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**4PL Service's Value Potential in Healthcare Supply Chain: A Case Study for a  
Finnish Medical Technology Company**

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## ABSTRACT

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Many companies are facing challenges with keeping up their service performance level while at the same time maintaining their supply chain management cost effective. This challenge was also noticed in the Finnish medical technology company when they were trying to find a solution on how to improve their current supply chain management procedure.

The objective of this thesis was to analyze the added value's potential that 4PL service can bring into medical technology company's supply chain concerning a single specific product. The aim was to see what would be the best solution for the case company's supply chain management. The research was conducted as a single case study and is qualitative by nature where interviews the case company representatives' and logistics service providers' interviews were used as the main data collection method.

The empirical findings from this research regarding the case company's requirements support the previous academic literature about the benefits that this kind of a service model can bring for a buying company. In addition, the interviews with the logistics service providers also supported the presumption that the case company should consider about outsourcing their supply chain coordination to this kind of service provider.

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Monet yritykset kohtaavat tänä päivänä haasteita ylläpitämällä heidän palvelutasoan samaan aikaan, kun he pyrkivät pitämään toimitusketjun johtamisensa kustannustehokkaana. Tämä haaste huomattiin myös suomalaisessa lääkintä teknologia yrityksessä, kun he yrittivät löytää ratkaisua kuinka he voisivat parantaa heidän nykyistä toimitusketjun johtamisen toimintamallia.

Työn tavoitteena oli analysoida neljännen osapuolen logistiikan palvelumallin tuoman lisäarvopotentialin lääkintäalan toimitusketjuun koskien yksittäistä tuotetta. Tavoitteena oli nähdä mikä on paras ratkaisu toimeksiantoyrityksen toimitusketjun johtamiseen. Tutkimus toteutettiin yksittäistapaustutkimuksena ja on luonteeltaan kvalitatiivinen, jossa toimeksiantajan edustajien ja logististen palveluntarjoajien haastatteluita käytettiin pääainestonkeruumenetelmänä.

Tutkimuksen empiiriset tulokset koskien toimeksiantajayrityksen tarpeita tukevat aiempaa akateemista kirjallisuutta koskien tämän tyyppisen palvelumallin tuomista hyödyistä ostavalle yritykselle. Tämän lisäksi myös haastattelut logistiikkapalveluntarjoajien tukivat olettamusta, että toimeksiantoyrityksen tulisi harkita heidän toimitusketjun koordinoinnin ulkoistamista tämän kaltaiselle palveluntarjoajalle.

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# 1 INTRODUCTION

In today's global economy, companies and organizations are forced to expand their operations and services to international scale in order to stay competitive and be profitable. According to Christopher (2011, 4– 5) it is not suitable anymore to assume that good products will sell themselves or that the company's current success would carry them forward in the future as well. According to Porter (1996) "a company can outperform competitors only if it can establish a difference that it can preserve". In other words, company's competitive success is based on two factors: cost advantage or on their value advantage or preferably on both (Porter 1996; Christopher 2011, 4). With the help of effective logistics and supply chain management, organizations can improve both of these factors by improving capacity utilization, reducing inventory, and improving customer service. (Christopher 2011, 8– 9)

Even though, expanding into foreign markets and effective logistics management can bring huge benefits, they can bring different challenges as well. Especially in supply chain management when the supply chains are becoming longer, more complex and more vital for company's competitiveness. At some stage, the supply chain management might get too demanding for the company to manage it by themselves. Today companies can outsource their entire supply chain processes to an outside party that can design and develop turn key supply chain solutions (Bade & Mueller 1999, 78). This service is called fourth party logistics (4PL)

Although outsourcing single logistics activities is not a new phenomenon, the scope of the services provided has broadened considerably, and the traditional third-party logistics (3PL) is not considered as a significant competitive advantage anymore but rather only as a mandatory option (Huang 2014). In addition, different manufacturing companies have expressed their lack of satisfaction on 3PLs service level (Büyüközkan et al. 2009). Nowadays buying companies are looking more strategic and long-term relationships with service providers that can oversee and take responsibility for all outsourced operations that companies have in purpose to increase market coverage, improve service level, and increase flexibility rather than just reducing costs. (Büyüközkan et al. 2009; Huang 2014, 2; Soinio et al. 2012, 31) Solution to this kind of a demand is 4PL service.



## 1.1 Background and objectives

As stated already, many companies are facing challenges with keeping up their service performance level while at the same time maintaining their supply chain management cost effective (El Mokrini et al. 2016). This challenge was also noticed in a Finnish medical technology company (study's case company) when they were trying to find a solution on how to improve their current supply chain management procedure. The challenge that the case company is facing is that one of their product's demand is expected to increase significantly within few years, which will create a huge logistical challenge on getting their products to their clients at the right time at the right place. Because of this challenge the case company might face the risk of deteriorating their service level, and in worst case scenario receive penalties for delays and purchase order cancellations. The problem at the moment is that the company doesn't have any specific staff member who would take care of the supply chain coordination in full-time scale, and the coordination is seen as a necessary but non-value adding work (Hines & Rich 1997).

The solution for this kind of a problem could be fourth party logistics (4PL) where the logistics service provider (LSP) could act as a solution integrator that manages a complete supply chain solution for the case company. As a solution integrator the LSP would integrate the technology and resources of its own and other service providers to establish an integrated supply chain solution that would deliver value for the case company throughout the entire supply chain. (Büyüközkan et al. 2009) Many firms have recognized the benefits when they have relied on external actors' abilities to take care functions that are outside their own capabilities (El Mokrini et al. 2016). By outsourcing their product's supply chain coordination to a fourth party logistics service provider (4PLSP) the case company could improve their service level, save their resources and focus more on their core activities.

The objective of this thesis is to analyze the added value's potential that 4PL service can bring into medical technology company's supply chain concerning a single specific consumable product. Therefore, the aim is to see what would be the best solution for the case company's supply chain management. The question is should they outsource their supply chain management entirely to an outside neutral party (4PL), or should they outsource the supply chain management to a *lead logistics provider* (LLP) that

would also give comprehensive integrated supply chain solutions but who could use their own assets and resources to perform it (Saglietto 2013). Or the third option should they internally invest on their supply chain management capabilities and maintain the control within the company. There has been conducted several studies about the advantages of 4PL and typical characteristics and development ideas of the healthcare supply chain. However, any research that would have combined these two issues together could not be found.

The closest articles that could be found related to the subject were World Trade's (2006) and El Mokrini's et al. (2016). However, the former article is limited only on describing the gained benefits of the partnership and doesn't describe the deeper outsourcing decision process that GE Healthcare has made with regards to its inventory and shipping management. It is also focusing more on the large-scale product's and not on one specific product. In addition, the article is 11 years old, which means that the current technological solutions might have been updated. El Mokrini et al. (2016) presents a decision model that considers the risks of outsourcing logistics in the pharmaceutical supply chain, but it does not specifically seek to investigate how suitable the 4PL service concept could be for a medical technology company nor how much value it can bring for a single medical company.

Regarding healthcare supply chain studies there seems to be a consensus among researchers that flexibility, integration of processes between supply chain members, and more improved technology could help the supply chain coordination in healthcare (Aronsson et al. 2011; Elmuti et al. 2013; Nabelsi & Gagnon 2017). However, many of the sources implied also that the 4PL service concept is still not entirely familiar among enterprises and is often mixed with 3PL and LLP (Saglietto 2013). In addition, only few companies have outsourced their entire supply chain governance to an outside party. (Langley 2016; Langley 2017; Lu et al. 2014; Win 2008) This why it is necessary to see how the 4PL service concept could improve the performance level in medical industry sector.

Based on presented background and the research gap the main research question for this thesis can be distinguished:

*How can 4PL service add value to unique medical technology company's supply chain concerning a single specific consumable product?*

In order to answer this main research question, three more concise sub-questions have been distinguished:

1. What are the benefits and risks of outsourcing supply chain management?
2. What are the case company's demands for the logistics service provider (LSP)?
3. What are the solutions that the LSPs can offer for the case company and how they match with their demands?

The reason why first sub-question was selected is because the make or buy decision for supply chain coordination is the basis for the whole study. It is important to know how the outsourced supply chain coordination can improve the profitability and competitiveness but also what kind of risks might be related to it. Blomqvist et al. (2002) have stated that the partnership allows the partnering companies to focus more on their core competencies and reach higher specialization and efficiency but it should not be considered as a solution to every situation. For example, asymmetric information, opportunistic behaviour, and lack of trust can cause the partnership to fail, and the successful outsourcing arrangement is very much dependent on the relationship between the buyer and seller (Blomqvist et al. 2002; Tsai et al. 2012; Webb & Laborde 2005). Only when a company has considered all of these issues it can make a proper decision whether to outsource its supply chain management or to maintain it within the company's activities.

The second sub-question was selected because it is important to understand what is needed and wanted from the service provider. Kavcic and Tavcar (2008) state that the outsourcing can be a fatal decision for the companies and it is very important that the company has carefully studied and analyzed the possible outcomes, benefits and risks related to decision of outsourcing. The purpose is to discuss and to understand the typical issues related to medical supply chain, and what might be the consequences for the buying company in case the service level turns out to be poor.

Finally, the third sub-question addresses the importance of the decision-making process that is needed in whether to outsource supply chain management or not. Quinn and Hilmer (1995) have stated that the reality is that the supplier markets are very often imperfect and consist of several risks related to for example price and quality. Outsourcing involves unique costs in terms of searching, contracting, controlling, and reconstructing that in some cases might exceed the transaction costs

in making. It has been stated (Bensaou 1999; Kraljic 1983; Quinn & Hilmer 1995) that when the potential of competitive edge is high and creates value, they are also expensive to develop, maintain, and highly vulnerable requiring high degree of control. Mapping the current Finnish logistics service providers and their current activities and capabilities helps the case company to visualize the logistical value proposition 4PL service can contribute to them and whether this matches with their expectations and demands. In addition, it also discusses about the factors that should be considered in effective supplier selection and evaluation as well.

## **1.2 Key concepts and definitions**

Study's key concepts are described below to help the reader to understand the discussed topics. These concepts are healthcare supply chain, fourth party logistics (4PL), supply strategy, lean.

**Healthcare supply chain** constructs usually from nine different participants: drug and medical equipment manufacturers, distributors, medical service provisions, medical groups, insurance companies, government agencies, employers, government agencies and the final users of healthcare services. Healthcare supply chains goal is to deliver materials and information for the patient's so that they receive quality care. (Elmuti et al. 2013, 129 according to Burns & Lee 2008)

De Vries & Huijisman (2011, 161) describe it is as a traditional supply chain where different processes and flows are integrated between different stakeholders. When it comes to healthcare, supply chain management refers to the supply, information and financial flows from the supplier to the client aiming to optimize the clinical performance level. The emphasis in the healthcare supply management is on the integration of different processes that relate to patient flows, and physical products such as pharmaceuticals and medical devices. (De Vries & Huijisman 2011, 161)

**Fourth party logistics** is an integrator of internal and external capacity, resources, and IT-technology in order to coordinate and manage the whole supply chain. (Bade & Mueller 1999, 79; Huang 2014, 2) Win (2008, 677) define 4PL as a neutral actor who takes care of its clients' supply and demand chains by implementing and managing value creative business solutions by controlling time and place utilities, and who also influences on the form and possession utilities in the client's organization.

Performance and success of the 4PL is then seen as a value creation function within the client's organization. Van Hoek & Chong (2001, 463) define 4PL as a supply chain service provider who is participating in the supply chain's coordination rather than in its operational services. This also supports Win's (2008) definition of 4PL a neutral actor.

Even though it is not common in corporation world to outsource the entire supply chain governance to an outside party. It is interesting to see that there is a general assumption that 3PL providers would be the most suitable for elevating into 4PL providers (Hoek & Chong 2001). The problem with this assumption is that as the 3PLs are asset-based organizations they naturally gain to maximize their return in those assets for their own shareholders and thus may not always provide independent decision to maximize value for any 4PL clients. In other words, even though some LSPs that have their own assets might advertise themselves as 4PL providers, they more unlikely select logistics services from other LSPs over their own assets. Even if this would be the case, direct competitors rarely offer competitive quotations to each other. (Win, 2008)

Based on these previous definitions, the concept of 4PL is defined as a neutral logistics service provider who combines and exploits internal and external capabilities and technologies to manage and coordinate the case organization's supply chain. Neutral actor means an independent non-asset-based service provider that is not pledged to use any specific supplier or equipment in the supply chain.

**Supply strategy** can be considered as a plan of making decisions related to different actions in the supply function. It is constructed from the make-or-buy decision, organizations' core competencies and capabilities, supplier relationships, the size of the supply base, the geographic supply area, centralisation, decentralisation, collaboration and the purchasing consortia. (Ahtonen, Virolainen 2009, 276) In this study the main focus is in the first three of these factors.

**Outsourcing** according to Lei and Hit (1995) can be defined as "reliance on external sources for manufacturing components and other value-adding activities".

**Value** in its most simple form value can be defined as quality divided by cost (Smith et al. 2013). Products or services are not bought for themselves rather than for the promise of what they will "deliver". When companies are delivering greater value for

the customers they are enabled to charge higher prices as well. (Christopher 2011, 6; Porter 1996)

**Lean** has cumulated originally from Japan by Toyota's production systems. The main idea of this philosophy is to reduce waste and maximize the quality in the production process. (Träghård & Lindberg 2004) It is also very universal tool that can be applied in a similar way into many different business fields (Hines & Rich 1997). In lean philosophy, organizations should strive for optimizing supply chain processes and to create value for the customer together with their suppliers. The relationships with the suppliers should be close and mutual for all the participants are considered as stakeholders in the value creation process and the value creation concerns all the stakeholders as well. (Cox 1999, 167; Hines & Taylor 2000, 43)

This study uses process mapping and quality function deployment as tools to study the current situation of the supply chain and to discover and understand the case company's criteria for the 4PL.

### **1.3 Previous studies related to the topic and research gap**

#### **1.3.1 4PL**

Even though the 4PL services has been presented in 90's it is still quite unknown and vague as a concept for manufacturing companies, and only few studies have included these activities in the investigation (Alan 2008; Hsiao 2010). In 2017 only 10 % of the companies had outsourced their supply chain operations to a 4PLSP (fourth party logistics service provider). However, it can be noted that the adoption rate has increased since 2016 when the same percentage was 6 %. (Langley 2016, 13; Langley 2017, 12)

Huang (2014, 6– 7) found that the most important requirements for 4PLSP are it skills, and ability to make tailor made solutions. Study has defined three technical measures that a 4PLSP should consider. First one relates to the overall supply chain management performance. As the deliveries are becoming more complex and markets more uncertain, the ability to give good supply chain solutions is crucial because customers can easily switch supplier at any time. Second one concerns about the importance of human resource. As 4PL is considered to be non-asset based service, this means that the entry barrier to the markets is low and threat of new competitors

may exist, the main tool to increase this barrier is human resource. The final measure is related to the quality procedures especially in corporate social responsibility and green logistics. It might be essential for the 4PLSPs to have several different quality certifications to demonstrate their service level and standards. (Huang 2014)

Hingley et al. (2011) have studied the benefits and barriers of using 4PL management as a catalyst for horizontal collaboration in UK's grocery industry. The study found that there is a consensus among suppliers, LSPs and retailers that the physical distribution management in UK's grocery industry needs to be developed. However, only the suppliers and LSPs were willing for deeper collaboration but the retailers saw this as a risk of losing power over suppliers and control of their supply chain. (Hingley et al. 2011, 324) The risk of losing too much information or control to outside parties is without a doubt a risk that must be considered when making the decision for outsourcing.

The study also concludes that the more intense and complex the distribution and collaboration become, the more specialized 4PL must be in terms of assets and technology particularly in information flow supported by technologies such as radio frequency identification (RFID) (Hingley et al. 2011, 325). Limitations for this study are that it focuses on the horizontal collaboration and not on the vertical collaboration within the supply chain.

World Trade (2006) has presented the benefits that GE Healthcare has achieved when they found a LSP to take care of their warehouse and inventory management. The article states that Ge Healthcare has gained improvements in inventory control and stock when due to the outsourcing decision. This supports Win's (2008) study that a 4PL has added value for their client organizations by improving inventory tur and reducing inventory investments.

Due to the partnership, GE Healthcare- Clinical Systems' inventory accuracy had increased from 98 % to above 99,9 % across their stock keeping units. The key success factor mentioned in the article is the LSP's ability to be flexible in matching the IT and quality controls to match GE Healthcare's needs. (World Trade 2006, 26C) This also supports Hingley's et al. (2011) findings that have been mentioned above.

Even though outsourcing has its advantages, there are some critical issues as well that might harm the supply chain performance level and therefore should be

considered. First of all, logistics have developed from cost absorbing function into more strategic factor, which means that the outsourcing failures may have extensive consequences but the decisions of outsourcing are made with too narrow perspective. Second issue relates to the relationship between the buyer and LSP, which may be caused by lack of information sharing and consensus between two parties. (Gadde & Hulthén 2009; Tsai et al. 2012) In addition most LSP's are not full-scale chain coordinators. Instead they usually focus on offering different services such as freight services and warehouse management by using their own resources.

Due to these reasons, traditional 3PLs lack the capabilities to perform as a superior operator and can be the reason why it is still quite rare that companies have outsourced their supply chain management entirely to an outside party. (Lu et al. 2014 Langley 2016; Langley 2017) Which means that it is difficult to find real life examples that could help and give support in the decision-making process.

The complexity of supply chains makes the supply chain management more vital factor for competitive advantage and it has been stated that the 4PL is a vital part of organizations "new generation" value chains and will be the future of outsourcing (Win 2008, 676; Bade & Mueller 1999). Therefore, it can be considered as an opportunity for companies to be among the first ones to do this, and is something that should be studied more.

Even though Huang's study shows important aspects that what are the ideal characteristics for 4PLSP, the study limits describing the ideal measures only on the general level, and not from a medical industry's perspective. In addition, it has not been conducted from the buyer's perspective. Study suggests that further research could be conducted about how the service provider could deepen the collaboration between the buyer, and to act as a strategic partner. (Huang 2014, 7)

### 1.3.2 Healthcare supply chain

It has been acknowledged that in order for the hospitals to develop lean and agile healthcare services, supply chain management has a high potential for improvement. Especially in medical supplies, which often covers over 40 % of hospitals budgets. (Nabelsi & Gagnon 2017; Aronsson et al. 2011). Even though, effective SCM in health industry is a strong requirement for patient-oriented service there are some barriers



that hinders this progress. These barriers are for example: conflicting goals in supply chain activities, limited supply chain training, lack of data collection and performance measures and varying relationships between different supply chain parties. (Mckone-Sweet et al. 2005; Elmuti et al, 2013)

Elmuti et al. (2013) also found out in their research that the outsourcing decision and supplier power has a positive impact on organizational performance level in terms of cost reduction, improved quality, flexibility and expendability, which will result in improving competitiveness, profitability and effectiveness in general. In addition, one of the key contributors for a successful healthcare SCM are the strategies to increase the integration of activities such as information sharing, collaboration throughout the supply chain channel and establishing partnerships between with different actors in the supply chain. (Elmuti et al. 2013, 139)

Elmuti et al. (2013, 139) pointed out in their research that one the further research recommendations should be conducted in to confirm outsourcing/ SCM performance linkages, and should incorporate suppliers, customers, and other shareholders into the measurement and analysis process, not just health care professionals.

