Towards sustainable freight transportation

Evidence from the logistics sector

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Abstract

Transportation is one of the sectors emitting the most greenhouse gases worldwide. To protect the environment, more attention must be paid to energy efficiency in the transport sector. From an environmental point of view, rail transport is more efficient than road transport over long distances. Thus, one way to make logistics greener is to shift from road transportation to intermodal road and rail transportation. The European Commission has included this objective in its agenda for years. However, despite the EU’s efforts, the proportion of rail transport is still rather low in Europe. In order to understand sustainable transport, it is necessary to take a closer look at logistics service providers (LSPs): the companies to which transportation and logistics services are being increasingly outsourced.

This thesis has two aims. First, to explore LSPs’ opinions, experiences and actions regarding environmentally sustainable transport. Second, to investigate how institutional theory and the resource-based view of the firm can explain the external and internal forces that influence the adoption of environmentally friendly business practises. Institutional theory explains how desire for social legitimacy leads firms to conform to norms of institutionalised sustainability. Thus, it can extend the understanding of the external forces that push logistics companies towards environmental sustainability. Although companies may experience various pressures to adopt sustainable business practises, external forces are not necessarily the only reasons to move towards sustainability. Companies may also adopt sustainable business practises when it is economically viable to be green or because they possess special green capabilities. This issue is addressed using the resource-based view.

The research methodology includes quantitative and qualitative research methods. The survey data were collected from Finnish, Russian, Panamanian and Puerto Rican LSPs and Structural Equation Modeling was used to analyze the data. The qualitative interview data were collected from Finnish logistics sector. The empirical results suggest that LSPs experience external pressures to adopt environmental business practises. These pressures come from various sources, such as: customers, regulation, competitors and industrial associations. However, the results indicate that environmental actions lead to better environmental and economic performance.

Keywords Institutional theory, Sustainability, Transportation, Resource-based view, Logistics, Environment, Freight, Intermodal transport, LSPs


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Helsinki, October 26th 2017

Pinja Raitasuo
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1. Introduction

Part I of this dissertation—the overview—is divided into five chapters. Chapter 1 presents the motivation and background for the study by explaining why studying environmental sustainability in the logistics context is both important and topical. It also discusses the objectives and positioning of the study. Chapter 2 presents a literature review. Chapter 3 discusses the research methodology. Chapter 4 summarises the results obtained in the individual researchs. Finally, Chapter 5 discusses conclusions and contributions to theory and practise. Part II of the dissertation contains the four original research papers.

1.1. Motivation and background

When sustainability researchers examine the current state of world, they do not feel comfortable. Modern society is driven primarily by the combustion of non-renewable resources, such as fossil fuels. Once these non-renewable resources are gone, they are gone forever. Furthermore, in addition to quickly running out of non-renewable resources, we are also releasing CO$_2$ emissions into the environment far faster than nature can process. There is an urgent need to find better solutions to these issues. Making transport more environmentally friendly is one such solution.

Transportation is one of the sectors emitting the most greenhouse gases worldwide (EC, 2001, 2012). This is problematic because, in modern society, it is impossible to imagine a life without transportation and well-
functioning transportation systems. Not only do people want to travel, they also want to buy goods that need to be delivered to their local stores or homes. Gross domestic product (GDP) growth and transportation growth tend to go hand-in-hand, largely because freight transportation is derived from demand: that is, the more money people have to spend on buying tangible goods, the more money flows into freight transportation. Both the volume of freight transport and its constant growth have been recognised at the EU level. The European Commission has also sought to decouple transportation growth from economic activity for years. Unfortunately, so far, all measures to limit this growth have been insufficient, and we have not yet witnessed a true shift to greener freight transportation.

Although the current state of the environment is rather worrying, environmental sustainability and environmental business practices have recently become popular topics within the field of operations and supply chain management (OSCM). Most of the published studies on this topic focus on manufacturing companies, perhaps because service sectors are traditionally assumed to have significantly smaller environmental impacts than manufacturing sectors (Rossi et al., 2013). The logistics sector differs somewhat from other service sectors in that its operations have several negative environmental externalities, such as air pollutants, hazardous and solid waste disposal, noise, congestion, accidents and climate change (Murphy et al., 1994; Wolf and Seuring, 2010). Transport operations have a great impact on supply chain sustainability (Roth and Kaberger, 2002), and transportation emissions increase annually (EC, 2009) due to the expansion of road transport. It is clear that greening the delivery chain is a step that all companies need to take (Skjoett-Larsen, 2000).

Since relying on fossil fuels is not sustainable, better solutions are needed. From an environmental point of view, rail transport is more energy efficient than road transport over long distances (Campisi and Gastaldi, 1996). Thus, one way to make logistics greener is to shift from
road transportation to intermodal road and rail transportation (Campisi and Gastaldi, 1996; Eng-Larsson and Kohn, 2012). The European Commission has included this objective in its agenda for years (see EC, 2011). However, despite the EU’s efforts, the proportion of rail transport is still rather low in Europe. In 2012, total goods transport activities in the EU-28 (The European Union (EU) comprises 28 member states) amounted to an estimated 3,768 billion ton kilometres (tkm), of which road transport accounted for 44.9% and rail accounted for only 10.8% (EC, 2014). This raises an interesting question: What is hindering the switch from road to rail, and how can we increase the share of rail transport in the EU?

The motivation for this dissertation comes from the fact that transportation contributes to climate change and creates several negative externalities for the natural environment. To protect the environment, more attention must be paid to energy efficiency in the transport sector. In order to understand sustainable transport, it is necessary to take a closer look at logistics service providers (LSPs): the companies to which transportation and logistics services are being increasingly outsourced (Lieb and Lieb, 2010). Studying LSPs can increase our understanding of the transport sector’s stance towards environmental issues, since LSPs are the most likely actors in their sector to be familiar with the current state of sustainable logistics trends. Furthermore, despite LSPs’ significant role in reducing the environmental burden of the supply chain, little research has examined sustainable transport among LSPs (Colicchia et al., 2013). This thesis aims to fill this gap through four papers examining sustainable transport from the viewpoint of LSPs. The first Paper examines the challenges of intermodal rail transport in Europe. The second Paper investigates the main drivers of intermodal transport (i.e. ways to actually increase the share of rail transport). The data for both Papers (1 and 2) were collected from interviews of Finnish logistics service providers. The third Paper contributes to institutional theory by examining whether technological uncertainty influences the
pressures on LSPs to adopt sustainable business practises and whether these pressures positively influence environmental performance. The fourth Paper takes the resource-based view by examining LSPs’ green capabilities and their influence on various performance measures: namely, innovation, financial and environmental performance. This Paper seeks to determine whether it makes economic sense for a logistics company to develop its green capabilities. Further background on the theories used to explain environmental sustainability in operations management (OM) are provided in the literature review section in Chapter 2.

1.2. Aims of the study

This dissertation focuses on the logistics sector. It has two aims: first, to explore LSPs’ opinions, experiences and actions regarding environmentally sustainable transport, and second, to investigate how institutional theory and the resource-based view of the firm can be used to explain the external and internal forces that influence the adoption of environmentally friendly business practises. The first aim is practise-oriented, whereas the second is theory-driven. Accordingly, this research seeks to offer conclusions significant for both theory and practise within the domain of sustainable transport. The research questions of this dissertation can be formulated as follows:

A) What are the challenges and drivers related to intermodal rail transport?
B) How do the external pressures influence sustainability in logistics industry?
C) Can internal motivation lead to sustainability in logistics industry?

The thesis comprises four papers. Each of the research questions is discussed in one or more of these papers. The next section takes a closer look at the papers and the research process.
1.3. Outline of the study

This dissertation comprises two parts. Part I presents an overview of the dissertation. Part II consists of four original research papers:


Papers 1 and 2 focus on proposition development. Specifically, they investigate the adoption of one specific mode of sustainable transport: intermodal rail transport. Paper 1 presents a literature review of the key challenges to rail-based intermodal transport in Europe and builds propositions for the topic based on empirical data from Finnish LSPs. Paper 2 continues the theme of intermodality, but takes a somewhat opposite approach by exploring the drivers of intermodal rail transport in Europe. Papers 3 and 4 focus more on the theoretical aspect of the field by testing theories in order to provide generalizable results. These papers
study the performance effects of sustainability. Specifically, Paper 3 adopts the lens of institutional theory to investigate the pressures LSPs experience to adopt environmental business practices and to explore whether technological uncertainty produces greater rates of environmental performance. Paper 4 continues with the performance theme, drawing on the resource-based view of the firm to investigate the relationships between logistics companies’ green capabilities and performance outcomes. Thus, Paper 4 focuses on internal motivations for sustainability (capabilities and performance), whereas Papers 1, 2 and 3 focus mainly on the external forces influencing companies. Figure 1 demonstrates the impacts of various external forces and internal dynamics on the adoption of sustainable business practices.
Institutional theory explains how desire for social legitimacy leads firms to conform to norms of institutionalised sustainability. Thus, it can extend our understanding of the external forces that push logistics companies towards environmental sustainability. However, it does not explain the internal factors that influence firms’ decisions to adopt sustainable practices, since it focuses solely on the ‘outside in’ determinants. This issue can be addressed using the resource-based view. Accordingly, this dissertation used both institutional theory and the resource-based view. At an organisational level, different sustainability initiatives can be best understood by combining the perspectives of...
different theoretical frameworks (Sandhu et al., 2010). Together, these theories foster a greater understanding of the external and internal motivations to adopt sustainable business practises. These theories also work in effective symbiosis and provide a holistic explanation of the external (institutional factors) and the internal (resource-based view) dynamics affecting sustainable transport. The research process often iterates between theory and empirical study, and the initial theoretical findings can be applied to different empirical studies before final conclusions are drawn (Kovács and Spens, 2005; Spens and Kovács, 2006). Figure 2 demonstrates the research process of this dissertation work.

