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ABSTRACT

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Abstract

Outsourcing is a common strategy for companies looking for cost savings and improvements in performance. This has been especially prevalent in logistics, where warehousing and transporting are typical targets for outsourcing. However, while the benefits from logistics outsourcing are clear on paper, there are several cases companies fail to reach these benefits. The most commonly cited reasons for this are poor information flow between the company and the third party logistics partner, and a lack of integration between the two partners. Uncertainty stems from lack of information, and it can cripple the whole outsourcing operation. This is where enterprise resource planning (ERP) systems step in, as they can have a significant role in improving the flow of information, and integration, which consequently mitigates uncertainty. The purpose of the study is to examine if ERP systems have an effect on a company's decision to outsource logistics operations. Along the rapid advancements in technology during the past decades, ERP systems have also evolved. Therefore, empirical research on the subject needs constant revision as it can quickly become outdated due to ERP systems having more advanced capabilities every year.

The research was conducted using a qualitative single-case study of a Finnish manufacturing firm that had outsourced warehousing and transportation operations in the Swedish market. The empirical data was gathered with use of semi-structured interviews with three employees from the case company that were closely related to the outsourcing operation. The theoretical framework that was used to analyze the empirical data was based on Transaction Cost Economics theory.

The results of the study were align with the theoretical framework, in that the ERP system of the case company was seen as an enabler for their logistics outsourcing operation. However, the full theoretical benefits from ERP systems concerning extended enterprise functionality and flexibility were not attained due to the case company having an older version of their ERP system. This emphasizes the importance of having up-to-date technology if you want to overcome the shortcomings of ERP systems in outsourcing situations.

Key words	Logistics outsourcing; enterprise resource planning; uncertainty
Further information	

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Tiivistelmä

Ulkoistaminen on tyypillinen strategia yrityksille, jotka etsivät kustannussäästöjä ja parannuksia suorituskyvylleen. Tämä on erityisen tavallista logistiikassa, jossa varastointi ja kuljetustoiminnot ovat tyypillisiä ulkoistamisen kohteita. Vaikka logistiikan ulkoistamisen hyödyt ovat paperilla selkeitä, monet yritykset eivät ikinä saavuta näitä hyötyjä. Syinä tämän taustalla on monesti huono tiedonkulku sekä integraation puute yrityksen ja logistiikkapalveluntarjoajan välillä. Epävarmuus kasvaa tiedonkulun puutteen vuoksi ja se voi lamauttaa koko ulkoistamisoperaation. Toiminnanohjausjärjestelmillä voi olla merkittävä rooli tiedonkulun ja integraation parantamisessa, joka johtaa epävarmuuden vähenemiseen. Tämän tutkielman tarkoituksena on tutkia toiminnanohjausjärjestelmän vaikutusta yritysten päätökseen ulkoistaa logistiikkatoimintoja. Teknologian viime vuosikymmenten nopean kehityksen ohella myös toiminnanohjausjärjestelmät ovat kehittyneet. Täten empiirinen tutkimus aiheeseen liittyen tarvitsee jatkuvaa tarkastelua sillä se voi nopeasti vanhentua toiminnanohjausjärjestelmien omatessa vuosi vuodelta yhä laajempia ominaisuuksia.

Tutkimus suoritettiin laadullisena tapaustutkimuksena, jonka kohteena oli yksi suomalainen valmistavan teollisuuden yritys, joka oli ulkoistanut varastointi- ja kuljetustoimintojaan Ruotsin markkinoilla. Empiirinen data kerättiin teemahaastattelujen avulla. Haastateltavina oli kolme yrityksen työntekijää, jotka olivat läheisesti mukana ulkoistamisprojektissa. Empiirisen datan analysointiin käytetty teoreettinen viitekehys pohjautui transaktiokustannusteoriaan.

Tutkimuksen tulokset olivat linjassa teoreettisen viitekehyksen kanssa. Toiminnanohjausjärjestelmä nähtiin yrityksessä kulmakivenä logistiikan ulkoistamiselle. Toisaalta, kaikkia toiminnanohjausjärjestelmän teoriassa tarjoamia hyötyjä yrityksen ulkopuolisen toiminnallisuuden ja joustavuuden osalta ei pystytty realisoimaan, koska yrityksellä oli käytössä vanha versio omasta järjestelmästään. Tämä korostaa ajan tasalla olevan teknologian käyttämistä mikäli haluaa välttyä toiminnanohjausjärjestelmien puutteilta ulkoistamistilanteissa.

Asiasanat	Logistiikan ulkoistaminen; toiminnanohjausjärjestelmä; epävarmuus
Muita tietoja	

Turun yliopisto
University of Turku

MITIGATING UNCERTAINTY IN LOGISTICS OUTSOURCING WITH ERP SYSTEMS

Master´s Thesis
in Operations and Supply Chain Management

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List of abbreviations

3PL	Third party logistics
CIO	Chief information officer
EDI	Electronic data interchange
ERP	Enterprise resource planning
HPAC	Heating, plumbing, air-conditioning
ICT	Information and communication technology
MRP	Material requirement planning
MRPII	Manufacturing resource planning
SCM	Supply chain management
SME	Small- and medium-sized enterprise
TCE	Transaction cost economics
XML	Extensible markup language

1 INTRODUCTION

1.1 Background of the study

For the past few decades, companies have focused on streamlining their internal operations regarding product quality and manufacturing. As these aspects are reaching greater optimization, companies have turned their eyes on supply chain management as the next frontier. The role of logistics has grown from a mere back-office operation to a source of competitive advantage that is vital to companies. This is evident by the increase in the amount of resources companies invest in logistics (Langley 2012). Even though logistics is seen as a support process for many businesses, especially in the manufacturing sector, it is still a critical one. As customers require faster deliveries and quick responses to their needs, these days many firms see logistics as a major function to their success. In the most recent report on the state of logistics in Finland (Solakivi, Ojala, Lorentz, Laari & Töyli 2012), it was noted that even up to 50% of a firm's competence can come from logistics. This conveys the importance of logistics for firms. Overcoming challenges related to it is therefore a priority for top management in any firm.

Outsourcing of logistics operations has for the past few decades been a staple strategy among firms looking to improve efficiency and to lower costs. The outsourcing decision stems from the classical "make-or-buy" decision, in which a firm either invests time and money to keep a function in-house, or they can contract it out (Maltz & Ellram 1997). The most widely cited benefit of outsourcing is enabling firms to focus on their core business while exploiting the expertise of external service providers (Sink & Langley 1997). Handling of non-strategic activities is better left to the hands of others who make it their priority. Kakabadse and Kakabadse (2002) present three primary reasons for outsourcing in general, which are lower costs through efficiency and economies of scale, transfer of risks associated with uncertainty, and access to specialized resources that the client does not have.

Outsourcing has previously been about improving the internal performance of a company by outsourcing e.g. some part of assembly. Now that these activities have reached a mature state, companies have started to seek new ways of improvement from external performance, in which customer satisfaction through efficient logistics is one aspect. In order for manufacturing firms to stay true to their core business, firms have turned to third party logistics (3PL) providers to handle their logistics in some level (Power, Sharafali & Bhakoo 2007). It is usually the generic supporting processes such as transportation and warehousing that are outsourced. Outsourcing has been prevalent in industry, especially among firms that see logistics as a major function to their success. The case firm in this study, a traditional Finnish manufacturer, fits this description.

According to estimates by Langley, Allen and Tyndall (2001), over 70% of this type of firms use a 3PL provider to handle at least some of their logistics activities. Transportation and warehousing are now mainstays in the services that 3PL providers offer, and companies acquire, while two decades ago they were just emerging (Langley 2005). 3PL has been a focal point in logistics research for the past few decades, with the majority of publications focusing on "the types of activities outsourced, the reasons behind these decisions, and on benefits of logistics outsourcing" (Marasco 2008). The 3PL industry has seen some noticeable growth in recent times due to the increased demand of 3PL services (Langley 2012; Langley, Allen & Colombo 2003).

Managing the information flows that run through the company has become a critical aspect of supply chain management (SCM) by reducing uncertainties in dimensions such as cost, delivery, and quality (Byrd & Davidson 2003). Uncertainty usually arises from poor flow of information. According to literature (see Jäger, Ujvari & Hilmola 2007), information and communication technology (ICT) is one of the key points to succeed with logistics outsourcing. Knowledge is power, as they say, and to obtain it firms must invest in systems that help them in the gathering and handling of information to aid the decision making process. To answer this call for efficiently managed information flows, enterprise resource planning (ERP) systems have become a key asset for firms in order to take advantage of the amount of information available to them in an attempt to mitigate challenges arising from uncertainty.

1.2 Purpose of the study

The overall goal of this thesis is to study the role of ERP systems in logistics outsourcing decisions. The point of focus is in the capabilities of an ERP system to mitigate the possible challenges that can occur due to uncertainty when outsourcing logistics functions. Through a literature review, and a case study on a Finnish manufacturing firm with logistics outsourcing experience in the Swedish market, this thesis tries to answer the following questions:

- What are the typical challenges linked to outsourcing transportation and warehousing functions?
- What kind of benefits are there in implementing an ERP system from the perspective of logistics and SCM?
- How did their ERP system affect the decision of the case firm to outsource their warehousing and transportation from the viewpoint of operational uncertainty?

Technology and ERP systems have developed tremendously over the years when compared to what the early versions could offer to firms. This continuous improvement can lead to a situation where studies conducted no more than five years ago can already be outdated, as ERP system providers continually develop their services to cater all aspects of business, including supply chain management. This outlook highlights the importance of continuous research on these topics in order to ensure up-to-date knowledge. There have been many studies on the effects of ERP systems on supply chain performance (see Bardhan, Mithas & Lin 2007), and this study adds to this research field by exploring the relationship between ERP systems usage and outsourcing of transportation and warehousing. While the implementation process is critical to the overall success of the ERP system, it is left out of the scope of this study as there has already been significant research on the topic (see Schlichter & Kraemmergraad 2010).

