \quad (1)$$

In this equation, the value added in logistics means, according to Rutner and Langley (2000, p. 79): 'A logistics value-added service either provides additional service(s) or exceeds customer service requirements that further reduces the supply chain costs or increases the partner's profits and gains competitive advantage in the marketplace'.

In relation to the environmental impact, McIntyre et al. (1998) suggest that the only way supply chains will improve their environmental performance is to establish all the

externalities involved. This, in principle, can be intuitively recognised as a reasonable assumption, but calculating the negative externalities related to supply chain activities remains an obstacle (Himanen et al., 2005: Korhonen and Luptacik, 2004), i.e. transport emissions where the costs associated with air pollution are not met by the polluter (Korhonen and Luptacik, 2004; Massaroni and Rossi, 2007). In addition, the calculation of CO_2 emissions is very complex because a global standard is still missing and there are differences not only among different countries, but also among companies within the same country (Roth and Kaberger, 2002).

Pullman et al. (2009) reinforce the need to measure the outcomes of eco-efficient initiatives by testing the indirect impact of these practices on product quality, which are the proxy for reducing costs. Schmidt et al. (2004) frame the eco-efficiency analysis in a wider managerial perspective. They interpret the tool as an instrument to compare alternatives in terms of environmental impact and costs, and to then support strategic management, optimise products and processes, compare strengths and weaknesses in relation to competitors, and market eco-efficient products.

The literature suggests mixed results in terms of cost savings; according to the insights provided by Zailani et al. (2011), most companies operating in the logistics industry are willing to invest in order to become eco-efficient. On the other hand, Lieb and Lieb (2010) highlight the well-known trade-off between economic and environmental outcomes, exacerbated by the ambiguity of innovation outcome (Matos and Hall, 2007). The two key points we can summarize from research by these authors are: 1. the mixed results about the outcomes of environmental initiatives need to be further investigated in order to understand how companies evaluate both their environmental and cost impacts; 2. eco-efficient initiatives could also bring soft benefits but it is not clear how companies perceive or measure them. Several articles refer to the growing adoption of eco-efficient standards as a requirement for companies to be selected by clients and included in their supply chains (Ciliberti et al., 2008; Beske et al., 2008; Seuring and Müller, 2008). The adoption of eco-efficient standards seems a basic requirement that has neither links with nor impacts on competitive advantage. Furthermore, a number of contributions, among those selected through the systematic literature review process, cover the opportunity to improve environmental and economic performances through collaboration along the supply chain (Davies, 2008; Hamprecht et al., 2005;

Henningsson et al., 2004; Hutchins and Sutherland, 2008; Rao and Holt, 2005; Schliephake et al., 2009; Schmidt and Schwegler, 2008).

There are several studies focussing on supply chains belonging to specific sectors; for instance: fashion retail (de Brito et al., 2008); grocery retailing industry (Erol et al., 2009); distributors (Kickham, 2008); a recycling logistics network (Quariguasi Frota Neto et al., 2009). Eco-efficiency measures for LSPs are lacking and this represents a gap in the existing literature, since they could support managerial decisions, as suggested by Schmidt et al. (2004). A set of performance measures directly descending from both the business strategy and the supply chain strategy is needed in order to strengthen the decision making process to gain a competitive advantage over competitors. The present paper aims to understand if and how companies have developed specific methods or indicators for eco-efficiency measurement.

Logistics innovation

There are different definitions of innovation used and provided in a vast body of literature. As far as the supply chain context is regarded, Flint et al. (2005) define logistics innovation as the development of new logistics services and products that are different from what has been offered in the past and that create greater value for customers. Panayides and So (2005) state that 'innovation in supply chains is a broad process of learning and implementing new ideas, procedures and technologies'. In these definitions two main dimensions of logistics innovation can be distinguished in the same term: the concept of "new", referring both to the use and creation of knowledge to offer a new product/service to customers or to the development of new process-based solutions, and the concept of "customer value", defined as the customers' perceptions regarding functional and service desires related to economic value. Since what customers value changes over time, the challenge that LSPs have to confront is to strive to anticipate customers' needs, understanding what they are likely to expect in the near future (Flint et al., 2005), thus the need to investigate this issue.

According to these dimensions, three different typologies of logistics innovation can be identified: process, product/service offering and network/relationships innovation (Lin and Ho, 2008; Panayides, 2006). Process innovation might help supply chains to reach their objectives in terms of lower costs and higher service provided, while product/service innovation is the response to new market needs. Beside these two

traditional forms of innovation is network/relationships innovation, which offers new ways of working across company boundaries.

In the age of knowledge-based economy, this latter innovation capability, based on inter-organisational relationships management, is extremely critical for the success of a company (Lin, 2008; Panayides, 2006). In this sense, logistics innovation is often seen as a key driver for enhancing the competitive advantage of a company. Christopher (1993) is one of the earliest contributions that relates logistics to competitive strategy and thus represents a reference point for the literature about logistics innovation. Building upon this and given the increased competition worldwide with its consequent downward pressure on prices and margins, several contributions argue that innovation in logistics could be an effective way to assure a sustainable competitive advantage for LSPs (Esper et al., 2007; Flint et al., 2008; Wagner, 2008). Such a focus on logistics, as a way to support and enable new strategic moves, has created increasing attention being given to logistics capabilities, both in theory and practice. Companies need to develop and leverage their capabilities to effectively learn new strategic approaches to logistics operations (Esper et al., 2007). This implies a firm being proactive by exploring new opportunities for customers that are intended to contribute to the performance and/or effectiveness of the firm (Wallenburg, 2009). Customer-related innovations have thus a great potential to generate value for the customer and create customer loyalty and, at the same time, help LSPs differentiate themselves from their competitors. However, LSPs exhibit significant shortcomings regarding customer-related innovations (Wallenburg, 2009) and the failure rate in logistics innovation is still high (Shen et al., 2009).

In the current competitive scenario, logistics innovation can gain a strategic role in improving the eco-efficient performances of a company and thus its global competitiveness (Zailani et al., 2011). This represents a further, new opportunity that LSPs need to exploit, as it is possible to observe in recent literature. As reported by Zailani et al. (2011) the success of innovations for eco-efficiency is strictly dependent on the ability to acquire new technology, management skills, organisational encouragement and support of innovation resources. According to Matos and Hall (2007), radical innovation is needed in order to overcome ambiguities that characterise the process of innovation for sustainability since conflicting pressures that are difficult to reconcile are involved. Notwithstanding the growing importance of eco-efficiency, the literature reveals that logistics is not amongst the newest industries and that

innovative ways to improve environmental performances are still needed in practice (Jumadi and Zailani, 2010). Questions to be addressed by our study arise about to what extent logistics innovation for eco-efficiency exists in practice among LSPs and how this can affect relationships with customers.

A framework for LSP innovation in eco-efficiency

The insights arising from the literature review were discussed by the researchers in order to identify the overlapping areas among the three different bodies of knowledge (i.e. LSPs and the environment, logistics innovation and eco-efficiency). The arising issues were reorganised according to a combination of the theoretical assumptions previously described (Green et al., 2012; Morash, 2001). They are co-ordinated into a single framework as represented in Figure 1, where culture and organisation include the themes related to the incorporation of eco-efficiency strategy into the mission; innovation in eco-efficiency refers to the development of eco-efficient processes, products and services to the customers; performance measurement encompasses the methods and indicators for eco-efficiency to assess the environmental performance and to cascade the environmental strategy within the organisation.

XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX

Take in Figure 1

XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX

From the literature review and the highlighted questions to be addressed three key themes emerge, which need to be analysed in order to understand the LSPs' innovation in eco-efficiency:

- Eco-efficiency culture and organisation – Does the company have a published environmental strategy? Who is responsible for environmental issues within the organisation? To what level is the environmental policy embedded in the organisation?
- Logistics innovation in eco-efficiency – What are the practices that the company has developed recently towards eco-efficiency? What are the customers' environmental needs that could be supported by LSPs? Does the company attempt to predict what customers will value?

- Performance measurement – Does the company have a set of performance indicators for eco-efficiency? How is the cost impact of the environmental sustainable initiatives perceived (i.e. negative, neutral, positive)? Does the company think it is possible to gain soft benefits by implementing an environmental strategy?

Furthermore, the context is described by analysing the drivers and inhibitors of the initiatives undertaken by the companies. These competing forces were explored to understand "how the organizational and environmental context is having an impact or influencing social processes" (Hartley, 2004).

4. Methodology

The insights arising from the literature review represented the starting point for building our empirical investigation, based on case studies. Case study methodology is well recognised to gain a deeper understanding of a phenomenon under development or whose dimensions are not yet fully understood (Yin, 1994). In particular, we decided to adopt a multiple case approach, by performing in-depth interviews within six different companies. We consider this number of case studies to be sufficient, given the primary objective of our research, i.e. to capture variations in theory and concepts, and not generalisability (McCracken, 1998; Strauss, 1987).

According to the objectives of the present research, we decided to concentrate the analysis on companies in the domain of LSPs, characterised by a supply chain operating on a global scale, with facilities based in Europe. The companies were deliberately selected for their high or low commitment to sustainability, in order to explore their unusualness not their typicality (Hartley, 2004).

