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Innovative technologies and value creation for LSPs

An exploratory study of the Norwegian logistics service industry

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Abstract

Logistic service providers (LSP) are exposed to a competitive industry that is constantly evolving. Customer requirements are becoming increasingly challenging and require more of the companies in terms of efficiency and quality of products and services. There is a great potential for innovative technology to help create value for the LSPs so that they can keep up with this development and continue to be competitive.

In this study, the authors intend to explore how implementation of innovative technology can create value for logistic service providers, hence the research question: *"How does implementation of innovative technologies contribute to value creation for LSPs?*". To answer the research question, it was considered necessary to conduct a comparative case study in which the authors conducted interviews with a selection of LSPs in the Norwegian industry. In addition, this research considers the barriers that are present for the implementation of such technology for the various LSPs. To gain a better insight into these barriers, the following sub-question has been asked: "*What are the barriers to implementing innovative technologies in the LSP sector?*". To best answer the research question, an exploratory study has been applied based on semi-structured interviews with a selection of logistic service providers. In addition two experts in technological development from one of Europe's largest independent research institutes have also been interviewed. Furthermore, the theoretical background consists of relevant literature in the industry for LSPs, as well as an insight into the current technology for this research. The results are based on the findings from the interviewed LSPs and in addition, the experts who have provided answers to both the main research question and the sub-question.

The main conclusion for this research is that the implementation of innovative technology can create value for the logistic service providers through what the authors have revealed as three main fields, namely increased efficiency, improved quality of service and sustainable operations. The barriers to the implementation of innovative technology for LSPs are presented through a systematic overview that is categorized using a PESTEL analysis.

Acknowledgement

The writing process of the master thesis has been interesting, challenging and educational. The COVID-19 pandemic has raised some of the biggest challenges in the process, but also an experience of value. Anyhow, our master thesis marks the end of our five years of higher education, and we would like to extend our gratitude to the individuals that made this possible.

Firstly, we would like to extend our gratitude to our supervisor, Bente Merete Flygansvær. The collaboration has provided good discussions and feedback throughout the process, which in turn has been of support to guide us towards the right direction of our thesis.

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We would also like to thank all other individuals that have supported us throughout five years of higher education at BI Norwegian Business School. At last, we will thank each other for the partnership through this master thesis, which has been thoroughly great from the start to the end of this process.

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1. Introduction

Logistic service providers (LSPs) play a key role when distributing goods throughout the world. There is little or no doubt that we are all dependent on these goods arriving in the right place at the right time. This is challenging, especially considering the developments that have taken place in the industry regarding complex collaboration and dual innovation strategy (Kagermann, 2014). Through innovations, especially aimed at digital and technological changes, one has already seen major changes and opportunities for development at LSPs. For many, these technological changes can create problems, if one does not have the ability or motivation to utilize and implement these. Nonetheless, it also appears as an opportunity for those who choose to take this chance for further development (Skapinyecz et al., 2018).

The term innovative technology can be seen as rather wide and non-specified, but is in this thesis narrowed down for the ones who are applicable for LSPs. Literature expresses that automation (e.g., Baker & Halim, 2007, Harrison & Van Hoek, 2008), autonomous technologies (Shamout et al., 2022), artificial intelligence (Garg, 2021), and zero-emission technologies (Earl et al., 2018) are considered as technologies that will impact the future of the logistics service industry. These are the technologies that are at the core for this thesis and thus provided with further investigation in both the literature and the data collection.

Through existing research and literature, several barriers emerge with the implementation of various technologies that logistics service providers need to handle. Some of the challenges that stand out are the complexity of the logistics network, lack of resources and employees' resistance to change (Cichosz, 2020). The logistics service industry is moreover considered as a field with small financial margins (Piecyk & Björklund, 2015), which pose economical barriers for investing in advanced and high priced technologies. Although these challenges can be difficult to overcome, it is of interest to see what values a company can achieve if they first manage to overcome these barriers.

It must be said that many choose to outsource their logistics activities to what is described as a service provider, or third-party service provider. Several different drivers can be pointed out for this phenomenon, but among other things, increasing globalization of the economy can be a key driver (Jharkharia & Shankar, 2007). The growing popularity around the just-in-time (JIT) principle may also appear as a massive contributor to why more people choose to outsource such activities (Razzaque & Sheng, 1998). It is this development and the challenges within the industry that further provide the basis for continuous development and the ability to create value. As mentioned above, the basis for value creation through innovation and technological development has created challenges, but at the same time solutions that are believed to be of interest to investigate further.

To be able to present this thesis which focuses on the implementation of innovative technologies for LSPs, the authors have conducted data collection through semi-structured interviews with various LSPs in the Norwegian market. In addition, interviews have been conducted with two experts from one of Europe's largest independent research institutes to give academic weight to the data.

1.1 Motivation

The authors are highly motivated to explore how innovative technology can create value for LSPs. The motivation lies in the author's own interest in the field, investigating how LSPs can create value through new technology, and how barriers affect such implementations. Together with the logistic service providers and the experts who have been interviewed, we believe that the findings will have implications for the literature relating to the area of interest and implications for practice in the field of business.

Furthermore, the field of supply chain and technological development is constantly evolving and new customer requirements are becoming ever greater. It is a wish of the authors to see where this change will lead and how the various LSPs handle these requirements. It is of interest to see what barriers the LSPs must overcome to be part of this change and possibly how they actually do overcome them. By specializing the master's study within operations and supply chain management, the authors know how digitalization, climate change, increasing cost pressure, and customer demands require even more of the LSPs today. In addition, we believe

that this knowledge will help to make this thesis a contribution for the industry and the LSPs.

1.2 Problem statement and research question

The authors intend to research innovation through technological development and how this can have an impact on logistic service providers, especially aimed at its value creation. To be able to answer the research question, data has been collected through semi-structured interviews with LSPs in the Norwegian market. The main research question of the thesis is as follows:

"How does implementation of innovative technologies contribute to value creation for LSPs?"

The authors have been open to the fact that the LSPs can have different forms of value creation through innovative technology, but this is also the purpose of the research. The LSPs are of different sizes, but all operate within the same field. It is therefore important to get an insight into the current situation and not least to get an overview of current barriers in such an implementations of new technologies. Through existing literature, it is therefore desirable from the authors to add a sub-question that deals with the barriers to the implementation of innovative technology at LSPs. The reason why this is necessary is because it is seen as important to shed light on the barriers that prevent companies from being innovative and potentially creating value. In addition, the authors believe that the sub-question will be essential to answer and create an understanding of the primary research question. The sub-question is therefore the following:

"What are the barriers of implementing innovative technologies in the LSP sector?".

1.3 Value of research

As previously mentioned, different challenges are associated with the implementation of new technologies in the industry. There is literature that provides insight into what are considered challenges and what are described as success factors when talking about digital transformation at logistics service providers. Nevertheless, it is desirable to dig deeper into how these implementations can create value for the companies in the industry. With this, it is desired that the research will contribute to a better understanding within the academic field and hopefully be of benefit to further development of the industry.

Through a theoretical framework, the thesis will provide a basis for readers to gain an insight into the literature of implementing innovative technologies, while at the same time provide an understanding of the technology itself. Previous research and literature will create a basis for saying something about the current situation in the industry and further expressing potential value creation. In its entirety, it is intended that the research will create a framework for further research as there appears to be little or no previous research on how innovative technology creates value for LSPs in the Norwegian context.

1.4 Thesis structure

The structure of the thesis will be based on a standard thesis structure with a division of introduction and research question, which will be followed by a literature review. The thesis will go through research methodology which goes in depth on how the research has been done in addition to the overall structure of the thesis. Furthermore, the thesis will consist of findings that provide a description of the actual findings that have been made through data collection. This allows further analysis and discussion, where the thesis will end with a conclusion and the thesis' limitations and recommendation on future research. As a supplement to the assignment, the two interview guides will be attached under appendices.

2. Literature review

2.1 Introduction

The literature review provides an overview and discussion of previous studies and theories related to our topic. The basis of this stems from our research question, "*How does implementation of innovative technologies contribute to value creation for LSPs?"*. The purpose of the literature review can be displayed in two ways. Increased understanding and knowledge gained from previous works will enhance our ability to work further on with our research. Additionally, we expect to determine the theoretical gaps in previous literature with respect to our topic, which justifies how our study could contribute to less covered concepts within the field. This review will hence form the underpinnings in regards to our study.

2.2 Logistics service providers and their role in the supply chain

The logistics service industry is considered as rather new and has been experiencing growth since its appearance in the late 1980s (Sheffi, 1990). Providing a specific definition of a LSP seems diversable, as the literature expresses them by a wide range of labels and lack of consensus. Delfmann et al. (2002) suggest defining LSPs on a general basis as companies which perform logistics activities on behalf of others. Fabbe-Costes et al. (2009) express that the development of LSPs have proved them to be significant actors of the supply chain, even acting as consultants or substitutes for shippers. This paper applies LSP as a synonym for similar terms such as carriers, forwarding companies, transport(ation), companies, third-party logistics providers and logistics service providers.

As seen from these denotations, Fabbe-Costes et al. (2009) emphasises further that there exist different types of LSPs, which implies that it is challenging to provide one, single definition of the term. However, along with other businesses, the competitiveness in the logistics industry has increased throughout the years. Improved logistics efficiency through added value, infrastructural improvement and economic development pressure are among numerous implications that increase competitiveness in this sector (Liu & Li, 2019). The logistics industry calls hence for improved processes and services, and as LSPs are the main enablers of this, their importance is undoubted.

LSPs often act as intermediaries between suppliers and customers in supply chains (Hertz & Alfredsson, 2003), and as they handle larger shares of their customers´ activities, they are considered as significant actors in supply chains (Forslund, 2012). As mentioned, the literature applies LSP as a term of high diversity when labeling them, as well as when addressing their role in the supply chain. Fabbe-Costes´ et al. (2009) research found that several previous papers viewed LSPs as genuine members of the supply chain, while some papers viewed them as enablers/tools. Chow et al. (2007) take it a step further, and consider LSPs as a major actor in supply chains; "LSP helps both the up and downstream supply chain parties maximize their activities linkage within the supply chain". The actor role of a LSP is perhaps the most interesting perspective to study them from (Fabbe-Costes et al., 2009), but the least developed context at present.

2.3 Innovations and innovation management

As a consequence of the digital age, innovation has been broadly acknowledged as a source of utmost significance when dealing with increased competitiveness in industries. It offers the potential for competitive advantage (McGrath & Ming-Hone, 1996), as the literature expresses that it can help to save costs or improve quality of existing processes (Kahzanchi et al., 2007). Busse & Wallenburg (2011) support this statement, which recognizes innovation as an advantageous investment with respect to market trends and increased competitiveness.

Kagermann (2014) highlights the need for Germany's manufacturing industry to keep coming up with new innovations to maintain its position as a leading manufacturing equipment supplier. It is therefore reasonable to argue that innovation plays a decisive role for companies´ competitiveness. Market dynamics are changing, partly due to digital transformation, which calls for new ways of thinking when operating in the diverse industries. Digitization tends to be used interchangeably with digital transformation, but could be defined as the networking of people and things and the convergence of the real and virtual worlds that is enabled by information and communication technology (Kagermann, 2014). Moreover, these triggers and enables innovations (Mathauer and Hoffmann, 2019), as digitization appears to be the main driver for innovation and change in all sectors of our economy (Kagermann, 2014).

Despite being recognized by many as an important contributor, innovation has to be managed properly to provide a successful outcome. Hence, innovation management has been regarded as a highly relevant topic (Busse & Wallenburg, 2014) for companies to be attentive to. Busse & Wallenburg (2011) argues that an innovation is considered as successful when an innovation is the output, which in turn generates positive, economic payback. Nevertheless, tasks beyond the management of an innovation are decisive in coping with e.g., challenges, resource conflicts, etc. (Busse & Wallenburg, 2011). Without being aware of the importance of innovative management, companies will find it difficult implementing innovations successfully. By delivering lasting success, a successful innovation system is required (Kagermann, 2014).

Amazon and Alibaba-e-tailers are examples of companies that have entered the logistics market successfully by managing innovative and technological processes properly. They have for instance established a strong, competitive position by investing in technology-supported warehouses and transport (Cichosz, 2018). Innovating processes tend to be individually unique, as there always will exist different factors for different settings. Therefore, it stands to reason that it might not be necessary to generalise how to manage innovations in one, single way, but rather consider the specific context that the innovation takes place in. This is hence what researchers have turned their attention to (Busse & Wallenburg, 2014), which indicates that the literature is somewhat diverse when elaborating on this topic.

2.3.1 Innovations and innovation management for logistics service providers

Innovation has gained amplified attention for LSPs throughout the years. Busse & Wallenburg (2011) highlights environmental trends such as globalisation and deregulations as contributing factors for LSPs´ need to be more innovative. It is particularly the digital transformation that LSPs are witnessing which triggers the need for properly managing and implementing technological innovations. This concept encompasses the technological development of an invention combined with the market introduction of that invention to end-users through adaptation and diffusion (Garcia & Calantone, 2002).

Logistics activities can be performed by non-LSPs, and LSPs can provide non-logistical activities, which implies that logistics innovations and LSPs innovation are not identical (Busse & Wallenburg, 2014). Previous literature proves that the term innovation in relation to LSPs or 3PLs is not at the core yet and lacks research. However, the innovation related findings that exist shows that LSP innovation can be achieved in collaborative relationships (Busse, 2010; Selviaridis & Spring, 2007). Furthermore, Bellingkrodt & Wallenburg (2013) argue that innovation at LSPs has a connection and is valuable for targeting new customer business. In addition, innovativeness is considered a strong driver of LSP's overall firm performance. Nevertheless, there is no clear definition of what innovations in LSPs really are and whether technological development is required is part of this (Bellingkrodt & Wallenburg, 2013).

Some literature splits innovations in two main categories; incremental and radical innovations. Busse & Wallenburg´s (2011) findings showed that LSPs historically tend to be considerably more focused on incremental innovations rather than radical innovations. This implies that new processes and services are somewhat new to the firm, but not new to the market. Whether this is a corresponding factor to how literature addresses their innovation management is not something that is further considered in the thesis and addresses innovation in its entirety.

LSPs are being challenged on fulfilling a broader spectre of global and multi-channel supply chain services on demand and on time (Kilcarr, 2010). As innovation is regarded as a major source of competitive advantage in today’s market, LSPs innovation management is a field that requires attention. An innovative mindset could be a decisive factor to prevent high-cost services for themselves and their customers. Nevertheless, LSPs have been considered as less innovative compared to other industries (Busse & Wallenburg, 2011). The question arises why this is the situation, as innovation is based on an organization's willingness and ability to innovate (Garcia & Calantone, 2002).

