DIGITALIZATION IN THE CONTEXT OF SUPPLY MANAGEMENT

Evidence from Finnish, French, Italian and German-based (EU) Companies

Lappeenranta–Lahti University of Technology LUT

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ABSTRACT

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The adoption of digitalization has increased over the last 2 decades, and an increasing number of industries automatized their organizational operations through digital tools. Therefore, great technology in the form of digital tools has been adopted by industries to develop transparency and make supply management flow better. However, the adoption does not occur instantly but thus comes up with long planning and many challenges.

The objective of the study was to find out how Digitalization transforms the supply management function concerning supply chain processes and purchasing functions. In addition, the study investigated what benefits Digitalization provides, Digital tools adoption in SM departments and what barriers hinder the adoption of digital tools.

This research was conducted as a qualitative study. Semi-structured interviews were used to gather the primary data for this study from twelve individuals that are working in SM departments, and industries managing their operations in Finland, Germany, Italy, and France. The research data was analysed with the thematic analysis approach.

Empirical findings reflect that the impact of Digitalization on supply management is based on digital transformation, digital procurement, improved customer service, streamlining and interoperability. The result of the study provides practical benefits of transparency and visibility through digitalization and highlights potential challenges and barriers that come in the way to endorse digital technologies. In addition, the study creates the conceptual framework for the digital transformation of SM.
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Alishba Amanat
ABBREVIATIONS

SM- Supply Management
SCM- Supply Chain Management
SCP- Supply Chain Processes
PSM- Purchasing and Supply Management
DT- Digital Technologies
AI- Artificial intelligence
IoT- Internet of things
RPA- Robotic Process Automation
BC- Block-Chain
ERP- Enterprise resource planning
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1 Introduction

Digitalization (Brennen and Kreiss, 2016) has been a significant driver of change in many industries, and the function of supply management is no exception. The integration of technology and digital solutions has revolutionized the way supply chains are managed, enabling organizations to achieve greater efficiency, transparency, and agility (Wu, L., Sun, Chang, Zhang and Qi, 2022). With the increasing demand for digital transformation in supply management, it is becoming increasingly important to understand the impact and benefits of digitalization in this context. The adoption of digital tools and technologies in purchasing and supply chain processes has the potential to greatly improve efficiency, reduce costs, and enhance decision-making, said Farahani, Meier and Wilke, (2017). Despite these benefits, many organizations still struggle to fully integrate digital tools into their operations. Several factors can hinder the successful adoption of digital tools in these processes, including resistance to change, lack of investment, and inadequate skills and training. (Giunipero, Hooker and Denslow, 2012)

1.1 Background of the Topic

The research topic and study are interesting to examine because digitalization is an emerging trend which integrates many technologies to make things flow better in business processes. Digital technologies are big achievements and innovations which capture the entire system and provide technical and operational support, said by (Benitez, Ayala and Frank, 2020; Dalenogare, Benitez, Ayala and Frank, 2018; Frank, Dalenogare and Ayala, 2019). It argues by Cifone, Hoberg, Holweg and Staudacher, (2021) that digitalization can also enhance and enlarge the scope of lean strategy. The common viewpoint is that digitalization will improve operational performance and ultimately organizational performance will improve (Koh, Orzes and Jia, 2019).

The more the businesses are growing the tighter the competition is happening, and with that organizations must maintain their competitive advantage to be sustainable in the market (Narasimhan and Narayanan, 2013). It is of utmost importance to explore and adopt new
emerging technologies to create innovative business models that can be utilized by companies (Agrawal and Narain, 2018). Additionally, digitalization has the potential to improve supply chain performance, reduce costs, increase efficiency, and enhance customer satisfaction. As such, understanding the impact of digital technologies on supply management can help firms to improve their overall supply chain performance.

1.2 The objective of the study, research questions, and methodology

This thesis contributes to the research gap identified by Agrawal and Narain, (2018) who suggested that there is an opportunity to explore and adopt digital technologies to innovate business models. The objective of this study is to identify the role of digitalization in supply management and provide insights into the current state of digitalization in SM. The study will cover the topic from the viewpoint of the SM department and organization concerning supply chain and purchasing processes.

Henao-Hernández, Muñoz-Villamizar and Solano-Charris, (2021) note that there is a growing amount of research on supply chain management's digitalization, the authors contend that further empirical studies that look at the effects of digital technologies on supply chain performance are still necessary. For these reasons, this research topic is relevant and worth investigating from a theoretical standpoint. Thus, the study in this thesis brings empirical evidence from the supply management context and combines the transformation and benefits of digitalization on SM.