**Figure 2. Research process**

As presented in figure 2, this dissertation project started with the notion that, though it is general knowledge that the current freight transport system is not sustainable, we have not witnessed a change towards more
environmentally friendly freight transport. Environmental regulations in the EU can be considered stringent compared to those of many other geographic areas, but the EU’s freight transport remains dominated by road transport, despite the European Commission’s goal of moving from truck-only transport to intermodal rail transport. Thus, the first stage of the dissertation project applied a qualitative case study approach to explore the challenges and drivers of intermodal rail transport. The findings of Papers 1 and 2 suggest that external forces play a major role in facilitating the movement towards sustainable intermodal rail transport. These findings indicate that institutional theory can provide some useful explanations for this phenomenon. Thus, existing phenomena related to intermodal transport were approached from a new perspective that led to new insights (Kovács and Spens, 2005). Specifically, in the second stage of the dissertation work, the aim was to determine whether institutional theory could explain the adoption of environmental business practices in the logistics industry in a wider context. To draw some generalisable conclusions, this stage of the dissertation project adopted a survey method. Finally, in the third stage of the project, a resource-based view was adopted to investigate the internal green capabilities necessary for LSPs to achieve better performance. Table 1 (in the next chapter) presents the focus and research questions of each of the papers, as well as the methods used.

1.4. Positioning of the study

The following positions the thesis by explaining the terminology and discussing previous LSP and sustainability research. The key terms of this thesis are logistics service provider (LSP), intermodal transport and sustainability.

*Logistics Service Provider (LSP)* refers to a provider of logistics services that performs all or part of a client company’s logistics function (Delfmann et al., 2002). This includes at least the management and operation of the transportation function, as well as other services, such
as the management of materials services (e.g. inventory management), information-related services (e.g. tracking and tracing) and value-added services (e.g. secondary assembly) (Berglund et al., 1999).

Green transportation refers to environmentally responsible transportation. Transportation is an important aspect at the operational level of green logistics. There are many ways to mitigate the negative environmental effects of transportation, such as the efficient use of transport resources, the selection of optimal transport modes and fuels, the scheduling of deliveries (Ubeda et al., 2011) and the consolidation of freight flows. One way to make transportation greener is to shift from road transportation to intermodal road and rail transportation (Eng-Larsson and Kohn, 2012).

Intermodal transport refers to ‘The movement of goods in one and the same load unit or vehicle by successive modes of transport without handling of the goods themselves when changing modes’ (European Conference of Ministers of Transport, 1997). This definition is shared by several organisations, such as the Organisation for Economic Co-operation and Development (OECD), which uses it in its Glossary of Statistics (2013).

Environmental business practises are practises that firms adopt in order to be more environmentally responsible. Such practises can include several components, such as pollution prevention (Fowler and Hope, 2007), the design of goods and services that reduce energy consumption, collaborations with suppliers and customers to achieve environmental objectives (Zhu and Sarkis, 2004; Vachon, 2007) and the implementation of ISO 14000 environmental auditing (Sarkis, 1998). However, to be environmentally responsible, a company must have certain green capabilities that enable the implementation of environmental initiatives.

Technology uncertainty refers to the extent of technological changes evident within the industry (Chen and Paulraj, 2004). This form of
uncertainty can be problematic for companies, since it makes predicting new products and processes in the industry difficult (Patel, 2001). Companies operating under uncertainty may be more prone to mimic other companies (DiMaggio and Powell 1983).

*Green capabilities* can be generally understood to be the organizational skills that enable firms to improve their performance on environmental issues (Lee and Klassen, 2008). Green capabilities are capabilities that companies must possess in order to adopt environmental business practises and achieve competitive advantages. Thus, green capabilities and environmental business practises work in symbiosis. Green capabilities

All of the four original papers focus on *logistics service providers*. Papers 1 and 2 discuss *intermodal transport* using a qualitative research method. Paper 3 investigates the *external pressures to adopt environmental business practises* and the role of *technology uncertainty*. Paper 4 examines whether *green capabilities* can lead to enhanced performance outcomes. The papers’ different epistemological stances are discussed later in the method Chapter.
2. Literature review

The Chapter 2 presents a literature review. Section 2.1 discusses previous applications of institutional theory in the field of OM. Section 2.2 summarises previous RBV applications in OM. Finally, Section 2.3 discusses the several factors that affects the attractiveness of intermodal rail transport.

2.1. Are external forces driving companies towards sustainability?

The purpose of a firm in a modern society is to create wealth for its shareholders. It would be rather optimistic to think that companies would move towards sustainability merely out of benevolence. Why, then, do some companies adopt environmental business practises that go beyond regulatory compliance? Previous research has found that the answer lies, at least partially, in the external pressures companies experience. Companies do not operate in a vacuum; therefore, they experience pressures from various sources to develop sustainability initiatives (Glover et al., 2014). Sustainability initiatives can include several components, such as pollution prevention (Fowler and Hope, 2007), the design of goods and services for reduced energy consumption, collaborations with suppliers and customers to achieve environmental objectives (Zhu and Sarkis, 2004; Vachon, 2007) and the implementation of environmental auditing (Sarkis, 1998).

Ketokivi and Schroeder (2004) prompted OM scholars to invoke theories not traditionally used in OM in order to better understand and explain empirical phenomena. One such theory—institutional theory—is
increasingly used to explain the adoption of environmentally friendly practises in supply chain management (see e.g. Tate et al., 2010; Sarkis et al., 2011; Tate et al., 2011). Table 2 summarises the prior research that has applied institutional theory in the field of sustainable OM.

**Table 1. Institutional theory applications in OM**

<table>
<thead>
<tr>
<th>Authors</th>
<th>Objectives</th>
<th>Method</th>
<th>Findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Zhu and Sarkis</td>
<td>Theory testing</td>
<td>Qualitative research method</td>
<td>Chinese manufacturers have experienced increasing environmental pressures to implement GSCM practises. These have improved environmental performance.</td>
</tr>
<tr>
<td>(2007)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Heras-Saizarbitori a et al. (2011)</td>
<td>Theory testing</td>
<td>Survey</td>
<td>Internal drivers to implement and certify ISO 14001 standards have a greater influence than external drivers, irrespective of the size of the company or the sector of activity.</td>
</tr>
<tr>
<td>Tate et al. (2011)</td>
<td>Theory building</td>
<td>Conceptual paper</td>
<td>Suppliers are more likely to adopt environmental practises if coercive, normative and/or mimetic institutional forces are in play.</td>
</tr>
<tr>
<td>Wu et al. (2012)</td>
<td>Theory testing</td>
<td>Survey</td>
<td>This study investigated the relationships among GSCM drivers (i.e. organisational support, social capital and government involvement) and GSCM practises (i.e. green purchasing, cooperation with customers, eco-design and investment recovery). The results show that GSCM practises are positively affected by GSCM drivers.</td>
</tr>
<tr>
<td>Hsu et al. (2013)</td>
<td>Theory testing</td>
<td>Survey</td>
<td>There are four crucial drivers of green supply chain adoption that collectively affect a firm’s green purchasing, design-for-environment and reverse logistics initiatives. There are several relationships between green supply chain drivers and initiatives among Malaysian manufacturers.</td>
</tr>
<tr>
<td>Pagell et al. (2013)</td>
<td>Theory testing</td>
<td>Survey</td>
<td>The results indicate that managers respond to institutions (e.g. nation and country) when making investment decisions and that, in some countries, there is a general level of underinvestment in the environment, which is likely harming both organisational and environmental outcomes.</td>
</tr>
</tbody>
</table>
### Institutional Theory Applications in OM

<table>
<thead>
<tr>
<th>Author(s)</th>
<th>Research Approach</th>
<th>Methodology</th>
<th>Summary</th>
</tr>
</thead>
<tbody>
<tr>
<td>Glover et al. (2014)</td>
<td>Theory building</td>
<td>Qualitative method</td>
<td>This study applied institutional theory to explore the role of supermarkets in the development of legitimate sustainable practices across dairy supply chains. The findings revealed that supermarkets are the dominant players in the supply chain, and they exert pressure on other smaller organisations across the supply chain.</td>
</tr>
<tr>
<td>Hoejmose et al. (2014)</td>
<td>Theory testing</td>
<td>Survey</td>
<td>This study investigated buyers’ decisions to implement GSCM through either coercive or cooperative approaches. The findings indicate that institutional pressures significantly determine cooperative approaches to GSCM, while coercive practices are driven by downstream customer demands.</td>
</tr>
<tr>
<td>Tate et al. (2014)</td>
<td>Theory testing</td>
<td>Survey</td>
<td>This study used transaction costs and institutional theory to help understand why more conservative or reactive suppliers may or may not be likely to adopt environmental practices. The findings indicate that perceived transaction costs affect supplier cooperation in the adoption of environmental practices. The data did not support the hypotheses concerning institutional pressures.</td>
</tr>
</tbody>
</table>

The institutional perspective focuses on external forces that influence companies to adopt similar practices. It is based on the observation that firms often demonstrate remarkable similarities that cannot be explained solely by industry type. These similarities are not always the result of rational economic decisions (DiMaggio and Powell 1983, 1991; Scott 1995). Instead, companies experience several external pressures, and their decision-making is strongly influenced by external norms, values and traditions (Meyer and Rowan 1977). Together, these norms determine what constitutes appropriate behaviour for an organisation (Oliver 1997). As can be seen from table 1, there are several applications of institutional theory in the field of OM. Furthermore, many papers that have not adopted institutional theory have examined the external pressures leading to the adoption of environmental business practices. Based on institutional theory, there are three kinds of pressures that
influence companies: coercive, normative and mimetic (DiMaggio and Powell, 1983). Coercive pressures include both formal and informal pressures exerted on organisations by other organisations (DiMaggio and Powell, 1983). Mimetic pressures derive from uncertainty, which encourages imitation (Zsidisin et al., 2005). Finally, normative pressures come from universities, associations and other similar actors in networks (DiMaggio and Powell, 1983).