Furthermore, in order to ensure the reliability of the study, a formal interview protocol was developed, taking into account as a primary driver the objectives of the current research, combined with the insights gathered from the literature review. The interview protocol predominantly contained open questions and is composed of five main sections:

- General information on the interviewee(s) and on the company
- Drivers/Inhibitors of environmental sustainability
- Structure of the company business and of the sector
- Strategy towards environment and organisation

- Logistics innovation and eco-efficiency

The respondents were asked to express their opinion on the influence of the drivers and inhibitors for environmental sustainability using a five-point Likert scale.

The interview protocol was submitted preferably to sustainability and/or quality directors of leading European LSPs. In companies where a specific figure responsible for sustainability issues is not present, the quality manager is usually in charge of those issues. A summary is presented in Table 2.

XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX

Take in Table 2

XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX

The number of respondents for each company was limited to the availability the researchers were allowed: beside the responsible for environmental initiative, at least one other respondent – where possible – was interviewed.

A pilot test was performed before the interviews with a panel of practitioners and experts in the logistics field. As a result, the wording of some of the questions was changed in order to make them both easier to understand and more focused on the areas of interest. This step is aimed at providing a solid structure for the interviews and facilitating a comparison of the cases at the analysis stage.

Each interview lasted between one and two hours (plus a further check for data validation), was tape recorded, transcribed and interview reports were produced to enable data analysis. Moreover, documents that companies share with their stakeholders about their environmental policy were examined in order to triangulate data and provide rigour to the study. Internal presentations, reports, and external documentation, as well as websites, third party reports, etc., were included in order to ensure an acceptable degree of triangulation. The information gained was matched with the insights arising from the interviews in order to obtain precise details about the company's strategy towards sustainability and the initiatives currently being undertaken. Discrepancies among different sources of information were resolved through a recalling of the respondents.

Subsequently, a cross case analysis of the case studies was performed, with the aim of searching for emergent themes, patterns of commonality and key differences, by comparing the outcomes of the cases (Ghauri, 2004).

In order to analyse the data, the methodology chosen is the use of templates in the thematic analysis of the interviews (Crabtree and Miller, 1999; King, 1998; Miles and Huberman, 1994).

For confidentiality reasons, in the following empirical analysis, the companies will be referred to only by alphabetical letters from A to F inclusive.

5. Cross case analysis

As already mentioned, the insights arising from the literature review represented the starting point for building our empirical investigation. A cross case analysis, organised around the three main themes highlighted in Figure 1 is presented below.

Drivers and inhibitors

The respondents interviewed were asked to assess the relevance of each driver and inhibitor affecting the initiatives undertaken by their companies, giving a score from 1 to 5, where 1 is very low relevance and 5 is very high relevance (Table 3).

XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX

Take in Table 3

XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX

Most of the companies consider customers to be a major driver (five out of six companies' managers give this driver the maximum score). They confirm the great potential that customer-related innovations could have to drive major change programmes towards eco-efficiency and they are trying to be proactive in this sense. Notwithstanding this, it emerged that sometimes LSPs complain about a lack of real commitment from customers.

> *"None of them really ask for much evidence from us. It's becoming more and more important to be ISO 14001 accredited to be included in a tender, but I get the impression they don't really care, it's just a case of they can tick a box and say 'yes, that company's ok." (Company C).*

Therefore the real drivers for eco-efficiency become regulations and marketing, ranked second and third by the interviewed managers.

Internal factors seem to have a medium/high influence (the score given by companies was three or higher) when either the necessity to cut operational costs is high or the culture of the company regarding the environment is very strong. Staff attractor gains only medium or minor influence. Finally, the companies involved in our analysis provided very different outcomes regarding the assessment of the influence of competitors' behaviour on companies' strategy. Indeed most of the companies believe that competitors cannot provide them with insights for good environmental initiatives. All the companies seem to compete on the same ground, with similar resources and capabilities and the interviewees reported that initiatives for eco-efficiency seem unable to influence the competitive scenario.

As far as inhibitors are concerned, industry specific barriers and costs are the factors that most inhibit the adoption of environmental initiatives, with an average score of 4.67 and 4.5 respectively. Costs are considered by most of the companies to be a key inhibitor, given the low margins of the industry in which they compete. Examples of "industry specific barriers" mentioned by interviewees are poor infrastructure, lack of supply chain collaboration among different players of the same supply chain, increasing pressure on prices, and the extreme efficiency of the operations without any focus on environmental quality.

Lack of legitimacy is mostly a medium inhibitor. Most of the companies state that often there is no recognition of the environmental efforts undertaken by stakeholders and the future results in terms of environmental impact are not well understood. Poor commitment is not, in general, a relevant barrier but if the company does not emphasise the initiative, this can be a strong inhibitor since motivation is missing.

Regulations, as mentioned above, is one of the major drivers, but surprisingly is considered by half of the companies to be a barrier as well, giving a high score to this inhibitor. This is due to the fact that regulations are not clear and normative complexity makes the design phase of environmental initiatives harder.

The attitude towards legislation can be reactive (Company E), simply accomplishing the minimum standards (Companies B, C, D, F), or proactive (Company A), trying to influence forthcoming legal requirements. These results possibly suggest LSPs implement eco-efficiency projects just to meet the minimum requirements set by governmental institutions.

Eco-efficiency culture and organisation

Sustainability is a topic of great interest within the logistics field. All the interviewed companies are aware of this issue and its importance within the business scenario. Notwithstanding the rising awareness, companies show different stages of commitment at a strategic level.

The most advanced stage, where eco-efficiency is formally embedded into the company strategy, sees specific patterns within authority direction, the clear definition of environmental responsibility and of the company goals' designation. The environmental management process has a top-down nature, descending from the awareness of the owner (Company A) or the Group Board (Company B) that eco-efficiency can be a significant source of competitive advantage. The responsibility for eco-efficient initiatives and strategy implementation is very clear and it remains at the Board level (Figure 2). When the Board is actively involved in the implementation of eco-efficient goals, acceptance among members of staff within the company broadens.

The intermediate stage is characterised by an informal awareness about environmental concerns, translating into a mixed management process, both top-down or bottom-up, according to the specific context. Company C, for instance, started from a bottom-up approach according to which the single branches suggest possible environmentally friendly initiatives in their own countries and communicate them to the group. Company D has no formal strategy but they are taking a number of environmental initiatives due to the high level of awareness of the company. These companies at this stage do not necessarily have a public environmental policy, and there are no specific roles suggesting and managing environmental initiatives, but this topic is faced through the collaboration of the Board (Figure 2). Sometimes companies do not count eco-efficiency as a top priority in defining their strategic choices: this is reflected in the lack of formalisation of an environmental strategy, characterised in Companies E and F.

XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX

Take in Figure 2

XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX

Logistics innovation in eco-efficiency

Evidence from the case companies showed a different level of innovation towards eco-efficiency. As clarified in the literature review, three different typologies of logistics

innovation can be identified. The data from the case studies will be presented accordingly.

Process: All the companies but one aim to minimise the impact of their operations on the environment, implementing a series of initiatives, covering both transport and warehousing (see Table 4). The most sophisticated, environmentally driven companies believe that continuous improvements in processes must take place in order to guarantee market leadership. Even if

"Innovation lasts one day" (Company B),

as mentioned by one of the interviewees, it is necessary to focus constantly on reducing energy intensity as well as reducing the carbon footprint.

On the other hand, in a context characterised by a higher pressure on costs and strict service level requirements, the other companies felt it was difficult to be innovative in the area of environmental sustainability, due to the amount of investment needed.

XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX

Take in Table 4

XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX

Product/service offering: Innovation in the product/service offering seems less important than might be expected. The quality of the services expected by the customer remains the same. Moreover, they are not willing to pay a premium price for more eco-efficient logistics services. While other logistics service providers have created a "green line" of environmentally friendly services, the companies analysed did not launch any new products.

However, what a manager in Company A said is interesting:

"The concern with eco-efficiency made our offer shift from service delivery to solutions development."

Network/relationships innovation: Environmental initiatives have an impact on supply chain relationships and boundaries between companies. When the relationship among the partners is established and long-term, a shared strategic vision of eco-efficiency cements it and ensures a longer formalised collaboration. On the other hand, initiatives for eco-efficiency undertaken with new customers can "cause" a closer relationship.

Companies A and B experienced a stabilisation in their demand, with partners sharing a common and strong vision on eco-efficiency.

In some cases (Companies B and C), environmental performance plays a double role: it ensures a longer collaboration with established customers and helps in the establishment of stronger relationships with new customers.

Companies D and E, pushed by their customers' needs to develop initiatives, are witnessing a change towards to a new paradigm that involves closer partnerships for the continuous improvement of supply chain environmental performance.

Finally, Company F is experiencing no value added exchanges with customers in the light of their operational environmental sustainability initiatives.

> *"Customers involved in environmental practices are pushed only by possible economic advantages or strict regulations that, if not complied with, cause penalties." (Company F)*

Performance measurement

None of the companies analysed has a set of measures to evaluate eco-efficiency. Again, the responses from the six companies are very diverse, where Company A is developing a set of environmental metrics, but not yet considering the economic impact of the initiatives. Their focus is primarily on measuring the efficiency arising from the innovations developed, but they also see the need to combine the two sides of eco-efficiency.