Garay-Rondero et al., (2020) uncovered the following gaps: a lack of models that address SC problems in a new technological environment; and numerous obstacles to the implementation of Industry 4.0 concepts and features in SCM from both a technological and a managerial perspective. From the conceptual point of view, the result of this study provides the future direction of the new conceptual model for the interconnectivity view with the Digital supply chain.
According to Seyedghorban et al. (2020), an integrated and boundaryless PSM function is an essential future research stream because a greater level of digitalization maturity is based on digitally integrated systems. Future studies should investigate how these small businesses are transforming digitally, particularly in terms of PSM processes and other industries. Additionally, more thorough research is needed and debates that focus on technology and applications are crucial for digital transformation (Karttunen, Lintukangas and Hallikas, 2023).

The idea of this study is to fill gaps in the existing supply chain theory and explore the areas that are likely to be impacted by the combination of knowledge, traditional and emerging technologies so that SCM 4.0 will over time manifest substantially differently from conventional SCM (Hofmann et al., 2019). Furthermore, Hennelly, Srai, Graham, and Fosso Wamba (2020) present the research gap to focus on the application of Supply Chain 4.0. Businesses have a significant opportunity to alter their supply chain operations and gain a competitive advantage with supply chain 4.0.

To achieve the objective of the study, one main research question and three sub-questions are set. The sub-questions are defined to support finding the answer to the main research question.

The main research question is:

\[ RQ: \text{How digitalization transforms supply management?} \]

The first sub-question constitutes the transformation of supply management through digital tools, and supports the main RQ:

\[ SQ1: \text{What are the digital tools transforming supply management?} \]
The second sub-question relates to the benefits of digitalization in the supply Management context:

**SQ2: What are the benefits of digitalization?**

The third sub-question relates to the barriers that led to the adoption of digital tools in the supply Management context:

**SQ3: What might hinder the adoption of digital tools in Supply management?**

1.3 Conceptual Framework and the scope of the study

The conceptual framework of this research is illustrated in Figure 1. The sub-questions cover the topics of digitalization benefits, barriers, and transformation of SM through digital tools. Both topics and sub-questions connect to the main research question. As well, digitalization adoption is a closely linked topic to this study, and it relates to supply management evolution. Figure 1. Depicts the relationship between digitalization and supply management with that shows the connection of all together research questions. This framework illustrates the impact of digitalization concerning the adoption, benefits, and barriers of digital tools in SM.
This study has some delimitations. The study covers the topic of supply management in the context of digitalization from the optimisation of the supply chain and purchasing processes by implementing digital tools. In addition, the thesis topic is covered only from the viewpoint of individuals working in the case companies and therefore excludes the views of buyer-supplier relationships and any two-way relationship so that the study does not become too extensive.

Furthermore, this qualitative data analysis thesis is delimited to the context of European companies (Finnish, French, German and Italian) and their supply management practices. The study aims to explore the barriers and benefits of digitalization in supply management, focusing specifically on companies that have experience with digital tools in their operations. The research will not cover the implementation of digital tools in other areas of business operations beyond supply management. Additionally, the study is delimited to a sample of supply management professionals from various European companies who have experience with digital tools in their operations, and the findings cannot be generalized to other contexts.
or populations. The research will also be delimited by the availability and willingness of potential participants to take part in the study, which may affect the diversity and representativeness of the sample.

1.4 Definitions of the key concepts

The below-mentioned definitions explain the different terminologies that describe the concept of phenomena used in this thesis:

**Digitalization**

“Digitalization is the use of digital technologies to change a business model and provide new revenue and value-producing opportunities; it is the process of moving to a digital business.” (gartner.com/it-glossary in August 2015).

- **AI**

AI stands for Artificial intelligence, also referred to as machine intelligence, and is the replication of human intelligence in devices that are programmed to carry out operations that traditionally demand human intelligence. AI is the process of creating computer systems that can perform functions like speech recognition, decision-making, problem-solving, and learning. (Akerkar, 2019)

- **ERP**

Enterprise resource planning is known as ERP. It is a software platform that unifies multiple company operations and activities. Modules for areas like finance, human resources, supply chain management, inventory management, and more are frequently included in ERP systems. An ERP system's goals include streamlining and automating business processes, increasing productivity, enhancing data visibility and collaboration, and offering a
comprehensive picture of an organization's assets and procedures. (Matende and Ogao, 2013)

- **IoT**

IoT stands for Internet of Things, and it gathers and exchanges data over the internet, a network of physical objects, including machines, automobiles, appliances, and other items, must be equipped with sensors, software, and connection (Korte, Tiberius and Brem, 2021). IoT gadgets can include everything from straightforward everyday items like thermostats and wearable technology to more intricate systems like smart cities and industrial machines (de Vass, Shee and Miah, 2021).

- **Robotic process automation**

Robotic process automation is known as RPA. It is a technique that uses computer programs known as "bots" to automate routine, rule-based actions in corporate processes. RPA bots execute activities including data entry, data extraction, form filling, and report preparation by imitating human interactions with software programs (Rozario and Vasarhelyi, 2018). RPA bots can be built to adhere to present rules and workflows and can communicate with a variety of systems and applications to carry out tasks efficiently and accurate.