Customers are typically seen as the main source of coercive external pressure. In the context of a supply chain, several authors have suggested that buyers can pressure their suppliers to adopt sustainable business practices (Ytterhus et al., 1999; Hall, 2000; Hoejmose et al., 2014), creating a ripple of environmental concern that then spreads upstream through the supply chain (Gonzalez et al., 2008). Coercive governmental pressure to adopt environmental business practices has also been a major topic of interest in the literature (see e.g. Winter and May, 2001; Williamson et al., 2006; Pedersen, 2009; Lee and Kim, 2009; Wu et al., 2012; Hoejmose et al., 2014). There is evidence that regulatory factors are important sources of pressure influencing the adoption of environmental business practices (Winter and May, 2001; Zhu et al., 2005; Wu et al., 2012). Mandatory environmental regulations can be combined with monitoring and penalties for non-compliance to encourage firms to improve their environmental practices. Furthermore, threats of new environmental regulations or explicit government support of sustainable business practices can incentivise firms to participate in voluntary sustainability initiatives (Winter and May, 2001). Regulations, together with firms’ broader institutional environments, can encourage purchasing companies to use cooperative approaches to green supply chain management that then promote sustainability along the supply chain (Hoejmose et al., 2014). Normative pressures derive from values and practices promoted by professional networks, industry associations, and academic institutions (Rivera, 2004). Research on the role of normative pressures in the adoption of environmental practices is scarce,
but a few studies addressing the topic do exist (see e.g. Zhu and Sarkis, 2004). For example, Tate et al. (2011) drew on institutional theory in their conceptual study proposing that suppliers are more likely to adopt environmental practices if this kind of behaviour is encouraged by their own or their customers’ industry coalitions.

Mimetic isomorphism in organisation theory refers to the tendency for companies to resemble one another. Institutional theorists propose that mimetic isomorphism occurs when firms copy other firms in the same industry in order to avoid taking risky actions or when the outcomes of certain actions are ambiguous (Martinez and Dacin, 1999; Bansal, 2005). However, the role of uncertainty has played only a tangential role in the application of institutional theory to sustainable supply chain management (SSCM) literature, with Miemczyk (2008) conducting one of the few studies on this topic. Miemczyk (2008) found that when manufacturers mimic one another’s actions due to uncertainty, the results can be suboptimal. Uncertainty and institutional theory, thus, provide an interesting research avenue. Paper 4 answers the call to assess how uncertainty influences firms’ behaviours (see Kauppi, 2013).

2.2. Can internal dynamics explain the adoption of environmental business practises?

Although companies may experience various pressures to adopt sustainable business practises, external forces are not necessarily the only reasons to move towards sustainability. Companies may also adopt sustainable business practises when it is economically viable to be green. This is why the resource-based view (RBV), which explains why some firms perform better than others, is frequently used in sustainability research. The RBV suggests that not all firms have similar competencies. Instead, it suggests that firms differ in their available resources and capabilities and that the key to gaining competitive advantage comes from accumulating resources and capabilities that are rare, valuable, non-substitutable and difficult to imitate (Barney, 1991). An organisation
obtains competitive advantage through a particular and unique set of capabilities and resources (Wernerfelt, 1984; Barney, 1991; Rumelt, 1991). In recent years, the RBV has been used to evaluate firms’ capabilities and performance in the area of environmental business practises. Some initial evidence suggests that specific capabilities are needed to implement green supply initiatives (Bowen et al., 2001) and that a proactive environmental approach can foster firms’ capabilities in environmental management (Bowen et al., 2001). Table 2 presents prior applications of the RBV in the field of sustainable operations management.

**Table 2. Previous RBV applications in sustainable OM**

<table>
<thead>
<tr>
<th>Author(s)</th>
<th>Objectives</th>
<th>Method</th>
<th>Findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Russo and Fouts (1997)</td>
<td>Theory building</td>
<td>Qualitative</td>
<td>The results suggest that ‘it pays to be green’ and that this relationship strengthens as the industry grows.</td>
</tr>
<tr>
<td>Shang et al., (2010).</td>
<td>Theory testing</td>
<td>Quantitative</td>
<td>This study investigated differences in firm performance and GSCM dimensions among four groups. Based on the results, the green marketing-oriented group performed best.</td>
</tr>
<tr>
<td>Gavronski et al. (2011)</td>
<td>Theory building</td>
<td>Qualitative</td>
<td>Plant resources are positively related to green manufacturing capabilities, which, in turn, are positively related to GSM capabilities.</td>
</tr>
<tr>
<td>Gimenez and Sierra (2013)</td>
<td>Theory testing</td>
<td>Quantitative</td>
<td>The results suggest that supplier assessment and collaboration have positive and synergistic effects on environmental performance.</td>
</tr>
<tr>
<td>Golicic and Smith (2013)</td>
<td>Theory testing</td>
<td>Quantitative</td>
<td>Results show that the links between environmental supply chain practises and market-based, operational-based and accounting-based forms of firm performance are positive and significant.</td>
</tr>
<tr>
<td>Longoni (2016)</td>
<td>Theory testing</td>
<td>Quantitative</td>
<td>Green operations practises impact customer benefits, but not HR benefits. Social sustainable operations practises have a direct impact on HR benefits.</td>
</tr>
</tbody>
</table>
Yu et al. (2017)  | Theory testing  | Quantitative  | The results suggest that both green purchasing personnel and green supplier selection have a positive effect on green supplier collaboration. Furthermore, building green collaboration with suppliers is positively related to both environmental and operational performance.

Machado et al. (2017)  | Theory building  | Qualitative  | Sustainable operations management involves a cumulative and evolving set of practices and experiences that enable a company to develop green capabilities at different maturity levels.

Many of the previous RBV applications in OM have studied the impacts of ‘going green’ on company performance. The existing literature suggests that sustainability is not a wasted investment, although companies’ results have been mixed. In their meta-analysis, Golicic and Smith (2013) reviewed 20 years of research on environmental supply chain management to determine the overall effect of green practices for a firm. Their results support the view that SSCM can increase firm performance. Although implementing green practices involves certain costs (e.g. increased investment, training costs, new equipment costs) (Zhu and Sarkis, 2004), there is evidence supporting a positive link between environmental performance and financial performance, suggesting that it actually ‘pays to be green’ (Russo and Fouts, 1997).

Sustainability can also be a source of competitive advantage for a company (Porter and Kramer, 2007; Nidumolu et al., 2009). Previous RBV applications from Russo and Fouts (1997), Shang et al., (2010) and Longoni et al., (2016) have investigated the link between green practices and company performance. Shang et al. (2010) investigated GSCM capability dimensions and firm performance in the electronic industry in Taiwan and found that green marketing-oriented companies had better business performance than other green-oriented companies. This indicates that companies should invest more in green marketing capabilities, since such marketing seems to improve financial performance. Companies within green marketing groups were found to
be especially good at collaboration. In their study, Gimenez and Sierra (2013) found that collaboration with suppliers improves companies’ environmental performance. Thus, it seems that collaboration with suppliers benefits companies both environmentally and financially. Longoni et al. (2016) took a different stance on competitive advantage, operationalising competitive advantage as the product of internal and external intangible benefits, such as human resources (HR) and customer benefits, rather than focusing on financial performance. Furthermore, they did not focus only on green operations, choosing instead to clarify the different roles of green and social operation practises in the achievement of competitive benefits.

Other studies have investigated the link between green practises and company performance without drawing on RBV, such as Hart and Ahuja (1996), Carter et al. (2000) and Zhu and Sarkis (2004). Hart and Ahuja (1996) studied the link between reducing emissions and financial performance. They found that efforts to prevent pollution and reduce emissions drop to the ‘bottom line’ within one to two years of initiation and that those firms with the highest starting emission levels gain the most. Carter et al. (2000) studied green purchasing practises and found a positive link between environmental practises and firm performance in terms of net income and return on investment. Zhu and Sarkis (2004) found evidence that green supply chain management practises lead to better financial and environmental performance (e.g., reduced air emissions, waste water and hazardous material) because adopting green practises often decreases the costs of materials, energy consumption and environmental accidents.

Centobelli et al. (2017) noted in their review article that there is a clear research gap concerning the impact of green initiatives on LSPs’ performance. Indeed, most extant studies have focused on the manufacturing sector (see e.g. Hart and Ahuja, 1996; Zhu and Sarkis, 2004; Shang et al., 2010; Machado et al., 2017; Yu et al., 2017). Furthermore, nearly all of the previous RBV applications in OM are single
country-based, with research conducted in such countries as Taiwan (Shang et al. 2010), China (Zhu and Sarkis, 2004), Canada (Gavroski et al., 2011) and Italy (Longoni et al., 2016). Studies including multiple countries are rare, with one exception: Gimenez and Sierra’s (2013) work, which collected data from Spain and Germany. In addition, a few studies focus on the development of green capabilities (Gavronski et al., 2011; Machado et al., 2017; Yu et al., 2017), but also all come from the manufacturing sector. Gavronski et al. (2011) found that intangible resources, such as external knowledge exchange, are related to the development of green manufacturing capabilities, while tangible resources, such as environmental investments, are not significantly related. This is in line with the RBV, since Barney (1991) argued that competitive advantage comes from resources and capabilities that are rare, valuable, non-substitutable and difficult to imitate. Tangible resources do not easily fall into this category. Machado et al. (2017) found that sustainable operations management is an evolving and cumulative process of practises and experiences that enable a company to develop green capabilities at different maturity levels. Yu et al. (2017) found that employing green purchasing personnel is positively related to green supplier collaboration, which is, in turn, positively related to both environmental and operational performance.