Similar conclusions have also presented Aronsson et al. (2011). They have studied the issues that are important to consider when developing healthcare supply chain and how lean and agile can be exploited as process strategies to improve supply chain performance level by using examples from Swedish healthcare setting that describe patient flows and planning processes. Their studies conclude that the lean and agile supply chain structure can be gained when all the supply chain members are oriented to see the supply chain as a whole, and the operational and strategic capabilities should be more closely integrated.

Nabelsi and Gagnon (2017) demonstrated in their study how supply chain integration serves directly hospitals to be more patient-oriented. They suggest that all systems that serve both internal and external processes should be integrated with the help of technology such as radio frequency identification (RFID) and internet of things, which will help to automate different medical supply management in every step. Because the hospital staff requires medical supplies in a daily basis there is a high risk for equipment shortage which results on time waste and negative impact on patient care.

One of their key findings in their study was that the intra-relationship between hospital and manufacturer and the activities related to it e.g. delivering the goods has a direct impact in the efficiency of supply chain management. In order for the hospital to offer patient-oriented care, processes must have fully integrated and unified SCM principles. (Nabelsi & Gagnon 2017, 3632, 3640) Even though Nabelsi's and Gagnon's study is from the hospitals point of view, it gives a good impression on the focal company's clients' and the problems they are facing.

Finally, Lee et al. (2011) have found out that innovative design of supply chain impacts on the selection and cooperation of suppliers, improving supply chain performance and encouraging quality management practices. Their study's results indicate that different products deliveries are important to support hospitals' critical activities and strategies. (Lee et al. 2011, 1209)

#### **1.4 Research design**

This chapter first discusses the conceptual framework of the study. After that it demonstrates the process and time-line that the research has, in addition what kind of a strategy will be used in conducting the research. Finally, the limitations of the study and planned time table for the study.

##### **1.4.1 Conceptual framework**

As mentioned in before the theoretical background of the thesis is based on supply chain management in healthcare industry, fourth party logistics, and supply strategy. Study's main concept is supply chain management but the focus lies in the healthcare industry and the potential value the 4PL service concept can bring for the case organization, which could help them to make a strategic decision on whether they should outsource single consumable product's supply chain coordination to an outside party or maintain the activities within the firm. Because of the implications that the study can contribute to the case company, the approach is more practical than

theoretical.

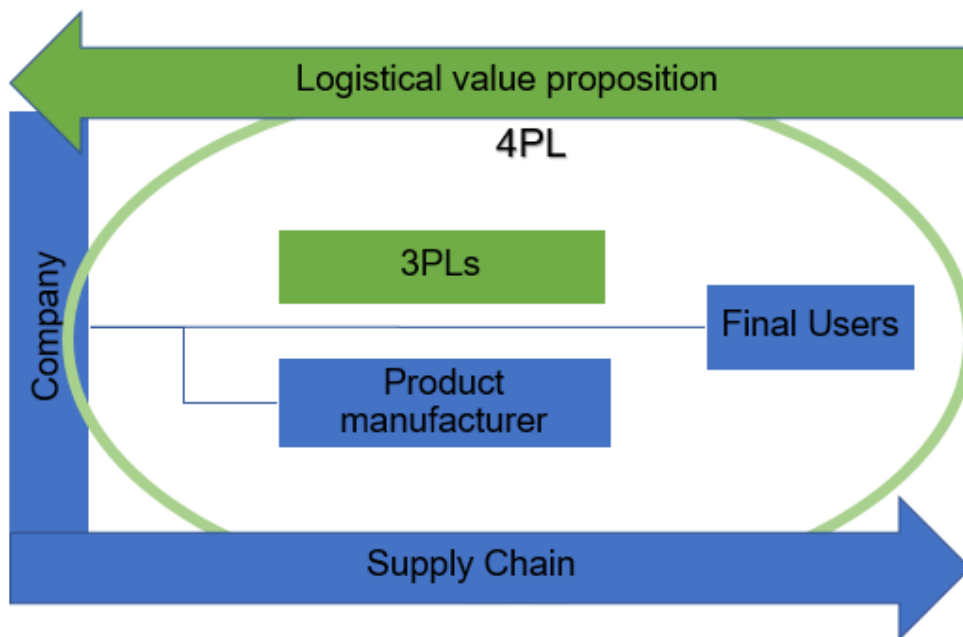


Figure 1. Thesis's conceptual framework

Figure 1 demonstrates the context of the thesis. The left side describes the upstream of the supply chain where the case company is located and the right side downstream where the final user is located. The circle describes the 4PL supply chain coordination field between different parties. However, small linkages are still left between the focal company, product manufacturers and clients for the study limits only to the material and inventory management. Other fields such as purchasing, production and supplier management are left for the case company and off course the direct responsibility towards the customer which are also marked in blue. The green fields describe the 4PLSP responsibility areas and the logistical value proposition that it can provide for the case company.

#### 1.4.2 Research methodology

According to Saunders et al. (2003) there are usually two different factors which require consideration when determining the consistency and the quality of the collected data: reliability and validity. Descombe (2010) adds to these the generalizability and objectivity. Validity refers to the accuracy and precision of the data. In other words, it means the research instrument's ability to measure that was originally intended to be measured. Reliability means the degree to which data collection method is neutral in

its effect and consistent across multiple occasions of its use. Generalizability refers to the prospect of exploiting the findings from research to other examples of the same phenomenon. Objectivity refers to the nonappearance of preconception in the research. It tries to indicate that the research is unbiased and that the data collection and analysis are fair and even-handed. Furthermore, according to Denscombe (2010) research should be transparent in the way how the data has been collected and analyzed.

According to Tuomi and Sarajärvi (2009) consistency and ethicalness are factors that should be considered when making a qualitative research. Consistency means the credibility of the argumentation that can be showed with the amount and quality of the sources that has been used. Ethicalness refers to the way how the research has been planned and prepared. A good research plan should be carefully formulated, and the objectives should match with the research problem. Most of the sources in this thesis are collected from different scientific journals and, therefore, can be considered of high quality. Many of the statements and arguments made in this thesis are based on more than a single source to imply better credibility. The quality of this research will improve when the findings of the empirical research that are based on theories are reported as clearly as possible.

According to Tuomi & Sarajärvi (2009) in qualitative research it is important that the researcher is able to be objective when he or she is examining respondents' opinions. In other words, they should not be reflected with examiners personal opinions. Since the researcher has chosen the research problem, the sub-objectives and methods to be used, it can be said that this research is affected by the researcher's subjectivity. However, the analysis and the interpretation have been tried to make so that they would be equivalent to respondents' comments. In addition, interviewees' opinions have not been tried to effect nor purposefully to give any specific answers.

The empirical research of this thesis is based on a single case study and it is qualitative by nature where different interviews are used as the main data collection method. Secondary data is used to see case company's previous deliveries; their background and their possible defects. Because of the subject's characteristics are related to logistics and supply chain management, a case study is a suitable research method for this thesis. This is because it allows the collection of comprehensive and thorough

data, which then can be used to analyze the phenomenon in question that can be highly critical for example in terms of developing supply relationships (Kähkönen 2011). The philosophy of this research can be described with interpretivism as it seeks to find supportive arguments for an accurate business problem. In interpretivism the research views the study environment as a complex constantly changing world where it is almost mandatory to explore subjective meanings that motivate people's behavior and actions. This philosophy is quite common in business and management research where the situations are not only complex but unique as well. (Saunders et al. 2003) As the research aims to help the case company to make a decision on whether to outsource its supply chain management to an outside service provider, this philosophy gives good support for the research.

Due to the philosophy and nature of this study, an inductive research approach has been selected instead of the deductive one. The inductive research approach means that the researcher collects qualitative data and develops a theory based on the results of the data analysis, whereas in deductive approach, the researcher develops a theory and designs a research strategy in order to test this theory quantitatively. Deductive approach is preferred when the study's philosophy is positivist and, hence, based more on scientific principles. (Saunders et al. 2003)

When aiming to gain a deeper understanding on a subject or phenomenon, in this case 4PL's value proposition for the case company, a qualitative research is more suitable and convenient study method than a quantitative approach that focuses more on finding information that can be generalized. (Saunders et al. 2003) Due to these reasons, qualitative research approach is chosen instead of the quantitative one in this research. In addition, the implementation of a quantitative research would also be difficult because the objective is to study the topic from the case company's perspective. It would be quite impossible to find enough respondents who would be competent enough to make the survey results consistent and valid.

The most suitable research strategy for this thesis was chosen to be a single case study strategy. When doing a case study research, the researcher has a need to understand complicated social phenomena's. It allows the researcher to focus more on the actual case and maintain overall real-world perspective. In case study research, the cases are limited only to support and serve as a background for the actual research

interest. Therefore, it can be said that the main interest is what the case company represents, and not in the case company itself. Case study strategy can be used in a situation where the investigator has only little control over the events and when the attention is focused on a prevailing phenomenon within a real-life context. (Yin 2014)

The aim of this thesis is to gain a better understanding of the benefits and risks involved in outsourcing supply chain management; their possible implications on delivery costs and accuracy, and the solutions that the logistics service providers can contribute to the needs of the case company. These are prevailing phenomena and the investigator cannot influence on these events. As mentioned the case company is not directly the main interest but since they are facing a logistical challenge, they are a perfect subject for this study's research problem.

After suitable research approach and strategy has been determined, the next phase is to consider how the empirical data could be collected and analyzed to match the objectives of the thesis. When the research questions have been defined the researcher needs to create appropriate measurement instruments to capture the data for future analysis (Stuart et al. 2002). Data collection can be categorized into two sections: primary and secondary data. The former data is the new data, that the study collects and uses specifically for the research purpose. The latter is the data that has already been collected from previous studies and, therefore, another purpose. (Saunders et al. 2003) In this research, primary data will be collected through interviews, in addition tools such as value stream mapping and quality function deployment will be used as tools so that the problem areas and the demands could be clearly characterized and visualized.

Interviews, observation, questionnaires and different kinds of documentations (e.g. financial reports) are good examples of data collection methods in case study research (Saunders et al. 2003). This research applies interviews as the main data collection method because interviews can be expected to give the most truthful and realistic answers about the interviewees thoughts on outsourcing supply chain management to an outside party; what are their requirements for the service and the potential risks they might recognize and considered in the outsourcing decision. It is also very challenging and more time consuming to find enough relevant documentation, which would offer as deep answers to the questions as interviews might offer. Interviews

would most likely allow better focus on the issues that are related to the research questions.

Interviews can be defined in three different types: structured, unstructured and semi structured interviews. The first one includes only questions that are carefully set and thought in advance. It also excludes all free conversation on the topic. Unstructured interviews can also be described as open interview, meaning that they include only few predetermined questions and the data is mostly collected from the free conversation about the research subject. Semi structured interview is also known as theme interview is technically a hybrid model of the two previous ones. Semi structured interview contains predetermined questions only to give guidelines for the interview in order not limit respondents to answer alternatives and giving a chance for open conversation as well. Objective of the theme interview is to get answers to questions that are based on the theory that has been collected from secondary data. (Saunders et al. 2003)

This thesis follows semi structured interview theme due to the reason that the research problem requires the interviewees to understand the questions correctly and that they are asked some specific questions. However, considering the research problem it is important to also have free conversation and to hear the interviewees' thoughts because it would have been impossible to create perfectly inclusive questionnaire or structured interview about the topic.

Finally, qualitative research also enables the researcher to use several different data collection methods if required. It is also often useful to do so. By using a multi method strategy the investigator can employ different methods for different purposes in the study, and also use different data collection methods in one study. This way the investigator can gain confidence and better vision for the results reliability. (Saunders et al. 2003)

#### 1.4.3 Limitations and process

According to Tuomi & Sarajärvi (2009) in qualitative research it is important that the researcher is able to be objective when he or she is examining respondents' opinions. In other words, they should not be reflected with examiners personal opinions. It can be said that this study is affected by the researcher's subjectivity, since the researcher

has chosen the research problem, the sub-objectives and methods to be used. However, the analysis and the interpretation have been tried to make so that they would be equivalent to respondents' comments. In addition, interviewees' opinions have not been tried to effect nor purposefully to give any specific answers.

In order to get most truthful results, this study focuses only on case company's single product's inventory and distribution management in the supply chain, and rules out for example supplier management, purchasing or production functions in the outsourcing decision-making process. In addition, this study does not compare different decision-making methods in the supplier selection and what would be the best tool for this.

Figure 2 demonstrates the preliminary process description for this thesis. The study constructs from four phases and each phase is estimated to last 1-2 months which means that the estimated time table for the thesis is 6 months. The first phase is based on observing previous literature related to the topic and the academic data, and investigating possible benefits and risks that concern 4PL services and the characteristics for health care supply chain. This phase is still theoretical part and closely related to the first sub question: What are the benefits and risks of outsourcing supply chain management?

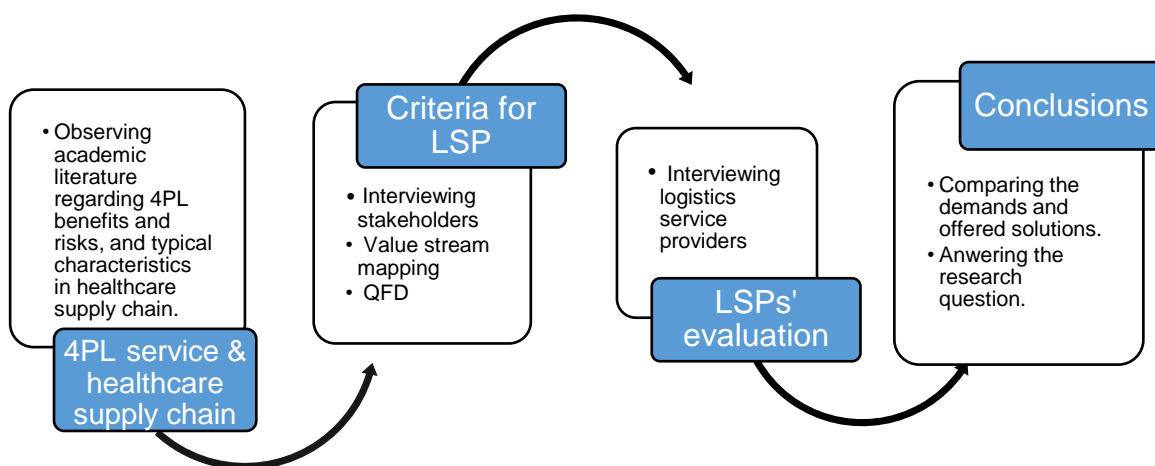


Figure 2. Study's process description



The second phase relates to the second sub question: *What are the case company's demands for the logistics service provider (LSP)?* This will be conducted by interviewing internal stakeholders in the case company. Aim is to investigate how closely their needs are related to the previous studies observations and if other issues arise that also should be considered in outsourcing health care supply management to an outside party. In this phase value stream mapping will be used to see the current supply chain structure and quality function deployment (QFD) to discover what are issues that arise from the stream mapping and how these could be tackled with 4PL.

In the third phase of the study the possible 4PLSPs will be interviewed exploiting the results from QFD and analyzing the possible offered solutions with the case company's demands. The aim is to get an answer to the third sub question: *What are the solutions that the LSPs can offer for the case company and how they match with their demands?*

Finally, the based on the results the study will make its conclusions and answer to the main research question: *How can 4PL service add value to unique medical technology company's supply chain concerning a single specific product?*

## 2 THE OUTSOURCING OF SUPPLY CHAIN MANAGEMENT

Every company has their own way of performing their business that is based on their strategy. The concept of strategy has been defined in many ways. For example, Chandler (1962, 13) has defined it as “the determination of the basic long-term goals and objectives of an enterprise, and the adoption of courses of action and the allocation of resources necessary for carrying out these goals”. Porter (1996) states that the core of strategy is to choose to perform company’s activities differently than their competitors to deliver inimitable mix of value. When companies try to create a competitive advantage against competitors they usually make strategic commitments, which are decisions that have a long-term impact and are difficult to reverse at least in inexpensive way (Cool et al. 2002, 63). One way to approach strategy formulation is called value-based view of strategy that starts by defining the fundamental values of the company that motivates the staff. These values are then translated into management policies and practices that express them in a daily basis which will finally produce the core competencies and capabilities of the firm. (O’Reily & Pfeffer 2000, 15) Over the last twenty years, corporate strategy’s main interest has been in outsourcing as way of creating value and improving competitiveness (Leavy 2004).

This chapter will discuss about the issues related to outsourcing. Starting with explaining the benefits of outsourcing and motivations why companies choose to outsource their business activities to outside parties. After this the focus will be on the different risks of outsourcing and motivations why companies decide not to outsource. After this the chapter will present previous literature related to what is required for a successful outsourcing process. Finally, the chapter will discuss more detailed about logistics outsourcing.

### **2.1 Definitions of outsourcing and its theoretical foundation**

Even though, companies are increasingly broadening their approach to outsourcing as they try to improve their competitiveness and have began to view outsourcing as more than a simple cost-cutting play, the term *outsourcing* has not achieved unified and clear definition in academic literature (Deloitte LLP 2016; Gilley & Rasheed 2000; Li-Jun 2012).

Li-Jun (2012) states that outsourcing can be named as external commission, and the nature of outsourcing is to delegate activities which organizations can't do well or at all to other actors that are more suitable to manage and perform those activities. Handley & Benton (2009) conceptualize outsourcing as a process where the starting point is the development of a sound business case for outsourcing, which is then followed by the implementation of the external sourcing model, and ultimately the management of the relationship with the supplier. Gilley and Rasheed (2000) note that outsourcing is not simply a decision to purchase because the true strategic nature of the issue cannot then be apprehended. Instead outsourcing should be considered as a strategic decision that can cause ripple effects throughout the entire company that can arise in two ways: substitution of external purchases for internal activities, and abstention from internalization even though the company would have the resources and capabilities to make the activity internally. (Gilley & Rasheed 2000)

When looking briefly at the history of outsourcing, the early outsourcing agreements began in 1970 when manufacturing companies started to contract out the production of components to smaller, specialized suppliers. In 1980s companies started to outsource singular business processes for example accounting services and word processing. The interactions were relatively simple, and the main focus was on reducing costs. In 1990s companies started to focus more on their core activities and transaction cost reductions. This meant that firm's business strategies started to shift and all the noncore activities such as telemarketing, logistics and warehousing were outsourced. (Vitasek et al. 2013, 17– 19)

According to Deloitte LLP outsourcing survey (2016) cost reductions continue to play a leading role in outsourcing, but capabilities around mergers and acquisitions (M&A), capacity, service quality, robotic and cognitive process automation, cloud, and innovation are growing in importance. Nowadays firms are redefining the benefits of outsourcing by inquiring their suppliers and other service providers to add value in ways beyond cost cutting, such as enabling M&A activity, providing required capacity, and moving forward functional capabilities. In addition, companies are now changing the way they enter into outsourcing relationships to secure the benefits of innovation while at the same time they aim to defend the business from regulatory and cyber risks.

It can be expected that companies aim to enhance the competitive process in upcoming outsourcing initiatives by targeting better service level agreements and stronger vendor management organizations. Companies have also started to acknowledge the value of dedicating more time at the beginning of an outsourcing partnership to select the right partner and put in place supporting service level agreements and organizational capabilities. Finally, the survey state that transformation management in particular would become critically important to smart clients that use outsourcing as a channel to build innovation within their organization. (Deloitte LLP 2016)

### 2.1.1 Make or buy decision

When companies are reconsidering about outsourcing they practically evaluate whether they should withdraw the previous decision to make. It basically means that the company is then restructuring its business boundaries. Because it is impossible for a singular company to perform all activities within its value chain at least in an economical way, one of the most essential decisions related to company's business performance is what functions or activities the company should perform internally and what activities it should entrust for markets to perform (Möller et al 2005; Pehlivan et al 2013). In practice this means that the company should focus on their core competences and outsource the non-core competences.