LSPs innovation management has been characterized as rather reactive (e.g., Oke 2008; Busse & Wallenburg 2011), i.e. a response to customers´ preferences, requests and needs. Oke (2008) expresses that this could pose a more difficult innovation process, as the time frame to deliver is shorter, compared to proactive innovation management. To provide value and quality services for customers, improved infrastructure, IT-systems, and automation (Kilcarr, 2010), are among several effects that can be reached through proper integrated innovation systems and management.

Nonetheless, challenges follow along with new implementations, especially for digital innovativeness. Barriers concerning costs and time consumption are addressed in the literature regarding innovative technologies (Hoffmann & Osterwalder, 2017). On one hand, such implementations have the potential to be profitable by increasing operational efficiency and reducing cost-stimulating errors (Riedl et al., 2018). Nevertheless, more problems and higher costs can often occur with an unproven technology, by using more money and time on the investment and implementation than first anticipated (Spessard, 2001). It therefore appears that there exists acknowledged pros and cons with innovative technology and the implementation of it in the literature. Spessard (2001) argues that challenges usually are resolved, and there is little or no doubt that to solve or mitigate these uncertainties starts with well-organized innovation management.

2.4 Digital transformation in the logistics service industry

Digital transformation changes competitive dynamics of industries, including the logistics service industry. Creating value is identified as a key output of digital transformation, and includes, among other forms of value creation, operational efficiencies and improved customer experiences (Cichosz et al., 2020). Logistics activities have progressively been sourced out to 3PLs and increasingly been challenged by new digital technologies in the recent years (Hofmann & Osterwalder, 2017). Align with the fact that LSPs differ in how they add value to their customers and clients, they also differ in the way they deal with technologies (Marchet et al., 2017).

In correspondence with LSPs lack of innovation capabilities, they are likewise struggling to adapt new technologies as the market develops. As emphasized earlier, LSPs have historically been considered as rather reactive than proactive. The competence and capabilities among employees´ skill set is therefore regarded as a potential challenge for dealing with digital transformation. This is one of the main barriers highlighted in previous literature, as Cichosz et al. (2020) findings showed that the ability to adapt technologies in LSPs top management were somewhat low. Among other implications, lack of technological know-how, low educational levels of the workforce and difficulties with innovation transfer are being stressed as struggles for logistics service companies (Cichosz, 2020).

Despite experiencing struggles by adapting technological changes, digitalization for logistics service providers is recognized as an opportunity to enhance value propositions. This may contribute to operational efficiency, as well as improving their competitive strength in their market. Furthermore, it eases their ability to respond to new trends and follow markets´ development. Being able to exploit these opportunities, 3PLs not only need to adapt technologies, such as autonomous vehicles, drones and robots, but also foster the development of their own technologies to stay in the lead (Hofmann & Osterwalder, 2017). It is additionally worth mentioning that the impact of digitalization on LSPs has gained restricted attention in the literature (Hoffmann & Osterwalder, 2017), which is an aspect that will be further investigated in our thesis.

A final dimension to consider regarding digital transformation is the enabling of increased information sharing by information and communication technologies (ICT). This facilitates higher degrees of connectivity and collaboration between entities within a supply chain. Thereby, the need for regulation and safety on the "information superhighways" has been necessary to address by national governments and international agencies (Broadhurst, 2006). Increased levels of information sharing has raised an issue regarding cyber-crime, which is a recognized barrier for the LSPs toward digital transformation. O´Donell-Welch (2021) expresses that the supply chain sector is a recognized target for cybercriminals, as important information continuously is going astray.

2.4.1 Automation and autonomous technologies in the logistics service industry

Higher levels of collaboration and coordination within the supply chain encourages new ways of thinking for maintaining competitive positions in businesses. Automation and autonomous operation are being viewed as key enablers for these implications. Results from Schafer´s (2015) study indicate that some IT enabled systems and practices, mainly intelligent transportation systems for freight and integrated information sharing, do positively impact transportation outcomes. Literature emphasises that autonomous guided vehicles and automated storage has already been used by 3PL providers to reduce cost and increase internal and external efficiency on activities (Hoffmann & Osterwalder, 2017). Furthermore, emerging technologies, such as 3D printing, drones and autonomous vehicles are being considered as potential technologies that alter supply chain and logistics operations in several ways (Pagano & Liotine, 2019).

Hofmann & Osterwalder (2017) address further that the high degree of standardisation of LSPs makes transportation and warehousing accessible for new technologies, hereunder automation and autonomous vehicles. Hence, customer experience and operational efficiency are among other areas that may improve through implementation of automation processes (e.g. Cichosz et al., 2020; Riedl et al., 2018). One could partly conclude that automation facilitates operational improvements, but there are rather few specific examples in the literature of how it may be or have been accomplished.

The environmental impacts that the transportation stage of a supply chain facilitates demonstrates barriers which are considerable. Companies are today expected from the government and other stakeholders to pursue sustainable practices to a greater extent. Current solutions to reduce the impact of freight transport in urban areas aim to reduce the number of vehicles, for instance by governmental traffic regulations and restrictions (Paddeu & Parkhurst, 2020). Electric, autonomous cars and trucks are therefore predicted to impact the future of transportation in the logistics sector to a higher degree. Automated Vehicles (AVs) or Driverless Vehicles (DVs) are described to be used for road freight transport on the long haul or to deliver goods within urban environments (Priemus et al., 2005).

These vehicles are expected to come with high investment cost, but also benefits that especially improve the environmental and economical measurement of transportation. Paddeu & Parkhurst (2020) argues that the overall system of electric automated driving could reduce congestion and polluting emissions, while also reducing operating costs and improving overall efficiency. Nevertheless, the legal policies of using fully autonomous vehicles are today not sufficiently developed to be applied, due to traffic safety. Related to regulations, these vehicles are in many countries not allowed to circulate on the roadway or footway because they might reduce the accessibility for pedestrians with mobility and visual impairments (Paddeu et al., 2019). Aligned with the high prices of autonomous and electric vehicles, this poses barriers for LSPs to accommodate governmental demands of greener transportation policies.

2.5 Sustainability impact in logistics

Digitization has been seen as an enabler to enhance logistics companies´ sustainable conducts. Rethinking digitally-based business models and redesigning the way of business processes along the supply chain to sustainable development is one way digital logistics is seen to improve sustainability (Kayikci, 2018). It is also emphasized that digitization is an important instrument in realizing a reliable and sustainable future transport systems and supply of goods (Nowak et al., 2015). In the matter of LSPs, they encompass an important division of the logistics industry and then especially for the transportation of goods, with respect to the sustainable dimension.

The growth in environmental responsibility for the logistics industry is considered as a result of governmental regulations, economic considerations, and increasingly strong market signals from environmental conscious consumers (Goldsby & Stank, 2000: Scholtens & Kleinsmann, 2011; Tacken et al., 2014). Literature emphasizes however challenges such companies are facing, where profit margins in the third party logistics market are low, thus only limited resources to pursue sustainable solutions (Piecyk & Björklund, 2015). Their customers increasingly expect new and innovative solutions (Busse & Wallenburg, 2011) and the question arises of LSPs´ capabilities to meet requirements through such investments.

New technologies itself raise issues towards sustainability, hereunder the non-recognized levels of energy consumption. Continuously new information and communication technologies to apply is found to provide heavy pressure on electrical demands or energy consumption (Lu, 2018). It is acknowledged that measuring energy consumption is a difficult task (Garcia-Marin et al., 2019), but illustrates however an environmental barrier for adapting new technologies.

2.6 Value creation in the logistics service industry

Value creation can be seen from multiple perspectives with various factors affecting it, which implies that the literature provides a wide range view of the term. It lacks consensus and standardization of the term "value" in the literature. Value is seen as difficult to count and estimate (Sampson & Froehle, 2006; Bowen & Jones, 1986), as it is highly dependent on the market, the situation and the firm itself. Improved value propositions for shippers and their customers are however recognized as an area of high importance for growing and maintaining competitiveness for LSPs (Prock et al., 2012; Marchet et al., 2017).

Riedl et al. (2018) indicate that improved value proposition is achieved through increased operational efficiency. Hereunder, industry problems such as high fragmentation, low transparency and costly manual processes are highlighted. Regarding the logistics service industry, value creation is considered as a term of high significance. This can be emphasized by their main purpose, which is to perform services that add more value to a shipper´s business than the shipper would be able to achieve alone (Deepen et al., 2008; Berglund et al., 1999). LSPs have historically struggled with their innovative capabilities, which raises the issue of their ability to create value in a fast changing environment.

Some literature highlight the service level with shippers at minimum cost while dealing efficiently with the industry complexities (Min et al., 2013; Lieb & Bentz, 2005) as a form for value creation. Others provide a different angle of how value creation takes place in the industry, and underlines skill development and operational expertise as major considerations for delivering higher value services (Selviaridis & Norman, 2015; Large et al., 2011; Yeung et al., 2006). This supports the fact that value creation can be viewed from many perspectives, given the

diversity of firms and markets. Furthermore, this may also indicate that there exists conflicting goals of how to create value in the sector.

How 3PL service providers adapt, reconfigure and transfer capabilities in the industry by learning from existing relationships to better customize their services to their clients´ needs, is suggested as an area to focus on in the literature (Prock et al., 2012). Supported by Cichosz et al. (2020), customer interaction is a critical determinant for LSPs´ value creation. One can assume that this infers a challenge for LSPs, as ineffective transfer of knowledge in regards to levels of involvement and relationship with customers (Oke, 2008) are illustrated problems for 3PL providers. The corresponding factor to this might be that LSPs mainly struggle with the complexity of the logistics network and lack of resources (Cichosz et al., 2020).

Resource-based theory (RBT) and transaction cost economics (TCE) are according to Marchet et al. (2017) the two most prominent and adapted theories that literature supports upon created value by 3PL providers. Resources in particular are being regarded of great significance when highlighting LSPs´ ability to create value for customers and clients. The literature acknowledges that resources refers not only to tangible assets, but also intangible assets, such as expertise, knowledge and organizational assets (Marchet et al., 2017). However, lack of resources and resistance to change has proved to be significant barriers for LSPs´ ability to create value by adapting new technologies. Cichosz et al. (2020) expresses that non-skilled resources make digital implementations wait. Furthermore, couriers´ resistance to change is being highlighted when new systems and routines are being integrated into a firm's business. These implications represent the most recognized barriers in the socio-cultural dimension of implementing new technology.

2.7 Selected innovative technologies

Industry 4.0 influences and develops businesses, which paths the way for the entrance of new technologies. Due to increased demand of operational efficiency (Soni & Kodali, 2010), adaption of increasingly advanced technologies are seen to help logistics managers to go beyond logistics operations´ complexity (Lagorio et al., 2020). Innovative technologies encompasses a wide range of different technologies, and can be seen as a rather widespread and undefined term in itself.

This section will short and briefly introduce the selected innovative technologies for this study, providing a greater consideration in the case of the LSP-sector.

2.7.1 Automation: Logistics warehouses

A significant amount of the logistics costs stems from distribution centers or warehouses, where automation has been an answer to streamline internal practices. Warehouse automation can be defined as "The direct control of handling equipment producing movement and storage of loads without the need for operators or drivers" (Rowley, 2000). In the case of conveyor/sortation, automated storage and retrieval systems, automation has become fairly common for large warehouses (Baker, 2004).

As many markets are recognized as rather volatile, LSPs´ ability to respond to rapid market changes and increased service levels are today considered as vital, whereas automation in storages is viewed having an important role (Baker & Halim, 2007). One example highlighted is that automated sortation equipment may offer the possibility of stockless distribution centers operated on a true cross-docking principle (Harrison & Van Hoek, 2008). On the contrary, some studies also show that warehouses that use higher levels of automation tend to be less efficient, due to difficulties of reconfiguring to changing business requirements for instance (Hackman et al., 2001).

2.7.2 Autonomy and robotics

Innovations have increased people´s acquaintance with robots as a part of their daily lives (Gnambs & Appel, 2019), where autonomous robots are denoted as a type of intelligent machine that conduct assigned tasks with a high degree of autonomy (Shamout et al., 2022). Autonomous systems and technologies in general are characterized as a progressive source of automation, where smart objects have the possibility of communicating and making independent decisions based on data processing of their own and environmental characteristics (Radivojevic & Milosavlevic, 2019). Robotics is already highly relevant in diverse industries and has turned businesses into the field of autonomy to a greater extent than ever.

Literature argues that applying robotics enables improved quality of finished products and safety levels, reduction of errors, improving quality standards, etc. (Radivojevic & Milosavlevic, 2019). Robotics can also function for numerous operations, where robots for: collecting goods, unloading containers and self-delivery of goods to collection point, among other areas, are highlighted in the literature (Kückelhaus & Chung, 2018). Shamout et al. (2022), argues that the future business environment will be characterized by a variety of intelligent systems and autonomous robots. As such technologies replace human labor, especially when being fully autonomous, e.g., self-driving devices, robotics and autonomy are expected to play a key role in the future of the logistics service industry.

2.7.3 Artificial intelligence

Artificial intelligence (AI) is the technology that creates intelligent machines and computer programs to perform various tasks which require human intelligence (Dr. Karthikeyan et al., 2021). The usage of AI has shown to cut down the loss of time and profit that human error causes, which in turn generates improved efficiency (Sharma, 2021). Such a technology plays today a key role for several industries, and has historically been developed for different purposes.

Studies in 1955 suggested at an early stage that intelligent human behavior consisted in processes that could be formalized and reproduced in a machine (McCarthy et al., 2006). Human intelligence was thus previously the fundamental exemplar around which early automaton attempts were oriented (Dick, 2019). Floridi (2014) emphasizes however that researchers today want to design automated systems that perform well in complex problem domains by *any* means, rather than by *human-like* means. AI technology can therefore be seen as the main driver for why autonomous operations have arrived and likely will form the future for certain businesses. Automation is already at core for the logistics service industry, and intelligent systems are seen to lead the development of smart vehicles and autonomous machinery (Garg, 2021).

2.7.4 Zero emission technologies: Electric trucks

Increased requirements of sustainable operations from several stakeholders calls the need for technologies that reduces companies´ environmental footprint. In regards to the logistics service industry, electric trucks and vessels are incoming for LSPs to operate in an environmentally-friendly manner. Nevertheless, zero-emission trucks are more expensive in the near-term than their diesel equivalents (Hall & Lutsey, 2019), which pose a potential challenge to make similar investments. Aligned with the high investment cost, the technologies' maturity in form of low range and uncertainty of ZEV technologies appear to severely limit their marketability in the near term (Miller et al., 2017). Electric trucks are however considered as the most energy efficient solution for decarbonisation, and are predicted with further development to be more technically feasible for the time to come (Earl et al., 2018).

2.8 Closure

The literature review indicates that the logistics service industry struggles with technological development and innovative processes, where barriers emerge from all the chapters. Cichosz et al. (2020) express for instance that non-skilled resources make digital implementations wait, while Miller et al. (2017) address technological barriers in the form of the maturity of certain technologies. An additional and somewhat surprising aspect regarding the revealed barriers is that the legal dimension of autonomous technologies is of consideration, e.g., traffic safety for self-driving vehicles. This repetates a few of the addressed barriers in the literature and it stands therefore to reason that the range of the barriers´ characterization in the literature review is fairly wide.