The methods adopted in Company B to appraise the environmentally sustainable programmes are mostly based on reports of monthly data sent to their Headquarters and efficiency tests on their logistics processes. In order to do this, Kaizen and Six Sigma are the most frequently used approaches. The economic and environmental performances are monitored through specific Key Performances Indicators (KPIs), focused on the quality and efficiency of processes which are considered to be the major benefits resulting from the adoption of these practices.

The perception of the cost impact of the environmental sustainable initiative is mostly neutral. However, all the companies agree that most of the environmental initiatives can bring considerable expense and a poor return. This negative feeling can be due to the fact that the expenses related to environmental projects are not usually shared with or covered by the customer or the final user. Furthermore, the business has low margins that are close to the break-even point. In such a context the concept of

" 'doing it right' (it works correctly) seems much more important than 'doing it nice' (it has no drawback)." (Company F)

However, transparent and measurable goals become means to demonstrate a real commitment to customers.

Furthermore, companies are aware of the return on image and credibility they can gain by implementing environmental strategies and initiatives, but the difficulty in appraising these soft benefits is considerable.

A table summarising the main highlights of the cross case analysis is presented in Table 5.

XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX

Take in Table 5

XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX

6. Discussion

Theoretical implications

The theoretical implications of this paper derive from the application and extension of the literature on the logistics and learning capabilities in the context of eco-efficiency strategies and initiatives by LSPs.

As far as RQ1 is concerned, i.e. what are the strategies and initiatives currently undertaken by LSPs in the eco-efficiency arena, both the literature review and the case studies analysis show that LSPs are reacting to the eco-efficiency challenge with diverse initiatives, especially in terms of internal processes and product/service configuration.

Regarding RQ2, i.e. how can an LSP deploy capabilities to be creative for the client in creating eco-efficient supply chain solutions, the combination of logistics and learning capabilities to help explore the adoption and implementation of eco-efficient strategies and initiatives by LSPs are utilised. Both Resource Based View and Organizational Learning are the foundations to better understand the phenomenon.

By matching the issues arising from the interviews with the classification of the logistics and learning capabilities provided by Esper et al. (2007), it has been possible to identify which capabilities have to be developed in order to move towards the ideal scenario and to define prescriptions to enable LSPs to support their clients by developing eco-efficient initiatives.

The detailed answers to the research questions posed earlier will be organised according to the three main themes previously identified. The insights arising from the case analysis will be discussed in the light of logistics and learning capabilities.

Sustainability culture and organisation: The strategies undertaken by LSPs are still very diverse, and evidently follow an evolutionary path, going from a truly operational perspective towards the definition of an environmental strategy embedded within corporate strategies. The presence of different approaches among companies to reach eco-efficiency goals confirms the results of the study conducted by Lieb and Lieb (2010). The business models deriving from these different attitudes towards eco-efficiency are characterised by evident differences in terms of organisational structures, leadership and responsibility (Gattiker and Carter, 2010; Pagell and Wu, 2009), where the culture for eco-efficiency is positively reinforced by employees' involvement (Lieb and Lieb, 2010).

The different stages of commitment towards eco-efficiency that arose in the case studies can be interpreted through a combination of *cultural, structural* and *integration* capabilities. In fact, where there is a clear embedded strategy for eco-efficiency, its institutionalization provides an objective that is shared within the company through specific metrics and also there is clear leadership.

Logistics innovation in eco-efficiency: Our research reveals that innovation, in terms of process for eco-efficiency, is not able to predict any different behaviour in LSPs from a general business context. The network/relationship innovation, on the other hand, can explain a debated topic in the existing literature. All the companies but one (F), and Companies A and B more than the others, experienced growth in demand, strengthening their business relationships into long lasting partnerships. This finding is in clear contrast to the contribution of Lieb and Lieb (2010), who report eco-efficiency 'issues as not yet playing a major role in either the 3PL selection or the retention process and they were not being significantly reflected in 3PL contracts' (p. 529). The contrasting result can be explained by applying a combination of logistics and learning capabilities. In fact, the analysis of the attitude towards innovation in product/service for eco-efficiency reveals that the shift from service delivery to solutions development can be interpreted through the *customer focus* capability: eco-efficiency is led by the customers and their requests. Also, the strengthening of the relationships experienced by some of

the companies with their existing or new clients who have a "similar" attitude to sustainability can be interpreted through the *relational* capability as a key source of learning in the domain of eco-efficiency. This finding is aligned to Pagell et al. (2010); they revisit the Kraljic matrix in the light of sustainability, revealing how it turns commodities into more strategic products/services. Logistics services are considered to be a commodity. Our research clarifies how logistics services can migrate towards being more strategic services, based on more stable relationship with customers.

Performance measurement: Although the existing literature stresses the need to develop a comprehensive set of eco-efficiency measures (Bai et al, 2012), its almost complete absence among our sample reveals a scant commitment in deploying *measurement* capabilities. It is evident that there is a misalignment between the translation of the business objectives into operational and financial targets, which reflects in the perceived trade-off between "eco" and "efficiency". The lack of these capabilities slows down the learning path about eco-efficiency, freezing the *temporal* component.

Managerial Implications

We argue that innovation for eco-efficiency is imperative for LSPs and we provide recommendations in support of its operationalisation at a relationship and supply chain level.

Once the interviews were collected and organised according to the main areas that arose from the literature review, the research team had several rounds of discussion to evaluate the key challenges LSPs are facing to connect them to logistics and learning capabilities. The results were then presented to a broader academic community for evaluation. From our research it would appear that the key challenges are the following:

- Measuring eco-efficiency
- Fostering collaboration
- Managing the wider supply chain

XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX

Take in Table 6

XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX

Measuring eco-efficiency

A limited capacity in measuring both environmental and economic impacts is generally observed (Bai et al., 2012), and, aligned with Wolf and Seuring (2010), the two aspects are still managed separately. Environmental metrics are very useful, especially for internal use, but it is necessary to link the economic ones to have a clear measure of the value created for clients. LSPs involved in eco-efficient strategic initiatives should develop a set of eco-efficiency measures. This will also allow them to report to their client/stakeholders and to assess eco-efficiency performance along the supply chain (Björklund et al., 2012). The eco-efficiency concept is not new but its operationalisation in a specific context is a long way from being completed. In the LSPs' context, no previous attempts can be found. Starting from generic indicators suggested in the literature (e.g. Kalenoja et al., 2011; Mintcheva, 2005; Tsoulfas and Pappis, 2008; Verfaillie and Bidwell, 2000), further research should explore the business specific indicators for the logistics industry.

Furthermore, the interviews revealed a wide perception of soft benefits but a limited capacity in assessing them. As mentioned above, companies are aware of the returns on image and credibility they can gain from implementing environmental strategies and initiatives, confirming the evidence of the literature (Lieb and Lieb, 2010). The development of tools for supporting multi criteria decision making is suggested in order to appraise the soft benefits arising.

Fostering collaboration

Companies tend to assume an internal rather than a supply chain perspective while planning to implement environmental initiatives (Vachon and Klassen, 2006). It is evident that this is not an easy task and that it requires a number of dedicated resources. Both horizontal and vertical collaborations are suggested through leveraging a broad range of capabilities. Examples of existing practices are collaborative teams or assets sharing with the other members of the supply chain but further initiatives should be formulated. Network/relationship innovations could be key drivers to stabilise or increase the demand and to strengthen existing relations toward the creation of solid partnerships.

Furthermore, commitment towards environmental issues is sometimes lacking a common appraisal and is often driven by individuals within the company. Through an internal integration enabling cross functional teams and a better information exchange

facilitating decision making, a widespread appraisal and culture could be achieved. Our case studies reveal the need to have "champions" at senior level ensuring the cultural change to happen, as suggested by Gattiker and Carter (2010).

Managing the wider supply chain

Among the most significant external inhibitors, fragmented and complex regulations and insufficient infrastructures were mentioned by the interviewees, although regulations do represent the key drivers for a company to improve its eco-efficient performance (Lieb and Lieb, 2010; Diabat and Govindan, 2011; Hitchcock, 2012; Svensson and Wagner, 2012). A sense of confusion was experienced by some of the companies analysed, causing a misperception of what can be done and about the support from government and supranational institutions, both in terms of regulations and infrastructures. A challenging path to undertake is to try to pull the regulations towards standards set up within the industry through vertical and horizontal collaboration, by assuming a proactive approach. An example of that was given by Company A which is a member of a round table on CO_2 emissions calculation, organised by the FTA (Freight Transport Association-UK).

Also, none of our sample companies mention any linkage with any NGO, in line with some of the existing literature (Lin and Ho, 2008; Seuring and Müller, 2008).

Due to recent attention regarding the environment among LSPs, there is a lack of any guidelines on how to implement initiatives and the related benefits that could result from their adoption. First of all, it requires human resource development and exploitation to qualify specific expertise. However, launching initiatives on a small scale can provide good insights about the feasibility of the initiative on a larger scale.