Core competence is a set of skills and knowledge that provides potential entree to wide variety of markets, are difficult for competitors to imitate and are highly valued by clients (Prahalad & Hamel 1990; Quinn & Hilmer 1995). Prahalad and Hamel (1990) provides a good allegory for core competence when stating that company is a large tree. Its log and major limbs are the core products, smaller branches are business units, leaves, flowers and fruits are the final products. The root systems that provides nutrition, sustenance and stability can be considered as the core competences.

Quinn and Hilmer (1995) have defined two strategic approaches that enables companies to optimize their skills and capabilities when properly combined. First, companies should concentrate on their own resources on a set of core competencies where they are able to achieve definable superiority and provide unique value for the customers. Second, companies should strategically outsource all other activities from which they don't consider to have critical strategic need nor special capabilities. These

two approaches are related to transaction cost economics (TCE) and resource based view (RBV) theories that are used to define the business boundaries of the firm, and together formulate the foundation for make or buy decision (Handley & Benton 2009; Ahtonen & Virolainen 2009).

The main idea of TCE is that there are two governance structures markets and hierarchy where an organization may choose the most suitable one (Kyläheiko et al. 2002 according to Coase 1937; Williamson 1975). The transaction cost perspective says that organizations must think about the costs and resources required to effectively coordinate with an external party. Moreover, they need to ease the risks that are natural in external sourcing. (Handley & Benton 2009) With the help of TCE the company management can visualize better their governance arrangements (Poppo & Zenger 2002).

According to Barney (1991) company can gain sustained competitive advantage when it is implementing a value creating strategy that is not implemented simultaneously by any other current or potential competitor and who are unable to duplicate the benefits of that strategy as well. In the classical RBV companies are first required to consider what are the resources and capabilities that can bring competitive advantage for them when they are setting their business boundaries. Moreover, into what extent they bring value. (Barney 1999) This is closely related to core competence theory where the idea is that all resources, knowledge and capabilities of a firm cannot develop sustainable competitive advantage. Hence, companies must distinguish the core competences from non-core competences by examining the five following issues (Li-jun 2012):

- What are features that customers value?
- What separates the firm from their competitors and what is not easy to copy?
- Are there any alternatives available on the market?
- Can the competence create a series of other products and services and develop economies of scope through innovation?

The essence of this theoretical approach is that by combining resources available only in some region hosted by different firms or institutions, firms in that region are enabled to develop additional competencies that are unreachable to isolated firms (Steinle & Schiele 2008).

### 2.1.2 Benefits of outsourcing

As stated already there are lot of different motivations and benefits for companies to outsource such as cutting costs, enabling companies to focus more on their core activities, increased flexibility to configure resources to meet possible market fluctuations (Harland et al. 2005; Kremic et al. 2006 & Deloitte LLP 2016). Leavy (2004) presents Nike and Dell as practical examples of companies that have gained benefits by outsourcing routine business to other companies and focusing more on those resources and activities in the value chain that have the most impact on their customers. Another practical example of outsourcing benefits has been seen with Nokia in early 2000 when they decided to outsource part their production in order to slow down the growth of their employee rate and maintaining the momentum in the marketplace at the same time (Leavy 2004).

According to Harland et al. (2005) outsourcing enables firms to eliminate functional “silos” and barriers between them, which then allows them for better customer focus, flexing and changing offerings and processes to meet fluctuating markets. This can be considered valuable for larger firms that are more mature and have stronger hierarchical structures that make them less agile. With the help of outsourcing companies can then simply opt out from internal organizational changes where the re-engineering of business processes would be quite difficult. With the help of outsourcing companies can free themselves from established attitudes and taboos, provide new ideas and creativity for new ideas at the same time. (Harland et al. 2005)

Kremic et al. (2006) state that although naturally every company might have different individual expected benefits from outsourcing, they have collected many different benefits from different sources that are general enough that can be shared across organizations. These expected benefits are described in table 1.

Table 1. Summary of the benefits related to outsourcing

<p><b>Financial benefits</b></p> <ul style="list-style-type: none"> <li>- cost savings</li> <li>- released capital to other business functions</li> <li>- transferring fixed cost into variables</li> </ul>
<p><b>Quality benefits</b></p> <ul style="list-style-type: none"> <li>- quality improvement</li> <li>- improved flexibility</li> <li>- increased speed</li> </ul>
<p><b>Operational benefits</b></p> <ul style="list-style-type: none"> <li>- access to more professional skills and talent</li> <li>- access to latest technology/ infrastructure</li> <li>- increase focus on core competencies</li> </ul>

According to Harland et al. (2005) explanations for the expected benefits can mainly be found from on economies of scale and scope. The economies of scale can originate when a buying company uses larger-scale specialists for activities where they do not have the essential volume of requirement for current technology. The economies of scope can be gained by having access to a broader range of services that are provided by niche specialists.

### 2.1.3 Risks of outsourcing

Despite the numerous benefits that outsourcing might offer to companies and other organizations, it also contains several risks. In worst case scenario it can be a deadly strategic decision for the companies, not only for the outsourcer but the insourcer as well and, therefore, cannot be ignored (Kavcic & Tavcar 2008). Unfortunately, the decision to make or buy is not limited only on looking at the core capabilities and resources bringing value and the non-core activities that do not. Quinn and Hilmer (1995) have stated that the reality is that the supplier markets are very often imperfect and consist of several risks related to for example price and quality.

According to Momme (2002) another risk relates to human opportunism or bad employee morale. Outsourcing can be a sensitive subject and create negative reactions within organization's staff members if the process is not properly executed. The risk of breach of confidentiality must be taken into account as well. It also has to

be understood that the balance of power between two parties is not static and can change during the business relationship. In order to specify the baseline agreement, it has to be known precisely what knowledge and skills are required for the particular scope of outsourcing. In addition, the complexity of the nature of competencies needs to be understood so that the company identifies the areas in which they lack in-house resources, and capabilities calls for outside support. It can be considered as a key point that the longer the relationship spans, the higher switching costs and knowledge dependency are involved. Companies must also make certain reservations that even the most collaborative outsourcing partner contains a risk of failing to achieve the required standards. Therefore, firms should be strategically prepared to substitute or insource when terminating the contract. (Momme 2002)

According to Leavy (2004) the most vital risks in outsourcing decision are losing the key capabilities based on outsourcing core activities while gaining for short term advantages and outsourcing at the wrong time in the market's evolution by not seeing what the economics favor outsourcing. As stated in the introduction chapter, it is very important that the company makes its outsourcing decision after it has thoroughly evaluated all the possible course and outcomes, benefits and risks based on that decision.

Furthermore, outsourcing involves unique costs in terms of searching, contracting, controlling, and reconstructing that in some cases might exceed the transaction costs in making. It has been stated (Bensaou 1999; Kraljic 1983; Quinn & Hilmer 1995) that when the potential of competitive edge is high and creates value, they are also expensive to develop, maintain, and highly vulnerable requiring high degree of control. The more companies elaborate with each other the more attached they are with each other's success and failures (Kavcic & Tavcar 2008). While it is known that the number of risks related to outsourcing is quite broad some of the key risks related to it are described in table 2.



Table 2. Summary of the risks related to outsourcing

<p><b>Financial risks</b></p> <ul style="list-style-type: none"> <li>- hidden costs</li> <li>- high asset specificity costs</li> </ul>
<p><b>Contract risks</b></p> <ul style="list-style-type: none"> <li>- poor contract or poor partner selection</li> <li>- information asymmetry</li> </ul>
<p><b>Management risks</b></p> <ul style="list-style-type: none"> <li>- loss of control/ core competence</li> <li>- poor performance</li> <li>- opportunistic behaviour</li> </ul>
<p><b>Information risks</b></p> <ul style="list-style-type: none"> <li>- information leakage</li> <li>- loss of knowledge</li> </ul>
<p><b>Market risks</b></p> <ul style="list-style-type: none"> <li>- losing customers, opportunities or reputation</li> <li>- changing environment</li> </ul>

Deloitte LLP (2016) have noted in their survey that even though innovation is seen by respondents as a key driver of quality, firms struggle to define, measure, and motivate it in their outsourcing relationships. Only 35 % of companies in the survey said to measure the value delivered by outsourcers through innovation, 21 % of the companies make innovation a key part of contracts, and more than 30 % are under the impression that the service providers do not provide enough innovation. This shows a conflict between the original purposes of outsourcing where the aim is to improve quality through economies of scope and real-life situations. (Deloitte LLP 2016)

## 2.2 Outsourcing process

As already stated outsourcing decisions can bring huge benefits for organizations but it is not a simple task and can even deteriorate companies' competitiveness. Several surveys and studies (Giboux 2008; Lonsdale & Cox 1997; Weidenbaum 2005) have been conducted stating that outsourcing decisions have been made with the aim of

short term cost reductions instead of a long term strategic perspective and which has caused the outsourcing processes to fail.

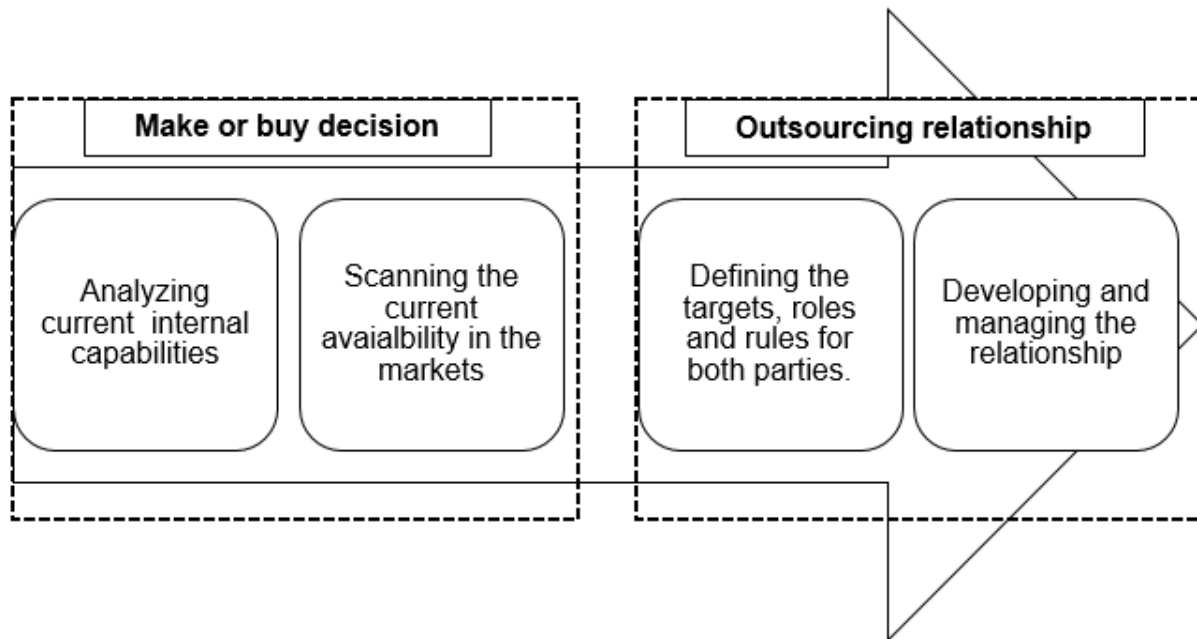


Figure 3. Outsourcing process

There are several different studies defining the elements of a successful outsourcing process, which all slightly differentiate from one another (Handley & Benton 2009; McIvor 2000; Momme 2002; Kuula et al. 2013). However, the main characteristics that they all contain are related to strategic evaluation of the current internal capabilities, and whether these can match with the market requirements, assessing the potential service providers available on the market, negotiating and setting the targets, roles and rules for the relationship, and finally managing the relationship. In addition to this the first two phases can be said to relate in the make or buy decision and the latter in contractual completeness and relationships management. These elements are presented in figure 3.

### 2.2.1 Make or buy decision formulation

According to Kuula et al. (2013) it can be difficult task to succeed in an outsourcing project, due to the reason that there are many parties and many linkages involved. Organizations tend to have challenges in knowing or identifying their actual vision. However, this must be recognized so that the organizations can implement change without any bigger difficulties. When the organization knows its overall vision or goal it is then easier to inform the target of a project or development and is also more likely

to be accepted by the employees that can absorb negative reactions (Momme 2002). According to Momme (2002) companies often tend to adopt a short-term perspective where the main motivation is direct cost reductions, and managers tend to believe that strategic planning is not a necessary.

In the first stage the company must recognize its core activities and separate them from non-core activities. Essentially this means that they must recognize the activities that bring value for the customer and competitive advantage, and the activities that do not, should be outsourced. (McIvor 2000) Even though this sounds simple to distinguish between core activities and non-core activities is a difficult task where the strategic decisions and the advantages should be considered carefully. A thorough evaluation of the firm's capabilities' current and potential strategic value is a critical part of the comprehensive strategic evaluation. Strategic evaluation means the degree to which the outsourcing team performs a complete evaluation of the strategic consequences of outsourcing the business activity. (Handley & Benton 2009) For it is crucial that the organizations can identify the skills that serve their business strategy, enhance their competitive advantage against competitors, and bring value for their customers.

At the same time the degree to which firms effectively perform a strategic evaluation is reflected by their assessment from a capability perspective and from a risk perspective. The capability or resource evaluation is grounded in the RBV of the firm, while the strategic risk assessment is guided by TCE. Capability evaluation is the level to which the outsourcing team evaluates the strategic value of the capabilities and resources that are connected with the business activity, considering the organization's current and expected sources of competitive advantage. Strategic risk assessment represents the degree to which the outsourcing team evaluates the multitude of strategic risks that are related with business activity's outsourcing. (Handley & Benton 2009)

According to Handley & Benton (2009) the strategic evaluation might minimize the outsourcing company's risk of outsourcing a core competence and other activities where the strategic risk is too high. In addition, it allows them to achieve a better understanding of the activity that is being outsourced and how it should then be managed and how the resources should be coordinated with the supplier. Their study

revealed that even though strategic evaluation does not have direct impact on the outsourcing performance, it has an impact on the relationship management. When the relationship is developed as a partnership where goals and incentives are integrated between buyer and seller, the possible strategic risks such as avoidance and opportunistic behaviour can be minimized. Hence it can be said that the strategic evaluation has an indirect effect on the outsourcing performance via relationship management.

### 2.2.2 Outsourcing relationship

Contractual completeness can be defined as “the extent to which the outsourcing firm and chosen provider develop a contract which effectively coordinates resources and addresses identified inter-organizational risks” (Handley & Benton 2009). Traditionally the more complex the contract becomes the greater promise specifications, duties, and dispute solution processes evolve. Complex contracts might accurately specify the roles and responsibilities of the contract parties, describe the procedures for monitoring and penalties for nonfulfillment, and define the wanted outcomes and outputs expected from the parties. (Poppo & Zenger 2002)

Handley & Benton (2000) conclude that the more accurate strategic evaluation is the better understanding it enables for the outsourcing firm on the possible implications related to the outsourcing, which can be then considered and used when formulating an effective contract by defining clearly the objectives, risks, and reward provisions by both parties. In other words, companies should have a good understanding on the outsourcing initiative and how it supports the strategic objectives and the risks involved in external sourcing.

Relationship management describes the reciprocal relationship degree that the buying company aims to have and maintain with the service provider (Handley & Benton 2009). It is constructed from relationship commitment; the level of the outsourcing party’s willingness and sense of duty for maintaining and developing a constant relationship with the supplier, and cooperation; the level where the involved parties work together to gain flexibility and solve problems (Prahinski & Benton 2004).

Handley’s & Benton’s (2009) findings for relationships managements impact to the outsourcing performance support previous studies by stating that in order to gain the

maximum value from the outsourcing decision, the organizations must commit to the relationship and act in cooperative and collaborative manner. Suppliers will only invest to the relationship when the buying party shows commitment to it (Handley & Benton 2009). The relationship specific investments that are joined with long-term orientation should eventually decrease the transaction costs related to contracting, monitoring, enforcement and opportunism while at the same time improves learning and operational performance (Dyer 1996; Helper et al. 2000).

When looking at the impact that the strategic evaluation has on the contractual completeness This knowledge should be applied when formulating the outsourcing contract. However, when looking at the contractual completeness impact on the outsourcing performance their study shows that the relation is statistically insignificant, which means that the contract can be simply used only as a legal legitimate form of power by defining responsibilities and providing legal means for addressing irresolvable disputes, but it does not guarantee a successful outsourcing performance objective. (Handley's & Benton's 2009)

Mclvor (2000) has illustrated a framework for the outsourcing decision evaluation process that tries to resolve some of the key problems related with outsourcing. This has been done by integrating some of the main elements that are related to outsourcing such as evaluation of company's core competencies, a value chain perspective, and supply base influences into the decision-making process.

As mentioned the framework constitutes from four different stages: defining the core activities of the business, evaluating the relevant value chain activities, total cost analysis of core activities and the relationship analysis. The second phase is to analyze company's competencies in these core activities in comparison with possible external sources, which means that the company must evaluate the activities that are relevant for the value chain by benchmarking them against external suppliers' similar activities. In addition, companies should identify and measure possible costs that are associated with the activity and see whether it is more profitable to perform them in house or outsourced. By doing so the company can see what activities bring competitive advantages and value for the customer and what activities are the ones that external suppliers can perform more economically. (Mclvor 2000)

According to McIvor (2000) each selected core activity in this analysis should be benchmarked against that activity's all possible external providers. For using benchmarking companies are enabled to view not just the product but also the skills in operations and management related to the product and find the best possible candidate to perform the activity. The activities relevant for this thesis are for example logistics, warehousing and the process design related to them.

The third stage of the framework is the effort to analyze all the actual and possible costs related to the activity both internally and externally. In other words, this stage tries to identify all the activities and costs that are related to the outsourcing decision. These costs can be divided into two different categories: the cost estimations of performing the activity internally (make), and the cost estimations of the potential provider performing the activity (buy).

After the company has benchmarked the competencies of the core activities it has two possible scenarios that it must choose from. In the first scenario company sees that it is more economical to perform the activity internally, so it can either decide to continue to keep this activity performed internally and develop it even further. Or it is possible that the company sees that it is not able to sustain the competence in the long term and therefore should outsource the activity to the most suitable service provider. It is possible that the company can gain more flexibility by outsourcing than performing activities internally and hence react faster to possible market fluctuations and demand variabilities. A company that has implemented this kind of a strategy can be called a "system integrator" that manages and co-ordinates a network where the best production and service providers are used. (McIvor 2000)

In the second scenario the company realizes that external sources are more competent than internal when it can decide to invest on performing the activity internally or once again strategically outsource the activity to the best service provider. In case the company decides to invest on internal performance it should measure the required amount in order to fill the gap between them and the more competent external suppliers. According to McIvor (2000) this can be the option in case the technology related to the activity is new and might have huge potential for the future's growth. However, this might be quite challenging in case the company's internal capabilities are dramatically behind the external providers.