The PESTEL framework encompasses six different components; political, economical, socio-cultural, technological, environmental, and legal, and are previously used as a tool to analyze barriers (Turk, 2020). The use of PESTEL analysis can be argued that it can be applied as a framework specifically aimed at the barriers in the findings of the thesis. Ahmad et al. (2017), for example, uses such an analysis in its study on Evaluation of the external forces affecting the sustainability of oil and gas supply chain. Similarly, Thakur (2021) has also used the model in his study regarding sustainable healthcare waste management. All the revealed barriers in the literature touch upon one or more factors in PESTEL, and

literature shows that the framework is previously well suited to be used for barriers identification. This analysis will therefore be applied to provide a further structure of the barriers into this thesis. Furthermore, it will also form the theoretical framework in the light of barriers identification, to better answer the sub-question and hence the research question of the thesis.

Improved capabilities of implementing innovative technologies may enhance operational efficiencies, service quality, sustainable conducts and their competitive strength. It is of high interest to investigate this further, as there exists a promised potential regarding this field for applying new technologies. The identified theoretical gaps, as well as the core elements for value creation and barriers in previous literature, create the underpinnings for this research paper.

2.9 Theoretical framework

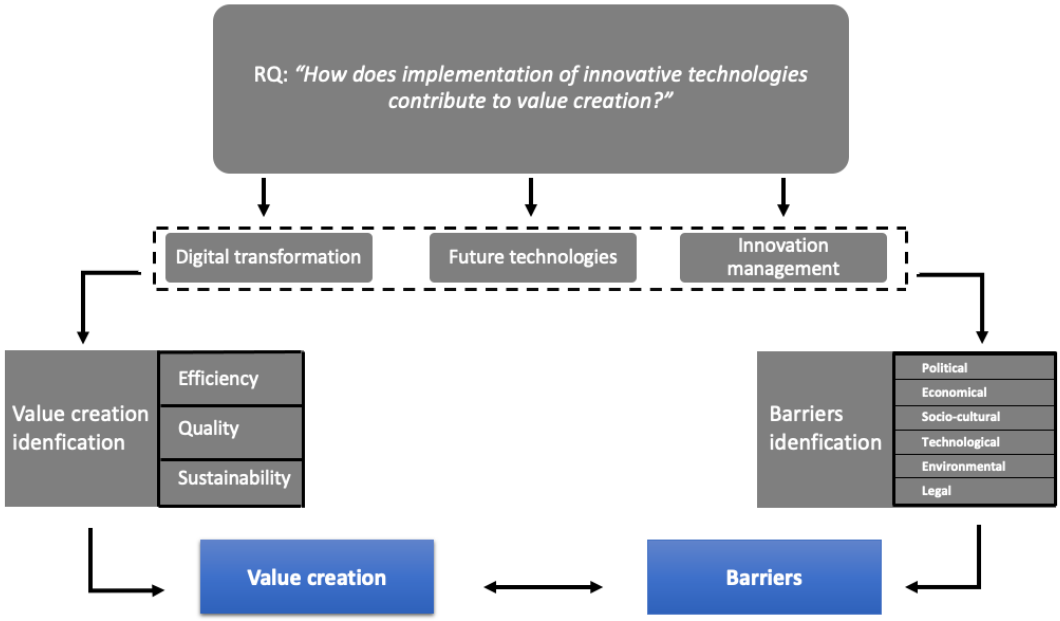

Figure 1: Illustration of the theoretical framework

The theoretical framework intends to serve as a basis for empirical findings and discussion in this thesis. Theory and literature are combined to provide an understanding of value creation through the implementation of innovative technology. This is reflected in the section's Digital transformation at logistic service providers; Future technology; Automation and autonomous technologies and Innovation management at logistics service providers. Value creation and

barriers form an interaction. However, the identification of them needs to be settled and recognized before answering how value creation and barriers emerge from implementing innovative technologies. Even though companies invest to create new value there are also barriers that will have an impact on how they will succeed, hence the interaction in the theoretical framework. Therefore investments in and implementation of new technology needs to balance value creation and barriers. The barriers will provide answers to the sub-question of this thesis and further help to answer the main research question regarding value creation when implementing innovative technologies for LSPs.

Digital transformation

Digital transformation at LSPs refers to both how value is created for the company and also barriers that can prevent the implementation of innovative technology. As referred to earlier in the chapter, Hofmann & Osterwalder (2017) express how LSPs must foster the development of their own technologies to stay in the lead. This begins with the company allowing the adaptation of new technology, which further fosters the development for digital transformation. With such a development, the company ensures that its competitive strength in the market is improved, especially through operational efficiency. It is precisely this operational efficiency that proves to create value for the LSPs, which in turn also can enable improved sustainable conducts.

Adaptation of new technologies has proven to be severe energy consuming, which raises an issue towards green practices within an organization. Furthermore, it is emphasized that LSPs have previously been considered reactive when it comes to digital transformation (Busse & Wallenburg, 2011). For instance, Cichosz et al. (2020) express that lack of skilled workers to new technologies is the second biggest problem that LSPs face, in regards to digital transformation. This implies that the employees' competence and capability in such skills are relatively weak, which therefore is considered as a critical barrier for such implementations. Aligned with their resistance to changes, this underpin the socio-cultural barriers of digital transformation.

Moreover, the modern supply chain is characterized by more collaboration and connectivity between entities, which implies that important information continuously is going astray. New national regulations and policies call for higher degrees of information sharing, also due to the impact of ICT. The supply chain is a field that encomasses important information, and as a result of higher levels of information sharing by governmental policies, cyber-crime is recognized as a major barrier to digital transformation. Urciuoli et al. (2013) argue that cyber-crime will occur more frequently in the future due to increased information sharing and that many companies in the supply chain must implement measures to avoid this. The EU is already focusing on how to better combat such cyber-attacks and improve the protection of European Critical Infrastructure (Urciuoli et al., 2013).

Future technologies

The literature emphasizes that future technologies such as autonomous vehicles, automated storage and AI are already creating value for LSPs by increasing the internal and external efficiency of their activities. It provides the LSPs with value creation through more efficient processes, increased quality of services and sustainable operations through less waste and errors. Nevertheless, it is seen that the LSPs are in an industry with small financial margins that create financial barriers both in terms of investment costs, but also operation and maintenance (Piecyk & Björklund, 2015). Furthermore, autonomous vehicles are impacted by legal barriers, where regulations and national policies of using them currently are not sufficiently developed, mainly due to traffic safety. The issue rises even more when governmental regulations today basically aim to reduce the number of vehicles on the roadway (Paddeu & Parkhurst, 2020). Lastly, the maturity of certain future technologies has been questioned and not recognized as suited yet for today's businesses, which illustrates an additional barrier.

Innovation management

Value creation and barriers also emerge from innovation management. McGrath & Ming-Hone (1996) state that innovations can help create a competitive advantage specifically aimed at the costs or improved quality of existing processes. Improvement of existing processes is an aspect that the thesis will emphasize further when it comes to value creation. Although innovation management can be described as a major source of competitive advantage, it requires more focus than

has previously been the case in the industry. This is an aspect that is important to consider as LSPs are seen as rather reactive when it comes to innovation management. There may therefore be grounds for saying that they do not have enough knowledge of how innovation management should be implemented and the financial resources may therefore not be in place (Busse & Wallenburg, 2011).

In the three aspects; Future technology, automation and autonomous technologies and innovation management at logistics service providers refers to the theoretical framework that provides further connection to the identification of value creation and barriers for implementing innovative technologies. As addressed in the literature review, the barriers emerge from all of the three main aspects. They are considered as wide-spread in terms of characteristics, which pose the need for a clear structure and overview of them. The PESTEL-framework is previously used as a tool in the study of supply chains to categorize and illustrate barriers, which also will be applied in this thesis.

3. Research methodology

3.1 Introduction

This chapter describes the methodological choices that have been made in order to best answer the research question. First, the research strategy and research design will be elaborated and put in context with the thesis. Furthermore, the chapter will look upon the sampling, data collection, both primary and secondary data, and an insight into the quality of research.

3.2 Research strategy

The thesis aims to explain how innovative technologies can help create value for logistic service providers, and not least create an understanding of how this can be done. The research strategy can be referred to "The general approach to research adapted, which will reflect one's methodological assumptions" (Bell et al., 2019). In the context of the research strategy, one can define two different approaches, namely quantitative and qualitative research. Quantitative research means a research strategy that emphasizes quantification in the collection and analysis of data. In contrast to this, one finds qualitative research strategy which, in principle, emphasizes words and images (Bell et al., 2019).

With a qualitative research strategy, it will be intended in this thesis to provide understanding through potentially non-quantifiable factors, since this is believed to provide a better opportunity in terms of understanding. It is also appropriate to point out that through innovative technological development and innovations within the relevant industry, there is a limited amount of quantifiable data available, due to limited use of such technologies.

Nevertheless, qualitative research can be seen as too subjective and impressionistic. Another aspect is that qualitative research is difficult to replicate and problems with generalization (Bell et al., 2019). The purpose of this thesis is to present understanding and insight through data that best emerges through qualified personnel in the industry or in the companies. In addition, it is believed that qualitative research opens up for how a process unfolds (Bell et al., 2019). Therefore, qualitative research has an ability to create space for the understanding

of the development on how innovative technology can create value. Such a development is thus a process that best can be described from the perspective of the development from different perspectives and provide more room for interpretation of importance and influence on the various LSPs.

Furthermore, one can look at the relationship between theory and research, which is often defined as either deductive approach or inductive approach (Bell et al., 2019). With a deductive approach, the researchers test the already existing theory, i.e. deduce a hypothesis that must be subject to empirical scrutiny. With an inductive approach, the theory is the outcome of research. In addition, there is also a third approach that combines deductive and inductive approach, namely abductive approach. This approach overcomes a number of limitations that one can experience with deductive and inductive approaches, for example strict logic of theory-testing and falsification hypothesis and the enabling of theory-building with data (Bell et al., 2019).

Abductive approach provides an opportunity to go back and forth between the theoretical framework, data and the empirical source (Bell et al., 2019). By using the abductive approach in this thesis, the authors will be able to take advantage of the benefits that lie in the freedom to go back and forth between obtaining data, theoretical framework and the sources. As we consider previous research in the implementation of innovative technologies to be limited, we believe this fits the thesis well. It is also argued by Kovác & Spens (2005) that logistics research needs the development of new theories on the basis of the abductive approach, which therefore supports the application of the approach.

3.3 Research design

The research design is meant as the framework for the collection and analysis of data (Bell et al., 2019). The choice of research design is reflected on the priorities of the various dimensions of the research process. In this research, it will be relevant to carry out a detailed analysis of how the implementation of innovative technologies can create value for LSPs, which is believed to fit best with a comparative case study. This is because this kind of research design provides the opportunity to give a detailed, intensive and comparable analysis within the study. In addition, it is believed that research carried out in connection with this thesis can

be seen as complex as an understanding of the research question is expected, which a comparative case study provides the opportunity to elaborate.

In this research, the exploratory case study is considered to be the best alternative as the idea behind this research is to explore how technology can create value for LSPs. An exploratory case study is used in contexts where the situation being researched does not have a clear outcome or one single explanation (Yin, 2014). The reason for this choice is based on the idea that there potentially is not just one clear outcome of what this implementation of innovative technology entails. In combination with the fact that there is not necessarily directly related research on how this can create value for LSPs, it is considered relevant to use exploratory case study as a starting point for the research.

A case study is desirable to use because it provides an opportunity for depth in research and a better understanding of the research question on the basis of limited time to research. In addition, the authors believe that the sub-question regarding barriers to implement innovative technologies can be answered in the best possible way by obtaining first-hand data from interview subjects who can freely express this.

3.4 Sampling

Sampling is about obtaining data from individuals or companies that hold important and correct information regarding the research. The method of sampling used in this research is what Bryman & Bell (2019) describe as purposive sampling. This is a non-probability form of sampling and is considered a well-known method of sampling in qualitative research (Bell et al., 2019).

In this thesis, the intention is to obtain data from suppliers of logistics services where those who were interviewed had a position that had knowledge of the company's implementation of innovative technology. In addition, two experts from an independent research institute in the technical field were contacted to comment on, among other things, the technology's possibilities, value creation, barriers, etc. The authors believe that this is the best sampling method in terms of the selected research design, and that it is absolutely essential to obtain data from qualified individuals. This form of sampling does not allow generalization and subjectivism,

but must nevertheless be considered necessary for qualified statements from the interviewees.

In total, seven semi-structured interviews were conducted with a duration of about one hour. Out of these seven interviews, there are five logistic service providers and two experts in their field, respectively. It was important for the quality of the data and for the sake of validity that the interviews of the LSPs were conducted with personnel who had a key managerial position. The authors consider the sampling size to be satisfactory and believe that the selected LSPs represent a varied selection of LSPs in the industries.

Object	Expertise	Role	Interview type and length
LSP 1	Logistic Service Provider	Co-owner and operations planner	Video conference - 60 minutes
LSP 2	Logistic Service Provider	System Manager	Video conference - 60 minutes
LSP 3	Logistic Service Provider	CIO Norway	Video conference - 60 minutes
LSP 4	Logistic Service Provider	System Directive	Video conference - 45 minutes
LSP 5	Logistic Service Provider	Head of Emerging Technologies	Video conference - 60 minutes
Expert 1	Technology/Management	N/A	Video conference - 60 minutes
Expert 2	Technology/Management	N/A	Video conference - 60 minutes

Table 1: Overview of the participants in the qualitative data collection.

3.5 Data collection

Data collection is essential and the key point of any research project (Bell et al., 2019). A common division of data will be primary and secondary data. In short, primary data will be a term for data that has been obtained itself, while secondary data is based on obtaining findings and research from previous literature. The thesis is based on both primary and secondary data where it is desirable to obtain primary data and analyze this with existing data to create understanding and discussion. In this context, one therefore sees the desire to apply a qualitative method to gain a deeper understanding of the primary data.

3.5.1 Primary data

Primary data collection will be the collection of data carried out by the authors themselves for the purpose of exploring this research further (Bell et al., 2019). For many, interviews and questionnaires are probably known methods for obtaining data in such a context. In this thesis, it is desirable to use a less structured form of data collection. Semi-structured interviews allow the researchers to keep an open mind, so that concepts and theory can be developed from this (Bell et al., 2019). This will strengthen the desire for the thesis to provide understanding and a basis to state something about barriers, motivation or other factors that play a role when implementing innovative technologies.