Concerns about the environment and future generations are still not included in customers' utility function so that the decision making process will not lead them towards a more environmentally friendly purchase, unless there are no differences in the final price (Massaroni and Rossi, 2007). Recent contributions reveal a growing education on sustainability among the consumers (Svensson and Wagner, 2012; Hitchcock, 2012). Even if the concerns are growing slowly, supply chains have to be aligned to the market's needs, choosing only those initiatives that are at least cost neutral. Companies and industry sectors can influence this change through a number of

initiatives able to enhance the current level of awareness customers give to this environmental topic.

These observations suggest that LSPs' strategies for eco-efficiency are still at an early stage of development, although there is great potential to gain efficiency and market advantages. In fact, 'outsourcing has a significant potential to increase sustainability in the supply chain as third-party logistics providers focus on improving resource utilization and making processes more efficient' (Facanha and Horvath, 2005). This research points out the relevant capabilities for LSPs to define and deploy their eco-efficiency strategies effectively.

7. Conclusions

The theoretical contribution of this paper is to apply and extend the literature on the logistics and learning capabilities in the context of eco-efficiency strategies and initiatives by LSPs.

The research findings extend and question the existing theory on LSPs and eco-efficiency by examining innovation in processes, products/services and network/relationships. LSPs feel pressure from their customers, which is the first driver for sustainability initiatives among our sample. However, customers' attitudes do not always appear to be clear, and are sometimes counter-intuitive, varying between simple compliance with legislation to the will to include their suppliers in their strategy for eco-efficiency.

Not all of the case companies were found to have a formalised and published policy on eco-efficiency. Both the existing literature and the case studies show that the main focus of LSPs in terms of eco-efficiency points directly towards their own operations i.e. packaging, route optimisation, educating employees, recycling, fuel conversion.

Our research suggests that there are many opportunities for LSPs to improve their approach to eco-efficiency as a source of competitive advantage. However, it appears that capabilities and tools to deploy a strategy for eco-efficiency are lacking. This paper contributes to filling this gap by including learning capabilities. The combination of the two sets of capabilities sheds light on some of the debated issues in the literature. Cultural and structural learning capabilities and logistics integration capabilities could

support the institutionalisation of eco-efficiency within LSPs' strategies, through appropriate leadership and responsibility structures.

Our analysis suggests eco-efficiency could be the driver for LSPs to migrate from simply delivering commodities to providing more strategic services. Eco-efficiency might have an impact on the broader issue of relationship/network innovation to develop new relationships and reinforce existing ones, through relational (learning) and customer focus (logistics) capabilities. Relationship/network innovation for eco-efficiency is neglected in the existing literature and this opens opportunities for further research.

The combination of measurement (logistics) and temporal (learning) capabilities could support the translation of business and environmental objectives into operational and financial targets. Our sample reveals a very fragmented and under-developed set of performance measures relating to the combined environmental and economic outcome of LSPs' operations. Further research is urged in order to provide LSPs with relevant performance measurement tools for eco-efficiency.

The managerial implications arising from this research affect a wide range of current practices in eco-efficiency from which strategic and operative directions to compete can be derived. Further research is needed to improve the generalisability of the findings. Input from customers would improve the richness of the findings relating to the relevance of eco-efficiency in building relationships between customers and LSPs highlighted in the present study.

References

Abbasi, M., Nilsson, F. (2012), "Themes and challenges in making supply chains environmentally sustainable", *Supply Chain Management: an International Journal*, Vol. 17 No.1, pp. 517-530.

Bai, C., Sarkis, J., Wei, X. and Koh, L. (2012), "Evaluating ecological sustainable performance measures for supply chain management", *Supply Chain Management: An International Journal*, Vol. 17 No. 1, pp.78-92.

Björklund, M., Martinsen, U. and Abrahamsson, M. (2012), "Performance measurements in the greening of supply chains", *Supply Chain Management: An International Journal*, Vol. 17 No. 1, pp. 29-39.

Colicchia, C., Melacini, M. and Perotti, S. (2011), "Benchmarking supply chain sustainability: insights from a field study", *Benchmarking: an International Journal*, Vol. 18 No. 5, pp. 703-732.

Colicchia, C. and Strozzi, F. (2012), "Supply Chain Risk Management: A new methodology for a Systematic Literature Review", *Supply Chain Management: an International Journal*, Vol. 17 No. 4, pp. 403-418.

Cozzolino, A. (2009), *Operatori logistici. Contesto evolutivo, assetti competitivi e criticità emergenti nella supply chain*, Cedam, Padova.

Crabtree, B.F. and Miller, W.L. (1999), "Using codes and code manuals: a template organizing style of interpretation", in B.F. Crabtree and W.L. Miller, (eds.), Doing Qualitative Research, 2nd edition. Newbury Park, CA: Sage.

Denyer, D. and Tranfield, D. (2009), "Producing a systematic literature review", in Buchanan and Bryman (Ed.), *The SAGE Handbook of Organisational Research Methods*, Sage Publications Ltd., London, pp. 671-689.

Ghauri, P. (2004), "Designing and Conducting Case Studies in International Business Research", in Marschan-Piekkari, R. and Welch, C. (Eds.), *Handbook of Qualitative Research Methods for International Business*, UK and USA, Edward Elgar Publishing.

Gimenez, C. and Tachizawa, E.M. (2012), "Extending sustainability to suppliers: a systematic literature review", *Supply Chain Management: an International Journal*, Vol. 17 No. 5, pp. 531-543.

Green Jr, K.W., Zelbst, P.J., Meacham, J. and Bhadauria, V.S. (2012), "Green supply chain management practices: impact on performance", *Supply Chain Management: An International Journal*, Vol. 17 No. 3, pp. 290-305.

Hartley, J. (2004), "Case study research" in Cassell, C.M. and Symon, G. (eds), *Essential guide to qualitative methods in organizational research*, London: Sage.

Hitchcock, T. (2012), "Low carbon and green supply chains: the legal drivers and commercial pressures", *Supply Chain Management: An International Journal*, Vol. 17 No. 1, pp.98-101.

Hugos, M.H. (2003), *Essentials of Supply Chain Management*, John Wiley & Sons.

Kaplan, R.S. and Norton D.P. (2001), *The strategy-focused organization: How balanced scorecard companies thrive in the new business environment*, Harvard Business Press.

King, N. (1998), "Template analysis", in G.Symon and C.Cassell (eds.), "*Qualitative Methods and Analysis in Organizational Research*", London: Sage.

Lieb, K.J. and 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.

Massaroni, E. and Rossi, S. (2007), "Utilizzo e distribuzione delle risorse naturali: verso l'impresa ecoefficiente", *Economia e diritto del terziario*, No. 1, pp. 119-150.

McCracken, G. (1998), *The long interview*, Beverly Hills, CA, Sage.

Mena, C., Christopher, M., Johnson, M. and Jia, F. (2007), "*Innovation in logistics services*", Centre for Logistics and Supply Chain Management at Cranfield School of Management on behalf of National Endowment for Science, Technology and the Arts (NESTA).

Miles, M.B. and Huberman, A.M. (1994), *Qualitative Data Analysis: An Expanded Sourcebook*, Beverly Hills, CA: Sage.

Perotti, S., Zorzini, M., Cagno, E and 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.

Porter, M.E. and Van der Linde, C. (1995), "Green and competitive: ending the stalemate", *Harvard Business Review*, Vol. 73 No. 5, pp. 120-134.

Rondinelli, D. and Berry M. (2000), "Multimodal Transportation, Logistics, and the Environment: Managing Interactions in a Global Economy", *European Management Journal,* Vol. 18 No. 4, pp. 398-410.

Sarkis, J. (2012), "A boundaries and flows perspective of green supply chain management", *Supply Chain Management: An International Journal*, Vol. 17 No. 2, pp. 202-216.

Strauss, S. (1987), *Qualitative Analysis for Social Scientists*, New York: Cambridge University Press.

Svensson, G. and Wagner, B. (2012), "Implementation of a sustainable business cycle: the case of a Swedish dairy producer", *Supply Chain Management: An International Journal*, Vol. 17 No. 1, pp.93-97

Walker, H. and Jones, N. (2012), "Sustainable supply chain management across the UK private sector", *Supply Chain Management: An International Journal*, Vol. 17 No. 1, pp.15-28.

Yin, R.K. (1994), *Case Study Research: Design and Methods*, 2nd edition, Sage Publications, Thousand Oaks, IL.