Companies might want to establish a partnership or strategic alliance with a supplier to use their capabilities, which means that the buyer and supplier should have a close relationship (McIvor 2009). Handley (2009) also stated that the encompassing strategic assessment highlights the potential strategic risk and emphasizes the need to form a partnership with the external provider rather than taking an arm's length approach to the relationship. In addition, the buying company should consider the risk of future competition in case the supplier gains the skills and know-how from the company it once served. From this analysis the buying company should examine all the possible service providers and in case it considers that there is no possible candidate the company should invest on performing the activity internally but in case a possible service provider is found, the company should strive to form a relationship. (McIvor 2000)

### **2.3 Logistics and supply chain outsourcing**

As mentioned, fierce global competition, more demanding customer requirements, and emerging supply chains and networks are setting pressure for companies' supply chain management mechanisms and different logistics activities are being increasingly outsourced to outside parties. However, studies have shown that logistics outsourcing does not necessarily bring value and might result in outsourcing relationship break-up. (Zhu et al. 2017; Wong & Karia 2010) Before moving further in to the subject, it is important to define what is meant with logistics and supply chain management and most importantly what is the difference between these two concepts. Although both concepts have received a lot of different definitions, this thesis will use the definitions based on Christopher (2011). Christopher (2011, 2) has defined logistics as "the process of strategically managing the procurement, movement and storage of materials, parts and finished inventory (and the related information flows) through the organization and its marketing channels in such a way that current and future profitability are maximized through the cost-effective fulfilment of orders." Therefore, it is essentially a planning approach and framework that is used to create a plan for the flow of products and information in business. Whereas supply chain management is defined as "the management of upstream and downstream relationships with suppliers and customers in order to deliver superior customer value at less cost to the supply chain as a whole" (Christopher 2011, 3). All in all, supply chain management tries to

integrate and balance supply and demand within and across organizations (Grzesińska 2017).

When looking briefly at the history of supply management, according to Stevens and Johnson (2016) the early focus was on improving companies inventory management and production planning and control in the early 1970s. After this the focus moved to systemizing the materials, production and transport management. Nowadays the focus has moved towards outsourcing all the non-core competencies to outside parties to lower cost economies and process improvement practices such as lean and six sigma with the aim to create agile supply chains in order to respond quickly changing demands (Aitken et al. 2002; Stevens & Johnson 2016).

### 2.3.1 Levels of logistics outsourcing

According to Solakivi et al. (2010) most of the studies related to logistics outsourcing have concentrated on what logistics activities have been outsourced and to what extent have logistics functions been outsourced. According to Hsiao et al. (2009; 2010a; 2010b) there are four levels of logistics outsourcing in which the former two are related in execution activities and the latter in planning and controlling the activities (Hsiao et al. 2010a).

First level refers to the execution level, for example transportation and warehousing, which have been broadly outsourced. Second level refers to the value-added activities such as packaging and labelling. The third level refers to the planning and control level of logistics activities, which includes inventory and transportation management (Hsiao et al. 2010b). In this level the LSP already offers customized solutions and their skills are complementary with their clients (Hsiao et al 2010a). Finally, the fourth level which is known as 4 party logistics refers to the strategic planning and control of the entire supply network (Hsiao et al. 2010b). The services in this level relate to entire supply chain restructuring, for example changes of the warehouse structure and reassignment of responsibilities among chain units (Hsiao et al. 2010a).

According to Solakivi et al. (2013) most of the Finnish manufacturing companies have outsourced the transportation management, and almost half have outsourced IT systems at least in terms of software and hardware types of functions whereas information processing was kept in house. The lowest level of outsourcing was in



materials management and value-added services such as inventory management and product customization. It is also interesting to see that the level of outsourcing warehousing activities is quite low in Finnish manufacturing companies when compared to international standards (Solakivi et al. 2013; Hsiao et al. 2010b; Langley & Capgemini 2010). However, one of the future trend is that companies are looking more into these activities as well (Solakivi et al. 2013).

The concept of 4PL can be defined by four different features that Huang (2014), and Christopher (2011) have presented. These features shown in table 3. The first feature *IT service provider / Supply chain infomediary* describes 4PLSP's ability to offer advanced IT solutions complete "turn key" solutions to supply chain and all related logistics activities. Second feature *resource provider* describes 4PLSP's ability to attain resources from other parties as well to give the complete solutions for the customer. Third feature *SCM/ Architect* describes is the service providers ability to incorporate and manages the client's supply chain process' resources practically, efficiently, and flexibly.

Table 3. 4PL attributes (Christopher 2011; Huang 2014)

IT service provider/ SC infomediary	Resource provider	SCM/ Architect	Consultation/ Control Room
<ul style="list-style-type: none"> <li>• IT system integration</li> <li>• IT infrastructure provision</li> <li>• Real-time data to information</li> <li>• Convert data to information</li> <li>• Provide info to point of need</li> </ul>	<ul style="list-style-type: none"> <li>• Transportation asset provider</li> <li>• Warehouse, cross-dock, property facility</li> <li>• Manufacturing – outsourcing</li> <li>• Procurement service</li> <li>• Co-packing service</li> </ul>	<ul style="list-style-type: none"> <li>• Supply chain visionary</li> <li>• Multiple customer relationship</li> <li>• Deal shaper and maker</li> <li>• Supply chain re-engineers</li> <li>• Project management</li> <li>• Service, systems and information integrator</li> <li>• Continuous innovation</li> </ul>	<ul style="list-style-type: none"> <li>• Experienced logisticians</li> <li>• Optimization engines and decision support</li> <li>• Neutral positioning</li> <li>• Manage multiple 3PLs</li> <li>• Continuous improvement</li> </ul>

Final feature *consultation/ control room* describes the service providers neutrality as they are non-asset-based and control other 3LSPs performance and act as coordinator between the customer and other LSPs. The development of internet has also helped supply chain optimization, smoother information sharing, and mitigated the 4PL's formation to provide better service to the client by detecting possible commercial risks, examining the key performance indicators, and managing alliance network. (Huang 2014)

### 2.3.2 Integration of supply chain

As the globalization is increasing the complexity of supply chains, the collaboration between the supply chain members becomes vital (Capgemini Consulting 2011). Even though the business environment has become more turbulent (Christopher & Holweg 2011), the technology advancement has improved and broadened the methods how companies can perform their daily operations (Johnson & Mena 2008), and the supply chain strategies have been matured and improved (Christopher & Towill 2002), the essential need for cooperation between supply chain members and integration of supply chain has not diminished over the years (Stevens & Johnson 2016). Supply chain integration can be described as “the alignment, linkage and coordination of people, processes, information, knowledge, and strategies across the supply chain between all points of contact and influence to facilitate the efficient and effective flows of material, money, information, and knowledge in response to customer needs” (Stevens & Johnson 2016).

According to Pearson (2014) there are four different capabilities that are important for supply chain management in fast changing environment:

1. getting all supply chain members on the same page,
2. putting the right skills to the right places at the right time,
3. dynamic decision making, and
4. executing smart, rapid responses to external or internal events.

As the global economy necessitates global supply chain management that requires responsiveness and visibility, factors such as information technology tools, process knowledge, sales and operational planning becomes more crucial (Grzesińska 2017). The development of the tracking of logistical chains from purchase order handling up to distribution and delivery of the goods is considered important for the trade sector and manufacturing companies (Leppänen 2012). It can be said that the objective of a 4PL is to use resources within the supply chain efficiently, but the actors of that chain must be involved as well because their individual demands have to be included (Mehmann & Teuteberg 2016). This can be done by information and communication tools (ICT) that are essential part of the management of flows among supply chain partners, in terms of enabling integration, synchronization, visibility and responsiveness (Vieira et al. 2013). ICT is comprised of traditional e-mail, fax and

telephone but also electronic data interchange (EDI), RFID, and different platforms with software modules related to different transportation management and planning activities (Mehmann & Teuteberg 2016).

Hoek & Chong (2001) have described the process of implementing the 4PL service into four phases. In phase A the manufacturing company is still managing the entire supply chain and buying different services from traditional 3PLs. In phase b the 4PL will take the control of process and flow management on their client's behalf and starts managing the physical supply logistics. In phase c 4PL is starting to develop into client's supply chain manager where it starts to engage with supplier interfaces and orders a replenishment once the inventory levels go under the reorder point. In addition, the supplier starts to receive and handle order fulfillments from the final users. In the final phase d, 4PL should be able to manage the synergies between the integrated flow of information and goods. (Hoek 2001) By doing so, the buyer is more capable to identify their customer's desires and demands and hence fulfill them more accurately (Rayport & Sviokla 1995).

Even though it is crucial for effective 4PL companies to understand the logistics concepts (quality management systems and process management), effective ICT management and the ability to exploit technological innovations, Leppänen (2012) found in her study that the logistics service providers in Southern- Finland district had a lot to improve in these fields. Especially with the capacity, network and service level of 3PL and 4PL, which are not considered to be sufficient enough in Finnish markets.

One of the main reason for implementing a 4PL strategy is that it allows companies from different industries to have a single point of accountability across both supply chains and demand chains. Only in the recent years companies have started to understand that in the globalized economy it is important to focus also in the non-core activities in addition to core activities to bring value for the customers. These non-core activities can include IT, HRM, accounting or other financial services and also logistics and the management of long-distance supply chains. (Hsiao et al. 2010a; Win 2008) In addition, Hingley et al. (2011) proposed a typology where collaboration intensity and complexity of collaborative distribution were used as dimensions. They discovered that the more intensive and complex the distribution and collaboration operations become the more relevant 4PL services become in terms of assets and technology. Especially

in information flow supported by technology such as RFID. This also supports Bensaou's (1999) findings that the more specific investments are made to relationship the more it correlates with practices that are associated with strategic partnership.

### 3 VALUE CREATION THROUGH SUPPLY CHAIN

One of the most important issues for firms' success is their aim for continuous improvement, and companies constantly seek ways how to improve their quality, increase output, satisfy customers, and provide innovations (Howell 2013). Even though, the concept of "value" is important for companies, it is still a vague term (Lindgreen & Wynstra 2005) However, it can commonly be thought to describe the trade-offs between benefits and sacrifices that are dependent on subjective estimations and interpretations (Forsström 2005; Walter et al. 2001; Win 2008). When talking about value creation the concept can be defined to be a process where the participating firms make use of each other's resources while aiming to maximize the value-adding in financial terms. (Forsström 2005; Holweg & Helo 2014) According to Kähkönen and Lintukangas (2012) value is created from three different perspectives: firms ability to compete and respond to environmental challenges in the industry, their ability to utilize relational capabilities, and the ability to understand and respond to customers' needs. Since supply management is not only about finding the right suppliers and vendors but also about how to deliver the right products at the right time at the right cost to the final user, it has a huge role in the value creation process (Kähkönen & Lintukangas 2012).

The main issue of this chapter is to discuss about the value creation and how it can be created through supply chain. This is done by first discussing about how the term supply chain is slightly inaccurate and why the term value network would be more preferable to use (Christopher 2011, 3; Gadde et al. 2003). After this the focus will be on value stream mapping that is used for analyzing and designing the flow of materials and information required to bring a product to the final user (Howell 2013). Finally, the chapter presents a quality function deployment tool that can be used to allocate potential contribution of improvements into customer requirements and hence maximize the customer satisfaction (Huang 2014)

#### **3.1 From supply chain to value network perspective**

According to Cox (1999) when discussing about supply chain it is important to understand that it has two different dimensions that determine its strategic and operational importance: the operational supply chain and entrepreneurial supply chain. The operational supply chain is what every company has, and which describes

the series of main and support supply chains that are constructed to offer the inputs and outputs that deliver the products and services to the final user (Cox 1999). In other words, it considers the strategies and tools for constructing and operating efficient inter-firm networks (Holweg & Helo 2014). The entrepreneurial supply chain refers to the way of thinking that recognizes all the goods or services produced for clients requires the construction of an entrepreneurially defined common supply chain. In addition, all the resources within the chain are something that have some level of competition among companies. When gaining the resources that have a low tendency for competition and high barriers for market entry it is possible to gain competitive advantage. (Cox 1999) This can more simply described as a value chain where the central element is to exploit linkages between different business activities (Bhatnagar & Teo 2009). For example, technology can be combined with material and labor inputs which are then assembled, marketed and distributed (Gereffi et al. 2005).

Holweg and Helo (2014) have presented five different elements of value chain architecture:

1. The nature of value provision that is driven by the core competence of the firm.
2. The operational footprint decisions for manufacturing, sourcing and distribution
3. The approach to risk management.
4. The order fulfillment strategy
5. The buffering strategy

Even though *supply chain management* as a phrase is commonly used and accepted, it is, however, slightly inaccurate. Christopher (2011, 3) state that more accurate phrase to use would be *demand chain management* because the chain should be driven by the markets and not by suppliers. The traditional approach in value creation is based on Porter's (1985, 36) definition that every company is a collection of activities that are performed to design, produce, market, deliver, and support its product. However, several studies (Christopher 2011; Gadde et al. 2003; Hines & Rich 1997; Kothandaraman & Wilson 2001) state that this approach is inaccurate. First of all, this approach considers the value adding activities from the individual firm perspective and ignores the links between the firms, and how these links bring value as a network (Kothandaraman & Wilson 2001). Bhatnagar and Teo (2009) state that target activities in the value chain should have a clear economics and a substantial impact in terms of

cost or differentiation. In addition, managers must seek how to utilize target activities' linkages by utilizing optimization and coordination, which contains the identification of dependencies and resolving the tradeoffs between different activities in order to gain better results when compared to improving each activity individually. Second issue relates to the narrow perspective of the value chain, when it considers that every company is involved only in one chain, when actually many firms are involved in several different chains and more accurately different firms form a network that includes all suppliers, clients and their possible clients. (Gadde et al 2003; Christopher 2011, 3) Stevens and Johnson (2016) predict that in the future the collaboration intensity within the supply clusters begins to grow which will lead to smaller and less intense supply communities where the relationships are reinforced by same norms and values and are adaptive to both supply and demand. "As a result, the relevance of narrow, linear-based supply chain models has been challenged as firms have looked more and more toward networked and collaborative supply chain strategies to deliver superior performance" (Stevens & Johnson 2016).

Therefore, instead of using a supply chain term, more accurately should be discussed about a value net where all the participants (customers, suppliers and company) are networked with each other trying to create value for all the participants and they digitally connected with each other. A value net can be said to have five different characteristics. They are customer-aligned meaning that the customer's choice is the generator for the activities used in company and its suppliers. Secondly, it is collaborative, and company engages a value-creating relationship with its customers and suppliers. They are also agile and scalable to different situations and fluctuations. They have a fast flow in order-delivery cycles and delivery dates are accurate. Finally, they are digital, connecting customers, suppliers and other value-adding activities. (Bovet & Martha 2000)

### **3.2 Value stream mapping**

According to Hammer (2002) company's success is dependent on its processes. If the processes are not well designed, it does not matter how much effort the staff places on their work for it cannot exceed the limit that the process allows them. A business process is an organized group of activities that are used to create value for the customer, and process management is a structured approach that is used to improve

these end-to-end business processes. It brings benefits by committing every staff member around the same goal and provides a framework how to redesign a process in case needed. According to Sunk et al. (2017) process management delimits, analyses, operates, measures, controls, documents and improves processes to fulfill customer demands. Process management systems is a good approach to improve processes in a comprehensive way because it can combine innovation leaps and constant improvement. Value stream mapping (VSM) is a valuable tool for continuous process development and waste reduction. It includes all value adding, non-value adding and supporting activities that are required to make the product (Sunk et al. 2017). VSM visualizes and records processes such as material flow and information flow that are related to the product from the point of origin to the final point of delivery (Sunk et al. 2017; Howell 2013).

The VSM concept has originated from Toyota where it was originally known as “material and information flow mapping”. With the help of value stream mapping, organizations can define the current state of their systems and decide in which direction they want to improve it. This future state map can then be used to develop different lean strategies. There are several different benefits that value stream mapping can bring for organizations. For example, it explains to all parties involved what kind of manufacturing processes are used in the organization, and it combines all the lean techniques, which forces all parties to perform as expected and not to neglect these expectations. (Howell 2013; Pepper & Spedding 2010)

However, value stream mapping has also its downsides. For example, drawing a process map might demonstrate the process in too simplified way which might also detract the focus from the actual problem. It also gives a static image of the process, which only shows the sources of waste at that current state but is uncappable to change in changing business environment. (Sheridan 2000) Solution to this might be to use a digital software that presents the value stream in dynamic way and more detailed than traditional “paper and pencil”. This allows organizations to see the overview in real time and look for constant improvement areas in changing environment. (Pepper & Spedding 2010)

In Toyota’s production system the seven commonly accepted wastes are: overproduction, waiting, transport, inappropriate processing, unnecessary inventory,



unnecessary motion, and defects. Overproduction is traditionally considered as the most serious waste for it disables the smooth product flow and can restrain the productivity and quality. It also can increase the lead and storage time which will result in late defects detection, deteriorated products. (Hines & Rich 1997)

The second waste waiting occurs when the time is not used efficiently, which occurs when the products are not moving or being processed. The third waste transportation means the movement of the product which should be minimized. Double handling and unnecessary movements increase the risk of damaging the goods. Inappropriate processing refers to a situation where a simple procedure is managed with a complex solution for example using a large inflexible machine instead of using several small but flexible ones. The over-complexity can encourage to overproducing the product to recover the investments in the complex machines that might eventually lead to excessive transport and poor communication. In addition, inappropriate processing can occur when the process is done without any safe guards, which may result in bad quality. (Hines & Rich 1997)

Unnecessary inventory usually increases the lead time, prevents rapid problem identifications and increasing space which thereby discourages communication. Also the unnecessary inventory tends to increase storage costs which will eventually effect on the company's competitiveness. Only solution to find these problems is to reduce inventory. The unnecessary motion refers to the personnel's' ergonomics in the production, and unnecessary movements such as bending, stretching and picking up materials will eventually reduce staff's energy and results to damaging the quality. Finally, with defects Toyota's philosophy refers to the direct costs that, however, should be considered as opportunities that can be improved rather than defects that should be traded off. (Hines & Rich 1997)

### 3.2.1 Lean management as theoretical background

From a historical perspective, lean has cumulated originally from Japan by Toyota's production systems. The idea of this philosophy is to reduce waste and maximize the quality in the production process. (Träghård & Lindberg 2004) It is also very universal tool that can be applied in a similar way into many different business fields (Hines & Rich 1997). When company focuses on its internal quality issues such as maximizing

the lead time of the production and minimizing the delays this results to improved customer satisfaction and cost reductions. Lean can be approached by three different ways. First of all, it is all about reducing the waste in the process. Second, it is a system that provides tools that can be implemented from lean thinking into real practice. Finally, it is also about the description of how to implement lean methods into everyday business. (Machado & Leitner 2010)

The principles of lean philosophy can be memorized with an acronym SIMOS. The first principle is to specify the things that create value from the customer's point of view, and not from the perspective of the supplier. The second principle stands for identifying all the steps in the process that are required to design, order and produce the product in the value stream. This needs to be done so that the non-value adding activities e.g. waste can be noticed.