Furthermore, it is believed by providing an interview-guide to the interviewees, this ensured obtained data that could be interpreted and compared from different interviews and strengthened the methodological framework significantly. Nevertheless, the purpose of the interview-guide was to provide the interviewees with a degree of freedom in their answers, as it is important to bring out information that they believe is essential. For the purpose of the thesis, it is important to allow this, as it is desirable to create an understanding of how the different companies in the industry operate and have different views on what can create value from the implementations of technology.

By this, the authors believe that semi-structured interviews are the best alternative for creating opportunities for understanding and elaborating on potential factors that may be important for further research. With the consent of the interviewees and guidelines from NSD, the use of audio recordings were conducted. This is to create reliability when the interviews were reviewed and put into context in the thesis.

The semi-structured interviews were conducted with the help of the interview guide, which is mainly questions aimed towards the research question, but also questions aimed at barriers and other factors that may help to shed light on the research question. The interview guide also intends to be a tool to avoid leading questions and therefore support the validity of the findings. The interview guides were provided for the interviewees' in their native language (Norwegian), to provide a better understanding of the questions asked, and not least that the interviewees have a better opportunity to elaborate on their answers. Two different interview

guides have been designed. The first interview guide is towards LSPs that are aimed at their area of expertise, while the second is for the two experts who have been interviewed in connection with their area of expertise in technology management.

All interviews were conducted using video conference, i.e. mainly using Zoom. The authors perceived this as a correct assessment as it is less time consuming for all parties involved. Although Bell et al. (2019) mention that the use of such digital tools may have some limitations, the experience is that this has in no way affected the responses from the interviewees. After a time of global pandemic and extensive use of such solutions, all the interviewees were well acquainted with how online video calls worked and it was never perceived as a barrier.

3.5.2 Secondary data

For the collection of secondary data, articles and studies are used in regards to how the implementation of innovative technologies can create value for LSPs. A challenge in this context is to find as much literature as possible with relevance for the thesis research question. Through the data and articles that have been collected, it turns out that there is limited literature that describes the research question. However, there is still relevant literature and research that refers to the implementation of new technology in a supply chain context, as well as barriers and success factors. One thus sees through the acquisition that there is a greater focus than before on the implementation of technology in such a context, but it still appears to be limited as the technological development is happening fast and what was innovative technology a short time ago is perhaps today's standard.

In addition, it should be emphasized that the authors gained valuable insight into the technological aspect of this thesis based on knowledge from the interviews conducted with the two experts. This is based on previous research that has been done in other industries, but which can still be linked to this research. This included automation, AI and machine learning in what is considered the working life of the future.

The literature study done in connection with this thesis is seen as extensive and deals with everything from existing research articles, reports, books, news articles, etc. By reviewing the literature study, it was discovered that there was little or no research that addressed the issue in its entirety, or the sub-question of the barriers to implementation in the Norwegian market. In addition, it is seen that technological development is happening faster than ever and therefore needs a continuous replenishment of research.

3.6 Data analysis

By using semi-structured interviews and therefore obtaining a large corpus of unstructured textual material, the authors experience that it was not straightforward with regard to analysis of data (Bell et al., 2019). Nevertheless, choosing a qualitative strategy makes it possible to obtain and analyze large amounts of information from the relevant LSPs and experts interviewed, and get back and forth between data and theory. This fits well with the abductive approach. Bell et al. (2019) refer to a strategy for analyzing qualitative data that also fits with an abductive approach, namely grounded theory. In this method, data collection, analysis, and theory are in close relationship to one another (Bell et al., 2019; Strauss & Corbin, 1998). This theory is well suited with the thesis when we are to investigate the relationship between innovative technologies and value creation in LSPs.

During each interview, notes were carried out, as well as audio recordings that were approved by each of the interview subjects. After this, transcription was carried out with the intention of creating a better overview of the findings, as well as reviewing the answers (Bell et al., 2019). Using grounded theory's principle of better finding patterns in the answers was important in order to categorize the data again. By doing this, the authors were able to bring out the key findings, as well as quotes of importance to the thesis. This made it much easier to link the findings to the research question and sub-question regarding barriers and its impact on value creation. The authors perceive the data analysis process as fairly straightforward and can be shown in its entirety through illustration.

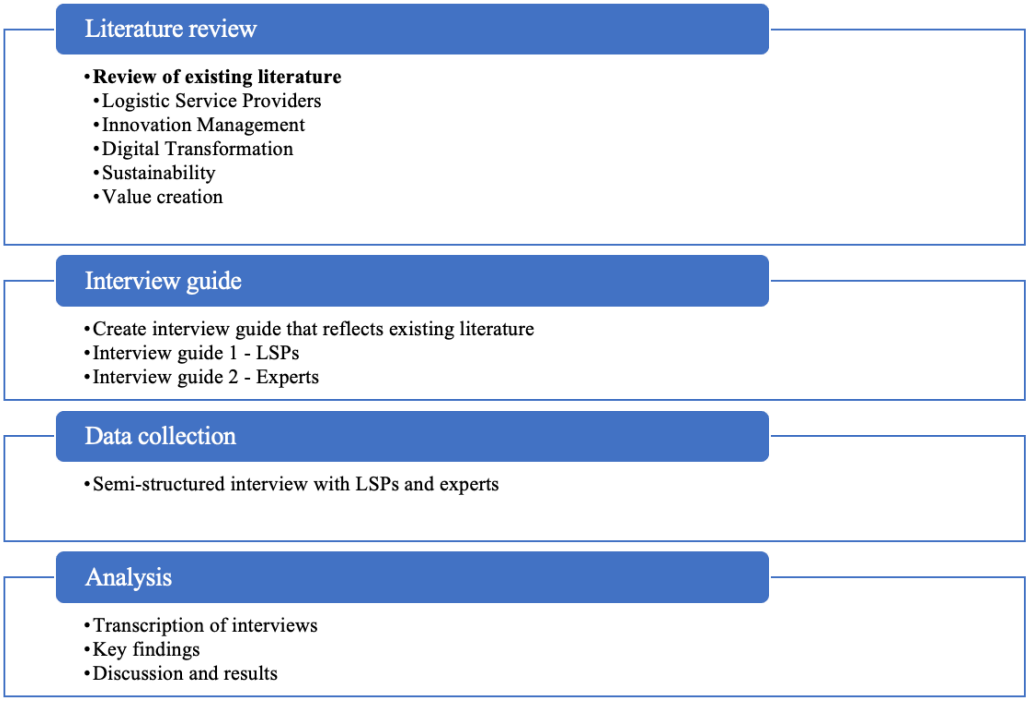

Figure 2: Illustration of the data analysis process made by the authors

3.7 Quality of research

Reliability and validity are criteria that are important for a business research to be considered when it comes to quality of business research (Bell et al., 2019). Nevertheless, these criteria are considered less important when it comes to qualitative studies and have therefore been proposed to be changed. The alternative criteria for assessing qualitative research are then trustworthiness and authenticity (Bell et al., 2019; Lincoln and Guba, 1985). Trustworthiness consists of four criteria: credibility, transferability, dependability and confirmability.

Credibility tells something about how credible the study that has been completed really is. To ensure that a high degree of credibility is achieved, researchers should seek more sources for their data (Bell et al., 2019). To this end, interviews will be conducted with various sources, as well as the use of literature to provide a greater degree of credibility. By ensuring that the interviewees are qualified to give an accurate answer, it is confirmed that these people hold the correct position and knowledge of the company's ability and opportunity to implement technological innovations. These aspects combined will secure the credibility of the findings.

Transferability means that one can take the research that has been done to use it in a different context (Bell et al., 2019). Typical of qualitative research is that one entails a study of a group or individuals sharing characteristics. This applies to research that is done in connection with this thesis where it is desirable to go in depth on how the implementation of innovative technology can create value for LSPs. The authors must acknowledge that it appears difficult, almost impossible, to carry out information retrieval of all LSPs in Norway, especially with regard to limited resources and time. Nevertheless, it is reasonable to use data from LSPs in the Norwegian market and that this is generalizable to many other LSPs in the same industry.

Dependability is in order to demonstrate that qualitative research is trustworthy (Bell et al., 2019). Collection of data will consist of conducting interviews with audio recordings that can be used for analysis and interpretation through the thesis. By analysing the data in such a way, the authors want to achieve a sufficient degree of dependability. In this context, it will also be important to follow the national rules that come from NSD regarding the processing and storage of audio recordings.

Confirmability is about whether the research that has been done has been carried out in good faith and that the findings that have been done are not affected by any of the researchers' personal values (Bell et al., 2019). To avoid this, the authors believe that by using audio recordings in interviews, one will to a greater extent avoid this, at the same time as interviews will be conducted with both the authors present. It appears as a requirement that one should, as best as possible, be objective about the findings that will be made.

3.8 NSD consideration

As mentioned in the section of research methodology, data collection will be obtained both as primary and secondary data. When collecting primary data, the authors have used semi-structured interviews as a tool to gather the necessary data. The consideration of how to process and store this kind of data is something that follows strict guidelines. The national center and archive for research data "Norsk senter for forskningsdata" (NSD) have clear procedures in the collection of data. The purpose of NSD is to ensure legal access to necessary personal data for research (NSD, 2021). NSD will provide a structured framework for how the data will be

collected, at the same time as it will provide an understanding of how to best systematize the collection. By following the guidelines from NSD, the authors will make sure to comply with both legal and ethical regulations.

To concretize the plan the NSD's notification form is used in advance of obtaining the primary data. The reason is because it is necessary to secure feedback on the draft for the data collection and at the same time allow changes along the way. When using the notification form by NSD, the interview guide was attached together with potensiale questionnaire, list of variables, etc., based on what was relevant to our thesis. As it was desirable to use interviews to obtain data for this research, an interview guide was therefore created. The Notification Form for personal data at NSD was already completed early in the semester of spring 2022. As the interview guide needed to be attached to this form, it was necessary to review guidance with our supervisor to ensure sufficient quality of the interview guide, as it is considered vital to extract the primary data for the research.

The section of research methodology / design goes in depth on how it is desirable to carry out the collection of both primary and secondary data. Semi-structured interview has been used as the preferred form of data collection and provides a better foundation for the interviewee to supply with relevant views on the topic. As previously mentioned, the interviews were conducted with audio recordings, which made it especially important to follow the guidelines for processing data. By reviewing these steps, it should provide a basis for ensuring that guidelines are followed, both legally and ethically.

4. Findings

In this part of the thesis, we will present our findings that have been made in connection with data collection via interviews. In order to structure these findings in an appropriate way, the division takes place in a similar way as the interview guides. The authors have therefore chosen a division that distinguishes between the interviews with practitioners (logistic service providers) and expert interviews. These two divisions again consist of subcategories that are in line with the interview guides and create the framework for further structure regarding findings. In order to refer to these findings, it will be appropriate to present them in text with accompanying quotes from the interviewees. The various quotes are known to be anonymised, but will be marked with a numbered designation of the various LSPs, as well as the quotes of the two different experts. Finally, there will be a separate section that addresses the current barriers in connection with the implementation of innovative technologies at LSPs, which were discovered through data collection.

The two interview guides are designed on the basis of research that has been done and may therefore contain some concepts that seem unfamiliar to the interviewees. In order to ensure that the interviewees gain an understanding of these concepts and the topic in its entirety, the authors have therefore defined and explained the concepts throughout the interviews, which may appear difficult or unclear. Furthermore, the authors wish to point out that the interviewees in this research are selected on the basis of the person in each company who has sufficient knowledge and competence in digital transformation and innovative technologies. In this way, the research ensures that one obtains to a greater extent qualified answers that create value for the research.

4.1 Interviews with practitioners

The interview with the various practitioners is based on claims about the current situation for logistics service providers that originate from the theoretical framework and previous research. The statements provide a basis for further discussion under the various sections in the interview guide.

4.1.1 Digital transformation at logistics service providers

The statement to which the interviewees responded was as follows:

Logistics services are constantly being challenged by new technologies and have changed the competitive dynamics of the market. Research shows that logistics service providers historically have, to a certain degree, been seen as rather reactive to implement new technology.

All the interviewees agree with the statement and believe in one form or another that this is true. Nevertheless, several of the interviewees believe that the ever-changing competitive dynamics are forcing through the technological change that is needed for LSPs in order to survive in the industry. Expectations from customers and other parties within the value chain expect constant development and improvement and it is therefore believed that new technology must be adapted to a greater extent than ever.

> *It has gone from many small businesses, to fewer larger units. In order to have the ability to use innovative technology, it will be an advantage to be a part of this. Those who, for example, have grown from small to medium-sized have not been able to use such technology to the same degree.* (LSP 2)

> *The industry is evolving towards customer needs and is definitely the leading aspect for us. From when the internet and technology really made their entrance, efficiency has been absolutely central, but it is a completely different league today than it has historically been.* (LSP 1)

Furthermore, the interviewees were asked what infrastructure should be in place for a successful transition using innovative technology. All respond that the human aspect is the most important form of infrastructure one can have, for example, business culture, attitudes towards change and management, while the physical infrastructures come second.

Having an attitude and understanding that one must change is important. If this is something everyone has, then the change will work. We have done this throughout history, which makes it natural for everyone in the company to have such an organizational culture. (LSP 5)

Everybody does the same, some will have success doing so and vice versa. The biggest difference is however if the LSP "dares" to use time and resources to form a business-culture where the willingness to change stands high. (LSP 3)

The logistic service providers were asked if they saw any immediate challenges or barriers to ensure an agile implementation process of innovative technology. The answer is once again that the human aspect is probably the biggest barrier. It is both important and difficult to get a corporate culture that is willing to change through new technology, as well as have the competence for such a change. Some of the interviewees also point out that they experience that the size of the company has an impact on the capability and possibility of agile transitions to new technology, in the sense that the larger companies have more resources for this type of change. These are barriers that are presented later in the findings under socio-cultural barriers.

4.1.2 Future technology: Automation and autonomous technologies

The statement to which the interviewees responded was as follows:

"Previous literature emphasizes that autonomous technology is already being used by LSPs for cost reduction and streamlining internal and external activities within the firm. Autonomous technologies are therefore being viewed as an important area to be attentive to, to increase LSPs´ competitive strength".

Automation and autonomous technologies are being viewed as an area of utmost importance for the practitioners, as the competitive dynamics are changing and increasing within the LSP-sector. For the majority of the LSPs, implementing such technologies is mainly considered as an economic incentive. The findings show that to focus on automation and autonomous technologies are practically considered as

a dealbreaker for surviving in a competitive market, and to secure the future of the firm.