Full list of papers contained in the systematic literature review

1. Abukhader, S.M. and Jönson, G. (2004), "Logistics and the environment: is it an established subject?", *International Journal of Logistics: Research and Applications*, Vol. 7 No. 2, pp. 137-49
2. Beamon, B.M. (1999), "Designing the green supply chain", *Logistics Information Management*, Vol. 12 No. 4, pp. 332-342.
3. Berglund, M., Van Laarhoven, P., Sharman G. and Wandel, S. (1990), "Third-Party Logistics: Is There a Future?", *International Journal of Logistics Management*, Vol. 10 No. 1, pp. 59-70.
4. Beske, P., Koplin, J. and Seuring, S. (2008), "The use of environmental and social standards by German first-tier suppliers of the Volkswagen AG", *Corporate Social Responsibility and Environmental Management*, Vol. 15 No. 2, pp. 63-75.
5. Bitran, G.R., Gurumurthi S. and Sam, S.L. (2007), "The Need for Third-Party Coordination in Supply Chain Governance", *MIT Sloan School of Management Review*, Vol. 48 No. 3, pp. 30-37.
6. Carter C.R. and Easton, P.L. (2011), "Sustainable supply chain management: evolution and future directions", *International Journal of Physical Distribution & Logistics Management,* Vol. 31 No. 1, pp. 46-62.
7. Carter, C.R, and Rogers, D. (2008), "A framework of sustainable supply chain management: moving toward new theory", *International Journal of Physical Distribution & Logistics Management*, Vol. 38 No. 5, pp. 360-387.
8. Carter, C.R. and Dresner, M. (2001), "Purchasing's Role in Environmental Management: Cross Functional Development of Grounded Theory", *Journal of Supply Chain Management*, Vol. 37 No. 3, pp. 12-27.
9. Chapman, R. L., Soosay, G. and Kandampully, F. (2002), "Innovation in logistic services and the new business model: a conceptual framework", *Managing Service Quality*, Vol. 12 No. 6, pp. 358-371.
10. Christopher, M. (1993), "Logistics and Competitive Strategy", *European Management Journal*, Vol. 11 No. 2, pp. 258-261.

11. Ciliberti, F., Pontrandolfo, P. and Scozzi, B. (2008), "Logistics social responsibility: Standard adoption and practices in Italian companies", *International Journal of Production Economics*, Vol. 113 No. 1, pp. 88-106.
12. Cui, L., Shong-lee, I. and Hertz, S. (2009), "How Do Regional Third-Party Logistics Firms Innovate? A Cross-Regional Study", *Transportation Journal*, Vol. 48 No. 3, pp. 44-50.
13. Darnall, N., Jolley, G., and Handfield, R. (2008), "Environmental management systems and green supply chain management: complements for sustainability?", *Business Strategy and the Environment*, Vol. 17 No. 1, pp. 30-45.
14. Davies, J. (2008), "Collaboration's Role in the Eco-effective Supply Chain", *Supply Chain Management Review*, Vol. 12 No. 4, pp. 10-11.
15. de Brito, M., Carbone, V. and Blanquart, C. (2008), "Towards a sustainable fashion retail supply chain in Europe: Organisation and performance", *International Journal of Production Economics*, Vol. 114 No. 2, pp. 534-553.
16. Defee, C.C., Esper, T. and Mollenkopf, D. (2009), "Leveraging closed-loop orientation and leadership for environmental sustainability", *Supply Chain Management: an International Journal*, Vol. 14 No. 2, pp. 87-98.
17. Diabat, A. and Govindan, K. (2011), "An analysis of the drivers affecting the implementation of green supply chain management", *Resource, Conservation and Recycling*, Vol. 55 No. 6, pp. 659-667.
18. Dias-Sardinha, I. and Reijnders, L. (2001), "Environmental performance evaluation and sustainability performance evaluation of organizations: an evolutionary framework", *Eco-Management and Auditing*, Vol. 8, pp. 71-79.
19. Dinwoodie, J. (2006), "Rail freight and sustainable urban distribution: potential and practice", *Journal of Transport Geography*, Vol. 14 No. 4, pp. 309-320.
20. Doll, C. and Wietschel, M. (2008), "Externalities of the transport sector and the role of hydrogen in a sustainable transport vision", *Energy Policy*, Vol. 36 No. 11, pp. 4069-4078.
21. Efendigil, T., Önüt, S. and Kongar, E. (2008), "A holistic approach for selecting a third-party reverse logistics provider in the presence of vagueness", *Computers & Industrial Engineering*, Vol. 54 No. 2, pp. 269-287.
22. Elkington, J. (1994), "Towards the sustainable corporation: Win-win-win business strategies for sustainable development", *California Management Review*, Vol. 36 No. 2, pp. 90-100.
23. Erol, I., Cakar, N., Erel, D. and Sari, R. (2009), "Sustainability in the Turkish retailing industry", *Sustainable Development*, Vol. 17 No. 1, pp. 49-67.
24. Esper, T.L., Fugate, B.S. and Sramek, B.D. (2007), "Logistics Learning Capability: Sustaining the Competitive Advantage Gained through Logistics Leverage", *Journal of Business Logistics*, Vol. 28 No. 2, pp. 57-81.
25. Esty, D.C. and Winston A. (2009), "*Green to Gold: how smart companies use environmental strategy to innovate, create value, and build competitive advantage*", Wiley & Sons, Hoboken, NJ.
26. European Commission (2001), "*European Transport Policy for 2010: time to decide*", Office for Official Publications of The European Communities, Luxembourg.

27. Evangelista, P. and Sweeney, E. (2006), "Technology usage in the supply chain: the case of small 3PLs", *The International Journal of Logistics Management,* Vol. 17 No. 1, pp. 55-74.
28. Facanha, C. and Horvath A. (2005), "Environmental Assessment of Logistics Outsourcing", *Journal of Management in Engineering*, Vol. 21 No. 1, pp. 27-37.
29. Faruk, A.C., Lamming, R.C., Cousins, P.D. and Bowen, F.E. (2001), "Analyzing, Mapping, and Managing Environmental Impacts along Supply Chains", *Journal of Industrial Ecology*, Vol.5 No.2, pp.13-36.
30. Flint, D.J., Larsson, E. and Gammelgaard, B. (2008), "Exploring processes for customer value insights, supply chain learning and innovation: an internal study", *Journal of Business Logistics*, Vol. 29 No. 1, pp. 257-282.
31. Flint, D.J., Larsson, E., Gammelgaard, B. and Mentzer, J.T. (2005), "Logistics innovation: a customer value-oriented social processes", *Journal of Business Logistics*, Vol. 26 No. 1, pp. 113-147.
32. Gattiker, T.F. and Carter, C.R. (2010), "Understanding project champions' ability to gain intra-organizational commitment for environmental management projects", *Journal of Operations Management*, Vol. 28 No. 1, pp. 72-85.
33. Goldsby, T.J. and Stank, T.P. (2000), "World class logistics performance and environmentally responsible logistics practices", *Journal of Business Logistics*, Vol. 21 No. 2, pp. 187-208.
34. Gonzalez-Benito, J. and Gonzalez-Benito, O. (2006), "The role of stakeholder pressure and managerial values in the implementation of environmental logistics practices", *International Journal of Production Research*, Vol.44 No.7, pp.1353-1373.
35. Green, K., Morton, B. and New, S. (1996), "Purchasing and environmental management: interactions, policies and opportunities", *Business Strategy and the Environment*, Vol. 5 No. 3, pp. 188-197.
36. Hamprecht, J., Corsten, D., Noll, M. and Meier, E. (2005), "Controlling the sustainability of food supply chains", *Supply Chain Management: An International Journal*, Vol. 10 No. 1, pp. 7-10.
37. Handfield, R.B., Walton, S.V., Seegers, L.K. and Melnyk, S.A. (1997), "Green value chain practices in the furniture industry", *Journal of Operations Management*, Vol. 15 No. 4, pp. 293-315.
38. Helminen, R.R. (2000), "Developing tangible measures for eco-efficiency: the case study of the Finnish and Swedish pulp and paper industry", *Business Strategy and the Environment*, Vol. 9 No. 3, pp. 196-210.
39. Henningsson, S., Hyde, K., Smith, A. and Campbell, M. (2004), "The value of resource efficiency in the food industry: a waste minimisation project in East Anglia, UK", *Journal of Cleaner Production*, Vol. 12 No. 5, pp. 505-512.
40. Hervani, A.A., Helms, M.M. and Sarkis, J. (2005), "Performance measurement for green supply chain management", *Benchmarking: An International Journal*, Vol.12 No.4, pp.330-353.
41. Himanen, V., Lee-Gosselin, M. and Perrels, A. (2005), "Sustainability and the interactions between external effects of transport", *Journal of Transport Geography*, Vol. 13 No. 1, pp. 23-28.