The third principle is to make the actions required to create value without disruptions or carelessness. Management team should focus on the issues related to measuring the performances and have a vision of what is the purpose and what could be the outcome of these measurements. The issues related to these issues are:

- Developing the key success factors. These are the areas where company's operations have to be handled in a correct way.
- Defining the business measures that have to be in line with the critical success factors.
- Checking the requirements for improvements in each business measure, and measures should have several different targets. They are preferably set between three to five-year timescale and with staged targets for every year or six months.
- Defining the key business processes, which should be limited between five and ten.
- Deciding which process needs to deliver against each target area, and which one of these processes needs to be mapped in detail. (Hines & Taylor 2000, 11-16)

Fourth principle is to understand the big picture, which makes it easier for the companies to recognize inefficiencies in the processes and how different flows and actions are connected with each other in the supply chain. It also helps organizations

to recognize what is preferred by the customer. Lean management philosophy does not only concern the top management level, but instead the whole workforce has to be included into the process. This is actually a common mistake that is made when implementing lean management, and will be discussed later on. By developing detailed action plans the company can ensure the effective adaption of lean thinking on the lower hierarchy levels as well. Detailed mapping can be constructed into six different tools: process activity mapping, supply chain response matrix, production variety funnel, quality filter mapping, demand amplification mapping and value analysis time profile. (Hines & Taylor 2000, 27)

Companies should include their partners among to the lean management and in cooperation finding the areas by using the mappings of the different processes and see what should be improved. For example, by using an activity map, companies can see real evidence of the activity performances and see ways how to improve those activities together with partners in the supply chain. (Hines & Taylor 2000, 43)

Eventually company should strive for optimizing the processes by reducing the non-value adding activities when they are discovered. Once the mapping has been done, company should go back to the beginning of the process and see how the improvement aims are meeting with the set targets (Hines & Taylor 2000, 47). Figure one below gives a good overview of how to proceed with lean philosophy. (Hines & Taylor 2000, 3)

Table 4. Framework for lean thinking. (Hines & Taylor 2000)

<b>Objective</b>	Understand customers and what they value	Define the internal value stream.	Eliminate waste, make information & product flows, pulled by customer needs.	Extend the definition of value outside your own company.	Continually aim for perfection.
<b>Method</b>	Setting the direction, targets and checking results.	An internal framework for delivering value.	Appropriate methods to make necessary change.	Externalize the value focus to the whole value stream.	Strive for perfection in the product and in all processes and systems.

However, just like any other management tool or philosophy, lean has also received some criticism. Pepper & Spedding (2010) have collected some of the downfalls that have been claimed against lean mainly related to companies that have lot of different

items and mass production. For example, when a company has a big product portfolio this means that the tasks might differ from each other and it is therefore impossible to implement standard production approaches. The product characteristics might also create limitations to the production process. Finally applying lean philosophy is very much dependent on the size of the firm, and smaller firms might face more inflexibility in their supply chain than the bigger competitors due to smaller amount of resources.

Lean philosophy has also been criticized for being more company oriented than employer oriented. It has been acknowledged that employees feel unsecure when company reaches for lean management, and that the management level is not willing to take responsibility when problems occurred. (Parker & Slaughter 1994) This is why it is important to understand that lean should only be used as an enabler and not as a tool for downsizing (Pepper & Spedding 2010).

### 3.2.2 Value stream mapping process

With the help of lean thinking, companies can recognize together the value stream for products from concept to consumption and optimize this. This is done by defining the corporate strategy and to recognize the key customer facing processes e.g. order fulfillment and how they relate to key non-customer facing processes such as supplier integration. (Hines et al. 1998) There are a lot of publications that describe the value stream mapping process. Even though some of them differ from each other they all include the following main steps: determining the product or the product family which process you want to improve, drawing the current state map, creating the future state map and creating, and finally creating a plan on how to get there. (Sunk et al. 2017; Manos et al. 2006; Mehta & Rampura, 2006)

Determining which product or product group should be mapped is the starting point of VSM. To decide which product or product family should be mapped, companies must consider for example what is the impact for the customer, what is the product's market potential, and what is the expected consumption volume. (Manos 2006) Christopher et al. (2009) have defined five different variables to classify the value stream: life cycle duration, delivery time window, volume, variety, and variability. To keep product's life cycle short, rapid time to markets and short end-to-end replenishment pipelines are required. This means that product development, logistics and manufacturing has to be kept at fast speed, as well as the time window for delivery has to be kept fast so that

the organizations can keep their products available for the customers. High volume mass markets allow for lean type production and possible to make-to-forecast strategies. Variety relates to the amount of stock keeping units, and it is important to recognize the required number of units that have different life cycles. For example, the units that are in introductory stage might be more popular than the units in declining stage. Variability refers to the demand and the supply predictability. (Christopher et al. 2009) It is also important to know that the VSM process should never be done by a one person but instead collect a team from different departments that are involved in the order-delivery process. (Lovelley 2001)

After the product family has been chosen the next step is to model the current state map based on the collected information. The ideal current state map illustrates how the process is currently performed and should start from the client's end. (Manos 2006; Lovelley 2001) It includes both the material flow and information flow. Material flow presents the physical handling of the products, that may be value adding activities but as well the non-value adding activities such as transportation and warehousing. The information flow describes the information exchange within the value process to make the production system complete. This flow includes all manual and electrical data exchange such as scheduling required and required production amounts. (Lovelley 2001) It is also important to note when mapping the current state, it is not necessary to capture the perfect data but clear out the disinformation. One challenge might also arise when trying to get the correct data from the parties that are being interviewed for employees often try to explain away the problems due to the risk of saying something that their manager isn't willing to hear. (Womack 2006; Manos 2006)

The final step of the value stream mapping process is to map the future state and most importantly implementing it to every day practice. The future state mapping shows how the ideal state of process would go. In other words, where the "just in time" ideology is optimal and client will receive a placement right after they have used the pervious one. It is important to understand that the future state map should describe how the process should be done go and not how it currently done, and lot of innovative ideas and creativeness should be used while implementing it. (Lovelley 2001) While drawing the future state map, staff should consider each step and whether it really creates value for the customer. Some easy improvement fields are for example rework and

item storage and placing as many actions as possible in continuous flow, which will reduce throughput time and reduce costs. (Womack 2006)

After the future state map has been implemented, an action plan how to get from the current state to the ideal state is required. This can be done by simply listing the differences between the two states and creating an action list. It is important to notice that in case the company hasn't done value stream mapping before, they should make the action plan to the location where the success is highly likely. This will motivate to continue towards the action items that are higher demanding. Finally, the company should re-evaluate their future state map and redefine their metrics and span the idea to other product families as well. (Lovellette 2001)

### **3.3 Quality function deployment**

One of the lean six sigma tools that are used to recognize the values in the value stream is the quality function deployment (QFD). The concept has originated from Japan in the late 1960s and early 1970s. (Chan & Wu 2002) It is customer-oriented approach with the purpose to analyze the voice of the customers that are used to develop and improve products and services that match with customer's expectations. (Karsak 2008) QFD does not have definite boundaries, which mean that it can be used in several different business purposes such as product development, quality management, customer need analysis, and decision- making. (Chan & Wu 2002) The benefits that the QFD can bring for the companies are decreased startup problems, improved market research, reduced development time, better communication between departments, and quality is built in the upstream (Govers 1996).

One significant tool of QFD is house of quality (HoQ) that has been first applied by Mitsubishi Heavy industry for shipbuilding industry. The tool is useful to target the improvement inputs into customer requirements (CRs), and the service provider can then maximize the customer satisfaction by executing the alternatives of improvement. The HoQ constructs from five different dimensions: customer requirements, technical measures, cross relationship matrix, correlation matrix, and target values. (Huang 2014)

Customer requirements dimension (WHATs) is used to consider what is the product or service that needs to be employed, who is the client, and what are their

requirements. When this has been done CRs are quantified by their level of importance and satisfaction for the customer. This way the relative weight of the CR can then be given which can be done by using scale from 1 (not very important) to 5 (very important). (Huang 2014) The technical measures(TMs) dimension (HOWs) are design requirements that have been translated from CRs and are developed based on the resources and coordination. TMs must refer to concrete observable characteristics and measurement methods. (Govers 1996)

The cross-relationship matrix compares each CRs and TMs and demonstrates the contribution level and relation of technical measure to each customer requirement. Since there is no typical one-to-one relationship and the intensity of interactions may vary, the dimension shows the strength description of the relationships. Typical degree of strength description used is low relationship, moderate relationship, strong relationship, and no relationship such as 9-5-1 or 9-6-3. The correlation matrix measures the relationships between TMs and how much they have influence on each other. The same degree of strength description is used here than in cross relationship matrix. (Huang 2014) Final dimension the target value describes the value of each TM, which then demonstrates what is the most important technical measure regarding the CRs and what priorities and directions should be improved (Govers 1996).

According to Govers (1996) QFD has all the same rules as any other project management. This means that it is clearly defined, has a team of experience-oriented people from different departments and with comparable rank in the company's hierarchy. It is a process where the company can make trade-offs between the customer demands and the company's affordable solutions. QFD covers the same activities that were originally performed by people but at the same time minimizes possible the unreliable and instinctual decision-making processes with an organized methodology, which establishes all relevant knowledge and experience from the organization. Therefore, it can be said to be the basis for the organizational learning.

QFD can be can be divided into four different phases (Dai & Blackhurst 2012; Govers 1996):

1. Strategy and concept definition (customer requirements)
2. Product/ service design & priorities
3. Process design

#### 4. Manufacturing/ performance operations.

As stated the QFD's has originally been developed for product development and quality management, however, it has also been suggested to be an appropriate tool for supplier assessment and selection as well (Dai & Blackhurst 2012; Ho 2010; Bevilacqua et al. 2006). However, there are some limitations that must be considered when using QFD for supplier selection purposes. First of all, it is very hard for the company to interpret the customer's voice. For often the "voice" is based on individuals' personal perceptions and linguistic evaluations that are subjective and imprecise (Chan & Wu 2005). In addition to the difficulty of interpreting the customer's voice, it should also be noted that since the voice is subjective it might create a degree of inconsistency and damage to the decision making (Ho 2008). The second problem relates to evaluating the potential trade-offs that come across as the customers tend to evaluate everything equally as important and the multiple requirements from customers may be conflicting for example when comparing the lowest cost to excellent quality (Ho 2008; Karsak 2008).



## 4 EMPIRICAL PART: POSSIBLE SERVICE REQUIREMENTS AND OFFERED SOLUTIONS

Eight interviews were made total for this research from which three were conducted with the case company representatives. All of them are closely involved with logistics and service operations: customer care specialist, sales and marketing (S&M) representative, and research and development (R&D) representative. After the case company interviews the next three interviews were conducted with three different potential service providers that had been searched through internet and approached via email. Finally, two of the LSPs' met together with the case company where the case company representatives could explain in their own words their logistical challenge and the LSP's could tell them in what ways they could be useful for them based on the information they received in personal interview sessions and during the meetings.

### 4.1 Introduction of the case company

The case company of this research is a medical technology company, whose mission is to help clinicians and researchers to treat their patients better in neurological and psychiatric diseases. Their headquarter is located in Finland but they also have offices in Europe and in the United States. Their technology is based on stimulation that is used in diagnostic and therapy. In year 2017, their expenses in materials and services was approximately 28 % of their net sales.

According to the case company, their current strategy is to validate and commercialize their technology in therapeutic indications that have suboptimal treatment options. Their aim is to build sales in the United States and large EU markets in currently approved indications, in addition to generate clinical data to attain regulatory approvals for new important large markets. They are also aiming to actualize the commercial potential of their technology in diagnostic, and they remain mainly focused on the potential of their differentiated technology in therapy, as this represents a larger market opportunity from their point of view, with a better model for sales growth in terms of consumables to which this thesis is also limited to. To give a better apprehension for the reader about the product, it can be briefly said that the consumable product is a

small item that contains a RFID tag. These products can be used only once for each patient session and are sold in 20-piece packages.

According to their latest annual report major risks that their board of directors have considered relating to the company and its business operations, and which are relevant for this research are:

- The Company's operations may be interrupted due to problems associated with its suppliers.
- Healthcare providers and hospitals may not adopt the Company's technology and treatment modality in the estimated manner or extent.
- The Company has limited experience in sales, marketing and distribution.

All the interviewees were met one at the time in their headquarters on the 23th of March 2018. The respondents were told that the interviews were more semi structured than fully structured, and that the pre-given questions were only used as guidelines for the interview, in order not to limit respondents answer alternatives and giving them a chance for open conversation as well. They were also informed that the interviews would last approximately thirty to forty minutes.

The interviews with the case company's representatives proceeded according to the themes and questions that are showed in Appendix 1. The themes of the interview were:

- Questions related to outsourcing
- Questions related to benefits & risks of outsourcing
- Questions related to the demands for the logistics service provider

The first theme was discussed to understand what are the company's core capabilities, and to see whether the case company estimates supply chain management to be crucial for the company's success but at the same do they have the resources and skills to fulfill their client's needs in terms of delivery accuracy and product availability. The second theme's purpose was to analyze what are the outcomes that the case company hopes to achieve in case their SCM is outsourced to an outside party, and what kind of risks can be associated with it. In addition, the second theme's purpose was to discover what kind of a relationship the case company is willing to create with

the possible LSP. The final theme was discussed to see what were the demands for the service provider, and whether the 4PL service model is suitable for their needs. Before the interviews started all the respondents were asked for a permission to record their interviews to make transcription process easier. All interviews lasted approximately from 20 to 60 minutes.

The examination of the data was done by considering the conceptual framework of the research, and its objectives so that only the relevant information would be left from the interviews. After ruling out all the irrelevant data, the answers were categorized under the interview themes. Finally, the empirical findings were compared with the theory that already exists and with each other to some extent. It has to be bared in mind that this part of analysis is very important to deduce and confirm the final conclusions. Study's conclusions have been deduced by observing how the collected empirical data matches with the previous similar studies and existing theories and whether there was a pattern that could be found.

### **Interview with sales and marketing representative**

The first interview was held with the sales and marketing representative. As mentioned already in their web pages their strategy is to move their sales focus from medical machinery into small dispensable consume products that is the main focus for this research. This strategic decision has been made approximately over a year ago and now they are facing a challenge in how they are going to familiarize their staff and their clients to this new sales model. According to the interviewee their existing European clients' resistance against costs that these kinds of dispensable products create is high because previously they have received a device that have been able to use in multiple patient sessions with different patients. Therefore, to minimize the resistance, they have to make sure that they deliver the products to hospitals and clinics as agreed, clients' stock levels should be as minimal as possible, and clients should not worry about the stock refills. According to the interviewee this can create a communication problem for them and means that the logistical chain and controlling becomes vital for their business.

Another issue that will arise is the expected volume increase with the consumables. Their main focus has been in the diagnostic field where the amount of patient sessions is approximately few hundred per year, which means that the required number of

packages is only a dozen and, hence, has not created a huge logistical challenge for them. However, now that the company is moving towards the therapy treatment the amount of sessions would increase from hundreds to thousands. This means that the logistical coordination will get more demanding. They present a single case real-life example for one delivery that was meant to be delivered from their headquarters up to a hospital that was located nearby. The logistics company they used picked up the package and the case company assumed that everything was taken care of after that. Few days later, however, their client was asking the shipments whereabouts, which they supposed had already been delivered. No one in the company had been following the delivery and the LSP was also not aware about the package whereabouts. They were lucky that the distance was only few kilometers so that they could easily send another package but if this would have happened in other side of Europe it would have had a negative impact on their client relationship.

Based on what had been said the interviewee was asked do they consider to have difficulties in managing the information flow and keeping the supply chain transparent. The interviewee stated that their whole order-delivery process is relying on e-mails and phone calls that is unsustainable situation when the growth starts. Hence, they must structure this into more standardized manner, and to instruct their clients on how the delivery operates. That they cannot just send us an order via e-mail but instead they have to adapt to a process on how the shipment is done. They also admit that their direct ability to follow up their shipments is low, which then creates confusion and additional work to check the deliveries from the third party.

The interviewee agrees that currently they lack the technology and capabilities to structure and synchronize the information flows between their clients and suppliers without them being in the middle. It is also stated that they have chosen a supplier who is capable of manufacturing large quantities of their product in case needed but as a tradeoff they are inflexible and require long forecasts for manufacturing amounts. They would require a logistics partner who could do the forecasting on their behalf or a partner where to channel all the orders and who would communicate with the manufacturer. Based on the discussion it became clear that they want to have a logistics service provider that would have an IT solution that could help their supply chain to become more proficient in terms of getting the products from point A to point B.

When moving on to possible risks related to supply chain outsourcing. The interviewee stated that the biggest risks he considers are related to partner's commitment on the relationship and reliability issues. Since this new product and the service model they are now launching will become crucial part of their sales strategy, it is highly important that the selected partner must be easily available and be ready to form a close relationship with them.

*"It is crucial that they would be almost as our own staff member, whom we can reach almost 24/7. We have to have some specific number and very close relationship that we can always feel free to contact and openly say when we have an emergency."*

In addition, the interviewee considers possible information leakage as a risk and notes that all possible information relating to whom they are selling in price must be confidential.

Regarding the LSP's neutrality and its potential as a value adding feature, the interviewee stated that so far, they have always separately competed the suppliers in different countries and the quality has been varying. They highlight that the final delivery to the hospital or a clinic is a business card for them. Therefore, it is important that the supplier will be someone who knows the background of their business, and how important these consumable products are for their clients and that they will give a good image of them. However, they don't see this as a mandatory option and it can be tendered on country basis as long as they fill credibility standards but if this new product goes to price competition then the costs in the logistics might become one of the terminating factors for the product's price. The interviewee considers it as a risk in case they end up in a "hold-up" problem where the supplier technically can obtain a monopoly situation and will increase their prices.

When discussing about quality management system ISO 13458 certificate, which is used to demonstrate company's ability to provide medical devices and related services that consistently meet customer and applicable regulatory requirements and can also be used by suppliers or external parties that provide products or quality management system-related services to such organizations (ISO 2018). Interviewee's opinion is that this would be more beneficial than mandatory for the possible logistics partner. From their point of view more important is the manufacturing plant possesses this certificate

because then they would have audited their supply chain as well. He wasn't sure if there would be a LSP in the markets that would have this kind of a certificate.

When it comes to LSP's supporting role in sales forecasting case company sees that the actual selling to the final client is their own competency but the LSP will have an important role with building their brand image in terms of delivery accuracy. When it comes to forecasting they find it hard to have exact forecasts for the sold volumes per site during the first years. This will be challenge when considering about the stock levels per site because they do not have data for now how much their clients would be willing to stock at their facilities. This depends a lot in how many patients the hospital or a clinic can treat per day and what kind of space facilities they have.

At the end of the interview the interviewee wanted to add that since they know what kind of a challenge this might become in terms of effective information flow. The thing that is important is that when they have sold their product, the client would immediately receive an order acknowledgment and delivery date information for example "thank you for your order you will receive our order confirmation within 24 hours with the delivery date". These are basic issues but now really challenging for them in this current situation that they are currently developing. This information should then be informed for the sales personnel as well so that they know when the goods should be delivered and in what way. This would erase a lot of unnecessary communication. Finally, when the order has been delivered, invoicing will become an important part of their work, so they need to have a proof of the delivery when they send an invoice. This is important because the person who will pay the invoice that can be worth over tens of thousands, wants to be sure that the goods have truly been delivered. Hence, the information that the client has received the goods combined with the invoice is important. Finally, the interviewee wanted to highlight the importance of having a quality control over the items before they are packed and shipped for the customers.

### **Interview with customer care specialist**

The second interview was held with the company's customer case specialist whose daily job description includes repair and customer support service management, and the production and distribution coordination. Currently the interviewee doesn't see any challenges as such in their supply chain management but admits that the time spent in packaging and shipping the goods always takes time and resources from other

tasks. Because of the current low consumption this is ok but when the demand and, therefore, the volume amounts start to increase this might get problematic when all working time is spent on packing and shipping, which means that there is less time for other tasks such as customer service and technical support.

Regarding the possible “worst case” scenarios the interviewee stated that the biggest risks now are if they run out of the stock. The interviewee’s impression is that they haven’t pre-planned their material flow operations quite well. He wanted to highlight that his opinion has always been that their competency has never been in the logistics or the production side, and that it’s not a good idea for them to take care of these issues either. In case possible they would like to channel the received orders directly to some external supplier because then they could be able to focus more on their main issues, which for him is customer satisfaction. At the moment when he has to do all the packaging and shipping he cannot be entirely sure whether they have enough items available at stock, hence, he cannot guarantee 100 % customer satisfaction either.