To conclude, existing research suggests that investing in sustainability can benefit companies both financially and environmentally. However, there is a lack of studies investigating the link between green capabilities and company performance in the logistics sector. Furthermore, most of the RBV applications in sustainable OM are single country-based, and studies including multiple countries are rare. Furthermore, sustainability can have benefits other than financial benefits. It can be assumed that those companies that adopt environmental business practises are more forward-looking than those that do not. These forward-looking companies can benefit from enhanced innovative performance. Furthermore, sustainability can be a key driver for innovation (Nidumolu
et al., 2009). This is an area that has not yet been sufficiently investigated; however, Paper 3 tests a theoretical model to investigate whether there is a link between a company’s green capabilities and its innovative performance. Finally, eco-innovation has become a popular research area (see e.g. Lin et al., 2013; Cheng et al., 2014; Przychodzen et al., 2015), but there is a lack of research concerning the possible link between green capabilities and innovative performance.

2.3. Barriers and enablers to intermodal transport

Despite the EU’s efforts to promote sustainable transport options, rail transport services continue to be seen as an unattractive alternative to road transport. Previous literature has identified possible drivers that could increase the use of rail-based intermodal transport, as well as factors that are hindering the shift towards intermodal transport. In this section, a brief summary of drivers and challenges of increasing the share of intermodal rail transport is provided.

Well-functioning infrastructures and commonly defined standards are both external drivers that can affect the feasibility of intermodal transportation. The demand for transport services may be stimulated by rail infrastructure expansion. Gorman (2008) evaluated the allocation of public funds to support the burgeoning freight transportation needs in the US and found that approximately one-quarter of truck freight could be handled at a 25% lower cost if the rail infrastructure necessary to support it existed. Furthermore, privatizations of railways has been suggested as a driver for increasing the share of intermodal transport. Markets for rail freight services were fully opened to competition in the EU in January 2007, but the shift is occurring slowly. The EC’s fourth railway package is a new effort to reform the EU’s rail sector, which is still dominated by state-owned railway businesses that control both the tracks and the trains. Sweden and the UK have been the European frontrunners in railway sector deregulation and re-organisation. In a
longitudinal econometric study, Jensen and Stelling (2007) found that the competition has lowered costs in Sweden.

Furthermore, the academic literature suggests several challenges that affect the feasibility and competitiveness of intermodal transport. They include factors such as costs (van Klink and van den Berg, 1998; Sommar and Woxenius, 2007), distance (van Klink and van den Berg 1998; Flodén, 2007), volatility of demand (Eng-Larsson and Kohn, 2012), flow volumes (Trip and Bontekoning, 2002), geographical factors (Henstra and Woxenius, 1999; Stank and Goldsby, 2000), product characteristics (Henstra and Woxenius, 1999), rate of loss and damage (Harper and Evers, 1993), transit times, Just-in-Time (JIT) styles of operation (Woodburn, 2003) and attitudes towards intermodal value proposition (Van den Berg and De Langen, 2015). Cost of service is an economic factor caused by an extra transshipment of a load from one mode to another, which adds to the costs of intermodal transport (van Klink and van den Berg, 1998; Sommar and Woxenius, 2007). Furthermore, the need to invest in dedicated infrastructure can be an additional economic barrier to intermodal transport (van Klink and van den Berg, 1998). The geography of the goods flow can affect the suitability of an intermodal solution. The common view is that intermodal solutions are more feasible if facilities are far apart, but close to railway infrastructure (Henstra and Woxenius, 1999; Stank and Goldsby, 2000). Typically, intermodal transport is not considered to be competitive on short distances, since no advantages arise until the savings in the long-haul system outweigh the extra costs in the terminal and distribution/collection systems (Flodén, 2007). Thus, a distance of about 500 km between sender and receiver has been suggested to be the minimum distance for normal intermodal transport between road and rail (van Klink and van den Berg 1998; Flodén, 2007).

Increasing oil prices can increase the attractiveness of intermodal transportation, largely because they negatively affect road transport. Maggio and Cacciola (2009) estimated that global oil production will
reach its maximum between 2009 and 2021. They pointed out that it is necessary to take preventative actions to avoid dangerous economic and political crises. Though the price of oil is currently low, this situation is likely to change in the future, which can increase the demand for rail transport. Furthermore, the environmental demands of transport buyers and final customers can create external pressures that can increase the share of intermodal transport. Hibbitt and Kamp-Roelands’ (2002) found that nearly all of the large European companies have implemented a corporate environmental policy.

One of the disadvantages of rail-based intermodal transport may be a long door-to-door transit time, which is affected by the difficulty of making connections between modes in a reasonable time, infrequent train scheduling, unpredictability in arrival times and the need to assemble and disassemble trains adversely (Harper and Evers, 1993). In addition, the flexibility and reliability of transport modes also have implications for the choice of transport. Some studies present trains not being as flexible as trucks. For example, Woodburn (2003) showed that companies primarily used road haulage and had become used to the flexibility it provided. Furthermore, the reliability of intermodal transport may suffer because each link may contain new risks of delay and damage (Van Schijndel and Dinwoodie, 2000). Wiegmans (2010) noted that current policy should focus on increasing the reliability of rail transport to make it more attractive. A lack of reliability may negatively affect the cost-to-quality ratio of intermodal transport (Trip and Bontekoning, 2002). Finally, loss and damage characteristics also have implications for the choice of transport mode, intermodal rail-truck services being claimed to have a poor damage record (Harper and Evers, 1993).

In summary, literature has identified several factors that affects the attractiveness of intermodal rail transport. These studies have shed light on the various different challenges and drivers of intermodal transport. Still, the debate has not developed a clear solution to the bigger picture:
how different factors work together to influence the actual usage of intermodal rail transport. Therefore, the Paper 1 and 2 of this dissertation provides a more holistic analysis of intermodal rail transport that considers all variables and their relationships.
This dissertation comprises four empirical papers, of which two are based on case studies (papers 1 and 2) and two are based on a survey approach (Papers 3 and 4). This section first discusses the paradigms and research approaches. Next, the research methods of each of the papers are discussed in more detail.

3.1. Paradigm

A paradigm is a researcher’s very general conception of the nature of scientific endeavour within which a given examination is undertaken (Mangan et al., 2004). It is built from three elements: ontology, epistemology, and methodology. Ontology refers to the assumptions a particular research approach makes about the nature of reality, including whether there is an objective reality or not; epistemology deals with how the researcher perceives the world; and methodology defines how knowledge about the world can be generated through the gathering of data (Frankel et al., 2005). Research problems cannot be solved using only one approach, since different types of research problems require different methods (Frankel et al., 2005). This dissertation adopts two different paradigm-based approaches.

Researchers often use multiple paradigms to bring alternative perspectives to a phenomenon (Gioia and Pitre, 1990), since the use of a single research paradigm can create too narrow a view of organisational reality (Burrell and Morgan, 1979). Research paradigms can be grouped into several categories. The functionalist paradigm is characterised by an
objectivist view of the world (Gioia and Pitre, 1990). Thus, it is similar to positivism, which has a strong logistics tradition (Spens and Kova´cs, 2005). The goal of positivism is to explain and predict reality by discovering causal relationships. Positivistic researchers consider themselves to be separate from the research setting and believe their findings to be time-free and context-independent (Mentzer and Kahn, 1995). By contrast, interpretivism aims to understand a phenomenon, but not to explain or predict. Interpretive researchers refute the claim that there are truly objective ways of conducting science (Hudson and Ozanne, 1988), since they consider research results to be subjective.

All of the four original papers in this dissertation focus on sustainability in the logistics sector; however, they take different epistemological approaches. Specifically, Papers 1 and 2 discuss intermodal transport using a qualitative research method. Papers 3 and 4 adopt a quantitative research method. Paper 3 investigates the external pressures on firms to adopt environmental business practises and explores the role of technological uncertainty. Paper 4 examines whether green capabilities can enhance performance outcomes. Table 1 presents the different epistemological stances of each of the papers.
Table 3: Research questions.

<table>
<thead>
<tr>
<th>Paper</th>
<th>Paradigmatic stance</th>
<th>Focus</th>
<th>Method</th>
<th>Research questions</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Challenges in the Use of Rail-based Intermodal Transport in Europe: case Finland</td>
<td>Interpretivist</td>
<td>Theory building</td>
<td>Qualitative comparative analysis (QCA) method.</td>
<td>What are the challenges of intermodal rail transport in Europe?</td>
</tr>
<tr>
<td>2. Drivers of intermodal rail transport in Europe</td>
<td>Interpretivist</td>
<td>Theory building</td>
<td>Qualitative research method.</td>
<td>How could the share of intermodal rail transport be increased in Europe?</td>
</tr>
<tr>
<td>3. Pressures towards environmental business practises—Evidence from the logistics industry</td>
<td>Functionalist</td>
<td>Theory testing</td>
<td>Survey method. Analysis done by structural equation modelling (SEM).</td>
<td>Does technological uncertainty lead to isomorphism, as predicted by institutional theory? Do external pressures toward sustainable business practises lead to increased environmental performance?</td>
</tr>
<tr>
<td>4. Green capabilities and performance outcomes in the logistics sector</td>
<td>Functionalist</td>
<td>Theory testing</td>
<td>Survey method. Analysis done by SEM.</td>
<td>Do green capabilities lead to greater environmental, innovative and financial performance?</td>
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</table>

Paper 1 can be positioned between the interpretivist and functionalist paradigms. A similar positioning was used by Hallavo (2014), who adopted the qualitative comparative analysis (QCA) method in his work. The QCA methodology is situated between positivism and social constructivism (Ragin 1987; Fiss, 2007). Although the QCA differs from the traditional distinction between qualitative and quantitative methods, Wagemann (2016) noted that the ‘Q’ in QCA stands for ‘qualitative’. Thus, Paper 1 follows a qualitative approach (interpretivism) to understand the phenomenon of intermodal transport, although the method used (QCA) allows investigation of causal laws (functionalism). Section 3.3 discusses QCA in more detail.