1.3 Structure of the thesis

The structure of the thesis is as follows: Chapter 2 focuses on the topic of logistics outsourcing through a literature review; presenting a definition to it, and linking it to SCM with the help of previous theoretical research, mainly transaction cost economics (TCE). The common challenges related to logistics outsourcing are also discussed. Chapter 3 focuses on ERP systems as a tool for supporting the supply chain process, including a brief overview of its history and business purpose. Chapter 4 illustrates the theoretical framework outlined by the researcher based on the literature review in the previous chapters. Chapter 5 covers the empirical part of this thesis, exploring a real-life example from the Finnish manufacturing industry with the means of case study research. The point of interest is how their ERP system affected their decisions to outsource transportation and warehousing. Finally, chapter 6 presents some conclusions on the effects of ERP systems on logistics outsourcing based on the literature and empirical data.

2 LOGISTICS OUTSOURCING

2.1 The role of logistics to firm performance

Logistics is considered to have a substantial impact on a firm's performance, especially in the manufacturing sector (Tracey 1998). It can mistakenly be thought as only the physical distribution of goods in and out of your facilities, but you need a more holistic approach to it in order to understand the impact it has on firm performance. According to the definition presented by the Council of Logistics Management (CLM) (1998), logistics is:

> *"...the process of planning, implementing, and controlling the efficient, effective flow and storage of goods, services, and related information from the point of origin to the point of consumption for the purpose of conforming to customer requirements. Note that this definition includes inbound, outbound, internal and external movements, and return of materials for environmental purposes."*

Through efficient inventory and transportation management, firms can achieve lower operating costs, and streamline processes to minimize delays. Also flexibility in the supply chain allows the firm to adapt to changing environments in the market. The information that goes along with the goods is equally important as the goods themselves, and it is the basis for successful management of logistics functions and the whole supply chain. It is also the main point for this study, especially in a 3PL setting.

These flows were traditionally handled in-house, as logistics was seen as a mere support process that doesn't require as much attention as, for example, the production of the goods for a manufacturer. However, in the past few decades firms have become aware of the importance of efficient logistics in satisfying customer needs. Deliveries have to be faster, and on time, but at the same time more flexible to the changing demands in the market. In addition, companies aim to lower inventory levels in order to decrease the amount capital tied to inventory and warehouses. These kinds of goals can be seen as rather contradictory but they have really pushed companies to develop their logistics in a comprehensive manner so that they can answer to these challenges.

When talking about logistics management, you cannot remove it from the context of supply chain management. Logistics is no longer just about handling your internal flows as efficiently as possible, but also coordinating them with your partners in the whole supply chain. This argues for the interchangeable use of the terms logistics management

and SCM. Mentzer, Dewitt, Keebler, Min, Nix, Smith, and Zacharia (2001) define SCM as:

> *"... the systemic, strategic coordination of the traditional business functions and the tactics across these business functions within a particular company and across businesses within the supply chain, for the purposes of improving the long-term performance of the individual companies and the supply chain as a whole."*

Christopher (1998) notes that logistics and SCM have ascended to such a strategic level that they enable firms to pursue both generic competitive advantages presented by Porter (1980); differentiation and low cost. Differentiation aims for advantage in value-adding services, whereas firms gain cost advantage by reducing costs. These two strategies have different logistics implications, as presented below in figure 1. Differentiation aims for service leadership in the market, while lowering costs aims for cost leadership.

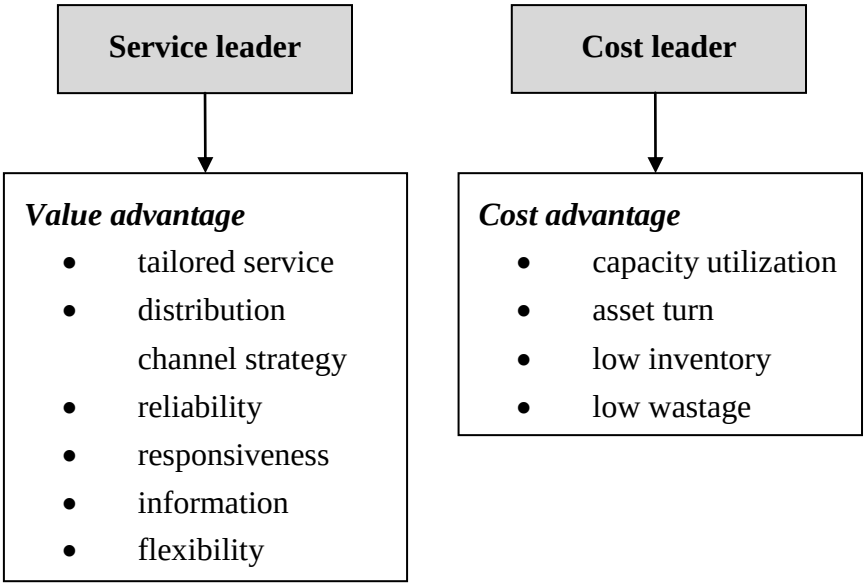

Figure 1 The logistics implications of different competitive positions (adapted from Rushton & Walker 2007)

Choosing a suitable strategy is always a firm-specific task to which straightforward solutions cannot be given. Some firms may value high availability and reliability of goods, while others want to minimize inventory. This strategic decision is also important when considering logistics outsourcing, as it governs on the desired outcomes of the 3PL relationship. It is traditionally thought that firms need to choose one or the other, but perhaps in the case of logistics there is so much potential to capitalize on that

both options are possible simultaneously, at least to some degree. (Rushton & Walker 2007.)

The efficient handling of logistics has definitely become important for companies from a cost perspective, as logistics is a significant portion of total costs for companies. According to the survey by Langley (2012), firms invest around 12% of their turnover on logistics. When examining on a national level, the share of logistics costs in Finnish companies is also around 12% from their turnover (Solakivi et al. 2012).

According to Agarwal, Shankar, and Tiwari (2006), SCM "helps firms in integrating their business by collaborating with other value chain partners to meet the unpredictable demand of the end user". The demand can be highly variable, and require swift responses from the supply chain. This calls for an agile supply chain. Lee (2004) defines supply chain agility as "the ability to react quickly to unexpected or rapid shifts in supply and demand". Christopher (2000) identified three key enablers for supply chain agility:

- the quality of supplier relationships
- a high level of shared information
- a high level of connectivity between firms in the supply chain.

The last point refers to e.g. the exchange of demand and inventory level information. The efficient handling of the last two points with the use of an ERP system is examined further in chapter 3. By working together in a coordinated fashion, firms can achieve a higher level of agility for the whole supply chain, compared to the sum of individual efforts of firms (Lin, Chiu & Chu 2006).

2.2 Contract logistics

Outsourcing logistics functions to 3PL providers has become a commonly employed strategy for firms to improve their logistics and to decrease costs (Jharkharia & Shankar 2007). It has also become increasingly important in the field of logistics research (see Selviaridis & Spring 2007). The term contract logistics is considered synonymous to using 3PL services. 3PL was not identified until the 1980s as a separate industry, but it has been the focal point of numerous studies as it has grown (Ashenbaum, Maltz & Rabinovich 2005). Lieb (1992) states that 3PL involves:

> *''... the use of external companies to perform logistics functions that have traditionally been performed within an organization. The functions performed by the third party can encompass the entire logistics process or selected activities within that process.''*

The most important factors that affect the outcome of any outsourcing operation are organizational support from top management, and coordination between the 3PL user and provider (Bowman 1995; Andel 1994; Trunick 1989). Staying true to the research problem, this study focuses only on the coordination aspect. When using 3PL providers, logistics is no longer just a function inside the company; it is a relationship between two parties. When you add the end-customer to the mix, it becomes a triadic form of relationship (Figure 2Figure 2 The logistics triad (Bask 2001)).

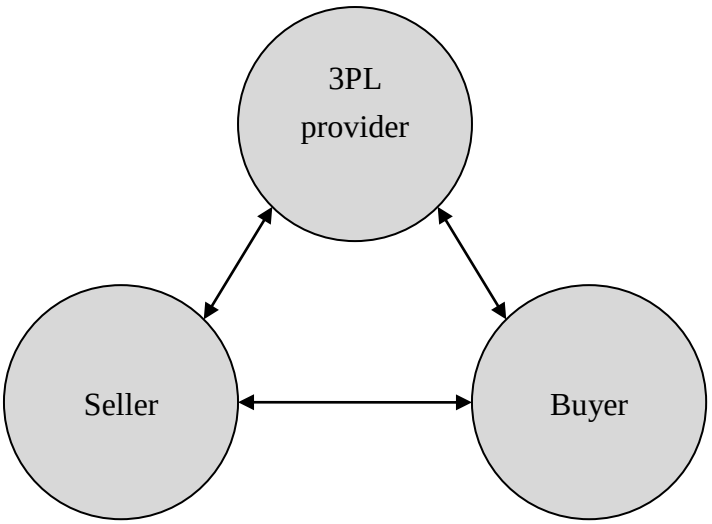

Figure 2 The logistics triad (Bask 2001)

According to Bask (2001), a logistics triad is "a cooperative, three-way relationship between a buyer of goods, the supplier of those goods and a logistics service provider moving and/or storing the goods between buyer and supplier". Using 3PL services is often seen only as a dyadic contract between the 3PL provider and the buyer of its services. However, to truly achieve an efficient supply chain when outsourcing logistics, one must take all the related parties into consideration. Bask (2001) describes these triadic relationships in supply chains as:

> *''... relationships between interfaces in the supply chains and third-party logistics providers, where logistics services are offered, from basic to customized ones, in a shorter or longer term relationship, with the aim of effectiveness and efficiency.''*

The key benefit in using contract logistics is the time and resources that are attained from the outsourcing of logistics operations, which can be invested in the core business of the company (Africk & Markeset 1996; Trunick 1989). Other potential advantages are access to world-class processes, improved ability to react quickly to changes in business environments, exchanging fixed costs with variable costs, and access to re-

sources not available in own organization (Persson & Virum 2001). Obtaining at least some of these advantages should result in more value to the company, as the 3PL provider is focusing on what they do best, while you are left with more resources to invest in your core business.