According to the interviewee one of the important issues that the possible logistics partner should concentrate on is the information flow i.e. how they can get the order information they receive from clinics and hospitals to the LSP and how would the LSP inform the confirmations and delivery dates to case company. In addition, the interviewee was asked also about the product availability and could they then see overproduction as a potential problem as well. According to interviewee overproduction is not a problem because the product’s costs for them are quite low and they have managed to sell all to their clients. In addition, the consumable product has a two-year usage time and usually they get shipped to the client a year before the due date.

The price should not be an issue for them either when considered that they would spend most of their time in packing and delivering instead focusing on their main tasks. The interviewee considers this scenario to be more expensive than to have a third party involved. When it comes to possible risks, the interviewee considers that there are always risks but he could not estimate the severity of the risks or name any specific risk that should be considered. However, he has heard that they are not the first company who is looking for a solution to this kind of a problem, where disposable

goods are delivered for clients, and estimates that there might be a lot of service providers for this kind of demand. Important is that the service provider can give comprehensive solutions and minimize the waste in the process.

At the end of the interview the interviewee once more highlights that logistics has never been their company's core competence. In addition, he estimates that the relationship with the service provider would be close and transparent. In addition, for the consumable product that is discussed in this thesis the case company has other items as well that could be shipped directly from their manufacturing partner to customer. This would decrease costs, increase efficiency and customer satisfaction. However, they do need to have one internal staff member for example a purchaser who would be the contact person for the LSP as well.

### **Interview with R&D representative**

Third and the final interview with the case company representatives was held with company's R&D representative whose responsibility is to oversee their research and development functions and recently their production as well. By production they imply to their equipment manufacturing and supply chain. He is not responsible for services or after sales but on material deliveries and procurement, stock levels and warehouse management. When asked about the problems regarding the consumable product's supply chain management and coordination, they are now moving the manufacturing entirely to a single supplier who can arrange all the components for it. Before this they have had to buy part of the components and manufacturer has made the assembling which they have then delivered to case company, and finally the case company has shipped the products to clinics and hospitals. Their aim now is to order the final products from the manufacturer who will take care all of the component purchasing. The next step from this is to get the manufacturer to deliver the final products for some third party that can take the orders from clients and deliver the goods for them as well so that eventually the case company will be entirely out from the order-delivery process.

Just as their customer care specialist the interviewee also thought that logistics is not their core competency. They do acknowledge its importance and that one cannot have any selling without logistics, but the coordination of different deliveries is not their strength. Because they are quite small company their core competency is focused on



sales and marketing, and research and development but not manufacturing. That is also the reason why they have outsourced the production. They consider that less they are involved in it the better. The other issue regarding the consumable product is the scalability. The scale where they are aiming is in such level that they do not have the resources or skills in reaching that kind of level. Which means that it has to be left for the professionals to take care of.

One of the main issues they see in their supply chain's is that the orders they now receive from their selling department are often vague, which means that they lack some level of formality in it. Currently they must double check that the orders are such that they can fulfill and clarify them with their clients afterwards. For example, what is the required delivery date. This creates unnecessary work. They face challenges with meeting up the delivery times that their clients require, which then creates the situation that customers are placing orders in advance. The challenge is that when they have to configure the products for the client, they might get changed during the process which means that they have to make double work and stock the previous items waiting to be shipped for someone else. This then creates more expenses and less income.

Regarding the system integration where the customer's order information would get transferred immediately to the supplier, the interviewee stated that they are not able to create this kind of an integration. One of the main issues is that they want to take themselves out of the chain. Aim would be to have an order handler that could in a way manage their warehousing and logistical process to whom they could inform the manufacturing contacts, and then they could follow the operations through a system from where they can get a follow up of the shipment statuses.

Thus, there should be an EDI system between the LSP and their manufacturer supplier into which the case company could have access. They do not consider it to be relevant that they know everything about their sub-contractor's sub-contractor. It should not be important for them because if it would be, then it would mean that there is a problem and they are trying to help fixing it. In addition, that they would have an order handler, they want it to be easy for their clients to approach and use, and that the possible LSP could fulfill their customer's demands in a way that client's stock levels should not be high but there shouldn't be any down time either.

The solution should neither be too expensive, it has to be process oriented and easy to us. When talking about scalability they don't necessarily demand that there should only be one supplier on a global scale. It could be for example one for North-America, one for Europe and the rest of the world. This of course can be taken care of by one supplier but not by expense of losing quality. Another thing that should be considered is the lead time. They estimate that the time between the customer placing an order up to receiving should preferably be one or two working days but not more than five.

When it comes to possible risks that should be considered in terms of letting an outside party to coordinate the supply chain the interviewee surprisingly doesn't see risks in leaking any information that the possible LSP could capture and sell unlike their sales and marketing representative. This is because they have made the manufacturing process in two stepped process where one supplier makes the product and the other manufacturer who makes the RFID tag for the product that transfers the information. So he sees this risk to be more in their manufacturing relationship. This is interesting to note because it is in contrast with their sales and marketing representative's opinion about the possible information leakage.

Regarding the quality standards and quality certificate ISO13485 the interviewee was not sure on how this would be useful concerning logistics. But he sees that they should have some kind of quality contracts with the potential partner to see the quality of operations for example in terms of stock levels and product's life cycle. Returning back to the system integration once more they do not have that kind of IT system that could be integrated together with their suppliers. However, they wish that the LSP would have this kind of a system, where they would have an access for monitoring the performance, for example a viewer-license. However, the interviewee acknowledges that they might also have to add something to their own system so that they can follow the money flow, and check that they receive the correct amount of money per sold items.

Regarding the importance of LSP's neutrality that they would not have own equipment and all the operational services would be procured form the markets, the interviewee does not see it that relevant, and considers that the partner is allowed to utilize their own equipment as well as long as their reputation reputation is not bad, and once more he refers to the quality contract which will be relevant for this possible business case.

They also don't see it relevant for their image what company or brand is used for their logistics operations. As long as it is not their competitor and its competitive it's ok for them. The interviewee adds to the competitiveness that they are not necessarily looking for the cheapest solution, but rather a partner with trustworthiness and good delivery accuracy. These are the most important standards before the price. Singular accountability is considered important as well but not as important than the ability to facilitate information flow and IT systems. They are ready to have for example three to four partners worldwide but not more.

When thinking about innovativeness in terms of improving their clients' (hospitals and clinics) service level it is relevant. For example, that the customer is not required to have a high level of stock at their facilities. Professional staff is not considered to be that relevant but the experience in the health care supply chain management is because it has to do with the quality standards and the supplier should know what kind of clients they have and what is considered relevant in health care industry. Issues related to abilities to work in operational and tactical level are important but not in the very beginning but rather few years later when they have had growth from thousands to millions in terms of sold volume. This is again related to the scalability and the development. Quality certificates are considered as a demand, but it does not necessarily have to be the mentioned ISO 13485, however, they need to be able to make audits for service provider when necessary.

LSP's ability to integrate and manage the various resources of client's supply chain processes practically, efficiently and flexibly is exactly what is wanted according to the interviewee so that they don't have to be involved in the chain performance. Demonstrated ability to manage supply and demand uncertainty is not considered that relevant. Due to the reason that when they sell one of their machines they know that the volume of disposable items will also increase, and this type of market doesn't have any seasonal fluctuations. Therefore, they can estimate the future demands in some level. However, once again they highlight the importance that the LSP has to be able to scale their operations from small consumption into almost exponential growth. Final feature was related to LSP's process rigor, here they do not see any difference with quality management because in their business these two factors go hand in hand. So, it is considered to be important as well.

## Summary of the current situation and service requests

Based on these three interviews this thesis presents a summary of the current process flow for the consumable product, what the case company considers as a challenge and what kind of future state process flow could be. The figure 4 below demonstrates the current process flow and the figure 5 demonstrates the future state process flow.

Both process figures present the case company in the middle, their customer on the right (downstream) and manufacturer on the left (upstream). For simplified reasons the processes intentionally exclude suppliers' suppliers from the process flow and also the suppliers and customers internal processes. It also only uses one customer in order to get a better understanding of the situation and what is wanted. The processes have been divided into two separate flows: information and material. The process steps have been numbered to show how the process proceeds.

As it can be seen from the current process the case company clearly has too many steps in the information flow that requires manual work inputs. As they are working with emails and phone calls there is a lot of potential risks for human errors that might disturb the process flow. In addition, the case company lacks a systematic approach on their order-delivery process which means that each order is managed case by case and might create additional work that doesn't bring any value for the client.

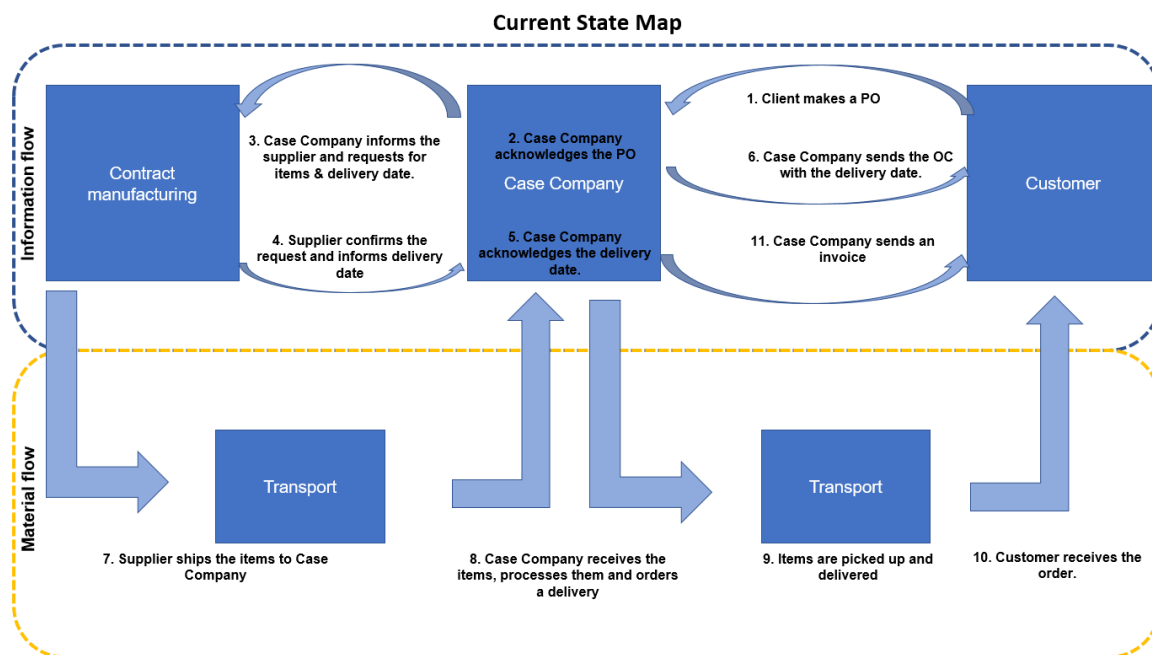


Figure 4. Current state map of the consumable product

Based on the defects that were brought up during the interviews and case company's requirements for the process, figure five was created that was used as well as a starting point when interviewing the potential service providers. The main idea was to get the case company out from the order delivery process and add the LSP as an order handler and where the integration of information flows between the parties has been made as smooth as possible.

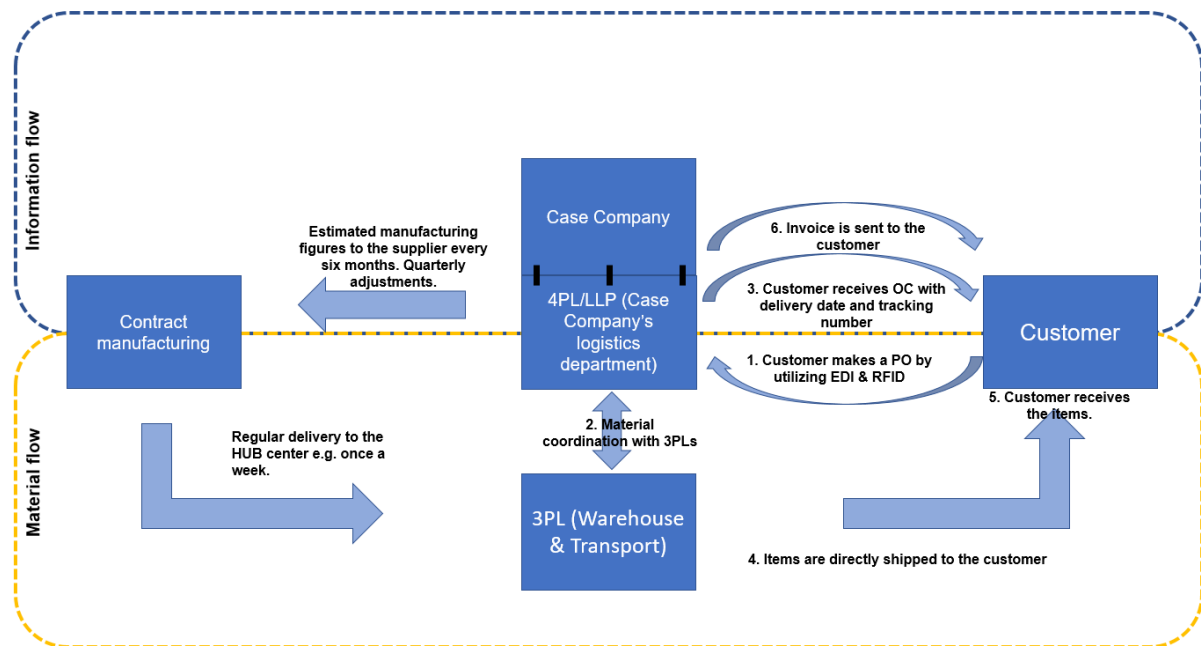


Figure 5. Future state map of the consumable product

The main thought for the future state map was that it should be made as easy as possible for the client. Hence, it was considered that the order process should be proactive instead of reactive. Client would have a consignment stock that utilizes RFID technology that would help following the stock levels and automate the refill requests. The future partner would monitor customers stock levels, would regularly basis contact the manufacturer and choose the right warehousing locations and transportation methods based on the customer's needs. They would also be in contact with the manufacturer and inform them the required amounts as per the forecasts and which would be adjusted on a regular basis. Shipments from manufacturer up to HUB centers would also occur on regular basis. All of this would be controlled by the 4PL or LLP party and would be transparently reported for the case company who would be ruled out from the delivery process and would only arrange the invoicing to their customers. These figures were used in logistics service providers' interviews.

## 4.2 Introduction of logistics service providers

The next three interviews were conducted with the potential logistics service providers. Due to the confidential information that LSPs revealed during their interviews, they all wanted to stay anonymous. First interview with supplier A was conducted with the company's owner and one their sales representatives, which lasted over one hour and 15 minutes. Second interview with supplier B was conducted with the company's CEO and lasted over two hours. The final interview was held with supplier C's business development director which lasted approximately 55 minutes.

The interviews with potential LSP's representatives proceeded according to the themes and questions that are showed in Appendix 2. The themes of the interview were:

- Questions related to 4PL service model
- Questions related to their company and their services

The first theme was discussed to understand how LSP's define 4PL service model and how does it differ from the traditional 3PL service, and how their definition matches with the academic definitions. The second theme was used to get a background of the company; to see what kind of services they offer and what kind of client base they have and how well these would match with case company, what is their personnel's skills /knowledge and if there would be possibility for a partnership. Before the interviews started all the respondents were asked for a permission to record their interviews to make transcription process easier and they were briefly explained about the background of this thesis. All interviews lasted from one to two hours.

### 4.2.1 Logistics service provider A

The first interview was conducted in with a company who presents themselves as a 4PL service provider. The company's official headcount is 18 employees in their headquarters, 3 employees in Estonia, 3 in Singapore, 7 in Malaysia, and in China they have a joint venture. They also have an office in the USA which is currently only used as a project office, but they are aiming to enter the markets in that regions as well.

In the beginning of the interview the interviewees were first asked to describe 4PL concept in their own words. According to them there are two main attributes related to 4PL: openness and neutrality. These are the main characters, and what differs 4PL from 3PL. 4PL operator promises to their customers that they do not have their own equipment. All services are bought from outside parties, bid requests made on client's behalf are transparent, and all transactions are transparent to customers. The aim for 4PL operator is to get well integrated to the client's supply chain and to develop the operations together with them. This is the main difference when compared to 3PL model where every transaction is based on managing client's shipments from point A to point B and solving the issues case by case and the 3PL model does not try to develop the supply chain as a whole. They do not see any difference between LLP and 4PL. However, they admit that if a large logistics corporation would start this kind of a service model where they would have an independent LLP department it might be challenging for them to convince their customers that they truly are a neutral logistics service provider.

Regarding the 4PL service model's historical background and its conspicuousness on the Finnish markets. The reason why this is still quite unknown and uncommon in Finland according to interviewees is because companies simply don't know that this kind of service exists, and they have had to put a lot of effort in presenting this concept to new customers. However, they estimate that in today's markets when the discussion has moved towards system integrations, global operations and networks the time for 4PL model has finally arrived. They have noticed this also with their clients who really appreciate this kind of service where an external party acts as an integrator and pulls the strings together. It is highly valued that through one service provider companies can have access to over 1000 other companies and have tight co-operation with them.

Second reason for 4PL's low conspicuousness on Finnish markets could be the lack of pure 4PL service providers. They consider that there are only two companies in Finland that offer this kind of service; they and their competitor who is described in this research as Logistics service provider B. There are a lot of different forwarding companies who state in their web pages that they are selling this type of service, however, in reality this is not the case. This also might create a credibility problem when a forwarding company starts to market themselves as a fourth party logistics

provider when they also use their own resources and equipment because then they are not actually neutral which is a key element in this concept.

According to the interviewees more explicit would be to use the term control tower, which in a way fulfills the same purpose. In control tower model the service provider is using its own assets for operating the supply chain management on customers behalf, but the *single point of contact* idea is more attached to it. They might even use other assets as well if this is considered necessary but in practice this means that the client should have over million-euro logistic costs before this kind of service is provided, and for small and medium-sized enterprises the only realistic option currently is 4PL at least in Finnish markets. They add that the same idea can be thought in production. If a company decides to outsource some specific component's manufacturing because it is not their business, then the same idea can be applied to logistics. Firms can outsource this function to an external party who has the skills and ability to perform it. In addition, it brings flexibility when thinking about companies that are project-orientated and have very periodic business because when outsourced the company has managed to transfer the fixed costs into variable costs.

When moving to the questions related to them, the interviewee state that most of the staff have graduated as logistics engineers. Some of them have gained experience in forwarding industry, and some have recently graduated. They consider this as a good advantage because it is easier to teach the company culture to someone who has not previously worked in forwarding business. In fact, they might not even consider it as a merit if a person has a long track record in forwarding business related to 3PL services because then they might have worked only in some specific field for example export to Sweden or Swedish road transport. Hence, they might not have experience in sea freight or air freight which makes it harder to teach them new things. In addition, a person who has bought logistics services from outside parties is also considered as a merit.

They have clients from bio industry, where they have handled dangerous goods, product development goods, and laboratory equipment. They have also had projects related to medical industry for example they exported one modular pharmaceutical plant to China just recently. All in all, they estimate that their client base is quite broad when considered different industries. In addition, they have customer relationships



with listed companies that have wanted to outsource some specific part of their logistics to LSP. They have their own staff located to their customer's facilities as coordinators. When asked more specifically about the health care supply chain and what kind of experience they have had, they have mainly shipped laboratory equipment but pharmaceuticals they have not yet transported.