Papers 3 and 4 follow the functionalist/positivistic approach. Both papers are based on a large survey, the aim of which was to draw generalisable results. Research grounded in the functionalist approach takes a rationalistic view of phenomena under investigation (Burrell and Morgan, 1979).

3.2. Qualitative approach to exploring intermodal transport

Qualitative research is often needed in the early exploration and concept development phases of research and many doctoral theses begin with one or more case studies (Voss et al., 2002). The first two papers of this dissertation explore the interesting phenomenon of intermodal transport in Europe. They both use explanatory types of questions (i.e. ‘why’ and ‘how’), whose answers require the contexts and experiences of actors (Bonoma, 1985; Benbasat et al., 1987). A case study research method was deemed applicable for these papers, as the aim is to investigate a phenomenon that has existed for several years without a full understanding of all of the various challenges and drivers. The insufficient exploration of the causes of this phenomenon (Lammgård, 2017) had produced a call for further studies investigating the challenges and enabling factors fostering the growth of intermodal transport (Colicchia et al., 2017). Therefore, a case study research method was chosen, since case studies are particularly suitable for developing new theory (Voss et al., 2002). A theory-building study seeks not to test a hypothesis, but, rather, to develop some initial assumptions, frameworks and perceived problems (Flynn et al., 1990).

**Paper 1** aimed to identify the main challenges facing intermodal transport in Europe and to analyse the causal relationships between these challenges and the actual usage of intermodal transport. Thus, a
A combination of qualitative and quantitative research strategies was considered to be the most appropriate. Combining a case study methodology and a qualitative comparative analysis (QCA) method in Paper 1 offered a holistic approach to the complex phenomenon under investigation. These two methodologies work together in effective symbiosis to support a level of understanding that could not be achieved by either methodology on its own (Barnham, 2012). The unit of analysis in this study is the LSP, and the interviewed individuals (i.e. CEOs and logistics managers) serve as representatives of their respective organisations. The managers’ experiences play an important role in increasing the practical relevance of the findings (Fisher, 2007). The empirical data in this study were collected from 14 LSPs operating in Finland. LSPs are frontline operators in developing sustainable intermodal transport services and are also most familiar with the challenges of intermodal transport. The sample selection was made for theoretical purposes, as suggested by Eisenhardt (1989), and it included various operators in the intermodal transport chain, such as LSPs, road carriers and sea carriers of different sizes.

The QCA method was developed by Ragin (1987) and is based on set theory and Boolean algebra. QCA is used to analyse small sample sizes to provide supplementary information regarding causal relationships. It operates between qualitative and quantitative methods and is meant not to test theories, but to support the formulation and development of concepts and theories. QCA can be used to simplify complex causal relationships, such as the decision to use intermodal transport, and offers a systematic way to analyse the numerous relevant factors in these relationships. QCA is rooted in set theory. Working with sets allows researchers to analyse the conditions that are necessary and sufficient for an outcome to occur (Wagemann, 2016). QCA has previously been widely used in sociology and political science; however, it has also recently been introduced to management research (Hicks, 1994; Goulding, 2005; Glaesser et al., 2009; Fiss, 2011). QCA complements case study research,
since the proper use of QCA requires a high degree of familiarity with the case(s) under investigation. Like quantitative methods, QCA is able to reveal important linkages between different cases. For all of these reasons, QCA is applied in this paper to investigate intermodal freight transport. The application of this method yields interesting insights about the causal relationships between perceptions and actual usage of intermodal transport.

**Paper 2** sought to examine the drivers that could increase the use of intermodal transport in the EU from the perspective of Finland. The objective of the literature review and the multiple case study was to collect first-stage insights and reflections concerning the key drivers of rail-based intermodal transport. Even theory-building research depends on *a priori* theory or constructs (Glaser and Strauss, 1967). Thus, in order to identify these drivers, a combination of a literature review and a qualitative interview research strategy with both open and scaled questions was used (Voss et al., 2002; Frankel et al., 2005). The goal was to gain insights into a broad set of drivers, including some new drivers not currently addressed in the intermodal transport literature. A framework was developed based on the findings of the literature review and the results of multiple case studies.

### 3.3. Quantitative approach

Flynn et al. (1990) suggested that the initial step in conducting empirical research is to articulate the theoretical foundation for the study and to determine whether the problem under investigation involves theory building or theory verification. Survey research is devoted to identifying causal relationships among variables using theory-based expectations concerning how and why variables are related (Flynn et al., 1990). Thus, the foundation for questionnaire development is the underlying theory (Flynn et al., 1990). Papers 3 and 4 used a survey to collect the empirical research data, since these studies concern exact relationships among the defined variables (Easterby-Smith et al., 2012). Before the actual
questionnaire was developed, institutional theory and the RBV were carefully defined based on references to the literature. Papers 3 and 4 collected survey data from the Finnish, Russian, Puerto Rican and Panamanian logistics sectors (N=173). The theoretical framework was subjected to analysis using structural equation modelling (SEM).

**Paper 3** investigated the relationships among technology uncertainty, institutional pressures (e.g. regulation, customers, competitors, suppliers and industrial networks) and environmental performance. The survey, which solicited Finnish, Russian, Panamanian and Puerto Rican LSPs, was conducted online during the autumn of 2014 and the spring of 2015 to examine the linkages among pressures concerning and the adoption of environmental business practises. The developed theoretical framework was analysed using SEM. Figure 1 describes the proposed relationship among the three abstract variables (i.e. constructs).

![Proposed framework from Paper 3](image)

**Figure 2.** Proposed framework from Paper 3

A questionnaire was designed with sections related to each construct or group of constructs: technology uncertainty, pressures and environmental performance. These variables were defined based on the literature. The institutional pressure items were based on Zhu et al.’s (2005) work, which addressed various pressures related to environmental business practises. The environmental performance items were based on the work of Zhu and Sarkis (2004). The technology uncertainty items were based on the research of Chen and Paulraj (2004), who operationalised their technology uncertainty construct using four items. All questions were designed using a seven-point Likert scale.
**Paper 4** sought to contribute to the RBV by investigating the role of green capabilities in the adoption of environmental business practises and competitive advantage in the logistics industry. Relationships between green capabilities and various performance outcomes—namely, environmental performance, innovation performance and financial performance—were examined. Figure 2 describes the proposed framework. The survey data were collected from Finnish, Russian, Panamian and Puerto Rican LSPs (N=173), and SEM was used to analyse the data and test whether proposed model offers a good approximation of reality.

![Proposed framework from Paper 4](image)

**Figure 3.** Proposed framework from Paper 4
4. Review of results

This Chapter presents the key findings of each of the original papers. First, it discusses the findings and propositions concerning the challenges facing intermodal transport within the EU, which were obtained by conducting case studies and qualitative comparative analyses in the logistics industry. Second, it presents case study results concerning the drivers of intermodal transport within EU. Third, it summarises the SEM results concerning the relationships among technology uncertainty and pressures towards sustainability and environmental performance in the logistics industry. Fourth, it analyses the relationships between green capabilities and financial, innovation and environmental performance in the logistics industry.

4.1. Challenges to intermodal rail transport

Paper 1 contributes to the literature on intermodal transport by investigating the various challenges to intermodal transport. It synthesises current knowledge by reviewing the literature on intermodal transport and evaluating the factors that limit the modal shift from road to rail with the help of multiple case studies. This paper focuses on the factors affecting the low proportion of rail-based intermodal transport in the EU from the perspective of LSPs. The data were collected from 14 LSPs operating in Finland, and the analysis was done using QCA.
The motivation for Paper 1 came from the notion that, though a modal shift towards intermodal rail freight transport has been on the European Commission’s agenda for years (see EC, 2011), the share of rail transport in the EU remains rather low. The study investigated the following research question: What are the main challenges facing rail-based intermodal transport within the EU, and is there a causal relationships between LSPs’ perceptions of intermodal transportation and their actual usages of intermodal transport? Although the European Commission aims to remove the barriers to intermodal transport use, the results of this Paper show that several challenges must still be considered when the EU exerts itself on behalf of intermodal transport. Thus, this Paper contributes to the policy discussion surrounding the obstacles hindering this shift.

A qualitative analysis revealed that the interviewees unanimously believed that a lack of services, high costs and time constraints are the main challenges limiting the use of rail–truck combinations. In short, the results obtained in Paper 1 can be summarised as follows:

- **A lack of services** was identified as the major reason for the failure to use existing train-based intermodal transports. This is an interesting finding, since the service aspect has been largely overlooked in earlier literature. One of the few studies investigating this topic (Harper and Evers, 1993) found a lack of availability of intermodal rail-based services for many potential customers and noted that users are mainly larger firms. The findings of this Paper suggest that the situation changed little over the past two decades and that the perceived lack of services also limits the use of intermodal transport by bigger firms.