Transportation and warehousing have long been the typical functions targeted for outsourcing when firms consider their logistics performance (Langley 2012, Razzaque & Sheng 1998). Using 3PL services enable firms to better scale these functions according to the market needs (Jharkharia & Shankar 2007). Handling them in-house typically requires heavy investments into human resources, facilities, and a fleet to handle all the volume, which further speaks for the use of 3PL services in order to avoid these initial investments. Maltz (1994), through his study results, presented that a typical third party warehouse user is:

> *"... a high volume shipper with relatively standardized customer requirements, probably in the consumer goods or chemical market. The company may be only moderate in size. The firm does not perceive changing warehouses as costly. Finally, the likely third party user believes that its warehousing needs do not require major financial or human investment from the third party provider."*

According to the most recent Third-Party Logistics Study by Langley (2012), 39% of total logistics expenditures in firms globally are directed to outsourcing. The corresponding level for European firms is 55%. To further exhibit the strong status of outsourcing in logistics, 71% of transportation expenditure and 48% of warehouse operation expenditure in European firms were handled by 3PL providers. Even though the study comprised of firms from a variety of different industries, these statistics speak for the belief and previous experiences that firms have on logistics outsourcing having a positive influence on their performance. 3PL users are generally enjoying reductions in logistics costs of up to 15%, while inventory cost reductions are around 8%. (Langley 2012.)

Inspecting this phenomenon on a national level in Finland, in order to explain the context of the firm in this case study, a study by Solakivi et al. (2012) reveals that over 90% of manufacturing firms have outsourced at least a part of their domestic transportation, while the equivalent number for international transportation was around 70%. Warehousing was slightly under 30%. However, the authors noted that Finnish companies are not as aggressive in outsourcing as their counterparts in Europe and North America. Hilletofth and Hilmola (2010) had similar findings from their concise sample of Finnish and Swedish firms in the industrial and service sectors. Their survey study showed that almost 90% of firms had outsourced their transportation and 50% had out-

sourced warehousing, to at least some extent. They also noted that firms in Northern Europe seem to be a little bit behind on the outsourcing trend when compared to the overall development in rest of Europe.

Solakivi, Töyli, Engblom & Ojala (2011) did a survey-based study on the logistics outsourcing of Finnish small- and medium-sized enterprises (SMEs). Their results pointed out that transportation was heavily outsourced, while warehouse-related operations were either moderately outsourced, or usually not outsourced at all. This was especially true for manufacturing companies, compared to the trading companies in their study sample. The respondents were also confident that the level of outsourcing in their logistics operations will continue to increase in the coming years, with warehousing and inventory management being two of the most likely candidates. Combined with the fact that larger enterprises tend to have higher logistics outsourcing levels than SMEs (Langley, Dort & Ang 2005), you could argue that outsourcing your logistics operations becomes more lucrative as your company grows in size. Another intriguing finding in their study was that in material management-related services "the levels of total logistics costs … were lower among companies outsourcing heavily or not at all, and higher for moderate outsourcers". As Solakivi et al. (2011) concluded, "the relationship between outsourcing and the level of logistics cost is not as straightforward as often assumed".

Power, Sharafali, and Bhakoo (2007), in their study of Australian 3PL service providers, came to the conclusion that 3PL offers "a set of benefits beyond mere cost control". They found substantial support for their hypothesis, that the 3PL provider's competitive priorities, service offerings, and use of technologies had significant association with the contribution of the 3PL to customer performance. It is the use of technologies that is the point of interest in this thesis. Even though their study focused on Australia, you can consider their findings as a guideline for other countries at least in the Western world.

However, outsourcing is not a magical cure to all your logistics problems. There are many reasons that discourage the use of outsourcing, from which loss of control to the 3PL partner is usually the most commonly cited reason (Langley 2012; Bowman 1995; Byrne 1993). Gaining value out of outsourcing is always connected to the context of the firm. Kenyon and Meixell (2011) noted that empirical evidence is not always on the side of outsourcing when talking about performance improvement. According to their findings on U.S. manufacturing firms, logistics outsourcing has a particular set of factors that impact the overall success of a firm's cost reduction plans on the level of goods sold. The results of the outsourcing process are strongly connected to the size of the firm, and the volume and mix of its product portfolio. Large manufacturers with low product mix tend to get the most benefits from outsourcing. This statement matches with the previously noted typical 3PL user profile by Maltz (1994). Kenyon and Meixell also point out that firms with low volume and product mix are better off keeping logis-

tics functions in-house, since their business isn't large enough to provide negotiating power towards 3PL providers. Interestingly, for manufacturers with high volume and product mix, outsourcing their warehousing functions tends to be beneficial, but outsourcing transportation increased costs on goods sold. However, Kenyon and Meixell noted that failures in outsourcing can also arise from "competitive priorities that emphasize dimensions other than cost or cost alone". Therefore, while the general opinion on outsourcing may point to one direction, firms should always consider their priorities and context when making decisions on logistics outsourcing.

Outsourcing discrete supporting functions, or revamping a distribution operation are totally different scenarios with distinct conditions and requirements. The strengths of the 3PL provider must be matched to the needs of your firm in order to gain high level customer service from outsourcing. This outsourcing decision should be based on explicit reasons, usually relating to costs, and measurable objectives that can be evaluated against the alternative of performing these operations in-house (Bowman 1995; Turnick 1989). This requires hard facts and data retrieved from the supply chain operations. Information systems that transform this data into critical information, and provide it to company management are therefore essential in the follow-up of logistics. ERP can be the solution, and its capabilities are discussed in chapter 3.

The 3PL sector has seen significant growth the past few decades as logistics outsourcing has become more popular. The increased demand has even lead to a certain degree of maturity in the 3PL industry, and the development of more expansive business models (Langley et al. 2001; 2003; 2005; Langley 2010; 2012). The 3PL provider is typically very near to the end-customer producing the key data, which should be facilitated to the 3PL user. The efficient management of this data can be the source of transformational insight (Langley 2012). This requires competence in information handling, and firms should require this from their 3PL providers. The IT capability of a 3PL provider can have a significant impact on its competitive advantage in the 3PL market (Lai, Li, Wang & Zhao 2008).

The ongoing trend in the 3PL market is that clients are reducing or consolidating the number of 3PL providers they use (Langley 2012). This puts the pressure on the providers to improve their services. This can also be seen as a trend towards more strategic partnerships with fewer parties on behalf of the client. The level of coordination and information integration between the 3PL user and provider will most likely be a key aspect in the 3PL market in the future.

Every firm needs to decide on whether outsourcing their logistics functions is beneficial to their performance. While outsourcing is seen as a lucrative option, some functions should be kept in-house if they are perceived as core competencies (Lieb 1992; Sheffi 1990) or if the volume or context of your business does not justify the outsourcing decision. Logistics is undoubtedly very important for manufacturing firms with ex-

tensive amounts of goods being transported in and out of their factories and warehouses. However, these functions can still be outsourced to achieve cost savings and even simultaneous improvements in quality, as discussed in the previous chapter. 3PL providers can have special assets, expertise, and experience that the buyer has deemed too expensive to have in-house (Razzaque & Sheng 1998). Through outsourcing, the client can access the benefits of these resources without investing in them internally.

2.3 Transaction cost economics

Transaction cost economics (TCE) was a theory largely popularized by Oliver E. Williamson (1975; 1985; 1999) even though he himself considers Ronald Coase as the father of the term with his classic paper "The Nature of the Firm" from 1937 (Williamson 2010). Coase saw the market and the firm as two different ways of organizing labor. In brief, TCE is at the core of the classic "make-or-buy" decision, and that is what outsourcing is all about. If it is more expensive for a firm to make something than to buy it from another firm, then the firm should outsource this function and buy it as a service.

In the realm of logistics, firms are looking to reduce operating costs and improve their customer service level. TCE posits that firms should use the sourcing method that will minimize the costs, be it in-house or outsourced. While logistics might be a key activity for your firm, it is the core business for 3PL providers, so it makes sense to buy their services instead of trying to handle it in-house. Also, by contracting out the operations, the resources previously tied in it can now be used to improve the firm's own core business (Aertsen 1993).

In addition to the nature of the transaction, Williamson saw that a human element of bounded rationality and opportunistic behavior also affect the total transaction costs. Due to the bounds on human rationality, contracts with 3PL providers will never be complete in the sense that you could predict and prepare for every possible outcome. This can leave you vulnerable to opportunistic behavior from the provider, if he tries to take advantage of your poor leverage in the situation. This will be especially troublesome, and expensive, if the outsourced function is later realized to be of such high importance to your competence that it should have been kept in-house.

Williamson (1999) identifies three factors in TCE that have an impact on the magnitude of these transaction costs or the probability of opportunistic behavior. These three factors are the frequency of the transactions, asset specificity, and the degree of uncertainty. The frequency of transactions is to some extent a two-sided coin. On one hand, frequent transactions can be an incentive for your 3PL provider to stay loyal to you. They do not want to compromise a profitable partnership. On the other hand, frequent transactions can also justify you investing in it yourself, because the high volume will

lead to benefits from economies of scale. TCE seeks to diminish costs not only on transactions, but also on production costs (Williamson 1999). The additional costs of investments in specialized assets are more easily recovered in transactions with high frequencies. Therefore the latter scenario is more in line with the principles of TCE, confirming that higher frequency of transactions should lead to keeping the operation in-house. Then again, there have been empirical studies that suggest the opposite, but the differences seem to be a result of different competitive strategies between companies (Maltz 1994). The frequency of transactions can be seen as dependent on business context.