42. Hoffman, A.J. (2005), "Climate Change Strategy: the business logic behind voluntary greenhouse gas reductions", *California Management Review*, Vol. 47 No. 3, pp. 21-46.
43. Hoffrén, J. and Apajalahti, E. (2009), "Emergent eco-efficiency paradigm in corporate environment management", *Sustainable Development*, Vol. 17 No. 4, pp. 233-243.
44. Huppes, G. and Ishikawa, M. (2005), "Eco-efficiency and Its Terminology", *Journal of Industrial Ecology*, Vol. 9 No. 4, pp. 43-46.
45. Hutchins, M.J. and Sutherland, J.W. (2008), "An exploration of measures of social sustainability and their application to supply chain decisions", *Journal of Cleaner Production*, Vol. 16 No. 15, pp. 1688-1698.
46. Jumadi, H. and Zailani, S. (2010), "Integrating green innovations in logistics services towards logistics service sustainability: a conceptual paper", *Environmental Research Journal*, Vol. 4 No. 4, pp. 261-271.
47. Kalenoja, H., Kallionpaa, E. and Rantala, J. (2011), "Indicators of energy efficiency of supply chains", *International Journal of Logistics Research and Applications*, Vol. 14 No. 2, pp. 77-95.
48. Keebler, J.S. and Plank, R.E. (2009), "Logistics performance measurement in the supply chain: a benchmark", B*enchmarking: An International Journal*, Vol. 6, No. 16, pp. 785-798.
49. Kickham, V.F. (2008), "Greening the Supply Chain", *Industrial Distribution*, Vol. 97 No. 3, pp. 27-29.
50. Kim, H., Yang, J. and Lee, K.D. (2009), "Vehicle routing in reverse logistics for recycling end-of-life consumer electronic goods in South Korea", *Transportation Research Part D*, Vol. 14 No. 5, pp. 291-299.
51. Korhonen, P.J. and Luptacik, M. (2004), "Eco-efficiency analysis of power plants: An extension of data envelopment analysis", *European Journal of Operational Research*, Vol. 154 No. 2, pp. 437-446.
52. Krumwiede, D.W., and Sheu, C. (2002), "A model for Reverse Logistics entry by third-party providers", *Omega*, Vol.30, pp. 325-333.
53. Lai, K., Lun, V., Wong, C., and Cheng, T. (2010), "Green shipping practices in the shipping industry: Conceptualization, adoption, and implication", *Resources, Conservation and Recycling*, Vol. 55 No. 6, pp. 631-638.
54. Langella, I.M., and Zanoni, S. (2011), "Eco-efficiency in logistics: a case study on distribution network design", *International Journal of Sustainable Engineering*, Vol. 4 No. 2, pp. 115-126.
55. Lieb, K.J. and 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.
56. Lin, C. (2007), "Factors affecting innovation in logistics technologies for logistics service providers in China", *Journal of Technology Management in China*, Vol. 2 No. 1, pp. 22-37.
57. Lin, C. (2008), "Determinants of the adoption of technological innovations by logistics service providers in China", *International Journal of Technology Management and Sustainable Development*, Vol. 7 No. 1, pp. 19-38.

58. Lin, C. and Ho, Y. (2008), "An empirical study on logistics service providers' intention to adopt green innovation", *Journal of Technology Management & Innovation*, Vol. 3 No. 1, pp. 17-26.
59. Lin, C., Ho, Y. and Chiang, S. (2009) "Organizational Determinants of Green Innovation Implementation in the Logistics Industry", *The International Journal of Organizational Innovation*, Vol. 2 No. 1, pp. 5-12.
60. Lu, L., Wu, C. and Kuo, T. (2007), "Environmental principles applicable to green supplier evaluation by using multi-objective decision analysis", *International Journal of Production Research*, Vol. 45 No. 18/19, pp. 4317-4331.
61. Mahler, D. (2007). "The Sustainable Supply Chain", *Supply Chain Management Review*, Vol. 11 No. 8, pp. 59-60.
62. Marasco, A. (2008), "Third-party logistics: a literature review", *International Journal of Production Economics*, Vol. 113 No. 1, pp. 127-47.
63. Markley, M.J. and Lenita, D. (2007), "Exploring future competitive advantage through sustainable supply chains", *International Journal of Physical Distribution & Logistics Management*, Vol. 37 No. 9, pp. 763-774.
64. Matos, S. and Hall, J. (2007), "Integrating sustainable development in the supply chain: the case of life cycle assessment in oil and gas and agricultural biotechnology", *Journal of Operations Management*, Vol. 25 No. 6, pp. 1083-1102.
65. McIntyre, K., Smith, H., Henham, A. and Pretlove, J. (1998), "Environmental performance indicators for integrated supply chains: the case of Xerox Ltd", *Supply Chain Management: an International Journal*, Vol. 3 No. 3, pp. 149-56.
66. Mentzer, J.T. and Williams, L.R. (2001), "The Role of Logistics Leverage in Marketing Strategy", *Journal of Marketing Channels*, Vol. 8 No. 3/4, pp. 29-47.
67. Michelsen, O., Fet, A.M., Dahlsrud, A. (2006), "Eco-efficiency in extended supply chains: A case study of furniture production", *Journal of Environmental Management*, Vol. 79 No. 3, pp. 290-297.
68. Min, H. and Galle, W. (1997), "Green purchasing strategies: trends and implications", *Journal of Supply Chain Management*, Vol. 33 No. 3, pp. 10-17.
69. Mintcheva, V. (2005), "Indicators for environmental policy integration in the food supply chain (the case of the tomato supply chain and the integrated product policy), *Journal of Cleaner Production*, Vol. 13 No.7, pp. 717-731.
70. Moller, A. and Schaltegger, S. (2005), "The Sustainability Balanced Scorecard as a Framework for Eco-efficiency Analysis", *Journal of Industrial Ecology*, Vol. 9 No. 4, pp. 73-83.
71. Morash, E.A. (2001), "Supply chain strategies, capabilities, and performance", *Transportation Journal*, Vol. 41 No. 1, pp. 37-54.
72. Murphy, P.R. and Poist, R.F. (2000), "Green Logistics Strategies: An analysis of usage patterns", *Transportation Journal*, Vol. 40 No.2, pp. 5-16.
73. Murphy, P.R. and Poist, R.F. (2003), "Green perspectives and practices: a 'comparative logistics' study", *Supply Chain Management: An International Journal*, Vol. 8, No. 2, pp. 122-131.

74. Murphy, P.R., Poist, R.F. and Braunschweig C.D. (1994), "Management of environmental issues in logistics: Current status and future potential", *Transportation Journal*, Vol. 34 No. 1, pp. 48-56.
75. New, S., Green, K. and Morton, B. (2000), "Buying the environment: the multiple meanings of green supply", in Fineman, S. (Ed.), *The Business of Greening*, Routledge, London, pp. 33-53.
76. Pagell, M. and Wu, Z. (2009), "Building a more complete theory of sustainable supply chain management using case studies of 10 exemplars", *Journal of Supply Chain Management*, Vol. 45, No. 2, pp. 37-56.
77. Pagell, M., Wu, Z. And Wasserman, M. E. (2010), "Thinking differently about purchasing portfolios: an assessment of sustainable sourcing", *Journal of Supply Chain Management*, Vol. 46, pp. 57-73.
78. Panayides, P. (2006), "Enhancing innovation capability through relationship management and implications for performance", *European Journal of Innovation Management*, Vol. 9 No. 4, pp. 466-483.
79. Panayides, P. and Lun, V. (2009), "The impact of trust on innovativeness and supply chain performance", *International Journal of Production Economics*, Vol. 122 No. 1, pp. 35-46.
80. Panayides, P. and So, M. (2005), "Logistics service provider-client relationships", *Transportation Research*, Part E, Vol. 41, pp. 179-200.
81. Patterson, K.A., Grimm, C.M. and Corsi, T.M. (2003), "Adopting new technologies for supply chain management", *Transportation Research Part E*, Vol. 39, pp. 95-121.
82. Piecyk, M.I., and McKinnon, A.C. (2009), "Forecasting the carbon footprint of road freight transport in 2020", *International Journal of Production Economics*, Vol. 128 No.1, pp. 31-42.
83. Presley, A., Meade, L. and Sarkis, J. (2007), "A strategic sustainability justification methodology for organizational decisions: a reverse logistics illustration", *International Journal of Production Research*, Vol. 45 No. 18-19, pp. 4595-4620.
84. Pullman, M., Maloni, M. and Carter, C. (2009), "Food For Thought: Social Versus Environmental Sustainability Practices And Performance Outcomes", *Journal of Supply Chain Management*, Vol. 45 No. 4, pp. 38-54.
85. Quariguasi Frota Neto, J., Walther, G., Bloemhof, J., van Nunen, J. and Spengler, T. (2009), "A methodology for assessing eco-efficiency in logistics networks", *European Journal of Operational Research*, Vol. 193 No. 3, pp. 670-682.
86. Rao, K. and Young, R.R. (1994), "Global supply chain: factors influencing outsourcing of logistics functions", *International Journal of Physical Distribution & Logistics Management*, Vol. 24 No. 6, pp. 11-19.
87. Rao, P. and Holt, D. (2005), "Do green supply chains lead to competitiveness and economic performance?", *International Journal of Operations & Production Management*, Vol. 25 No. 9, pp. 898-916.