- **Costs** were perceived as seriously limiting the use of intermodal rail–truck transport. This supports earlier findings that extra transshipments of loads from one mode to another create additional costs (van Klink and van den Berg, 1998; Sommar and Woxenius, 2007). Furthermore, when customers are not willing to
pay extra for sustainable transport, LSPs are not willing to develop their intermodal service offerings. If end consumers in the logistics industry do not demand products to be transported sustainably, why would manufacturers choose more costly green modes of transportation? Wolf and Seuring (2010) have suggested that LSPs seem to be ahead of their customers in terms of environmental protection. Martinsen and Björklund (2012) came to the same conclusion, finding that LSPs overachieve when it comes to greening their operations. The results of Paper 1 suggest that LSPs are interested in making their operations greener, but that they feel that their customers will not pay higher prices for green transportation services. The perception among LSPs that the costs of intermodal transport are higher than those of unimodal transport represents new knowledge, since some previous studies have suggested that the costs of intermodal solutions can be lower (Ludvigsen, 1999; Evers et al., 1996). Furthermore, Facanha and Horvath (2005) suggested that LSPs can reduce costs by, for example, improving transit time reliability in order to better utilise intermodal transport. Thus, in order to make rail-based transport more attractive, the European Commission needs to tackle the issue of price. The results suggest that costs play an important role and that LSPs need economic incentives to create positive environmental impacts.

- **Time constraints** were also seen as hindering the use of rail-based intermodal transport. This confirms earlier findings showing that one of the primary disadvantages of intermodal transport is a slow door-to-door transit time. The difficulty of connecting modes within reasonable timeframes, the infrequency of train scheduling and the need to assemble and disassemble trains all adversely affect transit time (Harper and Evers, 1993). This time constraint problem is also related to LSPs’ customers, who are often not willing to wait longer for their shipments.
The results obtained from the QCA provide a holistic analysis by considering all variables relevant to intermodal transport. The relationships among these variables were able to explain the causal reasons for the non-usage of rail–road intermodal transport in domestic transportation in Finland and the EU. The results suggest that different causal paths may lead to the same outcome: one in which a company does not use rail. This was the case especially for instances in which ‘ease-of-use for the customer’ and ‘location of consignor and consignee’ were considered important factors. This finding supports the common view that to increase the feasibility of intermodal solutions, consignor and consignee facilities should be far apart, but close to a railway infrastructure (Henstra and Woxenius, 1999; Stank and Goldsby, 2000). It also seems that intermodal transport is considered an overly complex transport solution, since those LSPs that did not use intermodal transport underlined that the lack of ‘ease of use’ limiting the transport method’s popularity. Thus, the results of this study suggest that combining different freight transport modes is still considered to more complicated than using a truck to provide door-to-door transportation.

4.2. Taxation is a powerful tool to increase the share of rail transport

Paper 2 contributes to the literature on intermodal transport by investigating the drivers to intermodal transport: that is, ways to increase the share of intermodal transport in Europe. Grounded in the literature and the case studies, this Paper provides a comprehensive framework of the main drivers of intermodal rail transport. The data were collected from 14 LSPs operating in Finland. A number of drivers that could increase the use of truck–rail combinations were identified and grouped into five categories illustrating the different forces that influence the use of rail-based intermodal transport: external economic drivers, external regulatory drivers, external infrastructure drivers, external customer drivers and internal drivers (figure 4). The findings suggest that LSPs are
interested in increasing the use of intermodal transportation with a rail-leg and that the main drivers are increased fuel prices, taxes and a better rail infrastructure. Although rising fuel prices were perceived as a main driver of increased purchases of intermodal transport, some respondents expected the price of rail transport to increase along with fuel prices. Since the majority of the EU’s railway lines are electrified, rail freight prices should rise much less than fuel prices when the price of crude oil increases.

<table>
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<th>External drivers</th>
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<td><strong>DRIVER</strong></td>
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<td>With higher</td>
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<tr>
<td>importance</td>
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<tr>
<td>Fuel Price</td>
</tr>
<tr>
<td>Taxes</td>
</tr>
<tr>
<td>Better infrastructure</td>
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<tr>
<td>Congestion on roads</td>
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<tr>
<td>Better intermodal infrastructure</td>
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<tr>
<td>Lack of truck drivers</td>
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<tr>
<td>With moderate</td>
</tr>
<tr>
<td>importance</td>
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<tr>
<td>Environmental demands from transport buyer</td>
</tr>
<tr>
<td>Environmental demands from final customer</td>
</tr>
<tr>
<td>Legislation and Regulation</td>
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<tr>
<td>Service demands from transport buyers</td>
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<tr>
<td>With lower</td>
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<tr>
<td>importance</td>
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<tr>
<td>ICT actors</td>
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<td>ICT systems supporting open markets</td>
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<td>Standards</td>
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<td>More intermodal research, statistics</td>
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<th>Internal drivers</th>
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<tr>
<td><strong>DRIVER</strong></td>
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<tr>
<td>With lower</td>
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<td>importance</td>
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<td>New business models</td>
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<td>Technological solutions</td>
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**Figure 4.** Framework from Paper 2 of external and internal drivers of intermodal rail transport

The findings suggest that external forces play a major role in the shift toward more environmentally friendly transport. Economic and regulatory issues, as well as infrastructure, have significant impacts on companies’ decision-making.
4.3. Uncertainty improves environmental performance

Paper 3 used an institutional theory lens to examine the pressures that motivate LSPs to adopt environmental business practices. Pressures to adopt environmental business practices were investigated from the viewpoint of whether higher levels of technological uncertainty lead to greater rates of isomorphism in the form of environmental performance. This hypothesis was developed according to institutional theory and in response to the recent call for studies on the topic (see Kauppi, 2013).

Survey data were collected from Finnish, Russian, Panamanian and Puerto Rican LSPs, and the developed theoretical framework was analysed using SEM. A total of 173 logistics service providers participated in the survey.

The empirical results suggest that higher levels of technological uncertainty lead to greater levels of isomorphism, as predicted by institutional theory. In addition, the results show that LSPs experience various pressures to adopt environmental business practices. Positive direct relationships were found between technology uncertainty and external pressures and between external pressures and environmental performance.

This Paper contributes to institutional theory by supporting the theory’s underlying assumption. There is a lack of research on the role of uncertainty in companies’ adoption of environmental business practices. To the author’s knowledge, this is the first research to empirically examine the link between technological uncertainty and the adoption of environmental business practices.

4.4. Green capabilities can enhance performance

Paper 4 focuses on firm-specific factors and firms’ internal dynamics, rather than solely external factors. This study investigates the role of green capabilities in the adoption of environmental business practices
and competitive advantage in the logistics industry. Relationships between green capabilities and various performance outcomes, including environmental performance, innovation performance and financial performance, are examined. The study uses RBV and the concept of green capabilities to explain why some logistics companies achieve better performance than others.

Bowen et al. (2001) stated that organisations will implement green practises if they believe that such practises will benefit them financially. This may often be the case among countries with lower GDPs, since the companies in these countries are typically trying to catch up to Western countries. The results of Paper 4 suggest a strong link between green capabilities and economic performance, which could provide an impetus for logistics organisations to ‘green’ their processes even further.

According to the study results from Paper 4, link between environmental pressures and green capabilities is stronger in Finland and Russia than in the Caribbean. This may be because Finland and Russia trade with European countries, which have witnessed a strong environmental movement, including the implementation of multiple related laws, over the last decade. All countries exhibit a significant positive relationship between green capabilities and environmental performance. This result is in line with previous studies and confirms the importance of green capabilities for LSPs seeking to meet regulations and customer requirements regarding green partners.

Paper 4’s results concerning innovative performance are mixed. In Caribbean countries, a positive link was found between green capabilities and innovative performance, whereas, in Finland and Russia, no link was found. This may be due to the high GDP of these countries (especially Finland), which has reduced the need for revolutionary innovation. This finding is in line with the work of Mena et al. (2007), who suggested that the logistics sector is not one of the most innovative sectors primarily because it is a mature industry. However, the recent growth in online shopping could evoke innovativeness within this sector. This is already
happening in retail businesses, where traditional brick-and-mortar retailers are supplementing their shops with online shopping services. Technology is increasingly blurring the distinctions between physical and online retailing, forcing all supply chain members to reconsider their competitive strategies (Brynjolfsson et al., 2013). Additive manufacturing (3D printing) is also changing existing supply chains, since it requires less material for production. This has implications for inventory management, transportation, warehousing and purchasing (Waller and Fawcett, 2014). However, for innovative logistics companies, such developments offer new opportunities. Thus, in order to remain competitive, logistics companies need to focus more on innovativeness.

Russia’s history as a member of the Soviet Union could partially explain the lack of innovativeness in its LSPs, since organisations in this country have only recently begun to focus on competition and efficiency. However, the Caribbean exhibited a positive link between green capabilities and innovation, which may be explained by these countries’ stronger competition and higher exposure to multinational companies.
5. Conclusions, discussion and future research

This Chapter concludes the findings by discussing how the research objectives were addressed in the study. It also compares the findings of the study with those of previous research. Furthermore, it presents the theoretical and managerial contributions of each paper. Finally, the Chapter discusses research limitations and future research directions.

5.1. Main findings

The research objective of this study was to explore LSPs’ opinions, experiences and actions regarding environmentally sustainable transport, as well as to investigate how institutional theory and the RBV of the firm can be used to explain the external and internal forces that influence the adoption of environmental business practises. This objective was divided into three more focused research questions, which are reviewed in the following.