> *In regards to autonomous technology, the logistics world has reached the point where you are either in for automation, or you will lose all competitiveness. Saying that you want to survive in this sector, as well as not being willing to make such investments, is not possible.* (LSP 1)

> *Autonomous technologies are important, especially to secure partners for cooperation and gathering customers with your systems.* (LSP 4)

> *We are not making such investments to be profitable for next year. The purpose for these implementations is to ensure that our company still is relevant and exists in 10-20 years.* (LSP 5)

The findings shows additionally that the LSP-sector is experiencing a change in regards to automation incentives. LSP 5 expresses that such investments previously were related to big, complex assembly line systems. In contrast, today's automation is mostly aimed to optimize smaller functions within the firm to be better suited for the fast changing environment in the LSP-sector. LSP 5 exemplifies this change by developing VR-technology for internal use of digital meetings and virtual training for truck drivers with realistic driving-scenarios. However, apart from one actor, the interviewees have in one way or another accomplished an implementation of autonomous technology during the previous five years. In regards to the infrastructure that should be in place for implementing autonomous technologies, interaction across different entities within the supply chain are highlighted as essentials. Competence within the LSP is also considered as a key aspect in the case of required infrastructure.

> *The whole value chain needs to communicate and share information between the entities. Despite us being a big company, collaboration within the value chain is critical. Furthermore, the firm needs access to competence regarding these technologies.* (LSP 4)

You will to a certain degree progress by developing autonomous operations internally in the firm. However, we are completely dependent by having a value chain that harmonizes and communicates with each other. (LSP 3)

Autonomous technologies are being regarded as valuable for the interviewees, and the pendulum leans mostly toward the economic standpoint. Efficiency and cost reduction are highlighted and repeated as the main values that such implementations provide. Incentives of sustainability have been slightly mentioned, but most actors consider the economic and environmental gains to overlap each other. The practitioners consider their market as highly competitive, which poses the need for investments that become profitable for the firm.

Autonomy can create more accuracy and hence less deviation – this creates value for us. Achieving this, profitability will be realized. (LSP 4)

The purpose of such implementation is to use technology in a new way, which stimulates increased profit and reduced costs. (LSP 5)

The value for us with these types of technologies is that the efficiency for our operations increases, as well as increased service-quality to customers. (LSP 3)

On the contrary, one of the interviewees does not recognize the potential gains that these investments can achieve, as the firm is not specialized or experts within this field. They collaborate with several other providers, which does not facilitate high quality implementation of automation. Nonetheless, they acknowledge that they probably have fallen behind regarding this field.

We consider our existing systems as good enough today, but we acknowledge that we lag behind regarding the field of autonomous technologies and the potential value it can provide. (LSP 2)

4.1.3 Innovation management at logistics service providers

The statement to which the interviewees responded was as follows:

Digitization has been seen as the most important driver for innovations in the logistics services sector. In order to realize a successful innovation, a well-organized internal system and a skilled management must be the basis for implementing this.

During this statement, several of the interviewees partly disagree and believe that it is not necessarily just as simple to look exclusively at the system and management. Some also disagree on the extent to which a skilled management must be present, where some say that they think this is overestimated and that the most important thing is to get the whole organization involved. Others believe that without skilled management one will not have a chance to realize a successful innovation. Nevertheless, several of the LSPs answer that it is important to be able to activate the entire organization to ensure that a successful implementation of new technology is realized.

> *I think one often overestimates the leaders in such a process. The manager is often an organizer, who is responsible for the process, but the key lies in the responsibility from the bottom up - that the employees are involved in the change, development and solutions.* (LSP 1)

> *Without a skilled management of technological implementations, and the involvement of the entire company through the process, it will not be possible to implement innovations successfully.* (LSP 2)

Regarding the question of whether innovations are considered an important focus area at the company, there is disagreement about how important it actually is for the LSPs. The two largest companies in the industry that have shown willingness to invest in innovative technology and similar projects, answer that this is important and refer to examples of implementations. The remaining interviewees believe that it is less important to them and that this is more customer-driven. This means that the new and innovative technologies that are implemented are as a result of customers demanding products or services that require better quality or efficiency.

These also answer that it is more important that the implementation of new technologies are profitable and that it will not be possible to introduce systems that do not improve the efficiency or quality of the services directly.

> *To think innovatively and think new is vital for our business. It is important to succeed within innovations where others do not.* (LSP 4)

> *At the moment, it is more important to standardize, harmonize and streamline ourselves than to be innovative. Nevertheless, it is the daily operation and making money that is most important.* (LSP 3)

The interviewees were asked about how important innovation management is for the implementation of new / innovative technologies, as well as how they stay up to date within innovative technologies to be competitive. The vast majority agree on the importance of innovation management, but that the most important thing is to engage the employees in the development and use of the technology. Nevertheless, there is a fairly different approach to how they stay up to date in technological innovations. Again, we see that the two largest LSPs interviewed answer that they have their own teams that work exclusively towards the use of new technological innovations for the company. The remaining companies say that they stay up to date by following the customer's ever-increasing demands for quality and efficiency.

> *If we are to be an alternative to the large national and international companies, we must have competitive systems. It drives us ever further in the development of our systems.* (LSP 2)

> *Commitment from the employees in the company is much more important than commitment from only the manager within such an implementation.* (LSP 1)

The LSPs are unanimous when asked if they work proactively for the implementation of innovative technologies, where they believe they are to some extent proactive. Again, it turns out that the two largest LSPs actually work proactively through projects and other innovative solutions that are not directly

related to customer requirements. The other three LSPs point out that they implement technologies that are innovative, but which in turn come as a direct consequence of the customers who make demands on efficiency and quality. This will be further discussed in the next chapter in analysis and discussion. Some of the interviewees note that their ability to be proactive is downgraded for the reason that daily operations must come first.

> *We desire to implement technology which streamline processes and operations. However, for practical issues related to our economy, we have not the willingness to pay to implement such investments.* (LSP 2)

> *The innovation team will not implement the project, but rather show what is possible with the new technology. It will be up to management and other roles to decide if it is actually profitable for the company.* (LSP 5)

4.1.4 Value creation at logistics service providers

The statement to which the interviewees responded was as follows:

Research shows that LSPs historically have struggled with their innovative capabilities. Thus, their ability to create value (operational efficiency, service-level, internal competence, etc.) in a fast changing environment/industry has been regarded as a potential challenge.

Organizational size is repeated as an argument by the majority of interviewees for why the statement seems to be accurate. Some LSPs express that there previously existed many, but small, entities within the sector, which made it rather difficult to establish an innovative mindset. However, the market is frequently changing and the answers show that acquisition by the already big LSPs of smaller actors tends to be a pattern nowadays. This implies that these companies today may have the ability and economic strength to realize such investments, without risking too much operationally. The struggle with LSPs´ innovative capabilities, and thus their ability to create value, stems mostly from how powerful and big the company actually is.

The small companies do not have the same opportunities as the big actors in the market. They will therefore struggle to innovate to create value, as they do not have the economic strength to make such investments. (LSP 1)

LSPs that were big 30 years ago exist mostly today – even bigger and better than previously. (LSP 5)

The interviewees are reasonably concordant in that their customers are a key aspect in regards to how such companies create value. Customers' requirements are increasing, which the LSPs are eager to fulfill. LSP 2 mentions additionally that creating a safe environment for the employees is regarded as an important form of value. However, the economic perspective is also of highest significance and seems arguably to illustrate the most important encouragement for value creation for the five LSPs.

Turnover and profitability is what we first and foremost consider as value creation, it is basically the essence in the logistics industry. (LSP 1)

Turnover and efficiency is without a doubt the most important for us. We operate in an industry where the margins are very small, and this becomes a compulsory focus. (LSP 3)

Cost reduction and creating operations with less deviation is important. By that, profitability will be achieved. (LSP 4)

Value creation in the form of sustainability is also considered as an important form of value creation, but mostly for the LSPs of a certain size. Furthermore, is it emphasized by the majority of LSPs that sustainability and economic gains in most occasions are highly correlated with each other.

To achieve sustainable solutions which in turn realizes economic rewards is definitely considered as a form of value creation for our firm. (LSP 4)

> *We must be best on sustainability in our market, regardless if we increase our profit or not. When we are, as today, best in this field, our customers are willing to pay more for our services. That is value creation for us, that our customers know how our firm operates, and that their expectations are being met.* (LSP 5)

To follow up the previous thematic, the interviewees were also provided a question of their willingness to implement technologies that created value for other purposes than economic gains. Sustainability was initially the most significant term to reflect upon, and the actors were rather distinctive in their answers regarding the question. Environmentally-friendly investments is regarded as an area where LSPs have been willing to invest regardless of economic benefits – but to a certain stage. Again, organizational size has been highlighted as a critical determinant and the responses showed that the two largest LSPs were more willing to invest for sustainable purposes than the other LSPs. Most of the responses showed anyhow, as previously mentioned, that sustainability and economic benefits are closely linked.

> *When it comes down to it, there has to be an economic reward for us to invest in new technology. The thought of implementing technology singularly for the environment is not possible.* (LSP 3)

> *We are willing to invest for other purposes than for profitability. Sustainability is important and we want to achieve internal, as well as external objectives in regards to the environment.* (LSP 4)

> *We are willing to implement new technology which creates value in other ways than it is profitable, for instance for efficiency and sustainability - as long as it fits our operational strategy.* (LSP 5)

The practitioners unanimously agree that current challenges within value creation can be solved by adapting new technologies, in the form of increased quality and efficiency in their services. Digitization and innovation are therefore, once again, considered of the greatest significance to create value for LSPs. The main issue surrounds each LSPs´ capability to actually make these investments, which mostly

relies on the size of the firm. Some firms also highlight that they operate successfully nowadays, and thereby do not pursue digital transformation at such.

> *New technology is always reasonable.* (LSP 1)

> *Nevertheless, we are quite profitable in our current services and we consider it not applicable to make the next step towards digitization yet. It will be more useful for us to make such investments when we acknowledge that it, at some point, is totally required.* (LSP 3)

4.2 Expert interviews

The experts have been selected to provide professional insight and a better understanding of how innovative technology can create value for LSPs. They are affiliated with one of Europe's largest independent research institutes and have several publications within digital transformation and technology. The experts are interviewed according to an interview guide which is divided into two categories, based on claims about the current situation for logistics service providers, as well as digital transformation that originates from the theoretical framework and existing research.

4.2.1 Adaptation of innovative technology

The statement to which the experts responded was as follows:

Societies and industries are constantly in technological and digital development as a result of industry 4.0. In that sense, keeping up with the changes and trends that are occurring is crucial for companies in today's market, if their competitiveness is to persist.

The question for the experts is what opportunities arise when using new technology in terms of competitive advantage. Both experts agree that regardless of the industry in question, it is largely a matter of creating capabilities through efficiency. It is pointed out that there are greater opportunities than ever when it comes to the utilization of data that can be used for customers and the market. The systems that use AI today have great opportunities to help companies with decision support, but this is completely dependent on the company having data of good enough quality.

A lot is about utilizing the data when it comes to digital transformation. (Expert 1)

Furthermore, the experts were asked what they consider to be the biggest challenges or barriers in using new technology in companies in a competitive market. Some of these barriers will be elaborated in connection with the next chapter. One of the most highlighted barriers is the maturity of technology and how it can create challenges for companies that want to implement innovative technology, because it is difficult to extract the effect of the technology. Competence is also something that both experts emphasize as a possible barrier and can be difficult for companies to acquire so that they use the technology in the right way. One of the experts also points out that cost is a barrier that many companies experience, where it is exemplified by acquisition cost, operation and any other associated costs.

Competence is a barrier that many companies experience. You are completely dependent on the users of the technology using it correctly so that you can take advantage of the effect such an innovative technology provides. (Expert 2)

The experts were further asked what they think are the main motivations for using new technology in companies in a competitive market. Here, both agree that it is largely a matter of achieving a competitive advantage and efficiency gains through new technology. With machine learning and innovative technology that is constantly being developed, there are great opportunities for companies to gain better customer insight that can create a competitive advantage. Nevertheless, it is emphasized that all this results in a financial incentive as a result of any efficiency, better quality or reputation for the company.

I think the financial incentive behind such an investment applies no matter what industry you are talking about. (Expert 1)

One of the biggest motivations for implementing new technologies is that companies can create new products or services that give them an advantage. (Expert 2)

One challenge is how companies must successfully handle new technology in a competitive market. Again, the importance is emphasized with competence and how important it is that the users of the system make full use of the new technology. In addition, such implementation should be as streamlined as possible to avoid unnecessary costs associated with implementation, operation and training.

4.2.2 Digital transformation at logistics service providers

Digital transformation at logistics service providers is a topic that the interviewees respond to based on their professional competence and insight into the industry. The statement to which the experts responded was as follows:

Logistics services are constantly being challenged by new technologies and have changed the competitive dynamics of the market. Research shows that logistics service providers historically have, to a certain degree, been seen as rather reactive to implement new technology.

From the experts' perspective, both agree with the claim that the competitive dynamics have changed, and that LSPs have to some extent struggled to adapt to the use of innovative technology. Nevertheless, it is pointed out from their perspective that this applies to several industries and that it is demanding to extract the effect of the technology that has been implemented. One of the experts believes that the size of the company can affect their ability to adapt to the implementation of new technology and points out that larger companies are slow to adapt.

> *It is demanding to extract the effect of new technologies and this is something we see regardless of industry.* (Expert 1)

From the experts' perspective, they were asked whether they believe that digital transformation of logistics service providers to a greater, lesser, or equal degree is important for value creation, compared to other industries. Here they agree that they consider it equally important compared to other industries, and say that less importance for LSPs is not an argument for possibly why they do not prioritize digital transformation. Again, the experts say that they do not have the impression that LSPs are lagging behind compared to others or industries.

> *This industry is not necessarily lagging behind other industries, but we see that many of these companies can benefit from digitalisation to a greater extent if they are able to utilize the technology.* (Expert 1)

In addition, the interviewees were asked what they consider to be the greatest risks associated with the use of new technology at logistics service providers. The answers here are somewhat similar, which are elaborated further under barriers, but investment costs, lack of competence and the maturity of the technology are again examples of risk for LSPs. In addition, one of the experts says that some companies find that their core business becomes more difficult to implement because the technology does not work for its purpose. This reflects a lack of competence about the scope of the technology.

> *There is a risk that the core task of a company will be affected because you implement a technology that does not work for its purpose.* (Expert 2)

One of the most important questions is related to the value created by the use of new technology at LSPs and the experts were asked what value they believe the implementation of new / innovative technology for logistics service providers creates. In their answers, the experts agree that efficiency and quality through goods or services is something that creates value for LSPs. In addition, reputation and marketing are mentioned as values that can come as a result of green technology and that many companies market themselves with sustainable solutions.

> *By optimizing existing solutions, one will utilize the value of efficiency and create quality for the customer.* (Expert 1)

> *Achieving sustainable solutions through innovative technology creates value through marketing and being the best in sustainable solutions.* (Expert 1)

4.3 Barriers

Questions concerning the barriers of implementing innovative technologies were provided throughout the interview-guides. Identifying barriers regarding our study is an essential aspect, which in turn will enhance our ability to answer the thesis´ sub-question and hence the research question. To categorize and arrange the discovered barriers, the PESTEL-framework is applied, which consists of; political, economic, socio-cultural, technological, environmental and legal components (Perera, 2017). The purpose of using this framework is to provide a broader perspective of implementing and adapting new technologies in the LSP sector, which also will be further discussed in the analysis section.