Asset specificity can be to some extent connected to the uncertainty factor, especially in the field of technologies required for the efficient handling of logistics. Investing heavily into assets that only serve the purpose of collaborating with the 3PL provider is a situation that you want to avoid. If the partnership happens to end abruptly, you are left with assets that have little purpose in other contexts. It is therefore more suitable to invest in your internal resources to handle the logistics in-house, if outsourcing requires very specific assets to begin with. This factor can as well be seen as dependent to business context.

Uncertainty is the factor that has the most intriguing nature for this study. High levels of uncertainty will speak for the use of in-house logistics. The sources for this uncertainty can be the buyer-seller relationship, market demand, meeting outsourcing goals, or technological advances affecting logistics services. In the face of uncertainty, control over your operations should better enable you to respond to the changes in the market. Managing, controlling, and possibly minimizing this uncertainty becomes a valuable advantage for any firm. While uncertainty can also be related to the business context of the firm, this is where the researcher sees the most potential for improvements regarding operational performance. Uncertainty can be reduced with proper procedures. While Kakabadse and Kakabadse (2002) presented that outsourcing is a way of transferring the risks related to uncertainty, it does not vanish completely. It merely introduces different kinds of challenges as now you need to control the outsourcing partnership with its own sources of uncertainty.

In general Williamson (1975) states that high levels in these three factors should lead to bringing the functions in-house. Contemplating on these three attributes regarding your specific business context and buyer-seller relationship should guide you in making solid outsourcing decisions. The trade-off between internal execution and external sourcing is the key determinant. However, one should realize that these factors are not static as you can improve your firm performance, for example in the way you handle uncertainty. This can make outsourcing more feasible.

2.4 Challenges in logistics outsourcing

Naturally, there are challenges and drawbacks in logistics outsourcing, and many of them are related to either organizational or firm context issues. Organizational concerns can be, for example, lack of support from top management, cultural incompatibility, loss of logistics expertise, or brand integrity (Rushton & Walker 2007). Firm context issues can be due to, for example, logistics being too important for the firm to outsource it, or corporate philosophy excluding the use of logistics providers (Langley 2012). These types of challenges are considered by the researcher to be more related to the transaction frequency, and asset specificity factors presented in TCE. While organizational and firm context issues have significant influence on whether a firm should even engage in outsourcing, this thesis is more interested in the uncertainty factor of TCE, which typically manifests on the operational level. Uncertainty is something a company can proactively try to minimize with focused efforts. Minimizing the causes of uncertainty will hopefully lead to better supply chain performance in logistics outsourcing operations, or at least encourage companies to engage in outsourcing (Williamson 2010).

Supply chain performance can be tied to relationships in the 3PL environment, because using 3PL services should be seen as a relationship of mutual interest, and not just a supplier-customer connection. Good relationships lead to good results, and the foundation lies in communication. Lynch (2000) stated that "poor communication is second only to poor planning as a cause of outsourcing relationship failure". Stank, Goldsby, Vickery, and Savitskie (2003) did a survey study on relationships in the 3PL industry, and came to the conclusion that "relational performance is antecedent to operational and cost performance". Wilding and Juriado (2004) did a study on the European consumer goods industry, and found that failed partnerships between 3PL providers and their customers were more likely due to intangible factors such as basic communication problems. They also noted that cost is losing its importance as a driver of outsourcing decisions. This argument is further encouraged by Solakivi, Töyli and Ojala (2013) in their survey study on logistics outsourcing in Finnish manufacturing and trading companies. They argued that while cost savings is a very highly ranked motive for companies, in the current business world "the need for flexibility seems to be the strongest motive for logistics outsourcing". Communicating the relevant information across the supply chain to ensure this flexibility is therefore of great importance for logistics outsourcing to succeed.

Staying true to the situation in the case firm of this study, the logistics challenges are inspected only in the transportation and warehousing functions. Transportation involves the management of goods from production to consumption, while warehousing is the storage of components, raw materials, and finished goods (Coyle, Bardi & Langley

2003). In the transportation and warehousing functions, some examples of typical managerial concerns are:

- changes in market demand
- capacity planning
- delivery lead time
- prompt deliveries
- inventory levels and replenishment
- backorders.

Every firm wants timely data and information on these issues in order to efficiently manage them. However, there can be distortions in the information flow along the supply chain which leads to highly variable demand signals; a phenomenon commonly called the bullwhip effect. The long replenishment lead time was identified by Lee, Padmanabhan and Whang (1997) as a major source for the bullwhip effect. This is even more prevalent in global supply chains due to longer distances (Bhatnagar & Teo 2009). Reducing the bullwhip effect has been a familiar goal for logistics managers for the past years, and it clearly requires efficient information flow management.

The level of integration between the firm and the 3PL provider determines their efficiency in managing information flows. Improved connectivity will ensure the sharing of information, and hopefully enable the firm to better control the operation. Conversely, poor development, testing, and implementation of information technology interfaces, which are essential for the new processes, can lead to failure in the 3PL relationship (Rushton & Walker 2007).

Along with the operations controlled by the 3PL provider comes the monitoring and measuring of their performance. This is also requires sufficient data and information. In a survey study done by Eyefortransport (2007), it was noted that the most likely factor leading to failure in outsourcing strategy is the inefficient management of the operations by the 3PL provider, with 67% of the respondents agreeing on this. However, only 37% said that problems evaluating and monitoring 3PL performance was a factor. The author sees a mismatch here between the effort put into managing the 3PL relationship, and the expected outcomes. While some of this can be explained by the reluctance of firms to take responsibility for failures and blaming it on the 3PL provider, there are opportunities for improved logistics outsourcing performance if the correct monitoring procedures are put in place. The analysis of the whole operation with suitable metrics is then necessary.

Uncertainty by its definition is not being certain about future events because you have limited knowledge. Therefore, increasing this knowledge is a simple remedy. However, the amount of data and information that you can gather from your business and the market is so vast that the task suddenly becomes quite demanding. With the

assistance of computers, firms have gathered, processed, analyzed, and interpreted this data for the past few decades. Information systems are used to manage uncertainty in supply chains by providing relevant information (Prater 2005), but the playing field for businesses has changed considerably. Firm boundaries are more transparent, and firms are increasingly engaged in partnerships and alliances that require the coordination of more than just your internal operations. Gaining the knowledge and sharing it with your partners in an effort to increase supply chain performance has become one of the missions of modern enterprise resource planning systems.

3 ENTERPRISE RESOURCE PLANNING SYSTEMS AND SUPPLY CHAIN PERFORMANCE

3.1 Information and communication technology as outsourcing enabler

ICT has an integral part in the coordination of companies across the supply chain. This is also true for 3PL providers, as ICT has become increasingly important in gaining competitive advantage among service providers (Rantala & Hilmola 2005). ICT is typically used in warehouse and transportation management systems that provide real-time information of the material flows in the supply chain (Helo & Szekely 2005). Inaccurate data or misinformation can lead to disruptions in the supply chain. This leads to increased logistics costs, but the efficient use of ICT can mitigate such costs (Pokharel 2005). While many 3PL providers also offer IT outsourcing, it is not necessary to outsource these kinds of systems to your 3PL provider as modern ERP systems can also handle these functions. The key point is then the coordination between your ERP and the system of the 3PL provider.

One of the main benefits of using technology is the increased availability and sharing potential of information. The collection, processing, and analysis of information are at the heart of ERP systems. Furthermore, sharing this information with your supply chain partners is the key to better supply chain performance. Knowledge sharing has such a substantial role for logistics success that you should engage in it even before the logistics contract is signed (Kerr 2005). Electronic data interchange (EDI) "aids interorganizational communication by coordinating information and material flows" (Tan, Kannan, Hsu & Leong 2010). EDI can also be defined as “a set of standards, hardware and software technology that permits computers in separate organizations to transfer documents electronically” (Boddy, Boonstra & Kennedy 2005). Thus, effective EDI use can facilitate cooperative relationships between organizations in order to share vital information. This alignment of information will hopefully reduce uncertainty and enhance visibility within the supply chain, which, according to the principles of TCE, will lead to lower transaction costs. (Tan et al. 2010.)

3.2 Enterprise resource planning systems

Modern ERP systems owe their existence to their predecessors in material requirement planning (MRP) and manufacturing resource planning (MRPII) systems that were developed a few decades ago. They were focused on the optimized execution of internal

operations, namely manufacturing. When ERP came along, it expanded inside the company as it handled more than just the manufacturing. Traditional ERP systems were called back-office systems because they focused on processes that didn't involve the customers, at least not directly (McGaughey & Gunasekaran 2007). Over time firms and ERP system developers started to realize more capabilities that they could utilize in their operations management, which was partially enabled by the advances in computer technology. This represents the evolutionary first step for firms striving for improved operational performance across firm boundaries. In modern planning systems firms have moved from optimized sub-operations to the coordination of the entire firm through efficient handling of material and information flows. (Yang & Su 2009.)

Tejeida-Padilla, Badillo-Piña, and Morales-Matamoros (2010) propose a definition for ERP:

> *"ERP is an information system that helps production systems to reach viability through several modules that process data and information as close to real time as possible and directs the information that flows around the various communication linkages."*

Another definition comes from Akkermans, Bogerd, Yücesan, and Wassenhove (2003):

> *"ERP is a comprehensive transaction management system that integrates many kinds of information processing abilities and places data into a single database."*

Raw data of different transactions can be hard to utilize, but the ERP system can

> transform this data into information, which can then be used to support
> making process of company management. Boddy et al. (2005) present a
> between data, information, and knowledge (

Figure 3). Data consists of raw, unanalyzed facts and figures which cannot be used until it has undergone at least some sort of data transformation through people, procedures, hardware, software, or other suitable methods. After this transformation the raw data is turned into information with a meaning to the receiver. Furthermore, when this information is combined with the prior learning and experience of the receiver, it is turned into knowledge which guides people towards actions.