88. Rodrigue, J. P., Slack, B. and Comtois, C. (2001), "*Green logistics*", in The Handbook of Logistics and Supply-Chain Management, Edited by Brewer, A.M., Button, K.J. and Hensher, D.A., Pergamon, Elsevier Science.
89. Roth, A. and Kaberger, T. (2002), "Making transport systems sustainable", *Journal of Cleaner Production*, Vol. 10 No. 4, pp. 361-371.
90. Rutner, S.M. and Langley Jr., C.J. (2000), "Logistics value: definition, process and measurement", *International Journal of Logistics Management*, Vol. 11 No. 2, pp. 73-82.
91. Sarkis, J. (2003), "A strategic decision framework for green supply chain management", *Journal of Cleaner Production*, Vol. 11 No. 4, pp. 397.
92. Sauvage, T. (2003), "The relationship between technology and logistics third-party providers", *International Journal of Physical Distribution & Logistics Management*, Vol. 33 No. 3, pp. 236-253.
93. Schliephake, K., Stevens, G. and Clay, S. (2009), "Making resources work more efficiently – the importance of supply chain partnerships", *Journal of Cleaner Production*, Vol. 17 No. 14, pp. 1257-1263.
94. Schmidheiny, S. and Zorraquin, F.J.L. (1996), "*Financing Change, The Financial Community, Eco-efficiency, and Sustainable Development*", MIT Press, Cambridge, MA.
95. Schmidt, I., Meurer, M., Saling, P., Kicherer, A., Reuter, W. and Gensch, C. (2004), "SEEbalance®: Managing Sustainability of Products and Processes with the Socio-Eco-Efficiency Analysis by BASF", *Greener Management International*, Vol. 45, pp. 79-94.
96. Schmidt, M. and Schwegler, R. (2008), "A recursive ecological indicator system for the supply chain of a company", *Journal of Cleaner Production*, Vol. 16 No. 15, pp. 1658-1664.
97. Selviaridis, K. and Spring, M. (2007), "Third party logistics: a literature review and research agenda", *The International Journal of Logistics Management*, Vol. 18 No. 1, pp. 125-50.
98. Seuring, S. and Müller, M. (2008), "From a literature review to a conceptual framework for sustainable supply chain management", *Journal of Cleaner Production*, Vol. 16 No. 15, pp. 1699-1710.
99. Sheffi, Y. (1990), "Third party logistics: present and future prospect", *Journal of Business Logistics*, Vol. 11 No. 2, pp. 27-39.
100. Shen, H., Wang, L., Xu, Q., Li, Y. and Liu, X. (2009), "Toward a Framework of Innovation Management in Logistics Firms: a Systems Perspective", *System Research and Behavioral Science*, Vol. 26, pp. 297-309.
101. Sheu, J.-B. (2008), "Green supply chain management, Reverse Logistics and nuclear power generation", *Transportation Research Part E*, Vol. 44, pp. 19-46
102. Singh, R.K., Murty, H.R., Gupta, S.K. and Dikshit A.K. (2009), "An overview of sustainability assessment methodologies", *Ecological Indicators*, Vol. 9 No. 2, pp. 189-212.
103. Skjoett-Larsen, T. (2000), "European logistics beyond 2000", *International Journal of Physical Distribution and Logistics Management*, Vol. 30 No. 5, pp. 377-387.

104. Soosay, C.A. and Chapman, R. L. (2006), "An Empirical Examination of Performance Measurement for Managing Continuous Innovation in Logistics", *Knowledge and Process Management*, Vol. 13 No. 3, pp. 192-205.
105. Svensson, G. (2007), "Aspects of sustainable supply chain management (SSCM): conceptual framework and empirical example", *Supply Chain Management: An International Journal*, Vol. 12 No. 4, pp. 262-266.
106. Szymankiewicz, J. (1993), "Going green: The logistics dilemma", *Logistics Information Management*, Vol. 6 No. 3, pp. 36-43.
107. Trowbridge, P. (2001), "A case study of green supply-chain management at advanced micro devices", in *Greener Management International*, Greenleaf Publishing, pp. 121-135.
108. Tsoulfas, G.T. and Pappis, C.P. (2006), "Environmental principles applicable to supply chain design and operation", *Journal of Cleaner Production*, Vol. 14, pp. 1593-1602.
109. Tsoulfas, G.T. and Pappis, C.P. (2008), "A model for supply chain environmental performance analysis and decision making", *Journal of Cleaner Production*, Vol. 16 No.15, pp. 1647-1657.
110. Vachon, S. and Klassen, R. (2008), "Environmental management and manufacturing performance: The role of collaboration in the supply chain", *International Journal of Production Economics*, Vol. 111 No. 2, pp. 299-315.
111. Vachon, S. and 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.
112. Vachon, S. and Mao, Z. (2008), "Linking supply chain strength to sustainable development: a country-level analysis", *Journal of Cleaner Production*, Vol. 16 No. 15, pp. 1552-1560.
113. Van der Vorst, J., Tromp, S. and Van der Zee, D. (2009), "Simulation modeling for food supply chain redesign: integrated decision making on product quality, sustainability and logistics", *International Journal of Production Research*, Vol. 47 No. 23, pp. 6611-6631.
114. Van Hoek, R.I. (1999), "From reversed logistics to green supply chains", *Supply Chain Management: An International Journal*, Vol.4 No.3, pp. 129-134.
115. Veleva, V., Hart, M., Greiner, T. and Crumbley, C. (2003), "Indicators for measuring environmental sustainability: A case study of the pharmaceutical industry", *Benchmarking: An International Journal*, Vol. 10 No. 2, pp. 107-119.
116. Venus, L.Y. (2010), "Green management practices and firm performance: A case of container terminal operations", *Resources, Conservation, and Recycling*, Vol. 55 No. 6, pp. 559-566.
117. Verfaillie, H.A. and Bidwell, R. (2000), "*Measuring eco-efficiency – a guide to reporting company performance*", WBCSD, http://www.wbcsd.org/newscenter/reports/2000/MeasuringEE.pdf
118. Wagner, S.M. (2008), "Innovation management in the German transportation industry", *Journal of Business Logistics*, Vol. 29 No. 2, pp. 215-231.
119. Walker, H., Di Sisto, L. and McBain, D. (2008), "Drivers and barriers to environmental supply chain management practices: Lessons from public and

private sectors", *Journal of Purchasing & Supply Management*, Vol.14, pp. 69-85.

120. Wallenburg, C.M. (2009), "Innovation in logistics outsourcing relationships: Proactive improvement by logistics service providers as a driver of customer loyalty", *Journal of Supply Chain Management*, Vol. 45 No. 2, pp. 75-93.
121. Walton, S.T., Handheld, R.B. and Melnyk, S.A. (1998), "The green supply chain: integrating suppliers into environmental management processes", *International Journal of Purchasing and Materials Management*, Vol. 34 No. 2, pp. 2-11.
122. Wolf, C. and 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.
123. Wong, L.T. and Fryxell, G.E. (2004), "Stakeholder influences on environmental management practices: a study of fleet operations in Hong Kong (SAR), China", *Transportation Journal*, Vol. 43 No. 4, pp. 22-35.
124. Wu, H.J. and Dunn, S.C. (1995), "Environmentally responsible logistics systems", *International Journal of Physical Distribution & Logistics Management*, Vol. 25 No.2, pp. 20-28.
125. Yang, C., Marlow, P.B. and Lu, C. (2009), "Assessing resources, logistics service capabilities, innovation capabilities and the performance of container shipping services in Taiwan", *International Journal of Production Economics*, Vol. 122, pp. 4-20.
126. Zailani, S., Amran, A. and Jumadi, H. (2011), "Green innovation adoption among Logistic Service Providers in Malaysia: an Exploratory Study on the Managers' Perceptions", *International Business Management*, Vol.5 No.3, pp. 104-113.
127. Zhu, Q. and Sarkis, J. (2007), "The moderating effects of institutional pressures on emergent green supply chain practices and performance", *International Journal of Production Research*, Vol. 45 No. 18/19, pp. 4333-4355.
128. Zhu, Q., Sarkis, J. and Kee-hung L. (2008), "Confirmation of a measurement model for green supply chain management practices implementation", *International Journal of Production Economics*, Vol. 111 No. 2, pp. 261-273.