4.3.1. Political barriers

The political environment is a highly significant consideration, and includes factors such as political stability/instability, government actions, and changes in political and national policies (Perera, 2017). In most businesses, there is an acknowledged and increasing call from governmental institutions to turn companies´ operations more sustainable. Hence, the environment has gained increased attention, which dictates companies to operate in a more environmentally-friendly manner.

> *There is today a greater governmental demand of utilizing companies´ resources. The focus on the environment and documenting sustainable processes is something that will just increase in our business-sector.* (LSP 2)

Interviews with the practitioners reveals that all companies desire to reduce their environmental footprints. Nonetheless, both high prices and availability for electric vehicles, for instance, are being viewed as barriers for the firms, where they basically want to accommodate political demands of green, operational behavior.

> *The price of an electric truck is considerable, as these vehicles cost nearly four times more than non-electric vehicles. In relation to our organizational size, we have not the willingness to pay those prices, which is what stops us today.* (LSP 2)

> *The big bummer comes when producers price electric vehicles that high - the price is definitely the biggest problem. If a company of our size has high levels of debt next year, the consequences will be enormous (negatively), compared to a bigger LSP. Furthermore, EL-trucks are for instance sold out and not available at the moment. We desire to fulfill environmental demands from the government, but these aspects prevent us from fully doing so.* (LSP 1)

LSP 1 stresses also that many potential partnerships and projects require an EL-truck for instance, which makes the situation even more frustrating. Based on these barriers, it is reasonable to believe that the current political regulations for both prices and availability for electric vehicles are not good enough today. One can see that the government might not have facilities well enough for LSPs to accommodate environmental demands, which is a barrier in itself.

One bigger LSPs emphasizes that sustainable operation is an important aspect on their agenda, where they desire to be best - despite making profit or not. The organizational size could hence be an explanation of why some companies struggle with such investment, and vice-versa.

4.3.2. Economical barriers

Economic factors are critical to organizational success and can be considered to be of most significance (Perera, 2017). Many of the LSPs deliberate over the small margins in a competitive market as of utmost importance, and that the investment in new technologies is costly. One discovered barrier is hence, as slightly mentioned under the political barriers, the high prices on new technologies. The willingness to pay can from that standpoint be viewed as an additional barrier from the economical perspective. Being cost efficient is also being viewed as a struggle for several LSPs, as the competition is strengthened and hence the margins are smaller. The fact that the margins in the industry are small is repeated by several interviewees and especially the smaller LSPs who point out that it is difficult to implement immature technology that does not create value immediately.

> *Numerous companies within logistics struggle to be cost efficient. We operate in a business where the margins are very small, and being cost efficient becomes therefore a "forced" focus. This may be the reason why many LSPs are waiting for such implementations.* (LSP 3)

> *Many companies become noncommittal to investments in new technologies, since their willingness to pay is restricted. They often wait until they feel pressured to make the investment or change, which removes a potential competitive advantage.* (LSP 4)

The experts point of view corresponds somewhat with the perspective of the LSPs. Moreover, one of the experts stresses the costs for a machine, not only in the implementation process, but also when operating.

> *The cost of investing in new technologies is a barrier, both for the implementation process and when using it afterwards. Paying attention to both of these costs are very important. Many firms are mostly concentrated on the investment cost, and forget the costs of maintenance for the machines.* (Expert 2)

> *The return of investment will always be challenging regarding implementation of technologies, independent of different sectors and markets.* (Expert 1)

Nevertheless, both experts emphasize that the costs will be covered when investing in new technologies. If companies are able to overcome the barrier of high prices, achievements in the form of streamlining processes and operations can be realized.

4.3.3. Socio-cultural barriers

The socio-cultural environment is an important dimension, where ethical values, perceptions and attitudes towards the business and the industry within the operating market are to be considered (Perera, 2017). Implementation of new technologies are often related to high cost, but it will also influence the workers in an organization. One barrier is discovered as lack of competence within the firm, and mainly for employers which will deal and work with new technologies. The

willingness to change is also acknowledged as a barrier within several LSPs, as some firms struggle to have an attitude of changing when necessary incorporated in the company's culture.

> *I think the biggest barrier for implementing new technologies is lack of access to people that dares to change and that understand that changing is required. Everybody does the same, some will have success doing so and vice versa. The biggest difference is however if the LSP "dares" to use time and resources to form a business-culture where the willingness to change stands high.* (LSP 3)

> *The implementation in itself is not the difficult part. To implement it into the organization requires changes in form of systems and routines. Hence, the main challenges are related to the employers, and if they actually are able to handle and work with new technologies.* (LSP 1)

> *Everybody knows that changes will happen, but still, they are fearing it. We need to have an organization where new ideas are being appreciated, and those ideas should be brought from the employees, and not the leaders – the employers are the ones who eventually will work with the new technologies.* (LSP 1)

> *An organization's culture and competence must be in place. The willingness to change is important within the firm, which must come from an incorporated culture to do so. The most important is hence the people within the firm, and their attitude towards changes.* (LSP 4)

Besides people internally in the firm, customers are being viewed as important stakeholders, which also brings some barriers into the light. Several actors emphasize that customers are much more important today compared to previous decades, and hold a lot of power within the business. A discovered barrier is that some actors tend to implement technologies that are not reversible. Hence, it becomes difficult for LSP to modify themselves with frequent changes in customers´ requirements, where especially smaller LSPs are struggling.

One challenge is that some companies have optimized themselves for one specific technology or business-area, which makes it difficult to change for future purposes. (LSP 5)

The requirements from our customers will not decrease, but rather increase for the time to come. People want shorter lead times and more speed, which stresses that we need to have efficient processes. It is here that new technologies will be decisive. Customers request increased sustainable operations for instance, which we must accommodate. However, our (small) organizational size limits our ability to make the investments that are required. (LSP 1)

4.3.4 Technological barriers

The technological barriers can be linked to the technical infrastructure, technical competence in the business, the productivity of the technology and is a vital part of the customer and is seen as a value driver to an organization (Perera, 2017). The findings revealed aspects of the technological barriers that can make it complicated for LSP´s to implement the use of innovative technology, as well as have a value-creating effect for the company. One barrier that was repeated throughout the interviews was the maturity of technology. This means that the innovative technology that one wants to implement is not sufficiently tested or requires even so many resources that it will not pay off for companies to implement the technology.

The experts point out that the predominance of LSPs will not have the opportunity to introduce such a system unless it actually provides value through being economically profitable. Although the technology's maturity is a barrier, it is still seen that some larger LSPs believe that this is something that must be utilized and researched today, so that when the technology is mature enough, the company will be ready to use it. Another finding is the lack of compatibility between systems in the value chain that makes it difficult to interact. Some systems do not have the ability to share information and therefore do not interact sufficiently with each other.

Furthermore, it is pointed out that the availability of technology is a barrier when it comes to certain LSPs.. It is seen that the demand for electric trucks is too great in relation to the quantity available. This means that the price can be up to three times as expensive as a similar diesel truck, which makes it difficult for the smaller companies to keep up with the large companies in the market.

> *The maturity of technology is a barrier for companies. Many of these new technologies such as automation, robotics or other digital technologies are not commercially available off-the-shelf and are therefore demanding to extract the effects of these technologies.* (Expert 1)

> *Autonomous robots, for example, are not necessarily mature enough for our market yet, but that we have already thought about it to this day gives a competitive advantage. The day the battery life and range are sufficient enough, we are two to three years ahead of most others and will therefore be able to recover the costs we have today.* (LSP 5)

> *The challenge in a value chain is that many parties must interact. Unfortunately, many of these parties do not have systems that are compatible, and you do not get the desired information flow*. (LSP 4)

> *The customer is pushing for environmental requirements, and we must be part of that. But the size ratios limit our ability to make the investments we want.* (LSP 1)

4.3.5 Environmental barriers

An ever-increasing focus on ecological and environmental concerns makes it important for a company to evaluate the environmental barriers. This means, among other things, carbon footprint, pollution, waste disposal and other factors that can affect the environment in a negative way (Perera, 2017). Although all interviewees answered that the development and implementation of new technology would in one way or another have a positive effect, it still turns out that this presents challenges regarding a negative environmental footprint.

The first barrier pointed out by one of the experts interviewed is the energy consumption to produce and operate the technology. This exemplifies technology that targets the use of BlockChain technology or similar solutions using machine algorithms that have enormous energy consumption. The further challenge regarding these levels of energy consumption is that the energy consumption itself is difficult to measure. It is stated that there exists a lack of appropriate tools to measure and build power models in existing machine learning suites, which makes estimation of energy consumption a challenging task (Garcia-Martin et al., 2019).

Another perspective when it comes to environmental barriers is the amount of waste as a direct consequence of the use of innovative technology. One comment that was given was the challenge with the use of lithium batteries and their utilization. It was pointed out that the use of lithium batteries in their autonomous drone could create challenges because as of today it is difficult to make full use of the batteries or reuse them. It was also pointed out that global resource shortages could arise if one continues to utilize the resources in the same way as one does today.

> *Building machine algorithms is not in itself environmentally friendly and requires a lot of energy to produce and operate, but what you get out of this algorithm has the potential for a positive environmental footprint.* (Expert 1)

> *A challenge for us is the batteries that the vessel uses and that this can create a challenge with waste. We need the batteries to be utilized to the maximum so that we avoid large amounts of waste, and that the costs will be reduced due to the longer life of the batteries.* (LSP 4)

4.3.6 Legal barriers

Laws, regulations, guidelines, principles, acts should be assessed under legal considerations. These factors vary widely from industry to industry, but should be considered as a guideline (Perera, 2017). The demand for information sharing is great between the parties in a value chain and makes it relevant for everyone to comply with the new law on the processing of personal data that was adapted in Norway in 2018 (Regjeringen, 2019). One of the stated experts says through the interview that there will always be a concern regarding privacy and in this

connection handling of cyber-attacks. This is repeatedly commented regarding barriers, handling of digital technology, as well as risks associated with the use of the technology.

Greater demands are placed on information sharing and documentation between companies today, where it is exemplified through environmental accounting and transparency. This ensures that the LSPs must spend both time and resources to handle data in accordance with the law. Furthermore, it is emphasized that the traffic and its regulations are so complex that it is very demanding to get self-driving vehicles to act legally and ethically correctly. The complexity of the traffic thus makes it challenging for self-driving technology to be integrated into a company and especially to be financially profitable for LSPs.

Furthermore, one sees that there are barriers that deal with the software for self-driving devices and its ability to learn the complex situation that involves traffic safety.

> *Cyber security is more important than ever, and companies must deal with it. The cost of this security can therefore be challenging and act as a barrier (...) Data relating to privacy must be processed in accordance with the law, but if digitalization is to succeed, data sharing, and data processing are important and those who are able to do so can achieve competitive advantages.* (Expert 1)

> *Information sharing is a dealbreaker.* (LSP 3)

> *Having a fully autonomous vehicle in a Norwegian city compared to the major open roads in, for example, California is not the same (...) It is difficult to make a reality about self-driving vehicles because the requirements are so high for companies to use it. Vision and today's reality are quite far apart.* (Expert 1)

Below, the authors have created a figure that summarizes key findings and these are divided into four, which refer to the interview guide Digital transformation at logistics service providers; Future technology: Automation and autonomous technologies; Innovation management at logistic service providers and Value creation at logistic service providers. This is to give an overview, but does not represent all findings. The findings are from both the various LSPs and the interviews with the two experts.

Figure 3: Key findings from LSPs and experts within the field

5. Analysis and discussion

In relation to our abductive approach, we are aiming to compare the most significant findings towards the theoretical foundation, grounded by the thesis´ literature review. This section will therefore provide the analysis and discussion of the findings, and thereby contribute to answering our research question, *"How does implementation of innovative technologies contribute to value creation for LSPs?"*. Aligned with literature and thus the theoretical framework, we have chosen to divide this section into four different segments, as there exists different forms of value creation for LSPs. This part of the thesis will discuss value creation in the case of efficiency (1), quality (2) and sustainability (3). Furthermore, as a fourth dimension, the barriers (4) will be analyzed in relation to answer the sub question of the thesis, "*What are the barriers of implementing innovative technologies in the LSP sector?*". In this final part, the PESTEL-framework has been applied to categorize and organize the different barriers identified in the data collection.

Figure 4 below illustrates the three identified forms of value creation. The figure is intended to create an overview of the divided value creations and further refers to how the value is actually created. These findings all lead to an ability to generate profit for the LSPs through their properties.

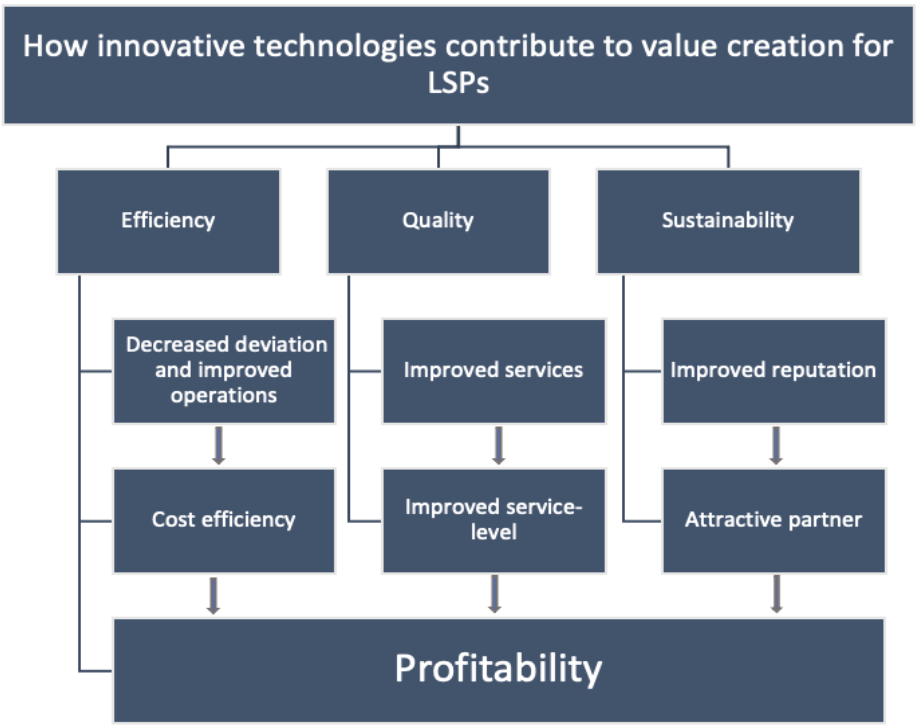

Figure 4: Illustration of the three identified forms of value creation

5.1 How innovative technologies contribute to value creation for LSPs

5.1.1 Efficiency

The findings reveal that implementation of innovative technologies has a promised potential to increase operational efficiency for the LSPs. It is stated in the literature that improved value propositions for LSPs is achieved through increased operational efficiency (Riedl et al., 2018). Robots and autostore are for instance in the findings highlighted as technologies of utmost importance to streamline internal processes within the LSPs. Moreover, this is in accordance with previous studies, where automated storages for instance already has been used by 3PL providers to reduce cost and increase internal and external efficiency on activities (Hoffmann & Osterwalder, 2017). By that, the findings reveal that increased profitability, cost reduction and decreased deviation can be achieved through the implementation of innovative technologies.