In Finland they haven't enabled any external quality management system because they haven't received any business case yet that would have required to do so. Considering how demanding it is to implement such a quality system they don't find it necessary unless their customer specifically demands it. It has been more traditional in sectors that have wanted to certify one specific process, and it is also subject to which business sector a company is working in. In logistics this has not been that traditional as a necessity. Of course they have had to fill anti bribery clauses and demonstrate that they are a reliable firm and that they use a reliable network but this doesn't require an ISO certificate according to them.

Regarding their IT-solutions that they can offer for companies, they are now launching a new RFID system that can be used for tracking different collies at project sites. They have had issues with their clients' item's traceability. When they have delivered a container to a specific location and items are picked from the container they have lost the traceability and have been forced to ship replaced items for the lost ones. With the help of RFID, they can now trace all the collies even when they have been collected from the container. They also offer portal service for clients where they can make bookings for different shipments and trace their entire shipment pool that goes via LSP. Their clients can also use their software for bid making and competing different 3PL companies. When asked about their possibilities of taking care of outgoing invoices to hospitals and clinics on client's behalf, they state that it is possible, and they have done it with some of their clients. However, in this case they would have to first check hospitals credit status. From this perspective the client network should be opened beforehand for them so that they can check these issues but if the shipments are continual for same clients then this is possible for them. They actually have one client that has requested them to buy components from China deliver them to Europe and send an invoice for the final receiver. This is according to them already approaching to 5PL service level.

According to the interviewee scalability is their Achilles heel at the moment. Every time they receive a new client it necessarily requires them to tie their personnel to the relationship. In a way they see this as a good thing in terms of customer service level, but their aim is to improve their software that can be used for bid making and invoicing. At the moment they feel that their coordinators spent too much their time in checking the invoices on clients' behalf, making consolidated invoices, shipment bidding and shipment tracking, which then means that they have less time for actual problem solving and overall supply chain development. This is something that they are aiming to get their personnel to have more time for actual supply chain development and the bidding is left for the machines to care of.

LSP agrees when thinking about the case company, and their consumable product's sales increases it is important not to have any breakdowns in the process nor to have any increase on the logistics costs. Essentially, they have almost limitless amount of resources because they constantly utilize their network. Whether a client ships a million or ten million shipments per year is not an issue for them because they can always buy externally. So technically the coordination might off course require more internal resources but not so that 100 employees would be handling the shipments but more likely one coordinator more that centralizes the purchases. In addition, once they have improved their systems the operations are even less dependent on their staff members.

When presented a citation (see Appendix 2) from Leppänen's study (2012), the interviewees admit that in 2012 they were a very small firm, but they do not recognize the issue because so far they have been able to provide the services that their customers have requested. They also don't see it as a criticism against them in case they do not have much competitors at the moment. On the contrary companies have been glad that this kind of service has been offered for them. Capacity has not yet been a problem for them. They have also been able to match their technological solutions with their clients demands, and they can happily state that whatever the client needs in terms of supply chain development they can offer it. It is all about finding the right partners from markets and what systems are integrated to their systems everything is possible. It is all about customer's willingness to develop the partnership. They also add that the situation describes more of that times circumstances when companies had difficulties in imagining a "trucking company" to take care of this kind

of business but now due to all developments in information technology companies have become more demanding in this sector. The interviewees state that they sometimes feel even frustrated when different firms get anxious enough when they can make delivery bookings by using only one portal. They consider that quite many companies are still in their infancy when it comes to technology that can be exploited in logistics, and they eager to stick in the traditions in how the logistics has been managed for the last 30 years and are reluctant for a change.

After the general and company related questions had been discussed, the interview moved on to describing the case company's current situation and what they want from the service provider. It was briefly explained that the case company wants a partner who is ready to commit on the relationship could think them and their clients' needs 24/7 since the product they are selling is unique and they will request high charges from their customers then the service level naturally has to be good quality as well. Because of the patients' wellbeing, delivery accuracy is the main criteria for the case company. After this comes scalability and previous experience in health care supply chain management.

Regarding the RFID solution for stock surveillance more convenient and cheaper solution could be QR tags or bar codes. In addition, all order penetration points should be defined client specifically since the stock facilities and consumption rate varies for each customer.

*RFID is more related to tracking the locations of the goods but if purpose is to only monitor the stock levels then QR code or a bar code can be more convenient solution. With the help of QR tag you can already open for example some specific web site or an order system where you can place an order for refill.*

When it comes to forecasting the interviewees state that they can help in making the forecasts, but the data has to come from the case company. They think that the most challenging issue will be in creating the system and crucial issue would also be in choosing the right software.

They also agree that it doesn't make any sense that the products are first shipped to the case company's facilities where they are then forwarder to customers. Instead they see that there should be a HUB center to which the supplier ships the products on a

regular basis. However, they consider this to be more courier type of delivery and this kind of services are already available on the markets such as DHL, TNT and UPS. Their suggestion is to formulize a consultation contract between them and the case company. The service provider would help them and tender out the suitable courier companies that already offer this kind of web-based service and help in choosing the right software and creating the system around it. They, however don't see that their systems of software could bring any additional value for this case.

#### 4.2.2 Logistics service provider B

The second interview was conducted with another 4PL service provider's CEO. The company is privately owned family company that has been founded in 2010 and currently has five staff members, all of which have slightly different educational background but are mainly focused on international trade. Their mission is to support their customers in SCM and provide standardized and tailor-made services. (Leafhill 2018) According to them, 4PL service provider is a supply chain integrator, collector and connecting link that assembles and manages the chain with their own resources and supplements it with external parties' resources.

According to them today's trend is going towards a business model where companies coordinate the business, instead of owning it and running it. The interviewee presents an example of Über that doesn't own taxis but instead coordinates the transportation services between their drivers and clients with a mobile app technology. This is why they don't need a huge amount of staff because they coordinate the business, and how they coordinate it efficiently is by utilizing technology and keeping up staff's know-how. When all of these elements: internal and external resources, technology and know-how are combined, the supply chain can be effectively managed as a whole.

Other important issues are service provider's neutrality and trust between the buyer and supplier. If these two issues aren't in order, effective co-operation is hard to reach. Because in this business field companies are considering whether to *make or buy* logistics. When they decide to buy the important thing is the trust so that the buyer can see whether the supplier can fulfill their needs. The business has to be profitable, and another issue is related to the increasing level of complexity and challenges in logistics. Therefore, customer has to evaluate are their skills and knowledge better than external parties and depending on the company's size are they able to commit

the right people to the company. Enabling technology is important factor. According to the interviewee, logistics is a conservative business sector in terms of exploiting technology. Lot of the information is transferred by PDF files, e-mails and phone calls and the same information is then rewritten to different systems.

When discussing about the differences between 4PL, 3PL and LLP, the interviewee presents one of their presentation slides (figure 6) that visualizes the different logistics outsourcing levels. The main attributes for 3PL is that they buy services from 2PL service providers. In addition to transportation services 3PL also provides other services such as contract logistics. In this level the service provider's responsibility area is in planning and coordinating warehouse, transportation and value-adding services but the tactical level is still managed by the buying company, and invoicing is based on cost plus model.

Whereas in 4PL model the tactical level is outsourced for service provider, the invoicing is based on transactions and gain sharing model. This basically means that the pricing is based on how much savings the supplier has been able to accomplish for a client. The second issue is that 4PL has to be neutral actor. In other words it cannot request quotations from shipping companies directly because then they are competing directly with 3PLs in the same market and this might damage their relationships and jeopardize the chance to receive the best solutions from the markets.

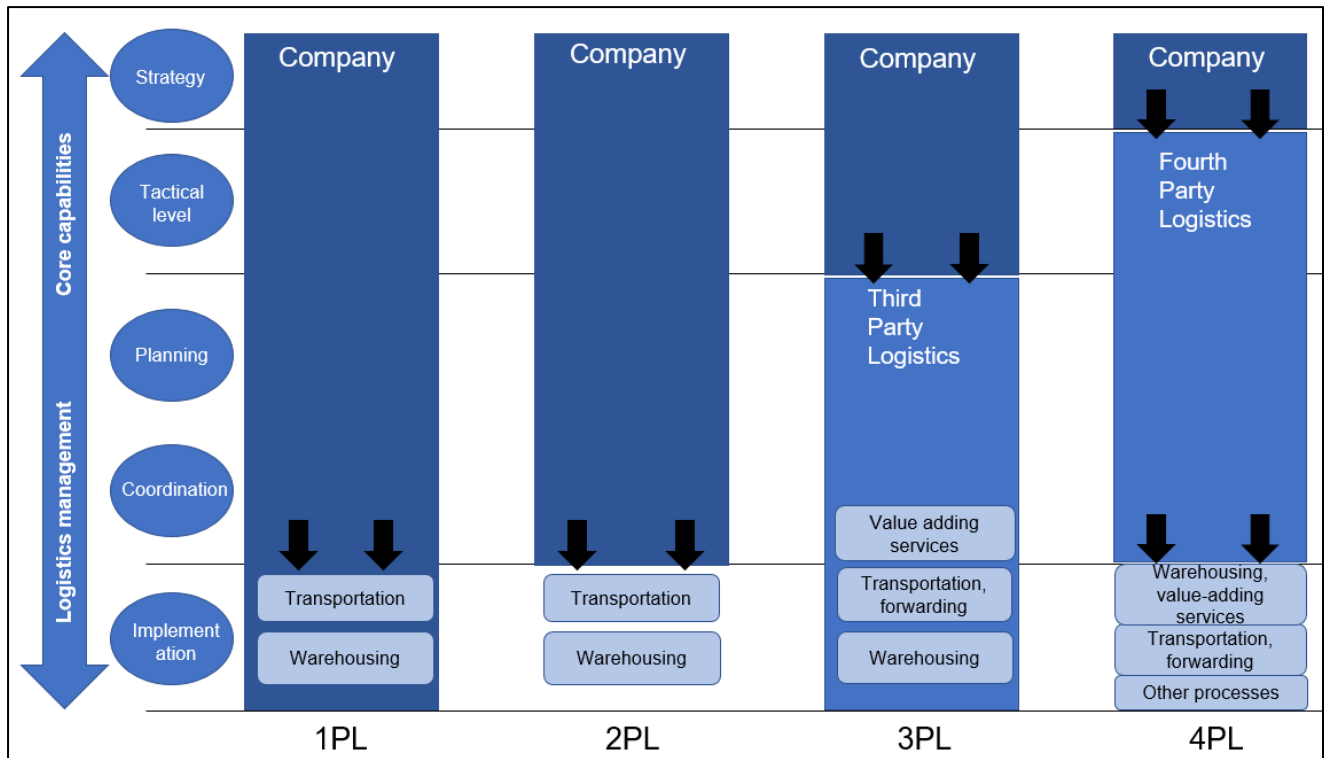


Figure 6. Logistics outsourcing levels

According to the interviewee, the LLP service model the concept was first branded by DHL. LLP is a part of 3PL service provider's corporation that has their own 4PL department. The interviewee also mentions briefly the 5PL service where the idea is to manage entire supply networks on client's behalf.

The main reason why the 4PL service model hasn't reached its full potential according to interviewee is that even though there are service providers, companies are unaware that this kind of service exists because of the lack of studies and references regarding the issue. In addition, the interviewee estimates that because of the massive competitive advantage that 4PL model generates, many forwarding companies have not wanted to highlight it. The interviewee believes, however, that this kind of a logistics service model will become a huge megatrend when thinking about potential outsourcing areas such as IT, payroll administration, and maintenance and repair services. All of these have been outsourced in today's business. Logistics is also becoming more complex, which means that companies do not have the competence to evaluate how it should be effectively managed. Traditional forwarding companies are constantly trying to blur the view of what the service level and pricing actually is. The interviewee gives a case example of one of their client that used Lufthansa express to ship their products to South- Korea. Then they took over the coordination

and started to compare different options, and eventually chose Finnair's standard service. Their client stated that they do not want a standard service level and instead demanded to maintain the express level. In this case, however, Finnair's standard service was faster and only one third of the price when compared to Lufthansa's express service. Therefore, it is important to understand the complexity of the business.

In addition, the electrification of different booking systems and service portals that almost every forwarding company has creates complexity as well because you eventually would have several accounts to different portals, and you still must manage them by yourself. So, it is easier when a company only has one interface where they can channel all their shipments and one contact that will take care of the entire network management and choose the right transportation method. To summarize it up, the unawareness of this service model's existence, and other forwarding companies aim to blur the markets with different service terms are reasons why 4PL model is still quite unfamiliar in Finland. There are a lot of companies that might advertise this service model as well, but when thinking about the academic definition, they are more likely to be LLP providers.

After this the interview moved on to questions related to the service provider's services. The services they describe are quite broad, but the service can be a *turn key solution*, or it can be some specific part of the process that they produce. They have two different modules that they offer: logistics department and logistics development. Before they start the business with a client they first sign a confidentiality agreement and arrange a *work shop day* together with the client where they go through clients general background, such as organization charts, production and procurement processes, and client's software.

*First of all, one has to have a regime in supply chain management. That is why we have every process description and manuals who is responsible of what, who is being informed and consulted. Logistics cannot be outsourced if the rules have not been defined. It must be defined how the operations are performed. We have process descriptions and working manuals from every client so that our operational staff can have check lists in order to perform homogeneous work. There have been often*

*situations where the logistics outsourcing has failed. This cannot be an option. It has to be done in a way that every party understands what is being outsourced, what will be done, and when is the ball passed to the next player.*

In addition to this, the service provider understands that the customer can fear of becoming too dependent over the supplier, and the supplier might take advantage of this monopoly situation by raising prices for their service. Consequently, they have created logistics management manual for every customer, which contains all the guidelines and process descriptions so that the client can take over in case they want. They also have customer happiness guarantee, so in case the customer is unhappy with their services they will help them to find a better solution.

They are also able to receive the customer's purchase and sales information into their system in which it is then transformed into transportation order. However, they state that they do not want to be an ERP producer for the client, so they do not per se produce ERP system for the customer, in other words they do not administrate client's supplier and client databases. They also require power of attorney to perform the agreed functions such as choosing the transportation mode and level service. This will clarify the roles and responsibility areas between them and the client and minimize redundant work. The interviewee also informed that they do not make re invoicing for customers. All transportation invoices go directly to customer if they do not bring any added value for the process. However, their personnel check and post the expenses in the customer's system because they know the right expenditures. Sending the outgoing invoices on customer's behalf is also not a problem.

They also offer consultation services in matters which are related to customs and packing. They can help customers in constructing a pricing tool that can be used to add the transportation cost immediately to the actual quotation. In addition, they can perform recalls, delivery supervision and quality control, choose and coordinate the right partners for warehouse management and inner logistics, and carbon footprint calculations. With the help of their service network they can scale their services efficiently. In addition, they can offer temporary staff members to work at client's facilities. However, this is presented in brackets because the interviewee state that they are not a staffing company. Their aim is to concentrate more on the logistics



department activities than in the logistics developing services. For example, 20% of their last years turnover came from developing services and the rest 80% from logistics department activities.

*The value for the customers comes from the actual business case. First of all, you have to create savings compared to an option where client performs the actions themselves. One important issue today is the skills know-how. Clients don't have this. They don't have the chance for benchmarking to see how it is taken care of by others elsewhere. These two issues bring the value to the business.*

Regarding the educational and professional background of their staff, they mainly have people that have experience from international trade, and just as logistics service provider A they do not necessarily see previous experience from forwarding business as an advantage. Due to the reason that the person might have difficulties in adapting to their way of thinking where the customer isn't charged 10- 15 per cent of every transaction due to transparent service. Another issue compared to traditional forwarding company is that they do not ask client's confirmation for every action because they have received the power of attorney from client and can act by using their own judgments. This is the way they want to build trust between them and the customer.

When discussed about their client base the interviewee states that the business is not dependent on any specific industry, and even though they have a strong hold on machine shop and manufacturing industry they have experience from building trade, chemical industry, agricultural produces and jewelry shipments. They do not have any quality certificates because these have not been necessities for their customers but they are ready to be audited in case required regardless of the business sector. Interviewee points out that quality certificates aren't usually considered as a necessity for logistics companies even though bigger companies do have these. For a small company, however, they do believe that their documentation is in excellent level and don't think that acquiring a quality certificate would be a challenge for them. When it comes to their IT-systems they have developed their software entirely by themselves and have complete ownership over it. They do have an external party that helps them in case they have any inconveniences, but they do have another service provider as

well ready to be used in case the current relationship turns out to become poor, hence they are not entirely dependent on one supplier.

After the general questions had been handled the interview moved on to describing the case company's current situation and requirements. They agree that the transparency in this case must as good as possible so that they can see the stock levels for each client in real time and that the re-order process should be as easy as possible for the client that there should indeed be a consignment stock that would be monitored. Forecasting will be quite challenging at first but the more data they receive the easier it gets. They suggest that stock levels should be maximized in the beginning which is better solution than to have delivery delays. Especially when thinking about the purchase price for one selling unit and how much capital it ties up when compared to risk of losing reputation this is much smaller risk.

All in all, the interviewee considers that that the case company's current situation could be a proper business case for them as well. They understand perfectly well the case company's needs and that they want to focus on their core activities and leave the rest to them. They finally conclude that the main additional value they bring when compared to traditional 3PL is that they can bring their own skills and know-how for customer's usage. They are not attached to any singular solution of method instead they can always flexibly find the best solutions from markets and try to maximize the value for them instead of trying to maximize their own profits.

#### 4.2.3 Logistics service provider C

The third interview was conducted with a logistics company that offers supply chain solutions and can be defined as LLP provider based on this research's standards but not as a 4PL actor. With their over 13 billion turnover, presence in 55 countries, and over 146000 employees they are one of the largest contract logistics service providers that have expertise within the automotive, consumer, chemicals, energy, engineering & manufacturing, life sciences & healthcare, retail and technology sectors. (DHL 2018)

Their business development director define 4PL as follows:

*4PL is an operator who arranges the logistics and operations related to it on customer's behalf. This can be for example shipment purchasing, warehousing purchasing, but it can also relate to invoice and reclaim management. So, in*

*practice it is an external operator who purchases and organizes the logistics on customer's behalf.*

The main difference between 3PL and 4PL according to the interviewee is that 3PL is more straightforward partner who in a transaction-based model takes care part of the logistical functions. Whereas 4PL service provider purchases these services from other 3PL operator. In some occasions 3PL and 4PL are slightly in an overlap. 4PL might be an actor who makes some the services and can buy some the services from other 3PL actors as well. Thus, they see 4PL as a kind of a hybrid model, and the difference between a 3PL and 4PL model is not always that clear as it might be stated in theory.

According to the interviewee the same issue is as well between 4PL and LLP. These two have some specific overlaps as well. LLP provider also organizes customer's logistics but in this model the service level goes deeper because the service provider often coordinates the entire supply chain. Focus is set more on developing the process instead of fulfilling clients demands. LLP provider contemplates the locations of warehouses, the appropriate key performance indicators, reasonable lead times for products and correct purchase volumes. This is the main difference that separates LLP from 4PL according to them. In LLP model the customer really outsources the entire supply chain management to a LLP service provider and they then start to focus on the development issues instead of the buyer would have the control at some level and told the service provider how to perform the process.

When thinking about how the service provider is then perceived the interviewee states that they are in a way 3PL, sometimes 4PL and LLP service provider as well. They have their own LLP organization and when they are performing as 3PL operator they offer their own warehousing services, but in case required they can also buy the service from external party and sell it to their customer. So, it depends on the situation how one defines their services. When explained to the interviewee that there have been published a study (Win 2008) where it is stated that these kind of service providers cannot exist that are both asset based and non-asset-based firms at the same time, they add that in their perspective the difference between 4PL and LLP is that the latter is actually a neutral. Their organization has been built so that if they have a project where they are using their own warehouses and where they have LLP service

included then there is a clear line between these two. They have their own P&L (profit and loss statement) for LLP services and they do not share information with each other so that the LLP can maintain their neutrality in their operations. The interviewee recognizes that the differences between these terms are often vague.