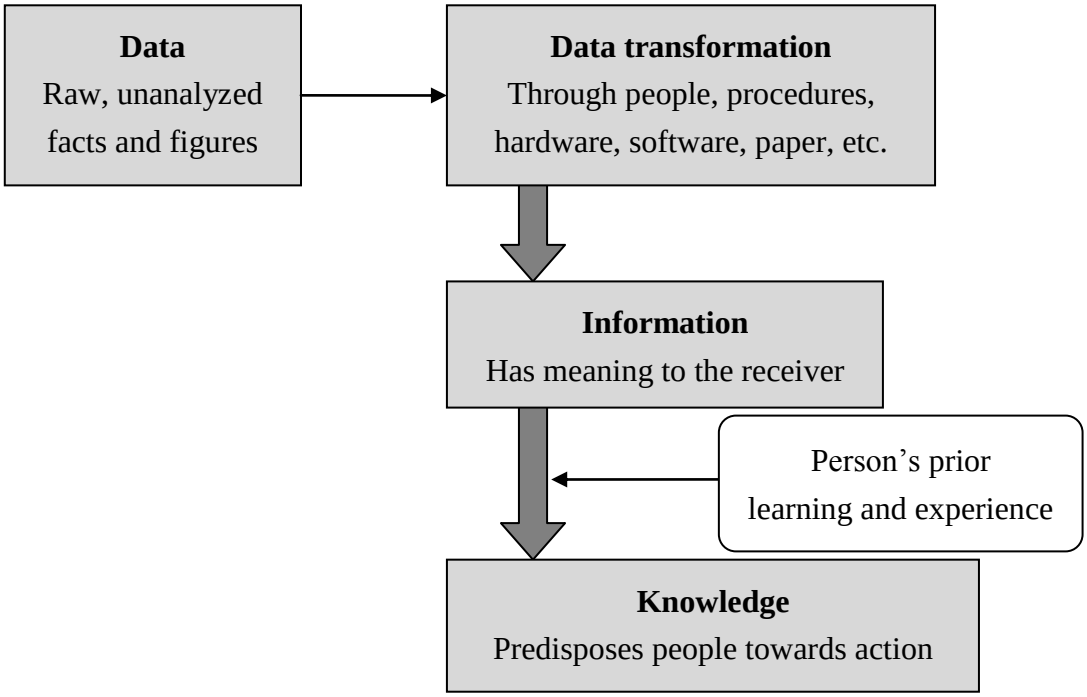

Figure 3 Data, information and knowledge (Boddy et al. 2005)

While the human element is always necessary for data interpretation, the data transformation through software, in particular ERP system, usage is in the interest of this study. McGaughey and Gunasekaran (2007) propose that the aim of the ERP system is to create value and reduce costs "by making the right information available to the right people at the right time". In other words, the aim is to acquire knowledge from raw data.

The implementation of an ERP system is a long, tedious, and expensive project which can take up to tens of millions of dollars, and several years (Shatat & Udin 2012, Rizzi & Zamboni 1999). It is also usually linked to business process re-engineering with the aim of developing the business process activities in the entire firm (Subramoniam, Tounsi & Krishnankutty 2009). Implementing an ERP system will change the way people work, so it seems logical to change the processes as well (Akkermans et al. 2003). While the implementation process is critical to the success of the ERP, and there has been extensive academic research on this topic (see Schlichter & Kraemmergraad 2010), it is left out of the scope of this study. As for the case firm at hand, the author presumes successful ERP implementation with little negative adjustment effects on the performance outcomes on the operational level.

3.3 Effects on supply chain performance

ERP systems can greatly benefit SCM as they answer to the task of controlling “related information from the point of origin to the point of consumption” found in the definition of logistics presented in chapter 2. Companies want their ERP system to "enable them to swiftly respond to the varied needs of their customers, to share appropriate real-time information, and to establish excellent relationship with supply chain partners" (Yang & Su 2009). There is strong support in supply chain research (Shatat & Udin 2012; Yang & Su 2009; Park & Kusiak 2005; Olson, Chae & Sheu 2005; Davenport & Brooks 2004; Zheng, Yen & Tarn 2000; Lee et al. 1997) that an ERP system can improve the performance of the supply chain through integration and coordination by sharing information with partners in the supply chain. This encourages cooperation among supply chain partners, which leads to lower transaction costs (Tarn, Yen & Beaumont 2002). Furthermore, transparency across the supply chain will reduce supply chain uncertainty (Akkermans et al. 2003). In our adherence to the theory of TCE, these are pleasing results.

However, Koh, Saad and Arunachalam (2006) suggest that companies should not solely rely on their ERP system for managing a supply chain, as ERP systems did not originally have the improvement of the supply chain as the main objective. Their initial focus was on internally-operated processes, such as finance, accounting, manufacturing, and human resources. Bridging the gap between internal production and external coordination is the direction where modern ERP systems need to evolve, and in some cases they already have. The term ERPII was already coined over a decade ago by the market analyst company Gartner Group (Bond, Genovese, Miklovic, Zrimsek & Rayner 2000). In brief, ERPII is about moving from internal management to external integration up and down the supply chain, aiming for inter-enterprise resource planning. It can also be seen as the summation of ERP, SCM and CRM (Bond et al. 2000). Web-based technologies, mobile technology, XML messaging standards, and cloud computing are some of the technological advances that have made the kind of collaboration possible that ERPII envisions. While the actual term ERPII is not widely used, it is still apparent from looking at the service offerings of the top ERP system providers that modern ERP systems are clearly moving towards increased integration across the supply chain. This development aligns with the current needs on the market, as Koh et al. (2006) argue that instead of it being firms against other firms, the competition has come to a point where “a company will compete in the market based on the overall strength of its supply chain”.

There have also been arguments against ERP as a source of supply chain performance. Akkermans et al. (2003) carried out a Delphi study where 23 Dutch supply chain executives from various industries discussed the impact of ERP systems on supply chain management. When discussing about the limitations to SCM performance,

ERP was interestingly seen as a hindrance to outsourcing SCM functions, due to the design of ERP systems being an integrated system for one firm. ERP systems were seen to have a lack of:

- extended enterprise functionality
- flexibility in adapting to changing supply chain needs
- advanced decision support capabilities
- open, modular system architecture.

However, one must note that their Delphi study was carried out in 1999. Although these results are from over a decade ago, which is a rather long period for technology to evolve, they still hold value in the sense that current ERP systems should be able to answer to these shortcomings that arose from the Delphi study. Based on the review of more up-to-date academic literature presented earlier in this chapter, and the offerings of current system providers, the researcher argues that these weaknesses have been overcome by many current ERP systems.

Another contradictory study was done by Wieder, Booth, Matolcsy and Ossimitz (2006). Through a survey study on Australian companies that had adopted an ERP system, they noted that there was no significant positive impact on supply chain performance from implementing an ERP system. However, upon closer inspection one could argue that their results are also outdated as the actual survey was carried out in 2001 while the study was published some years later. Things can change a lot in twelve years. In addition, they accompanied their results with the notion that the firms that had implemented a SCM system together with the ERP system had actually seen positive impacts in their supply chain performance. This division between ERP and SCM systems can these days be seen as non-existent, because many modern ERP systems already include SCM capabilities. Therefore the basis of analysis for ERP studies has evolved over the years, and comparing the results of Akkermans et al. (2003) and Wieder et al. (2006) to the ERP systems of today is dubious at best. Up-to-date research is therefore necessary.

The notion that an ERP system provides any positive impact on performance in any area of company management is naturally connected to the personnel using it. The level of training and experience required to fully use the capabilities of an extensive ERP system can take years. However, while this is also an interesting topic, it is not in the scope of this study, as the focus is on whether or not ERP systems can help your firm in the first place. Even though there has been strong evidence speaking for the positive effect of ERP systems on supply chain performance, it has not been unanimous, as presented in this chapter.

4 ENTERPRISE RESOURCE PLANNING SYSTEM BENEFITS IN LOGISTICS OUTSOURCING

Outsourcing has given many firms opportunities to lower their logistics costs while improving service quality. However, there can be disruptions in the supply chain caused by uncertainty. Koh and Tan (2006) describe supply chain uncertainty as "any unpredictable events that cannot be planned for during the production process in a supply chains". It can also be extended to the delivery process. Decreasing this uncertainty is a goal for every firm. It is also possible to transfer risks associated to uncertainty by using outsourcing (Kakabadse & Kakabadse 2002). This is also the case in supply chain uncertainty as the trend of using logistics outsourcing is growing. The task then changes to integrating the functions performed by the 3PL provider to the overall operation of the firm, as well as controlling the 3PL partnership so that the associated benefits are indeed acquired from outsourcing.

With improved information analysis and sharing capabilities through the use of a modern ERP system, firms can lower the uncertainty in their supply chain operations. This will lead to increased supply chain performance especially in the field of transportation and warehousing where transactions are frequent and flexibility is crucial. Furthermore, the ERP system will provide the necessary coordination and monitoring capabilities to manage transportation and warehousing even when they are outsourced to a 3PL provider. This can encourage firms to engage in further logistics outsourcing as the loss of control of their operations is minimized through efficient monitoring and evaluation of the 3PL partnership. Figure 4 illustrates the theoretical framework for this study by combining logistics outsourcing, theory from TCE, and the effect of ERP systems on uncertainty in order to explain supply chain performance. In transaction cost economics theory, the factors of frequency of transactions and asset specificity are seen by the researcher as related to firm context. This puts them in the realm where companies have little influence on these factors so investing time and effort on improving these elements can be considered a waste. On the contrary, uncertainty is something we can actively manage and hopefully minimize, as it stems from the lack of information and knowledge. By gaining more knowledge on the logistics tasks at hand with efficient information flow and management, you can mitigate the adverse effect of uncertainty on supply chain performance. This thesis analyzes the use of ERP systems as a means to this goal.