Autonomous technologies and systems are regarded as a dealbreaker for LSPs to be attentive to for keeping up with the ever-increasing competition, where efficient operations can be achieved. Apart from one LSP, the other actors acknowledge that automation and autonomous technologies creates foundations of increased internal and external efficiency within the firm. It is proven that large investments of automation, e.g., robots, will decrease deviations and hence provide more efficient processes. The speed of those processes will increase and facilitate more accurate operations within the firms.

The authors and the interviewees believe that automation will play a decisive role in the future of the LSP sector, with these benefits that come along with such technologies. On a smaller scale, renewing internal systems, i.e. software systems, is also considered as an activity that streamline operations. Relying on AI and automatic systems eliminates partly the risk of human errors, which facilitates decreased deviation for several functions. On one hand, the risk of technical issues and computer error increases. Nonetheless, the trade-off of gathering more accurate operations and processes will probably outweigh this concern, in regards to increased efficiency for LSPs.

An acknowledged concern is related to the maturity of the technology, which raises an issue towards certain technologies. Most of the practitioners believe that investing in an unproven technology is risky, which in turn can prove to affect the profitability of the firms negatively. On the other hand, the biggest and perhaps most effective LSP states that it is dangerous to consider any technology as immature. An argument is therefore that small modifications on an unproven technology can make it useful after all. Thus, competitive advantages can be achieved in the case of increased operational efficiency through an unproven technology, if the technology is being appropriately adapted. This seems to be somewhat overseen by the other LSPs. Grounded in literature, it is proven that LSPs innovation management often has been considered as rather reactive (e.g., Oke 2008, Busse & Wallenburg, 2011), which this might also reveal. To overcome this barrier, the LSPs unanimously agree that developing a business-culture that dares to change is partly a solution to such concerns.

However, it must be emphasized that organizational size matters, and the findings confirm that smaller LSPs often do not have the resources, nor the ability, to make such investments. In the light of LSP 5 for instance, they have the capability to possess an entire team which constantly are studying and working with innovations, which is rather distant for smaller actors to realize. Implementation of technologies that not most certainly guarantees increased efficiency and profitability cannot be considered, as the competition constantly is growing. Thus, this emphasizes why efficiency through economic benefits is perhaps the most important form of value creation, when implementing new technologies for the majority of LSPs.

The margins in this market are considered as small, and the findings indicate that most of the small LSPs choose the "safe route" in relation to implementation of new technologies. This might imply, in accordance with the findings, that the already big LSPs will continue to grow and vice versa in the case of the smaller actors. Having the economy and resources to study and implement new technologies, as well as the unproven ones, is undoubtedly a subject which is applicable to consider. Many investments of new technologies are regarded as very expensive, which restricts some LSPs to realize them. When it comes to it, implementation of innovative technologies creates value in the form of increased efficiency. Nevertheless, organizational size is proven to differ between firms in what

investments they are willing and capable to accomplish, and thereby how much value those implementations create for each LSP.

5.1.2 Quality

The findings show that the implementation of innovative technology at LSPs provides better opportunities for companies to create quality through their products or services. Better information flows through the value chain in collaboration with the companies being able to use, for example, automated processes that are streamlined and standardized. In addition, emphasis is placed on the fact that quality through customer satisfaction is largely a part of this.

AI and the ability to collect data through customers and the market provide greater opportunities for customer knowledge and therefore improve their competitiveness. It emerges from the findings that some of the largest players in the industry use the quality of their services as an argument for why the customer should choose them. By ensuring the quality of the services provided, it is meant that one needs to be less competitive on price, because the customer knows that high quality indicates a higher price.

These findings are in many ways supported by Wang et al. (2004) who says that the total customer value concept is complex, but consists of four main categories: service, quality, lead-time, and cost. Our findings indicate that at least one or more of these categories have been the reason why companies have implemented or have a desire to implement innovative technology.

The authors and interviewees believe that technologies that create value through the quality of products, services and customer satisfaction are something that will be seen to a greater extent in the future. There are several factors that are important to point out. Some of the smaller LSPs point out that they often implement innovative technology because of the larger LSPs being one step ahead. They see this as necessary because the customer requires better and more customized services that can be more easily adapted with, for example, automation in warehousing and delivery. Mentzer et al. (1997), points out that customer service, cost / profit balance, and quality is essential for value creation, which is something the authors agree with based on the findings from the interviewees. Improved services and

service-levels are seen to increase the overall quality of services, which in turn generate value creation through profitability.

5.1.3 Sustainability

The findings that have been made indicate that the implementation of innovative technologies is complex and that the interviewees provide insight into potential environmental challenges. Nonetheless, such investments are seen to have the potential to create value for companies. The findings indicate that many consider the environmental aspect as a positive consequence of the implementation of new technology, where first and foremost it is the economic perspective that is the leading driver. Nevertheless, there are several of the larger LSPs that say that sustainable operations are increasingly important and are therefore an important area for them.

It is difficult to determine whether the real driver is a desire for a good reputation, demands from the authorities or a genuine desire to be sustainable. Nevertheless, the findings show that the implementation of technologies that create a positive carbon footprint creates value through being a leader in the field, marketing to customers who increasingly demand more sustainable solutions and not least more efficient systems that save both the environment and costs. This is something that goes hand in hand with Fearne et al., (2012) which incorporates shared value and looks beyond the chain's internal stakeholders, with collaboration to sustainable competitive advantage and value creation for the company.

As mentioned, some of the LSPs point out that there are environmental aspects that are demanding, such as handling waste and used batteries for zero-emission vessels. This again refers to the maturity of the technology where the experts who were interviewed say that there are challenges for companies that try to implement technologies that in many ways are not mature enough. Anyway, even though these are challenges, the various LSPs point out that they are working on solutions to such problems and in their case, the benefit outweighs the cost. In addition, several of the interviewees say that the social aspect of technological development is important in companies. One of them says that innovation creates innovation, i.e. that you then attract competence through partners or new employees. This is supported by one of the experts who was interviewed who says that you create a

workplace that attracts young and talented people who can create a competitive advantage in themselves.

It is recognized that certain projects require some form of electric machines or vehicles when entering a collarboationship. Ever stricter requirements are set for sustainable operations, and it would be reasonable to believe that this will only become more relevant. The findings show that by developing greener practices, LSPs can improve themselves reputationally and hence become an attractive partner to other clients. Furthermore, this could accelerate the profitability of firms, by becoming suited for entering into a collaboration with more potential partners within the industry.

The authors' view is that in any case it will be the economic perspectives that determine the outcome of a possible implementation of innovative technology. By that it is meant that even if the intention is that the operation will contribute to sustainability, there must in any case be financial gain regardless of the size of the company.

5.2 Trade-offs (Compromise)

Findings that have been made indicate that there is great variation between the various LSPs when it comes to the possibility of implementing innovative technology. The authors are of the opinion that the larger LSPs in the industry have a greater opportunity to spend time and resources on being proactive in their search for innovative technologies that can create value for them. There is no doubt that innovative technology can create value for companies through efficiency, quality and sustainability, yet it is the case that some have the opportunity to realize this, while others do not.

The maturity of the technology will play a role in how the LSPs assess the technology's potential for value creation. The findings clearly indicate that if the technology is mature and tested for similar companies, then the barrier is smaller. Nevertheless, we see that those companies that actually have a greater focus on innovation can create greater value for the company earlier through technology that is not as mature. For some of the LSPs, the barriers are probably too great to be as

proactive, but for those who actually consider the trade-off to be favorable, it provides expertise earlier than with the competitors.

Our findings indicate that the industry is constantly evolving and our interviewees, in accordance with the experts, believe that the competition has become tougher. Greater demands from customers and authorities ensure that the LSPs must constantly assess their competitiveness and therefore also consider the implementation of various technologies. Although all of the LSPs in this thesis say that they want to be proactive, it appears that only the largest companies actually are. For everyone - but especially the smaller ones, it is the daily operation that is most important. This is why trade-offs are considered where one sees that the desire to be proactive in innovative technological solutions can not surpass daily operations and financial profits.

5.3 Barriers

In the light of the thesis´ sub-question, the barriers for implementing innovative technologies in the LSP sector are investigated and identified through the interviews. The combination of actors, i.e. LSPs and experts, provided a broad view of how barriers appear for these investments. A PESTEL-framework was applied, as it was considered as the most desirable tool for categorizing and structuring the revealed barriers. This section will discuss the most significant barriers that are identified, and a complete overview is presented in the table below.

Components	Identified barriers
Political	▪ Mismatch between environmental demands from the government and LSPs´ capabilities to meet them. Lack of regulations, considering: ▪ Restricted availability of electric vehicles ▪ Significant high prices of electric vehicles ▪ Regulations aim basically towards reducing the number of vehicles in the traffic
Economical	▪ The investment cost is high ▪ Expensive implementation process ▪ The competitive market creates small margins in the industry and decrease the willingness to make such investments ▪ Unproven technologies creates uncertainty in the case of ROI ▪ Maintenance of new machines is costly
Social-cultural	▪ Lack of organizational competence to work with complex systems and machines ▪ Customers become more demanding, which create challenges to keep up with their requirements ▪ Employees distress changes ▪ Being prepared and acceptant for routine-changes is not incorporated in the business culture
Technological	▪ Many technologies are considered as immature ▪ Lack of compatibility between systems in the SC – difficult to interact ▪ Restricted availability and high prices on electric vehicles
Environmental	▪ High levels of energy consumption of producing and using technologies ▪ Frequently new technologies to adapt generates more waste ▪ Shortages in global resources can be a reality
Legal	▪ Laws concerning higher levels of information sharing increase privacy concerns – cyber attacks ▪ Traffic complexity makes it challenging to use autonomous technologies, e.g., self-driving vessels ▪ Software for self-driving devices struggles to learn complex situations, as traffic safety

Table 2: Summary of identified barriers in the PESTEL framework

Although the PESTEL framework was considered as the most applicable tool for this section, overlapping barriers were not to be avoided. Perhaps the most important barrier to highlight is the high price and high investment cost, which is encompassed in three of the components in the PESTEL. The findings show that the LSPs desire to implement technologies for further organizational development, which is considered as critical to maintain a competitive position in the industry. Governmental demands of greener operations puts pressure on the firms to reduce environmental footprints and hence accomplish sustainable implementations. It is clearly not the motivation that averts LSPs to make necessary investments, but rather the prices for complex and advanced technologies.

The size ratio is clearly considerable and the smaller LSPs are the firms who have the lowest willingness to invest in new technologies, as their economical capabilities are restricted. It is reasonable to anticipate that political regulations should to a greater extent benefit smaller LSPs to make green investments, so that external environmental objectives can be achieved. As it stands, this seems to represent a barrier which prevents LSPs from implementing such technologies and thus their ability to create value for stakeholders. On the contrary, new technologies are costly to create and produce, which also represents the pricing of them.

Although several new technologies facilitate greener operations, such implementations also affect the environmental component in PESTEL. As the findings reveal, producing and using advanced technologies requires significant levels of energy consumption. According to the findings, this effect is often overlooked, but represents a barrier for implementing new and innovative technologies. Furthermore, to adapt and implement new technologies more regularly than before implies that the lifetime of systems and machines are being reduced. Replacing old technology on a higher frequency generates more waste and has therefore an environmental implication. Nevertheless, new technologies are always being developed. It is reasonable to believe that future technologies will be modified and improved, where the technology itself can facilitate a greener practice. The findings support this as well, where for instance new technology is predicted to utilize batteries´ lifetime to a greater extent than previously.

An essential barrier which touches upon the technological aspect is the matureness of new technologies. The findings shows that LSPs´ willingness to implement new technology decreases due to the concern of it being immature for the time. Once again the organizational size ratio is highlighted, and it is considered as risky for smaller actors to make such implementations. The consequences are regarded as critical if the technology fails for its original purpose, especially for small LSPs. If a heavy investment does not generate profitability in a certain time, the economic situation of small actors will be highly pressured.

On the other hand, the findings also reveal that an interviewee finds it "dangerous" to consider a technology as immature. New technology is considered as "always reasonable" and small modifications can prove the technology to be more than useful and gathering a competitive advantage to the ones who dare to adapt it. Organizational size is considerable, as not every LSPs have the resources to study each technology and its potential in depth. Nonetheless, this is an opportunity of organizational development one can miss out for.

Laws in terms of increased levels of information sharing between entities pose an additional barrier for implementing innovative technologies. The expert-interviews revealed that cyber-attacks are of highest consideration, as several new technologies connect different entities and devices together. The collaboration within the supply chain is higher than ever, which implies that important information is going astray, which marks the supply chain sector as a target for cybercriminals (O´Donell-Welch, 2021). The demand for information sharing increases and the need for using resources to handle data in accordance with laws are required. This poses a risk associated with usage of new technology and is an acknowledged barrier from the experts standpoint. Based on the findings, it is not recognized as a threat to the same extent by the LSPs, and needs therefore arguably further attention.

6. Conclusion

This research objective was to investigate how implementation of innovative technologies does contribute to value creation for LSPs. Hence, the research question of our study is formulated as: *"How does implementation of innovative technologies contribute to value creation for LSPs?"*. Based on previous research, the barriers of such implementations are considered as an important dimension, which raised the following sub-question: *"What are the barriers of implementing innovative technologies in the LSP-sector?"*.

The research found that implementation of innovative technologies creates value in the form of streamlining internal operations and hence increasing the overall efficiency of the firms, emphasized on internal processes. Replacing existing technology with new technology speeds up operations, decreases deviation made from human errors, and thereby increases efficiency in terms of cost reduction. Autonomous systems and machines is highlighted as the most essential technologies to be attentive to, and is considered as the technology which will form the future for the logistics service industry. Such systems are however under continuous development, which poses the need for LSPs to be agile and proactive in their business-culture to respond to frequent changes. The industry is as many others strongly affected by the industry 4.0, where keeping up with the digital transformation is considered as key for value creation. Adaptation of innovative technologies is highlighted to be of greatest relevance to enhance efficiency, where our findings reveal that the LSPs are positive to making such investments.

The second form of value creation in regards to implementing new technologies is identified as improved quality. Customers become more demanding, and to fulfill their needs and requirements is considered as a dealbreaker to survive in a highly competitive market. Adapting new technologies is seen to improve existing services and processes, hence increasing the overall quality of a LSP. Furthermore, it facilitates greater levels of information sharing within the supply chain, but especially for customer interaction. Investing in new technologies can increase LSPs´ ability to collect data through customers and gain knowledge, which in turn can stimulate improved levels of customer services. As the competitiveness constantly intensifies, creating value in the form of quality is highlighted as a case for why customers are choosing specific LSPs. This is revealed as an important

argument to implement new technologies, as the overall quality within the firm is being improved. Hence, greater profitability can be achieved, which is considered as vital for investing in innovative technologies.