*In 3PL model we can perform so that customers buy an output for example warehousing services where they collect the goods and charges some agreed amount afterwards. In LLP model they often work at customer's facilities where they can have a cost-plus account so that the customer knows exactly how much they will be charged and what is our profit percentage, what kind of expenses are included to the service and they have agreed some kind of gain sharing model so that their mission is to decrease customer's logistical expenses, and the more they manage to decrease the costs the more they receive profit. Therefore, the operation is more transparent.*

They add that in this kind of business relationship, the co-operations require a long-term perspective so that the mutual trust between members can be gained and state that trust can't be created only by contracts, in addition it comes through the experience that is created and developed.

According to the interviewee this kind of service (LLP) in Finland is more undeveloped than compared to Western- Europe. Finnish companies are still seen to be more conservative where mentality is to do everything by yourself. The interviewee estimates that companies are not ready to let over their business operation to an external party because they might think that an outside party doesn't fully understand the business, and that they are more capable of performing the business more economically. In addition, the interviewee adds the same statement as logistics service provide b that some of these companies might feel that when they outsource supply chain management, they might lose the comprehension of their business operations and the supplier knows them better and eventually companies are not able to withdraw their outsourcing decision. Another issue the interviewee states is that they aren't that many Finnish companies at the moment that would have a potential business interest for big international logistics companies to put efforts for this kind of business. There might be dozens of potential companies in Finland but not hundreds or thousands where this kind of a total LLP co-operation should even be activated.

When moving on to the company related questions, service provider's main services are warehousing, inhouse logistics, different transportation solutions, consultation, production and input logistics, and issues related to forwarding. In total they have over 50 services globally and can also offer financial services and turn key solutions. In Finland main services are warehousing, transportation and inhouse logistics. The value that they try to bring for clients is more functional logistics concept with lesser costs. They aim to improve their customers logistics so that it is more secure, flexible and cost efficient. It also depends on customer's requirements.

When thinking about LLP services, their traditional service setup in outbound logistics is that their system is integrated to client's ERP and warehousing system and when client's client places an order an EDI notification comes directly to service provider's system as well. Finally, the goods are picked up and delivered. In inbound logistics traditional operating model is where the manufacturer informs directly to logistics service provider C that the goods are ready to be shipped, after the goods have been received in their warehouse EDI notification is sent immediately to client's ERP system. Currently LSP doesn't handle their customer's outgoing invoices but the interviewee stated that this is more familiar business in abroad. They have over 400 employees in Finland and over a hundred subcontractors, which means that the educational background is understandably quite broad from logistics and warehousing basic examination up to higher educational background. When estimating the mediate logistics experience of their staff the interviewee estimates approximately 10 years of work experience.

They have one healthcare client in Finland but more in other European countries. Abroad they also have GDP (good distribution practice) and GMP (good manufacturing practice) licenses, in addition they have traditional ISO certificates related to environment for example 9000 and 14000 although the ISO 13485 related to medical devices they don't possess in Finland, but the interviewee is quite certain that this can be found from their foreign offices. When asked about their IT-solutions traditional setup is where customer's ERP system is integrated into their warehouse and transportation systems. When thinking about LLP services they can link five different transportation companies into their system to check the shipments status, depending on what is wanted. Today's trend is that the digitalization and transparency are strongly involved in business. For example, transparent supply chain is one of the

most important things currently where companies are striving at. When thinking about for example customer's customer who is asking when their shipment is arriving, it is quite unusual nowadays if this customer cannot track the shipment and can only say that it is coming at some point. Aim is to get it so that customers can immediately track shipments locations and will receive updates in case there is a delay that they don't have to supervise their shipments entirely by themselves.

According to the interviewee one of the main things that they try to bring for customers is flexibility and scalability no matter what the shipment volumes are. At this point the interviewee points out that when talking about the scalability it has to be known what the accurate quantity is. There is a difference when talking about ten parcels increase into one hundred parcels than one hundred thousand parcels increase into one million parcels. Thus, this is off course one factor that influences on the scalability level but can be solved by discussing with the client so that they can be well prepared.

Finally, the interviewee thinks that there is an oversupply on Finnish markets in LSPs especially in warehousing. Not necessarily the amount of LSPs but the oversupply in warehousing space. The interviewee considers this as a problem at the moment even though the situation has improved slightly from what it has been few years ago.

After a brief explanation about the case company's background and their challenges and presenting what would be their requirement for the LSP the interviewee agrees that the 4PL /LLP service model would be a suitable solution for their situation. Some questions that arise are related to how the case company would like to start the process and in what kind of schedule? Are they willing to start massive IT-projects immediately or do they first want to start with manual operations and in time think how the transparency and IT-solutions should be built? This directly effect on the costs whether to create the set up all at once or to start with small steps and developing the process along the way.

The service provider would be able to offer a web portal where case company's clients would receive each individual user account and price register in case needed. When client places an order the order information goes directly to their warehouse that collects it and ships it and in case required they can also send the invoice. However, for this they would need the price information from the case company. All in all, the model is quite advanced when compared to their traditional clients. However, the

future state process description does not seem to be insurmountable according to the interviewee.

#### 4.2.4 Summary of the service providers solutions & QFD matrix

Based on the conducted interviews with three different logistics service providers it can be stated that the case company's requirements can be fulfilled quite well with their offered solutions. The service requirements and the attributes of 4PL have been summarized in figure 7. The main service requirements that became apparent with the case company representative interviews were operational performance, quality procedures that describe the quality of the service and process rigor, single accountability, experience in healthcare industry, competitive pricing, and continuous innovation in terms of improving the service level for the hospitals and clinics. The requirements have been categorized into more compact categories to make to categorization clearer. In addition, it transpired during the interviews that there were some overlaps in the 4PL features that are presented in Appendix 1. The first row includes points 1, 5, 8, 9, 11 & 12 second row points 10 & 14, third row contains point 2, fourth row contains points 6 & 7, fifth row contains point 4 and finally row six points 3 & 13. When it comes to 4PL components, the research has used the attributes that were defined according to Christopher (2011) and Huang (2014).

<b>Relationship Key:</b>	<b>4PL Components (How's)</b>				<b>Importance (1-Low, 5-High)</b>	<b>Total</b>
	<b>IT service provider/ SC intermediary</b>	<b>Resource provider</b>	<b>SCM/ Architect</b>	<b>Consultation/Control Room</b>		
Strong	Medium	Weak				
Weight	9	3	1			
<b>Case companys requirements (What's)</b>						
Operational performance (scalability & operational reliability)	9	9	9	9	5	180
Quality procedures (quality certificates & process rigor)	3	3	9	9	4	96
Singular accountability	3	3	9	9	5	120
Experience in healthcare industry	1	9	3	9	4	88
Competitive pricing	9	9	9	3	3	90
Continuous innovation	9	3	9	9	4	120
<b>CTQ Priority</b>	139	147	201	207	694	
<b>% Importance</b>	0.20	0.21	0.29	0.30	1	
<b>Priority rank</b>	4	3	2	1		

Figure 7. QFD matrix of the service demands and 4PL attributes

Since the figures presented on the matrix are based on researcher's subjective and linguistic evaluations based on the data collected in the interviews they cannot be considered 100 % accurate, however, they do give directional estimations of the 4PL's suitability for the case company. Most of the requirements can be considered to have a strong or at least medium relationship with the 4PL components. Only one exception was the relationship between *experience in healthcare industry* and *IT service provider/ SC intermediary* because the technological solutions offered for companies are mostly considered to be independent from the industry field they are used.

As it can be seen the most important criteria for the case company was the ability to scale the operations almost exponentially when the business starts to gain its ground. In addition, the LSPs ability to take care the entire order-delivery process was also highly wanted from the case company and that they could have one channel to which the orders can be directed. Continuous innovation that will improve the service level for case company's customers and previous experience in healthcare industry were considered to be important as well, however, they acknowledge that their product is not that unique or time critical than for example some specific medicines and quality



certificates were not seen that mandatory as long as the operations run smoothly. Finally, according to all case company representatives, they know that their product quite unique which means that the service level has to be as well in good quality, hence the price is not their number one concern as long as it is competitive.

## 5 CONCLUSIONS

### 5.1 Theoretical implications

#### **Benefits and risks of SCM outsourcing**

The theory based on earlier literature regarding the benefits of outsourcing suggest that the main benefits are related to financial, quality, and operational issues (Harland et al. 2005; Kremic et al. 2006 & Deloitte LLP 2016). More accurately these are for example cost savings, transferring fixed costs into variable costs, improved flexibility, access to more professional talent and technology, and increased focus on core capabilities. The results for this study support this theory.

When looking to the benefits related to financial issues the results contribute to the fact that the case company is seeking to release more capital into their other business functions, which are stated to be sales and marketing, and research and development. However, when thinking about the direct cost savings, the results do not directly imply this to be the main motivation for the case company. This can be justified through the reason that their product's sales volume is quite low at the moment, and their main concern is related to maintaining the cost level in competitive level when the sales volume starts to grow. Therefore, it can be argued that the main benefits they are seeking from the potential partnership are related to quality and operational issues. They want to find a partner that can help them in developing their order-delivery process in a way that they can scale their operations almost with exponential growth, which means that the cost level has to remain competitive, and the quality of their operations in terms of easing the order process for the hospitals and clinics, and delivery accuracy should improve their brand image. When they have outsourced their supply chain management this will also enable them to focus more on their core capabilities, which have been stated to be sales and marketing, and research and development.

When it comes to the risks of outsourcing, earlier literature states that the main risks are related to financial, contractual, management, information and market issues. (Kavcic & Tavcar 2008; Momme 2002 & Leavy 2004). More accurately these are for example hidden costs, poor contract or poor partner selection, poor performance, opportunistic behaviour, information leakage and losing customers, opportunities or

reputation. The results of this research support earlier literature findings on this are as well although not in all areas.

When looking at the data the main risks are related to getting too dependent on partner, bad service level which will negatively effect on the brand image, the poor partner selection, poor performance, opportunistic behaviour, and losing customers, opportunities or reputation. As they highlight the importance of their new sales strategy, the right partner who is committed to help them in best possible manner becomes crucial in terms of improving their brand image, hence, a bad partner selection might jeopardize this. In addition, the results suggest that they consider it risk as well in case they become too dependent on the partner, which might take advantage of their situation and increase the price level. The results regarding the risks related to possible information leakage are slightly contradictory for the S&M representative sees this also as a possible risk scenario that should be considered but the R&D representative doesn't agree to this argument and sees this risk to be more related to their production suppliers.

### **Demands for the LSP**

According to earlier literature, typical characteristics that are seen as improving qualities in healthcare supply chains are flexibility, integration of processes between supply chain members, and more improved technology. (Aronsson et al. 2011; Elmuti et al. 2013; Nabelsi & Gagnon 2017). In addition, one of the key contributors for a successful healthcare SCM are the strategies to increase the integration of activities such as information sharing, collaboration throughout the supply chain channel and establishing partnerships between with different actors in the supply chain. (Elmuti et al. 2013, 139) The findings from this research correlates strongly with the earlier theory. The case company sees that they need to have more integrated systems in their supply chain in terms of using improved technology so that the information flow within different parties is smooth. They also want to remove themselves from the actual order delivery process and to have a partner who can manage their product's supply chain process practically, efficiently and flexibly so that they don't have to be involved in it.

In addition, the barriers that hinder the progress of making the health industry SCM more patient oriented such as conflicting goals in supply chain activities, limited supply

chain training, lack of data collection and performance measures and varying relationships between different supply chain parties. (Mckone-Sweet et al. 2005; Elmuti et al, 2013) This earlier theory is also partly supported by this study's findings. The case company considers that their lack of capabilities in running the daily supply chain coordination can be considered to the lack of supply chain training and also their unstructured order systems where everything is based on email and phone call interactions and confusion related to low ability to follow up their shipment can be related to the lack of data collection and performance measures. However, this research cannot give any support for the barriers that are related to conflicting goals in supply chain activities because all interviewees from the case company were aware of the unsustainable situation and there was a consensus of the targets and demands. Also, the barrier related to varying relationships between different supply chain parties cannot be argued due to the limitations of this study.

### **Offered solutions**

When looking at the requirements that the case company has presented and earlier literature regarding the 4PL definition of being a neutral logistics service provider who combines and exploits internal and external capabilities and technologies to manage and coordinate the case organization's supply chain. It can be argued that outsourcing their supply chain coordination to a 4PL party can bring value to them.

However, interesting finding was related to the fact that the case company doesn't necessarily see it as a necessity for the service provider to be a neutral actor. By neutral this research refers to a non-asset-based service provider that is not pledged to use any specific supplier or equipment in the supply chain. Therefore, it can be argued that LLP service model where the service provider could act as a control tower as the Logistics service provider A stated could also be suitable for them. However, as logistics service provider A stated it has to be considered as well that this kind of a service model requires traditionally bigger logistic costs than the case company currently has. As the Logistics service provider C stated in order to formulize this kind of a relationship the LSP also has to see a proper business opportunity for them as well to set up this kind of a model.

In addition to the theoretical support, the empirical findings based on the interviews with three different service providers also supports the decision for the case company

to set up a business relationship between this kind of a service provider. This can be argued due to the reason that all of the interviewed service providers saw a business case and agreed that 4PL or LLP service could be useful for them.

## **5.2 Managerial implications**

The conclusions of this research give practical suggestions that advocate about the benefits of 4PL service model and how the case company can gain value for outsourcing their product's supply chain coordination for this kind of a service provider. First of all, the most distinct reason is the case company's lack of competence in managing their daily order and delivery process. This is found to be the most important justification to outsource the supply chain coordination. In addition, their current order-delivery process is in unsustainable situation if the sale volume starts to grow. Due to the reason that they do not have any clear order system or software and all orders are based on e-mail and phone call communication.

Second reason is their unwillingness to invest internally to their supply chain management competence as well. They acknowledge that their core capabilities are sales and marketing and R&D but not in the logistics side. Their aim is to get them out of the logistic operations and instead have a partner, who could perform as their order handler and would structure their order-delivery process in an optimal manner. As the LSPs B and C presented the most common risks that the buying party might face is the risk of becoming too dependent on the service provider. However, this can be minimized by documenting all the steps in the work flow so that the buying company doesn't lose their perception of their business operations and are able to withdraw their outsourcing decision when ever needed. In addition, being as transparent as possible in order to gain mutual trust and defining clearly the responsibility areas between parties the risk of poor performance can be minimized as well.

## **5.3 Further research**

It was interesting to see how every service provider had a slightly different view from 4PL and LLP service models. When thinking about Win's (2008) statement that a logistics service provider cannot be an asset-based and non-asset-based service provider at the same time. However, at the same time it supports Saglietto's (2013) views why these terms are often mixed with each other. Therefore, further research

should be conducted about these terms overlaps and how well this difference can be seen among other Finnish logistic companies as well. Should they be considered as synonyms for each other or should they be clearly separated and defined?

As it came clear the 4PL service model is still quite unfamiliar on Finnish markets. Even though some possible ideas were brought up in this research what could be the reason for this, further research could be done from this perspective as well and see how well Finnish manufacturing companies are aware of this kind service's existence, and more importantly how big market potential this kind of business model possesses in Finland. During the interviews with logistics service providers, 5PL service concept was brought up as well. Similar research could be done for this as well to see what concept's conspicuousness on Finnish markets is and what could be the service model's market potential as well.

To conclude Elmuti et al. (2013) also found out in their research that the outsourcing decision and supplier power has a positive impact on organizational performance level in terms of cost reduction, improved quality, flexibility and expendability, which will result in improving competitiveness, profitability and effectiveness in general. In case the case company decides to outsource their supply chain coordination to an external party, further research could be conducted within few years to see in a measurable amount how much value the 4PL or LLP service has brought to them.

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## Appendix 1

### Case Company Interview Master's Thesis /LUT

#### Questions related to outsourcing

- Do you consider the supply chain important to your company's success?
  - Why/ why not?
- Do you consider every supply chain process as your core competency?
  - Which ones you possibly do?
    - Why/ Why not
  - Which ones you possibly don't?
    - Why/ why not?
- Does your organization face every day challenges in managing product x's supply chain?
  - Is there some specific challenge(s) that you want to solve?
- Do you find it hard to fulfill your customer's supply chain demands?
  - Is there any specific typical challenge?
- Do you have the technology capabilities to integrate your systems across your supply chain processes? Across your logistics service providers? Meaning that for example when a client places an order for you, other supply chain members would receive the same information as well at the same time.
- Do you think that you could make a better use for the money and other resources that is now used in supply chain coordination?

#### Questions related to benefits & risks of outsourcing

- What are the possible outcomes that you wish to achieve with the help of possible logistics service provider?
- What are the possible risks that you consider likely if you'd decide to outsource the supply chain coordination to an outside party?
  - Are there any worst-case scenarios that you consider possible?
  - How would you minimize these risks?
- What kind of information are you willing to share with other supply chain members?

- Why?
- What kind of information are you not willing to share with the possible logistics service provider or your suppliers?
  - Why not?
- Are you willing to integrate your systems together with different actors within the supply chain?
- Do you consider that the logistic service provider's neutrality could be a value adding feature to your business?
  - Why? /Why not?

### **Questions related to the demands for the logistics service provider**

- Is the service provider allowed to use their own assets in order to maximize return to its own shareholders and as such might not maximize the value for your business?
- What are the most important features that the logistics services provider should have?
  1. Ability to facilitate the information flow and advance IT applications
  2. Singular accountability
  3. Continuous innovation
  4. Competitive price
  5. Professional staff
  6. Experience in the health care supply chain management
  7. Understanding of the health care industry sector business
  8. Able to operate at operational, tactical and strategic levels
  9. Demonstrated ability to coordinate day-to-day logistics and supply chain management execution
  10. Quality certificates
  11. Ability to integrate and manage the various resources of client's supply chain processes practically, efficiently and flexibly
  12. Demonstrated ability to manage supply and demand uncertainty
  13. Capable of driving process change/improvement – especially in the areas of forecasting and sales & operational planning
  14. Process rigor
- Is there any other requirement that the logistics service provider should have?

## Appendix 2

### **4PLSP Interview Master's Thesis/ LUT**

#### **General questions**

- How would you describe the 4PL concept?
  - What are the main attributes of 4PL?
- What is the essence that differs 4PL from 3PL / LLP?
- Even though the concept of 4PL has been defined already in the 90's, and many have said that it will be the future of outsourcing, there are studies and surveys stating that it is still not quite common that companies would have outsourced their entire supply chain coordination to an outside party. Why do you think that is?

#### **Company related questions**

- What is your staff amount?
  - What is their educational background?
  - Average working experience logistics?
- How broad is your client base?
- Have you previously worked in health care supply chain management?
- What possible quality certificates do you have?
- What kind of IT solutions do you offer for supply chain integration and effective information flow?
- What do you estimate is your scalability potential when the client's business is growing exponentially?
- According to research especially small logistics service providers are considered to need improvements in understanding the logistics concepts (quality management systems and process rigor), ICT management, and ability to exploit technology innovations. The overall logistical chain follow up development from purchase order up to the final delivery is considered to be important for companies. However, the amount of 3PL and 4PL providers in Southern- Finland markets in are not considered high enough based on their capacity, networks and service level. Have you also received this kind of feedback and do you believe that you would have potential to improve your services in these areas?