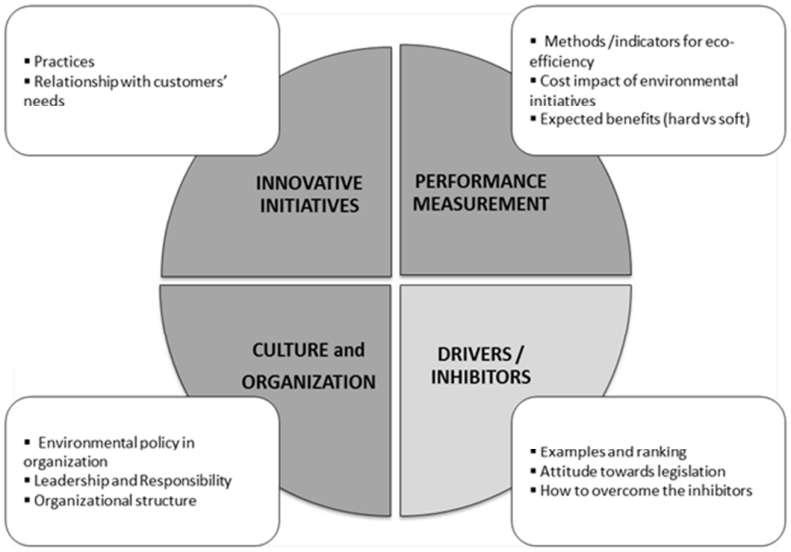

Figure 1 Factors determining LSPs innovation in eco-efficiency

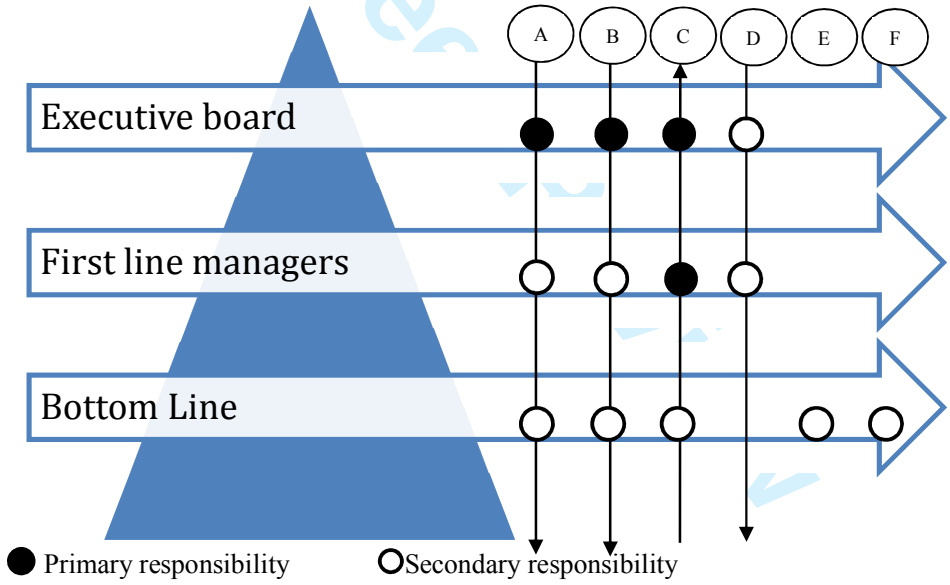

Figure 2 Position of those responsible for environmental issues within the organisation

Table 1 Logistics and Learning capabilities (adapted from Esper et al., 2007)

Capability	Description
Customer focus	Provides product or service differentiation and service enhancement for continuous distinctiveness for customers by targeting a given customer base and meeting or exceeding their expectations by providing unique, value-added activities.
Supply management	Involves: 1) total cost minimization, 2) effective management of time, 3)response to demand fluctuations, 3) postponement, modularization, and standardization.
Integration	Internal – communication aspects associated with interdepartmental activities, External – joint effort to create a different business model.
Measurement	Translation of business objectives into measurement-specific and operational and financial targets.
Information exchange	Acquire, analyse, store and distribute tactical and strategic information both inside and outside the firm.
Learning – cultural	Open-mindedness; shared vision; commitment to learning
Learning – structural	Internal – learning systems, practices, learning rewards, and technology to support learning
Learning – relational	Objectives similarities
Learning – temporal	Ability to implement change rapidly

Table 2 Interviewed companies

Company	Profile	Interviewees	Internal documentations	External documentation
Company A	A third party logistics provider based in the UK, operating since late 50s and privately owned since early 80s. The company positioned itself as a supply chain solution provider, becoming one of the largest groups in the UK among privately owned competitors. The company offers solutions related to transport and warehousing for a number of clients belonging to diverse sectors, building long lasting relationships.	Business Development Manager Director of Company A Environmental Department	Internal presentation to the Board	Environmental Reporting
Company B	Founded late 19th century. Nowadays it has more than 20,000 employees and with 332 facilities, including warehouses and office locations, it achieved in 2009 revenues of more than $4bn. The company offers to its customers a wide range of services, ranging from warehousing and distribution to value added logistics services.	Managing Director Managing Director Assistant Quality Manager	Internal presentation, Internal Environmental reporting (KPI)	Environmental Reporting
Company C	Established in early 20th century. A global leader in the supply of transport and logistics services and the core of a diverse 92-member group employing over 10,000 people worldwide. Its philosophy is to offer customers both Premium and Economy services that suit customers' needs.	Quality and Sustainability Manager	Internal reports	Environmental Reporting
Company D	A member of one of Europe's biggest group. The services it offers include transportation, warehousing and packaging.	Managing Director, Logistics Manager, Marketing Manager	Internal presentation, Description of some recent projects for eco-efficiency	Environmental Reporting
Company E	A global logistics service provider (mainly brokerage), whose mission is to deliver the highest quality and best customised service to their clients, with whom they set a win-win type of relationship.	Logistics Manager	Internal presentation	
Company F	From 2005 it has grown, broadening its offering to transportation, distribution, warehousing and integrated logistics services, establishing partnerships with specialised companies and founding new companies. It performs management activities within logistics businesses for food and non-food items exploiting its expertise in distribution chains.	Logistics Manager,	Internal presentation	

Table 3 Drivers and Inhibitors

DRIVERS	RANKING	A	B	C	D	E	F
Customers	21.2%	5	5	5	5	5	4
Regulations	19.7%	3	5	5	5	5	4
Marketing	16.8%	5	3	5	3	4	3
Internal factors	16.8%	3	5	5	3	3	4
Competitors	14.6%	3	2	3	3	5	4
Attracting staff	10.9%	3	3	1	1	4	3
INHIBITORS	**RANKING**	**A**	**B**	**C**	**D**	**E**	**F**
Industry specific barriers	25.69%	4	5	5	5	4	5
Costs	24.77%	5	5	3	4	5	5
Lack of legitimacy	17.43%	3	4	3	1	4	4
Poor commitment	17.43%	1	5	5	1	5	2
Regulations	14.68%	4	5	1	1	4	1

Table 4 Eco-efficiency initiatives implemented by the interviewed companies

Company	Process innovation
A	Conversion of the fleet from diesel to a combination of diesel and natural gas or bio-methane; rationalisation of the routes; energy and waste reduction in the warehouses.
B	Packaging recycling and installation of photovoltaic panels on the warehouses.
C	The main goals are to minimise or eliminate any emissions to air, land or water, promote educational programmes on environmental concerns for all employees, and develop initiatives towards recycling, recovery or reuse of materials for palletising and packaging. Notwithstanding the commitment of the company towards environmental sustainability, only *ad hoc* activities in order to apply for the ISO 14001 environmental standard have been introduced (e.g. tree planting, environmentally friendly lighting and heating of warehouses, recycling of paper and minimisation of packaging).
D	The re-use of the carton utilised as packaging at the request of a customer; warehouses and facilities built according to the most advanced environmental regulations; a photovoltaic plant has been implemented on the warehouse roof, enabling the use of renewable sources of energy.
E	Re-organising the logistics process.
F	The replacement of diesel engines with batteries for forklift trucks which are more environmentally friendly causing no emissions; differentiation of waste in food, dry food, frozen food and plastic films for pallets; warehouse rooves' coverage with photovoltaic modules.

Table 5 Main findings

MAIN THEME	SPECIFIC ASPECT	A	B	C	D	E	F
Culture and Organisation	Environmental policy	Published strategy	Published strategy	Published strategy	High level of awareness	Low level of awareness	Low level of awareness
	Organisational structure	Top down	Top Down	Bottom up	Top Down	Not formalised	Not formalised
	Leadership and responsibility	Executive Board	Executive Board	Executive Board and First Line managers	No specific role	No specific role	No specific role
Innovation in Eco-efficiency	Practices	Set of coordinated initiatives in transport and beyond transport	Some isolated initiatives	Set of initiatives related to an operative level	Set of coordinated initiatives in transport and beyond transport	Re-organisation of the logistics processes	Some isolated initiatives
	Relationship with customers' needs	Cause	Both approaches	Both approaches	Consequence	Consequence	Cause
Performance measurement	Cost impact of environmental initiatives	Neutral	Negative	Neutral	Negative	Neutral	Neutral
	Methods/indicators for eco-efficiency (Y/N)	N	N	N	N	N	N
	Soft benefits (Y/N)	Y	Y	Y	Y	Y	Y
Drivers/inhibitors	Attitude towards legislation	Proactive	Compliant with the standards	Compliant with the standards	Compliant with the standards	Reactive	Compliant with the standards

Table 6 Defining directions to reach the ideal situation in eco-efficiency

KEY CHALLENGE	CURRENT SITUATION	IDEAL SITUATION	HOW TO GET THERE?
MEASURING ECO-EFFICIENCY	Limited capacity in measuring environmental and economic impact	Set of eco-efficiency measures	Operationalising eco-efficiency measures for LSPs' services
	Limited capacity in assessing soft benefits	Methods to appraise soft benefits (e.g. image, competitive advantage)	Development of multi criteria assessment methods
FOSTERING COLLABORATION	Focus on internal perspective	Supply chain perspective	Horizontal and vertical collaboration (e.g. collaborative teams, sharing assets)
	Poor commitment	Widespread appraisal of environmental initiatives within the company	Champions at senior level
	Individuals driven engagement	Widespread environmental culture	Champions at senior level, changed mindset
MANAGING THE WIDER SUPPLY CHAIN	Fragmented and complex regulations	Common standards and procedures	Industry initiatives in collaboration with governmental institutions
	Insufficient infrastructures	Adequate infrastructures	Industry initiatives in collaboration with governmental institutions
	Lack of guidelines on how to implement environmental initiatives	Mapping the available initiatives/activities and the related benefits	Human resources development and exploitation, small scale trial
	Poor attention to the environmental topic	Environment included in customers' utility function	Industry initiatives