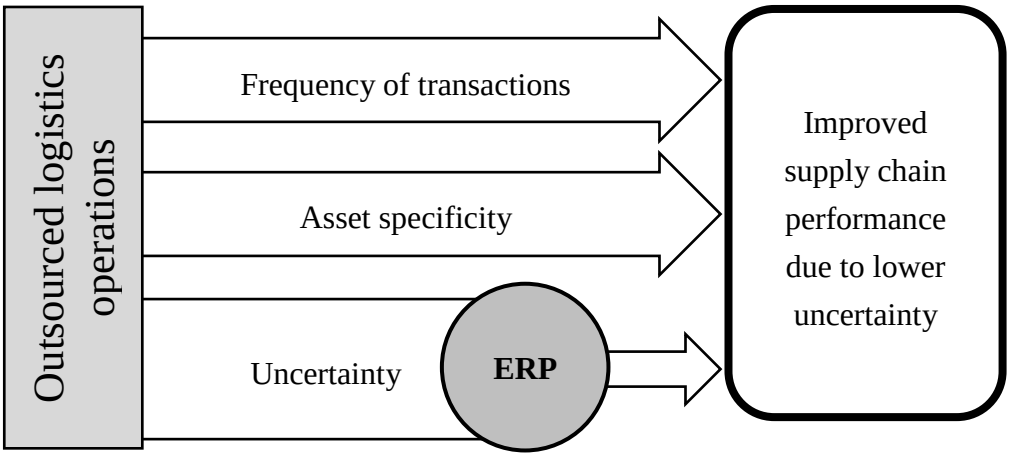

Figure 4 Benefits of an ERP system in logistics outsourcing and consequent supply chain performance

From the perspective of this study, the uncertainty is mostly related to the relationship between the firm and the 3PL provider, even though the demand planning is also of great importance. 3PL relationships should be seen as collaborative partnerships instead of mere supplier-buyer connections. Partnerships call for cooperation and integration between all parties, with the most fundamental piece of this arrangement being the efficient information flow between the parties.

This framework can be connected to the uncertainty circle concept presented by Childerhouse and Towill (2004). In brief, they illustrate different uncertainty sources as segments of a circle, with the aim of decreasing the surface area of each segment, i.e. the level of uncertainty. Figure 5 presents their model with the connection to this thesis. The sources of uncertainty presented by Childerhouse and Towill (2004) are related to demand, supply, control systems, and the value added by the firm.

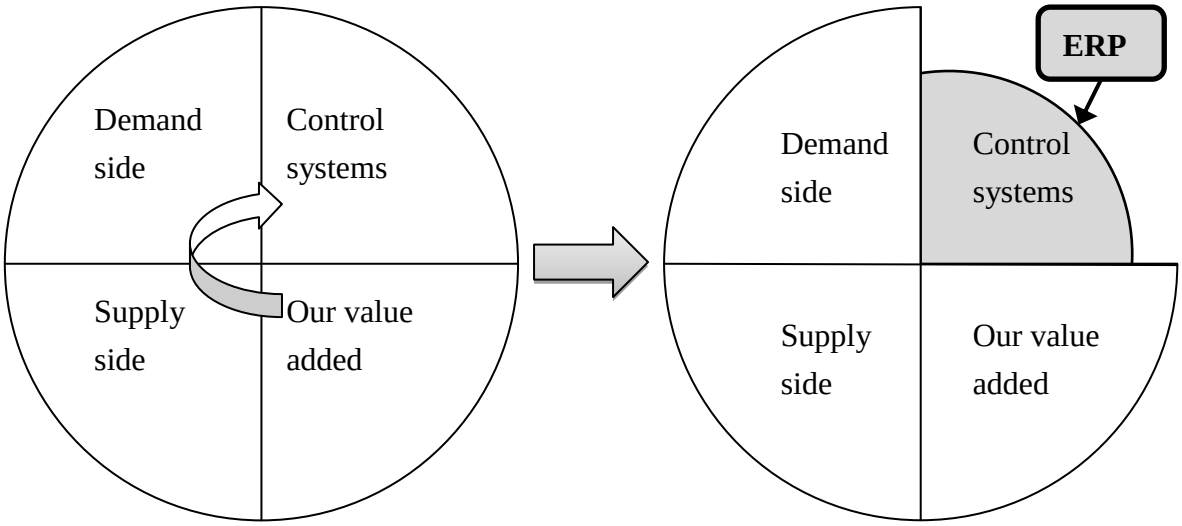

Figure 5 Concept of uncertainty circle (adapted from Childerhouse & Towill 2004) combined to the ERP perspective of the current study

The concept of uncertainty circle calls for a reduction in the surface area of each segment in a sequential fashion starting from the firm's own value added processes by using business process re-engineering. After the internal processes have been improved the acquired expertise is then put into use by improving supplier performance. Lastly the demand side is the target for improvement. Control systems can be seen as a continuous improvement with the uncertainty related to it progressively reducing during the whole process. This thesis is concerned with the segment of control systems as the uncertainty related to it is reduced by improving the information flow and sharing across the supply chain (Childerhouse & Towill 2004). This simplifies the synchronization and coordination of efforts, therefore facilitating better decision making. An ERP system is a potent tool for coordinating information flows across the supply chain.

In light of the theoretical framework, this thesis proposes that in logistics outsourcing situations the use of an ERP system as a tool for coordination and integration has a positive impact on supply chain performance. It does this by decreasing the uncertainty related to the 3PL relationship and market situation. This is achieved by improving the flow and use of information across the supply chain.

5 RESEARCH METHODS

5.1 Research design

This study is a qualitative study as it aims to gain in-depth understanding of a phenomenon, which is a focal element in qualitative research (Eskola & Suoranta 2008). There are many methods in the field of qualitative research, but this thesis uses the case study research method to find answers to the research questions. While many still consider case studies feasible only for exploratory research, they can also be used to describe and test propositions. In fact, it has been recommended by many researchers as an ideal tool for improving conceptual understanding of complex phenomena. The case study method allows the investigator to employ a more holistic approach to the studied phenomenon. It is preferred when examining contemporary events where you can observe the phenomenon and conduct interviews of the persons involved in it. (Yin 2003.)

The case study method receives criticism because its results supposedly cannot be generalized because of a small sample size, but this argument is based on false logic. Many of the critics tend to think in the ways of statistical generalization common to quantitative research, which is without a doubt not the role of case studies. Instead they are focused on analytical generalization by expanding and generalizing the study results to underlying theories, not enumerating on frequencies of events. (Yin 2003.) Expanding on current literature was the objective of this study as well.

The case study method was selected in order to test the theories in current literature regarding logistics outsourcing in a real-life situation. This empirical-descriptive approach is very common in the area of 3PL studies (Selviaridis & Spring 2007). By analytically generalizing the results of the case study to the theories that arose from the literature review, the researcher analyzes the validity of those theories. The selection of the case study method is also justified by its fit to the final research question; *how did the ERP system affect the decision of the case firm to outsource their warehousing and transportation from the viewpoint of operational uncertainty?* The point of interest is in the ERP system and how the company management perceives its benefits in logistics outsourcing decisions.

Within case study research, there is a division between extensive and intensive case studies. Extensive case studies aim at discovering common patterns across multiple cases. This study follows the intensive case study method as the focus was exploring only one case, but with more in-depth analysis. The objective is to develop an understanding of the case from the perspectives of the people involved in the case. While there is a difference in their approach, both case study methods can be used for either in-depth

analysis or theory testing, as it is mainly the decision of the researcher. (Eriksson & Kovalainen 2008.)

5.2 Data collection

The case company is a Finnish manufacturing company that specializes in technology HPAC solutions. Due to the request by the case firm, the identity of the firm and interviewees are not disclosed. The firm has business in Nordic countries and in the Baltic region. The firm can be classified as a large enterprise, having nearly 100 million EUR in turnover, and over 400 in personnel in 2012. The focus of this case study was their business in Sweden. There was no production in Sweden, so all the goods had to be transported from other countries, e.g. Finland. This presented a challenge from a logistical standpoint, as the firm had to make a choice between investing into a warehouse and personnel, or outsourcing this function. This process also required the expansion of their ERP system for the Swedish market.

The case company was selected for this study using a contact person with extensive business history with the firm. All communication was done by email. The CIO of the firm suggested a possible candidate for the researcher to begin with. After the first interview was conducted, additional candidates were discussed with the interviewee. He provided the author with the email addresses of suitable candidates, which were then contacted. The next candidates received the interview questions attached with the email message in order to decide whether they were suitable for an interview. The second interviewee also suggested some additional candidates. The researcher trusted the firm personnel to identify the most suitable candidates amongst themselves.

Overall three interviews were conducted. This was deemed as the saturation point by the researcher where further interviews would not have brought a significant increase in the information regarding the research phenomenon (Eskola & Suoranta 2008). This was a rather natural decision as some of the interview candidates declined to participate due to either believing that the earlier interviewees have most likely given the same answers as they would, or that their expertise was not high enough to give sufficient answers after looking at the questions that were sent beforehand. Therefore the researcher came to the conclusion that all the suitable candidates had already been interviewed. Table 1 displays the interviewees, their positions in the firm, the date on which the interview took place, and the duration of the interview.