The first research question was: What are the challenges and drivers related to intermodal rail transport? The empirical part of this research shows that intermodal transport is a complex phenomenon, involving several challenges and drivers related to intermodal rail transport in the EU (see Papers 1 and 2). This study has identified a perceived lack of services as the major reason for companies’ failure to use train-based intermodal transport. In the EU, priority is given to passenger trains during the day, which forces freight trains to
run primarily at night. Shifting demand from trucks to rail requires the introduction of new and reliable train services. Costs were also perceived as an important factor limiting the use of intermodal rail–truck transport. Extra transhipments of load from one mode to another create additional costs for intermodal transport (van Klink and van den Berg, 1998; Sommar and Woxenius, 2007). However, there are many ways to make intermodal transport more attractive. Findings from Paper 2 confirm that taxation is an influential way to promote the shift from road to rail. Policy makers can use their legislative power to implement several measures (e.g. taxes, tolls and restrictions) encouraging the use of greener transport modes. Rising fuel prices, in particular, would increase the attractiveness of energy-efficient transport mode like intermodal rail transport (Paper 2). The price of fuel is currently historically low, but if fuel prices begin to rise again, the economy can adapt to a lower availability of non-renewable energy supplies (Borowy, 2013). To address anticipated fuel shortages, regulators should reduce the need for fuel-intensive transport and increase the attractiveness of intermodal transport modes.

The second research question was: How do external pressures influence environmental sustainability in the logistics sector? Papers 2 and 3 answered this question. It is clear that external factors play a major role in driving LSPs towards more environmentally sustainable intermodal rail transport (Paper 2). Institutional theory suggests that those actors with coercive power can best push the logistics industry towards sustainability. Paper 3 proposes that LSPs face various pressures to adopt environmental business practises, such as reducing CO₂ emissions. However, it is important to consider the role of uncertainty, since a positive direct relationship was found between technological uncertainty and external pressures to adopt environmental business practises. In other words, the more uncertainty a company experiences, the more sensitive it is to external pressures.
The third research question was: *Can internal motivation lead to environmental sustainability in the logistics sector?* Paper 4 answered this question by proposing that dynamics that happen inside firms can also explain the adoption of environmental business practises. Drawing from the RBV, the results of Paper 4 suggest that companies possessing green capabilities can achieve enhanced financial performance. Bowen et al. (2001) stated that organisations will implement green practises if they believe that such practises will benefit them financially. This may be the case among countries with lower GDPs, since the companies in these countries are typically trying to catch up to those in Western countries.

The main findings and conclusions of the papers are summarised in Table 4 below.

**Table 4. The main findings and conclusions of the dissertation.**

<table>
<thead>
<tr>
<th>Paper</th>
<th>Research questions</th>
<th>Findings and conclusions</th>
</tr>
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<tbody>
<tr>
<td>1. Challenges in the Use of Rail-based Intermodal Transport in Europe: case Finland</td>
<td>What are the challenges facing intermodal rail transport in Europe?</td>
<td>The qualitative analysis revealed that a lack of services, high costs, time constraints, limited geographic coverage and infrastructure are the main challenges limiting the use of rail–truck combinations.</td>
</tr>
<tr>
<td>2. Drivers of intermodal rail transport in Europe</td>
<td>How could the share of intermodal rail transport be increased in Europe?</td>
<td>The findings suggest that LSPs are interested in increasing the use of intermodal transportation with a rail leg. The main drivers of this interest are: increased fuel prices, taxes and a better rail infrastructure.</td>
</tr>
<tr>
<td>3. Pressures towards environmental business practises—Evidence from the logistics industry</td>
<td>Does technology uncertainty lead to isomorphism, as predicted by institutional theory? Do external pressures toward sustainable business practises lead to increased environmental performance?</td>
<td>The empirical results suggest that a higher level of technological uncertainty leads to a greater level of isomorphism, as predicted by institutional theory. Furthermore, the results show that LSPs experience various pressures to adopt environmental business practises. Positive direct relationships were found between technology uncertainty and external pressures and between external pressures and environmental performance.</td>
</tr>
<tr>
<td>4. Green capabilities and performance outcomes in the logistics industry</td>
<td>Do green capabilities lead to greater environmental, innovative and financial performance?</td>
<td>The results show a positive link between green capabilities and financial and environmental performance in all four countries, though a link between green capabilities and innovation performance was found only in the Caribbean.</td>
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5.2. Theoretical implications

The individual papers offer different theoretical contributions. First, Paper 1 applies the QCA as a new way to investigate the use of intermodal rail transport. QCA supports a more holistic analysis by considering all variables and their relationships. Before conducting the QCA, a qualitative investigation was used to assess which factors limit the use of rail-based intermodal transports. The study provides an additional perspective on the challenges facing the use of intermodal train transport and supports a more holistic analysis by considering all variables and their relationships. The current lack of services was perceived as the main reason limiting the shift from road to rail. This is in line with Colicchia et al. (2017), who noted that it is possible to shift demand from road to rail, but that such a shift requires the introduction of new, reliable train services. The findings suggest that costs are another key issue limiting the use of intermodal train transport. Since the price of intermodal train transport is higher than that of the truck-only solution, there is little demand for intermodal train transport. Furthermore, the findings from Paper 1 suggest that, in Finland, the logistics sector is willing to move towards greener operations, but that LSPs feel that their customers are still focusing only on price. The interviewees compared Finland’s situation to that of Sweden, where the logistics sector is far ahead in terms of greening transport operations. Martinsen and Björklund (2012) suggested that Swedish LSPs might be overachieving with respect to environmental issues.
The findings of the qualitative analysis in Paper 1 offer interesting information about the possible reasons for the limited use of intermodal transport. However, these findings tell us nothing about causal paths, such as the conditions under which a company will decide to use intermodal transport. The QCA broadened the investigation by analysing whether factors with high standard deviations could explain the causal reasons for the non-usage of intermodal transport in Finland or in the EU, and the results of this analysis will hopefully generate further contributions in the intermodal transport field. Specifically, the results suggest that different causal paths may lead to the same outcome in which a company will not use rail, especially when ‘ease-of-use for the customer’ and ‘location of consignor and consignee’ are considered to be important factors. This finding supports the common view that, to increase the feasibility of intermodal solutions, consignor and consignee facilities should be located far apart, but close to railway infrastructures (Henstra and Woxenius, 1999; Stank and Goldsby, 2000). The locations of consignors and consignees naturally influence the price of intermodal transport. When there is no railway infrastructure nearby, it is not economically feasible to use intermodal rail transport.

The results of Paper 2 contribute to both the intermodal transport literature and institutional theory. Grounded in the literature and with the help of multiple case studies, Paper 2 identifies a number of drivers that could increase the use of truck–rail combination. These drivers are grouped into five categories: external economic drivers, external regulatory drivers, external infrastructure drivers, external customer drivers and internal drivers. Drawing on institutional theory most of these external drivers are coercive in nature. Previous studies of intermodal transport have typically focused on one driver at a time (Campisi and Gastaldi, 1996; Macharis et al., 2010; Van Schijndel and Dinwoodie, 2000); however, Paper 2 provides a more complete and holistic view of the drivers of intermodal rail transport. The shift towards intermodal transport is a complex issue, and there is no single way to
increase the use of intermodal transport, as evidenced by the limited success of this transport mode despite direct support from the European Commission. The detailed analysis in Paper 2 generates hypotheses for testing using a large number of studies. Specifically, based on the literature review and the findings from the data, Paper 2 proposes five hypotheses concerning ways to increase the share of intermodal transport.

Paper 3 contributes to the development of institutional theory. There is a growing research interest surrounding the use of institutional theory in sustainability-related OSCM literature. However, most such research does not question or test the theory’s underlying assumptions, even though challenging the underlying rationales of theories is the most fruitful avenue for theory development (Whetten, 1989). Institutional theory hypothesises that higher levels of uncertainty lead to greater rates of isomorphism (DiMaggio and Powell, 1983); however, to date, we lack empirical evidence on whether this holds in practise. Accordingly, the primary contribution of this Paper is its analysis of the role of technological uncertainty in the adoption of environmental business practises. The study results show a positive link between technological uncertainty and the pressures logistics companies experience towards the adoption of environmental business practises. In this respect, Paper 3 extends institutional theory and responds to the call from Kauppi (2013).

Paper 4 tests the RBV and finds a link between LSPs’ green capabilities and performance outcomes. Whereas most prior RBV applications in sustainable OM focus on only one country, this multinational study provides information regarding LSPs’ green capabilities and performance outcomes in different geographic locations. The results indicate that the link between environmental pressures and green capabilities in Finland and Russia is stronger than that in the Caribbean. This may be because companies in Finland and Russia trade with European countries, which have witnessed a strong environmental
movement (including the implementation of multiple related laws) over the last decade. Thus, Paper 4 provides new knowledge of how context and country can influence companies’ green capabilities and performance. All countries demonstrated a significant positive relationship between green capabilities and environmental performance. This result is in line with previous studies on the manufacturing sector and confirms the importance of green capabilities for LSPs seeking to meet regulations and customer requirements concerning green partners.

5.3. Managerial implications

The results of this dissertation have important managerial implications. The most important contribution in the field of sustainable transport is not to add further to the academic literature, but to provide results that can be applied to company strategy development and operations in practise (Roth and Kåberg, 2002).

The findings of this research suggest that LSPs are interested in energy-efficient transport modes, such as intermodal rail transport. However, the interviewees considered the perceived lack of services to be the major reason for companies’ failure to use current train-based intermodal transport methods. Although the perceived lack of services is currently limiting the use of train freight transport, it can also provide new business opportunities for LSPs. Rail market competition is still limited in many European countries, but the European Commission has supported rail-based intermodal transport via a progressive market opening (EC, 2013). Thus, as new actors enter the railway market, the role of LSPs in bundling services for customers grows. This provides opportunities to LSPs whose service developments fulfil the requirements of recent development trends in sustainable supply chain management.

The findings of this research can help LSPs trying to switch to more environmentally friendly freight transport services. Since external drivers are more important than internal drivers in companies’ adoption
of intermodal transport, it seems that LSPs are conforming to external pressures in their transport purchasing decisions. Thus, LSPs seem to have more reactive than proactive roles in the adoption of intermodal rail transport. If LSPs wish to influence these external forces, they could try lobbying to shape their institutional contexts. For example, the public sector is a critical participant in the creation of a well-functioning rail infrastructure; therefore, LSPs could lobby to improve rail infrastructure in the EU. In this way, LSPs can play a more proactive role.