The third and final form of value creation that this study reveals concerns the sustainable aspect of implementing innovative technologies. The demand for green operations are being intensified from both the government and customers, which pose the need for sustainable solutions. Reducing LSPs environmental footprints can be realized through investments in new technologies, and facilitated by making existing operations even more sustainable. By operating in a sustainable manner, reputational rewards can be achieved and thus make LSPs an attractive partner to customers. Nonetheless, the findings uncover that the sustainable and economic aspects are highly corresponding with each other. Most of the LSPs must see an economical reward in the case of implementing technologies that in turn encourages environmental operations, which could pose a challenge for creating sustainable value. Nevertheless, investing in innovative technologies is percepted of greatest importance to achieve both internal and external environmental objectives, as firms today are pressured to pursue sustainable solutions.

The study has found that implementation of innovative technologies contributes to value creation in the LSP sector for three main fields, namely increased efficiency, improved quality and sustainable operations. There is however little or no doubt that such investments are driven by an economic incentive, which is recognized by the competitive market. The practical and theoretical implications will be addressed in the next sections to gather a broader perspective of the conclusion of our research question. The barriers regarding the thesis´ sub-question will also be elaborated throughout the implications.

6.1 Practical implications

The authors of this thesis believe that the findings will have implications for practice in the field of business and management. The findings that have been made through the interview objects in accordance with the two experts interviewed, clearly show that the implementation of innovative technologies creates value for the LSPs. The findings show that by increasing the efficiency, improving the quality of services and products and reducing the environmental footprint has a clear impact on LSP's value creation.

In addition, extensive work has been done by identifying, discussing and categorizing barriers for implementing innovative technologies for LSPs. The authors believe that the barriers for the LSPs vary and are therefore difficult to generalize. Nevertheless, it can be seen by the findings that size is of importance. The size of the company creates ability and capability and can have a positive effect on their chances of implementing innovative technology that can contribute to value creation. It is also emphasized from both the LSPs and the experts who have been interviewed that the maturity of the technology is of importance for the practice of such an implementation.

The aim of this thesis has been to create an overview of the opportunities and barriers that exist for the LSPs and therefore help to shed light on the topic so that the research can help to create understanding for the logistic service providers, as well as other stakeholders. The feedback from all of the interviewees has been positive and the interest in the topic has been great. The two experts interviewed working for one of Europe's largest independent research institutes have also emphasized the relevance of the thesis and the research question.

> *The research question is highly interesting and relevant at the moment. Today, there are many challenges in this area for logistics service providers. The barriers are many and we therefore need more research on how this can be solved. It is not necessarily the case that being first is the best in this context, one needs knowledge of the consequences of such implementation.* (Expert 1)

6.2 Theoretical implications

We believe that our research provides a distinctive angle on how implementation of innovative technologies can contribute to value creation in the LSP-sector. From the previous literature we have gone through, the term "value creation" has been considered as rather wide and undefined. The difference from previous work and our study is firstly that this research specifies value creation in the light of the LSP-industry, and reveals what value creation represents in the sector. Our findings showed that increased efficiency, improved overall quality of operations and environmental solutions can be reached through implementation of new technologies. Profitability is however the dealbreaker for implementing any kind of innovations, and is considered as the leading motivation for adapting new technologies.

There exists a lack of research on the relationship between innovative technologies and value creation for LSPs, which is demonstrated throughout our literature review. Several previous studies tend to primarily concentrate on how LSPs not keep up with the digital transformation, and thus illustrate their struggles with implementing innovative technologies. This research shows that there exist numerous barriers, where the economical, social-cultural and technological dimensions arguably are the most important ones which might hinder implementation of innovative technologies. Although the barriers stand for a certain and important part of this research, our main objective is to reveal which potential such technologies can create value for LSPs. How LSPs can overcome these barriers were rather unclear, which was of our interest to further investigate. When it comes to it, implementation of innovative technologies will create value for these firms in several ways, but as addressed in these implications, some barriers restrict certain LSPs to do so.

An additional dimension to highlight is that including experts for innovative technologies offers a supplementary aspect for the research. This differs our thesis from other studies in the field, and provides an interesting angle to better answer our research question. It is acknowledged that there exists both similarities and dissimilarities in how the experts and LSP reflect upon the potentials and barriers of such implementations. The combination of the two groups offered a broader view of our study, and strengthened our ability and conviction to make a well-defined

conclusion. Lastly, we have not found any similar previous research in a Norwegian context. We do believe that addressing this topic specifically for Norwegian LSPs can encourage future research to continue investigating this environment, with other, relevant aspects to be explored.

7. Limitations

The study that has been completed has potential limitations that are worth mentioning to make readers aware of these, as well as be useful for any future research. First, it is worth mentioning that the lack of previous research in the field of how innovative technology creates value for LSPs is challenging. There is little or no research in this field in Norway, but it is still seen that research on the impact of technology on the industry is developing. It must be emphasized that this is perceived as expected and that innovative technology in an ever-evolving industry is a continuous development. Therefore, it is difficult to refer to research that is relevant to current technology.

Nevertheless, the authors found the current research to be sufficient to provide a good enough theoretical and research-based insight. Furthermore, it should appear that all the interviews were conducted in Norwegian. It is acknowledged that there may be a certain translation risk and that it is difficult to translate phrases or the like that give a different perception of the interviewee's real expression. In any case, the authors believe that interviews in the mother tongue have provided better data as the interviewees can to a greater extent express themselves without language barriers.

Another limitation is the lack of opportunity to quantify the economic perspective. Some of the LSPs interviewed are part of projects that are not in themselves financially sustainable. This is also reflected in the inability to determine actual costs. As the study is qualitative, it means that the data is mainly obtained by actors within the industry. It will therefore be probable that some of the responses obtained are influenced by personal experience and opinions and therefore not something that necessarily reflects all the LSPs in the industry. The obtaining of data from two experts in the field, it is in the belief that it will contribute to an understanding of the actual circumstances and to that extent avoid bias from the various interviewees. By interviewing a sample of LSPs in the industry, it is possible that one has missed out on findings, but by interviewing a representative sample of LSPs in the form of size, location and scope, it is believed that the findings are representative of the industry.

Furthermore, it should be emphasized that the research is done on the basis of limited time and resources. The time frame makes it necessary to limit parts of the thesis and does so in such a way that the deadline for submission is given greater priority. In addition, the authors have limited resources and all of the work is done without any kind of resources from both the authors, but also interview subjects. However, the research is of such a scope that it is fully possible to complete within the time frame given the above limitations.

8. Future research

Substantiated in this research and its limitations, we would recommend future researchers to conduct studies on implementing innovative technologies in other extents of the logistics industry. As autonomous technologies in particular are predicted to play a key role in the future for the logistics industry, implementation of these is especially recommended to investigate further. For instance, a quantitative study of cost/benefits for such implementations will add an interesting perspective of how valuable these technologies actually can be. Additionally, we believe that there exists an interesting relationship between adaptation of these technologies and the triple bottom line, which can be an additional dimension to consider. This might reveal important repercussions that such technologies create in three highly relevant areas, for any businesses. Exploring the value creation such technologies can provide in other industries could also be of interest for future studies to explore.

Our findings have also revealed that organizational competence is key for adapting new technologies in an effective manner and that some LSPs currently are struggling with this. It could therefore be of interest to investigate this setting further. Regarding such studies, we would recommend to include a sufficient number of actors to provide a representative sample and hence a conclusion of value from this viewpoint. To reveal why some LSPs are struggling with this, and some not, will be valuable findings considering the LSP industry and implementation of new technology.

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Appendices

Appendix 1

The interview guide towards practitioners/LSPs in Norway

Generelle spørsmål til alle involverte aktører

1. Samtykke til å ta lydopptak av intervjuet (JA/NEI)
2. Hva er din rolle hos «Navn på bedrift»?
3. Hvilke tanker har du om vårt forskningsprosjekt og dens relevans til deres virkeområder?

1. Digital transformasjon hos leverandører av logistikktjenester

Innledende informasjon

Logistikktjenester blir stadig påvirket av nye teknologier og har endret konkurranse dynamikken i markedet. Forsking viser at leverandører av logistikktjenester historisk sett har, til en viss grad, blitt ansett som reaktive for implementering av nyskapende teknologier.

a) Hvordan stiller du deg til denne påstanden?
b) Hva mener du må være på plass av infrastruktur for en vellykket overgang til digital transformasjon hos «Navn på bedrift»?
c) Ser du noen umiddelbare utfordringer/barrierer for å sikre en smidig implementeringsprosess?

2. Fremtidsrettet teknologi: Automasjon og autonome teknologier

Innledende informasjon

Forskning understreker at autonome teknologier allerede er blitt tatt i bruk av logistikkleverandører for å redusere kostnader, og følgelig effektivisere interne og eksterne aktiviteter hos bedriften. Autonome teknologier blir derfor sett på som et viktig fokusområde for å øke konkurransedyktigheten hos logistikkleverandører.

a) Hvordan stiller du deg til denne påstanden?

b) Har dere implementert eller har tanker om å implementere liknende teknologi?

   i. Hvis ikke - hvorfor?

c) Anser du slik teknologi som verdifullt for «Navn på bedrift»? Eventuelt hvilken verdi mener dere at dette tilfører/kan tilføre?
d) Hva mener du må være på plass av infrastruktur for en vellykket overgang?
e) Ser du noen umiddelbare utfordringer/barrierer for å sikre en vellykket implementeringsprosess?

3. Innovasjonsledelse hos leverandører av logistikktjenester

Innledende informasjon

Digitalisering er blitt sett på som den viktigste driveren for innovasjoner i logistikktjeneste-sektoren. For å realisere en suksessfull innovasjon, organisatorisk endringsvillighet og en god ledelse ligge til grunn.

a) Hvordan stiller du deg til denne påstanden?
b) Er innovasjoner innenfor «Navn på bedrift» ansett som et viktig fokusområde?
   i. Hvis ja: hvorfor og hvordan?

   ii. Hvis nei: hvorfor ikke?

c) Har «Navn på bedrift» gjennomført noen innovasjoner de siste fem årene?
   i. Hvis ja: hvilke?

   ii. Hvis nei: hvorfor ikke?

d) Hvordan sørger «Navn på bedrift» for å holde seg oppdatert innen innovative teknologier for å være konkurransedyktige?
e) I hvilken grad er innovasjonsledelse viktig for implementering av nye/innovative teknologier?

f) I hvilken grad jobber "Navn på bedrift» proaktivt for implementering av nye/innovative teknologier?

4. Verdiskaping hos leverandører av logistikktjenester

Innledende informasjon

Forskning viser at leverandører av logistikktjenester historisk sett har slitt med deres innovative kapabiliteter. Av dette, så har deres evne til å skape verdi (operasjonell effektivitet, servicenivå, kompetanseutvikling, etc) i en stadig utviklingsorientert bransje blitt ansett som en utfordring.

a) Hvordan stiller du deg til denne påstanden?
b) Hva mener du at er verdiskaping i «Navn på bedrift»?
c) Finnes det i dag utfordringer hos «Navn på bedrift» innen verdiskaping, som kan løses ved bruk ny teknologi?
    i. Hvis ja: hvordan

d) I hvor stor grad er «Navn på bedrift» villig til å implementere ny teknologi som er verdiskapende på annet vis enn det er økonomisk lønnsomt?
e) I hvilken grad mener du digitalisering og innovasjoner kan skape verdi for "Navn på bedrift»?

Oppsummering

Intervjuet nærmer seg slutten og vi har stilt de spørsmålene vi føler er hensiktsmessig angående vårt forskningsområdet. Føler du at det er noe vi har glemt å nevne eller spørsmål som burde blitt stilt angående barrierer og verdiskaping for forskningsprosjektet? Ønsker du å legge til noe på slutten av intervjuet?

Appendix 2

The interview guide towards experts within digital transformation and innovative technologies in the logistics service industry in Norway

Generelle spørsmål til alle involverte aktører
1. Samtykke til å ta lydopptak av intervjuet (JA/NEI) 2. Hva er din rolle hos "Navn på bedrift"? 3. Hvilke tanker har du om vårt forskningsprosjekt og dens relevans til deres virkeområder?
1. Adaptering av nyskapende teknologi
Innledende informasjon Samfunn og industrier er stadig i en teknologisk og digital utvikling som følge av industri 4.0. I den forstand, å holde tritt med endringer og trender som forekommer er avgjørende for bedrifter i dagens marked, dersom deres konkurransedyktighet skal vedvare. a) Hvilke muligheter oppstår ved bruk av ny teknologi med tanke på konkurransefortrinn? b) Hva anser du som de største utfordringene ved bruk av ny teknologi hos bedrifter i et konkurranseutsatt marked? c) Hva mener du er de viktigste motivasjonene for å ta i bruk ny teknologi hos bedrifter i et konkurranseutsatt marked? d) Hva mener du må ligge til grunn for å suksessfullt håndtere ny teknologi hos bedrifter i et konkurranseutsatt marked?
2. Digital transformasjon hos leverandører av logistikktjenester
Innledende informasjon Logistikktjenester blir stadig påvirket av nye teknologier og har endret konkurranse dynamikken i markedet. Forsking viser at leverandører av logistikktjenester historisk sett har, til en viss grad, blitt ansett som reaktive for implementering av nyskapende teknologier.

a) Ut i fra ditt perspektiv - hvordan stiller du deg til denne påstanden?
b) Hva anser du som de største barrierene for digital transformasjon hos leverandører av logistikktjenester?
c) Ut i fra ditt perspektiv - er digital transformasjon hos leverandører av logistikktjenester i større, mindre, eller lik grad viktig for verdiskaping, sammenlignet med andre bransjer?
d) Hva anser du som de største risikoene knyttet til bruk av ny teknologi hos leverandører av logistikktjenester?

Forskningsprosjektets hensikt/problemstilling

Vårt formål med prosjektet er å studere hvordan implementering av innovative teknologier kan bidra til verdiskaping hos leverandører av logistikktjenester. Vi ønsker derfor avslutningsvis å stille deg et åpent spørsmål knyttet til verdien som skapes ved anvendelse av ny teknologi.

- Hvilken verdi mener du implementering av ny/innovativ teknologi for leverandører av logistikktjenester skaper?

Oppsummering

Intervjuet nærmer seg slutten og vi har stilt de spørsmålene vi føler er hensiktsmessig angående vårt forskningsområdet. Føler du at det er noe vi har glemt å nevne eller spørsmål som burde blitt stilt angående barrierer og verdiskaping for forskningsprosjektet? Ønsker du å legge til noe på slutten av intervjuet?