Table 1 The interviewees of the research

Name	Title	Date	Duration
Manager A	Business application systems manager	18.6.2013	55 min
Director B	Director of plants	9.8.2013	50 min
Manager C	Customer service manager	21.8.2013	30 min

Manager A had the most experience with the whole outsourcing operation and the ERP implementation process. Director B was heavily involved in the Swedish market from a logistics standpoint, and also took part in the decision making for the outsourcing process. Manager C is currently stationed in Sweden and had been working with the ERP system on the operational level.

The data for this study was collected through semi-structured interviews as it gives some freedom to the researcher to adapt to the answers during the interview. A series of questions was used to guide the interview (Appendix 1) but based on the given answers the researcher also presented additional questions. The interviews for Manager A and C were done via Skype, while Director B was interviewed by phone. The interviews were not recorded, so the researcher was left with the task of writing notes during the interview. After each interview, the personal notes were written up and the summary was sent to the interviewee in order to check that there were no misunderstandings or factual errors during the interview.

5.3 Data analysis

Data analysis poses a considerable task to the researcher in qualitative studies as there are various options but no clear rules. The skills of the researcher are in a major role in order to analyze the data in detail from various points of view without losing any relevant information (Eskola & Suoranta 2008). Yin (2003) distinguishes three general strategies for analyzing case study evidence; relying on theoretical propositions, thinking about rival explanations, and developing a case description. This thesis follows the first option, as it presents a proposition, presented in chapter 4, that ERP systems have an effect on the decision of a firm to outsource logistics, and consequently on supply chain performance, by decreasing factors related to uncertainty.

As an analytical technique, Yin (2003) presents pattern matching as one of most desirable techniques. This technique was also chosen for this study. It involves comparing a predicted pattern to an empirically based pattern. If the patterns coincide, the initial proposition is then seen as valid. In this study, the researcher analyzes the answers given in the interviews in an attempt to identify common patterns among them. These pat-

terns are then compared to the proposition presented in conjunction with the theoretical framework. If there is real-life evidence that an ERP system has a positive effect on supply chain performance in logistics outsourcing situations, then the proposition can be held true, at least in this case.

5.4 Evaluating the validity and reliability of the study

The quality of this study will be examined through four conditions presented by Yin (2003):

- construct validity
- internal validity
- external validity
- reliability

Construct validity refers to the establishment of correct operational measures for the concepts being studied. Selecting the right measurement for the studied events is a common concern for case studies. In order to improve the construct validity of this study, the summary of each interview was given to the interviewee in order to check that there were no misunderstandings during the actual interview. Furthermore, a chain of evidence is created between the underlying theory and study results by ensuring that these two match on every conclusion made in this thesis. However, the major shortcoming for this study concerning construct validity is in the lack of triangulation. Triangulation refers to the use of multiple perspectives to refine and clarify the findings (Eriksson & Kovalainen 2008). From a theory perspective, using TCE as the only underlying theory explaining the studied phenomenon can lead to a narrow point of view. Using theories complementary to TCE, such as the resource-based view, or supply chain management theory, might have given more insight from a theoretical perspective. Additionally, only one source of data was used as empirical evidence; the interviews. Using multiple sources of evidence would have improved the construct validity of this case study.

Internal validity refers to the causal relationships in the phenomenon, whereby certain conditions are shown to lead to other conditions. This was the objective of the pattern matching technique in data analysis. As presented in the findings, there was evidence that patterns similar to the proposition were found in the case firm's situation. This result strengthens the internal validity of this study.

External validity is concerned with the generalization of the results. As previously explained, case studies do not aim for statistical generalization. The purpose is to use analytical generalization to the theory used as the basis of the study. If this connection can be made, then the theory itself can be used to identify other cases to which the re-

sults are generalizable. However, this requires replication across multiple cases. Due to this thesis being a single-case study, the replication process is left to future research in this field, and therefore this thesis cannot provide sufficient evidence for external validity until similar conclusions to this thesis have been found in other cases. This thesis can function as a point of comparison for those studies.

The last quality condition is about the reliability of the study, meaning that by following the same procedures that the author has described in the chapters regarding research design, data collection, and data analysis**Error! Reference source not found.**, anyone could come to the same conclusions. The author has strived for careful documentation of the operational steps taken during the data collection phase, as well as the analytical connections made from the results to the literature review. However, by not using a recorder during the interviews and transcribing the recordings afterwards, the author acknowledges that there were possibilities of data loss as the transcription phase after the interviews was done using hand-written notes made during the interviews and the memory of the author. Concerning the objectivity of the study, one must realize the focal role of the researcher in a case study interview (Eskola & Suoranta 2008). There will always be some level of subjectivity in the interpretation of the data given by the interviewee, as well as in the answers themselves. The dialogic nature of interviews always has an element of subjectivity. While this can affect the trustworthiness of the data, the author sees this as a necessary evil in order to explore cases in a more holistic and engaging way that cannot be done by simple measurements and statistical analysis. To improve the reliability of the study, quotations that support the research results are provided from the interview summaries. It should be noted that they were translated from Finnish to English by the researcher.

6 RESULTS

Overall, the findings from the interviews were aligning with theories from the literature review. The most interesting ones were related to the typical challenges with supply chains and ERP systems, and how outsourcing can lead to sidestepping these challenges. All respondents stated that logistics was not a core function to their firm but it definitely had a strong impact to its performance. The importance of logistics has increased during the last few years, and the modern global business environment has made it possible to manage logistics in new ways (Director B). Traditional logistics settings with company-owned warehouses and transport personnel have given way to outsourced logistics services provided by 3PL partners. The company had already operated on its current ERP system for some years, even though they implemented it in Sweden at the same time with the outsourcing operation (Manager A). This enabled them to bring their transportation and warehousing operations closer to their Swedish customers.

The main reasons for the outsourcing of their transportation and warehousing in Sweden were the closing down of their central warehouse in Finland, and customer demands in Sweden. They wanted to change their warehousing operations in general, and delivering from Finland to Sweden was seen as too slow and costly. This was also expressed by the customers and their demands for faster deliveries (Manager C). In addition, they wanted to differentiate themselves from the competitors in the market by focusing on faster delivery times (Manager A). This was seen as a competitive advantage in the current market situation. Customer behavior was also different in Sweden compared to other countries, as the customers usually ordered small quantities on a swift regular basis (Director B). The demand levels in Sweden justified the establishment of warehousing operations, but they wanted a flexible solution that can scale according to the seemingly unstable customer demand (Manager A). Outsourcing was seen as an option with lower risks compared to a company-owned operation, partly due to there being no initial investments on facilities and personnel (Director B). Therefore they chose to outsource the warehousing and transportation operation, as they trusted the expertise of their 3PL partner to handle this operation.

> *Logistics partners are more capable these days than for example three years ago.*
> (Director B)

Manager A noted that at some point the demand might increase to such a level that investing into a warehouse could be profitable, but at the time they saw outsourcing as a more beneficial solution. From the TCE perspective, the frequency of transactions was not high enough at the time to justify in-house investments.

3PL partner selection was perceived as a top priority in the outsourcing process (Manager A). It had to be a provider with enough resources and experience to handle these kinds of situations. This lead to a partnership with a large 3PL provider with extensive experience in the Nordic market, and a high volume of logistics operations. A larger provider was needed in order to enjoy economies of scale and ensure flexibility in capacity. The collaboration also led to some process reengineering on the behalf of the case firm (Manager A; Director B). For example, order flow processes had to be synchronized with the 3PL provider to ensure the reliability of the deliveries. A lot of effort went also into the standardization of product information. For example, package size and their conversions between the systems was one aspect. From a technological stand point, this did not prove to be a difficult task, but the more challenging part was achieving mutual understanding between the terminologies that the company personnel and systems used. It came down to basic communication.

> *We were talking of different things. For example, our picking list was their order.*
> (Manager A)

One of the major challenges in the outsourcing operation was indeed the communication between the firms, which was identified by all three respondents. This had mostly to do with the EDI interfaces between their systems. Larger 3PL providers are usually reluctant to adopt their customers' systems, so the connectivity between the two systems is a must. The information flow between the systems is usually handled via EDI messages, and this was a priority for the case firm (Manager A). In addition, there were challenges also outside the EDI messaging as people communicated through other means. The smooth communication between people required some effort as a lot of dialog is still done through email (Manager C). Transparency between the systems is still a challenge (Manager C), and more intensive managerial effort was deemed necessary from the 3PL provider (Director B). These communication challenges align strongly with the reasons for failure in the logistics outsourcing literature, as noted in chapter 2.4. Luckily for the case firm, the problems never escalated to such heights that they could not be overcome.

Their ERP system was seen as an enabler for the whole outsourcing process. It provided possibilities for the case firm to handle these functions. If their ERP had ceased to function, everything would have stopped (Director B).

> *Our ERP was a corner stone for the whole operation.*
> (Manager A)

The integration of their ERP system to the system of the 3PL partner was critical, as real-time information of the warehouse was a necessity to the efficient handling of the operations in Sweden. For example, inventory values is a factor that needs constant managerial effort, and even though the goods are located in the 3PL partner's warehouse you still need up-to-date information on them.

> *We can check the inventory levels in Sweden through our ERP as if we were looking at our own warehouse next door.*
> (Manager A)

From a statistical viewpoint, all respondents agreed that there was significant improvement after the outsourcing was carried out. Even though inventory costs have naturally increased in Sweden due to the new warehousing operation, the total costs have decreased due to significant drops in transportation costs (Manager A). Delivery times were also improved from the previous one week to approximately two or three days. One could argue that they have attained benefits both from the service and the cost leadership strategies, as presented in chapter 2.1. However, Director B noted that the value of faster deliveries must always be considered based on the strategy of the firm. All the customers do not need such short lead times, and therefore providing it can be a waste of resources. Ultimately, their outsourcing decision was seen as a profitable solution (Manager A). One of the downsides to outsourcing was that implementing new processes is slower due to the loss of control.