Paper 3 contributes to practise by illustrating the importance of LSPs knowing where they stand with regard to pressures influencing environmental business practises. As the results of Paper 3 show, stakeholders are currently demanding green actions from logistics companies. Managers who currently think that their companies are not affected by environmental pressures may be surprised by the different pressures that influence them in reality.

The results of Paper 4 show that developing green capabilities leads to better environmental and economic performance. This is good news for managers of logistics companies, as it demonstrates that investing in environmental management is not a waste of money. The results of this study provide new knowledge for LSPs of how context and country can influence companies’ green capabilities and performance. LSPs need to understand the broader institutional environments in which they operate and consider how a country’s culture, regulatory environment and GDP level might influence the adoption of environmentally friendly practises.

5.4. Implications for policy making

In addition to advancing research and practise, the individual papers of this dissertation have significant policy implications.

First, the findings of Paper 1 suggest that the two most critical factors limiting the choice of rail-based intermodal transport are a lack of services and higher costs. To increase the use of intermodal transport
involving rail legs, policy makers should focus on these issues and ensure the availability of a sufficient number of trains to meet the demand for intermodal transport. In addition, some interviewees connected the lack of services with the lack of infrastructure, pointing out that no services exist in areas without railways. This could be a direct call for European governments to extend the current railway infrastructure to tackle the current insufficiencies in the train services. Policy makers should continue evaluating the use of the existing rail infrastructure and identify underused tracks where more capacity can be added. The European Commission’s Trans-European Transport Networks (TEN-T) Programme is one example of a good approach to support the construction and upgrade of transport infrastructure across the EU.

Second, the findings of Paper 2 may help politicians consider possible ways to increase the share of intermodal road–rail transport. First, our results suggest that environmental taxes would increase the use of intermodal transport. This finding is in line with the results of a recent study by Colicchia et al. (2017), who suggested that one way to increase the use of intermodal transport is to introduce more taxes for companies that do not undertake sufficient measures to limit CO$_2$ emissions. Some European countries have already introduced taxes and restrictions for road transport (Gutiérrez et al., 2013). Charging tolls for road use may encourage more efficient vehicle use and foster a shift towards less-polluting modes of transport, such as railway transport. EU Directive 2011/76/EU, also called ‘Eurovignette’, offers criteria for calculating road toll fees in order internalise external costs (e.g. maintenance, accidents, pollution and noise). However, EU member states are under no obligation to apply this or any other road pricing scheme (Gutiérrez et al. 2013). Thus, in order to increase the share of intermodal rail transport in the EU, road pricing initiatives should be introduced in countries that can add more capacity to their rail tracks. Policy makers can also make intermodal transport more attractive by using incentive mechanisms. For example, they could increase fuel prices (as shown in Paper 2) or reduce
the fees related to operating on intermodal infrastructures (Eng-Larsson and Norrman, 2014). Fuel taxes, in particular, represent an easily implemented policy measure that could stimulate modal shift. However, it should be remembered that higher taxes and prices change only the relative attractiveness of the intermodal rail option; they do not directly enhance the efficiency of the transport system. Therefore, it is essential that, before other political measures are taken, the rail infrastructure be improved to ensure that the infrastructure is sufficient to support modal shifts. This should be politicians’ first priority. Policy makers should continue investing in rail infrastructure projects, such as Rail Baltica, which is one of the EU’s TEN-T rail transport construction projects linking Finland, the Baltic States and Poland. The results of Paper 2 suggest that the development of a long-distance Rail Baltica is a good approach to support the development of intermodal transport in the future. This is in line with a new cost-benefit analysis on Rail Baltica concluding that the Rail Baltica project has the potential to bring important socio-economic benefits, such as reduced travel times, lower emissions and increased exports to the whole region (EC, 2017). As one interviewee said in Paper 2: ‘if there were rails in the Baltics, we would use them’.

Third, the results of Paper 3 suggest that stakeholders are currently demanding green actions from logistics companies and that such demands lead to better environmental performance. This finding reinforces the conclusion that exerting pressure on logistics companies improves environmental performance. This is essential information for policy makers. Furthermore, based on the results of Paper 3, uncertainty leads to the adoption of environmental business practises. By informing LSPs about upcoming environmental laws, policy makers can encourage LSPs to be proactive and adopt environmental business practises before laws are actually implemented.

Finally, Paper 4 helps decision makers understand the internal dynamics influence companies’ environmental performance. The results of this
Paper show that LSPs that possess green capabilities have better environmental performance than LSPs that do not possess green capabilities. Thus, policy makers should not focus solely on coercive policy making; instead, they should also find ways to use softer tools to support companies in developing their green capabilities. For example, policy makers could try to educate companies about the benefits of environmentally friendly business operations. In addition, governmental actors could organise educational campaigns concerning green logistics. Table 5 summarises the key findings relevant to policy makers.

**Table 5. Key implications for policy makers**

<table>
<thead>
<tr>
<th>Paper</th>
<th>Implication to policy makers</th>
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<tbody>
<tr>
<td>1. Challenges in the Use of Rail-based Intermodal Transport in Europe: case Finland</td>
<td>Currently, a lack of services is limiting the use of rail freight transport. European governments should consider ways to increase the number of available train services. Policy makers should also continue evaluating the use of existing rail infrastructure and identify underused tracks to which more capacity could be added. Projects like the European Commission’s TEN-T Programme support the development and upgrade of transport infrastructures across the EU.</td>
</tr>
<tr>
<td>2. Drivers of intermodal rail transport in Europe</td>
<td>Increasing fuel prices, introducing environmental taxes and building better rail infrastructures are all powerful tools that policy makers can use to foster a modal shift from road to rail. A long-distance Rail Baltica is a good approach to support the development of intermodal transport in the future.</td>
</tr>
<tr>
<td>3. Pressures towards environmental business practises— Evidence from the logistics industry</td>
<td>Logistics service providers experience various pressures to adopt environmental business practises, and these pressures lead to improved environmental performance. Thus, policy makers should continue to use their exertive power to reduce CO₂ emissions. For example, policy makers can inform LSPs about upcoming environmental laws, which could encourage LSPs to be proactive and adopt environmental business practises before laws are actually implemented.</td>
</tr>
<tr>
<td>4. Green capabilities and performance outcomes in the logistics industry</td>
<td>The results show a positive link between green capabilities and financial and environmental performance. Thus, it seems that companies benefit from going green. Policy makers could try to educate companies about the benefits of environmentally friendly business operations. In addition, governmental actors could organise educational campaigns concerning green logistics.</td>
</tr>
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</table>
5.5. Limitations and future research

This research has focused on two major theories to increase the understanding of LSPs’ actions concerning sustainable transport. At the same time, it has excluded many other theories that could be useful in explaining environmental sustainability in OM. Future research can invoke theories not traditionally used in OM in order to better understand and explain empirical phenomena (Ketokivi and Schroeder, 2004).

This study has several limitations that offer interesting future research directions. First, the study’s use of institutional theory to explain the drivers of intermodal transport revealed that most drivers are coercive in nature. Further research focusing on mimetic and normative pressures in the intermodal transport context should be conducted.

Following the division proposed by Chen and Paulraj (2004), the Paper also contributed to the literature on uncertainty; however, it focuses only on technological uncertainty. Future research could investigate the roles of supply and demand uncertainty. Also different industries could be compared. These gaps provide fruitful avenues for further research, since comparing different industries would facilitate a deeper examination of the roles of supply and demand uncertainty in the adoption of sustainable business practises.

This study measured financial performance using LSPs’ perceptions of performance, following an approach similar to that of Zhu and Sarkis (2004) and Yeung et al. (2006). However, as Yeung et al. (2006) noted, future research may offer a more holistic picture of performance within the industry by addressing the perceptions of competitors. It would also be interesting to investigate the non-biased financial metrics of LSPs and to analyse their performance based on these metrics. However, many LSPs are small- to medium-sized enterprises (SMEs) and, thus, do not release their financial indices publicly. Therefore, collecting data for such research would be complicated.
Another interesting potential research direction involves taking a closer look at the impact of world politics on intermodal transport and LSPs’ green capabilities and performance outcomes. In 2016, the G20 economies promised to avoid protectionism to keep markets open (G20 Finance Ministerial and Deputies Meetings, 2016). However, in the current Brexit world, there is a growing fear of revived protectionism and increased trade barriers. This raises an interesting question: What will happen to the international transportation sector and LSPs’ performance outcomes in the coming years? Any reduction in world trade would negatively influence the international transportation sector. Furthermore, fear of trade barriers could reduce transport sectors’ willingness to invest in green transport solutions and develop green capabilities. Thus, a longitudinal study of LSPs’ green capabilities and performance outcomes could be conducted to study how global politics influence the transport sector.

Finally, this study investigated the link between green capabilities and performance capabilities in four countries. Including additional countries would make the results more generalizable. In addition, since our study investigated the perspective of LSPs, future research could investigate the perspective of shippers and then compare the two viewpoints. Similarly, since the respondents in this study said that their customers were interested in environmental issues but seemed unwilling to pay extra for environmentally friendly transport, it may also be interesting to further explore the customer side.
References


Transportation is one of the sectors emitting the most greenhouse gases worldwide. To protect the environment, more attention must be paid to energy efficiency in the transport sector. This thesis has two aims: first, to explore logistics service providers' opinions, experiences and actions regarding environmentally sustainable transport, and second, to investigate how institutional theory and the resource-based view of the firm can be used to explain the external and internal forces that influence the adoption of environmentally friendly business practices. Accordingly, this research seeks to offer conclusions significant for both theory and practise within the domain of sustainable transport.