The ERP system is their main operating system for every business operation. The aim is to have all the business data in one system, and therefore it is a prerequisite for all operations (Manager C). In order to gain information for decision making, the raw data is currently exported to an external reporting tool that ultimately produces all the reports for top management. Sharing this information and further integrating with supply chain partners is a future goal for the case firm, but a version update to their ERP system would be necessary to accomplish this (Director B). They are currently running an older version, which is typical for many firms as updating can be almost as demanding as the initial implementation. Therefore, the updating cycle can range anywhere from five to fifteen years. Nevertheless, they do exchange reports and information primarily via email with the 3PL provider, but sometimes there are mismatches between their reports even though they are generated supposedly from the same data through EDI interfaces (Director B). This can be due to differences in their ERP systems or the way the reports are prepared. These mismatches always require further investigation, and to avoid this the transparency between their systems should be improved. The lack of extended enterprise functionality and advanced decision support capabilities were pointed out by Akkermans et al. (2003) as a hindrance of ERP systems in logistics out-

sourcing, as presented in chapter 3.3. However, as previously discussed, these capabilities have improved in up-to-date ERP systems, and if the case firm decides to update their system version, these problems will most likely be solved. SCM capabilities are standard modules in modern ERP systems.

One of their goals is to simplify processes in order to shift away from manual work (Manager C). Controlling all the data from a single system ensures information integrity across all operations, and with supply chain coordination this information can be shared to partners. Even though the case firm has not reached this point in their efforts regarding their ERP system capabilities and supply chain collaboration, it is a clear goal in the near future.

When asked if their ERP system is a tool for minimizing uncertainty in general, all three respondents agreed that it was definitely important for their firm from that perspective, even though it might have been in a more indirect manner. Uncertainty might not be explicitly used as a term in their improvement plans, but they still aim to reduce it through various methods. They believe that the ERP system is a communication tool from which all information for decision making is retrieved so it is an absolute tool for every firm (Manager A; Director B). This aligns with the theory that efficient information flow is the key to success in logistics outsourcing.

7 CONCLUSIONS

The overall goal of this thesis has been to study the role of ERP systems in logistics outsourcing decisions. The point of focus was in the capabilities of an ERP system to mitigate the possible challenges that can occur due to uncertainty when outsourcing logistics functions. Through a literature review, and a case study on a Finnish manufacturing firm with logistics outsourcing experience in the Swedish market, this thesis tried to answer the following questions:

- What are the typical challenges linked to outsourcing transportation and warehousing functions?
- What kind of benefits are there in implementing an ERP system from the perspective of logistics and SCM?
- How did their ERP system affect the decision of the case firm to outsource their warehousing and transportation from the viewpoint of operational uncertainty?

Developments in technology, and more specifically in ERP systems, have given firms new possibilities to better manage their logistics operations. Logistics outsourcing has been a prevalent trend for firms in the past few decades, and they posit a challenge for firms to control operations that are no longer in-house. This loss of control has been the major reason why some firms have stayed away from outsourcing. However, improvements in ICT have been an enabler for logistics outsourcing as better information flow is the key for minimizing uncertainty; a source of disruptions in the supply chain and therefore higher logistics costs.

Transaction cost economics theory presents three major factors that affect outsourcing decisions; transaction frequency, asset specificity, and degree of uncertainty. The last factor has been the focus of this study in a logistics outsourcing setting. In this case the sources for uncertainty can be, for example, the relationship between the firm and the 3PL provider, or changes in market demand. Controlling and possibly minimizing this uncertainty should be a goal for any firm that engages in logistics outsourcing. This requires control systems that can improve information flow in the supply chain regarding logistics and market fluctuations.

ERP systems have been a vital asset for firms initially from a production perspective, but modern systems also encompass SCM and CRM capabilities. Its main purpose is to provide the right information to the right people at the right time. This directly battles the challenges that arise from uncertainty by ensuring smooth information flow. Sharing information with supply chain partners will improve collaboration and build trust in the relationship. On the other hand, there have also been arguments against ERP systems when outsourcing SCM functions. They were seen to have a lack of extended enterprise

functionality, and flexibility in adapting to changing supply chain needs. However, these claims are seen as outdated in the eyes of the researcher. While they have been valid arguments ten years ago, the situation has changed when compared to what modern ERP systems can currently offer. By expanding to SCM and CRM functions, ERP systems can take a broader and more integrated approach to various aspects in company management. The previously noted shortcomings have been surmounted by ERP system providers in their efforts to improve their products.

The case firm saw a definite positive impact from their ERP system when they started their logistics outsourcing process in the Swedish market. Nevertheless, they are still struggling with the same challenges regarding information flow and transparency between their firm and the 3PL provider. They recognize that their ERP systems lacks extended enterprise functionality and advanced decision support capabilities, which argues that their ERP system is actually a hindrance to the outsourcing operation. However, they also admit that this is mostly due to having an older version of the system. Updating it to the latest version with better SCM capabilities has been discussed for the past few years, but these kinds of operations always take time. After the update they could see themselves better prepared to manage their relationships with their 3PL provider and other supply chain partners through information sharing and collaboration.

As a general conclusion, ERP systems can be seen as having a positive impact on logistics outsourcing situations, although it comes with the notion that firms actually have a modern version of their system with the necessary SCM capabilities. In reality many firms operate with systems that were implemented five or even ten years ago. Naturally their capabilities are also lacking and they can ultimately be a hindrance to the management of outsourced logistics operations. The large 3PL providers of today invest heavily on information systems that enable them to provide better service to their customers through system connectivity and information integration. Even so firms cannot fully enjoy these services if their own system is not up to the challenge, or if they use a variety of different systems that are not connected to each other. Achieving the full benefits from ERP systems require regular updates to its capabilities, even though it presents challenges for the firm personnel to keep up with the updates.

7.1 Limitations

There are some limitations to this study due to its narrow approach to the theoretical background and the number of cases and interviews. Inspecting a complex phenomenon such as logistics outsourcing only through one theoretical viewpoint is bound to limit the conclusions one can make based on matching the empirical data to the theoretical framework. In addition, using only one source of empirical evidence also affects the

conclusions one can make of the researched subject. Overall, triangulation in various methods could have been improved in this thesis.

Selecting to use a single case study method also presents a clear limitation to the generalization of the findings. Even though case studies do not aim for statistical generalization through a large sample, they still require replication across multiple cases in order to validate the analytical generalizations made to the theoretical background. Being a single case study, this thesis cannot function as a final conclusion to the effects of ERP systems on logistics outsourcing situations.

Using semi-structured interviews with rather open-ended questions presents another limitation due to it leaving the researcher with the task of interpreting the answers given by the interviewees. Some level of subjectivity is always present in these situations. This can be seen as very typical to empirical research, especially when using interviews. The author also recognizes that the interview questions could have been improved to focus more on the supply chain collaboration between the case firm and the 3PL provider.

The number of interviewees can be seen as quite low, as intensive single case studies aim for a complete and holistic view on the firm. While the three interviewees represented different areas in the firm, having more respondents could have improved the reliability of their answers. Although three interviews were deemed as the saturation point, it was mainly due to the lack of persons that the contact person and interviewees suggested to the researcher. Instead of relying on their personal opinion, the researcher could have taken a more proactive role in selecting the suitable candidates. However, this requires good cooperation with the managers in the firm, or a person that is willing to help the researcher during the data collection.

This study analyzed only the transportation and warehousing operations in logistics, as they were suitable to the situation of the case firm. Future research should consider taking a broader approach to logistics, and possibly selecting case firms with more extensive logistics outsourcing. Another option would be to select other specific areas of logistics besides transportation and warehousing.

7.2 Contribution

Prior literature has had mixed opinions on the effects of ERP systems on logistics outsourcing. This thesis argues that it is mainly due to the evolution that has occurred during the past 15 years or so. ERP systems were originally only focused on production and had little to do with supply chain management. Naturally, they were seen as a hindrance if operations were moved outside of the control of that ERP, such as in logistics outsourcing. However, technology overall has developed tremendously during the past

few years and system providers have also focused on improving their products to better serve the needs of their customers. Current research proves that the situation has changed as ERP systems have evolved to collaborative systems that include SCM and CRM. The main point of this thesis is that ERP systems from ten years ago cannot be compared to what they are capable of today. Nevertheless, older research still holds value today due to the fact that most firms do not operate the latest ERP system versions that have extensive SCM capabilities. Therefore managerial decisions in today's logistics outsourcing can be based on seemingly outdated theory on ERP system benefits. The case firm in this study admits that updating their system would yield benefits in their current operations in Sweden. Other firms most likely also recognize the benefits in updating their system but carrying out the actual updating process is an entirely different matter.

The main contribution of this thesis can be seen as a single reference point to which future studies can compare their results. Replication is needed before we can come to the final conclusion that ERP systems definitely help in logistics outsourcing situations. The theory is there but further empirical research is required.

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APPENDIX 1 THE INTERVIEW QUESTIONS

1. Interviewee name and position in the firm
2. How is logistics seen in your company? (core business vs. support process)
3. What led to the decision to outsource transportation and warehousing?
4. What factors were seen as important to the success of the outsourcing project?
5. What was required of the ERP system to make the outsourcing succeed?
6. Did your firm have to change its practices from a logistics or information handling viewpoint in order to manage the cooperation with the 3PL provider?
7. What were/are the biggest problems or challenges in handling this situation?
8. Did the ERP system help in solving these problems?
9. Was there significant statistical improvement in your performance after the outsourcing?
10. How is the effect of your ERP system seen in your company?
11. How is the data collected by the ERP system transformed into information that supports the decision making of top management?
12. Do you use your ERP as a tool for integration among your supply chain partners?
13. How do you communicate with your supply chain partners?
14. Is your ERP system seen as a tool for minimizing uncertainty?