- **Block-Chain**

Blockchain is a distributed and decentralized digital ledger technology that enables safe and open transaction record-keeping. It functions by a chain of blocks, each of which contains a list of transactions that are connected utilizing cryptography (Pilkington, 2016). Decentralization, immutability, transparency, and security are some of the main characteristics of blockchain. Decentralization refers to the fact that a network of participants rather than a single body controls the blockchain network (Arun, Cuomo and Gaur, 2019).
Supply Management

The process of controlling and directing the movement of products, services, data, and money from suppliers to clients is known as supply management. It entails overseeing the numerous processes and parties involved in the creation, acquisition, distribution, and storage of goods and services (Giunipero, Hooker and Denslow, 2012). Supply management seeks to minimize costs, maximize inventory levels, and satisfy customer expectations while ensuring the efficient and seamless flow of products or services via the supply chain. It entails tasks including locating and choosing suppliers, settling disputes, controlling inventory levels, arranging for logistics and transportation, and working with partners to complete tasks along the supply chain. (Minna Koivisto-Pitkänen, 2011)

- **Purchasing**

A crucial component of supply chain management is purchasing, which is getting products or services from outside vendors to satisfy an organization's demands. It involves tasks including finding and choosing suppliers, negotiating contracts, placing orders, monitoring supplier relationships, and making sure that goods or services are delivered on time. (Baily, Farmer and Jessop, 2005)

- **Purchasing and Supply management**

An organization's sourcing, procurement, and supply chain activities should be strategically managed, according to the field of purchasing and supply management (PSM). Coordination of purchasing, supplier selection and management, negotiation, contract administration, and overall supply chain optimization are all part of this process. (Bals, Schulze, Kelly and Stek, 2019)
1.5 Structure of the thesis

This thesis consists of six chapters. The thesis begins with an introductory chapter that establishes the background and research issue, presents the study's aim and research questions, demonstrates the conceptual framework of the study, and specifies the main concepts of the study. The study's theoretical underpinnings are covered in the second chapter, which discusses the introduction to digitalization, digital tools, and the impact of digitalization on supply management concerning purchasing and supply management. The third chapter introduces the study’s validity and reliability and describes the research methodology, data gathering, and analysis techniques. The fourth chapter of the paper presents the empirical findings. The results are then combined and analysed in the discussion chapter considering the research questions. Finally, the conclusion chapter summarizes the main findings of the study, introduces theoretical and managerial contributions, provides the limitations of the study, and gives suggestions for future research.
2 Theoretical Background

This chapter introduces the theoretical background of the study. The chapter begins with an introduction to the SM and digitalization overview. The second sub-chapter discusses the topic of Digitalization and introduction to different digital tools. The following chapters cover the definition of Digital tools and continue by discussing the adoption of digital tools in SM. Next, the chapter covers the topic of the Effectiveness of digitalization in SM. Finally, Barriers to adopting digital tools are presented.

2.1 Supply management transformation through Digitalization

Digitalization has transformed the way supply management used to be. The below-mentioned literature presents the major transformations due to digitalization. According to Brennen and Kreiss (2016), digitalization is the use of digital technologies to automate and enhance corporate processes. This can involve using software to automate processes, analyzing data, making smarter decisions, and interacting with clients and suppliers through digital channels. Amentae & Gebresenbet (2021) stated that digitalization can aid in streamlining and optimizing procurement, inventory management, logistics, and other operations in a supply chain environment (Brinker & Haasis 2022). Additionally, it can aid in enhancing visibility and teamwork throughout the supply network (Sinha, Bernardes, Calderon, and Wuest 2021).

According to Bals, Schulze, Kelly and Stek, (2019), there are ten future and current process competencies of PSM which may be the advancement of digitalization. Table 1. Presents the 10 competencies and the colour difference presents the similarities in prospects and current prospects. The green shade presents the change in the current and future aspects due to the adoption of digitalization in PSM, for instance, the grey colour highlights the no change in the competencies due to the adoption of digitalization:
According to Remondino and Zanin (2022), several elements affect the adoption and use of digital solutions in these fields. These include the accessibility and availability of digital technologies (Holmström et al., 2019), the readiness and competency of the organization (Zekhnini et al., 2021), and the level of support from upper management. The digitalization of operations and supply chain management also has several advantages, such as higher efficiency (Danielsen, 2021), better agility, and improved visibility into supply chain activities (Milakovich, 2012; Srai, Lorentz, 2019). For instance, there are other obstacles to adoption, such as a lack of familiarity with digital technology, aversion to change, and a lack of leadership backing (Zhen, Yousaf, Radulescu, and Yasir, 2021). A comprehensive and holistic approach is required for the successful application of digital tools in operations and supply chain management, as stated by Thomas and Palmer (2014). Power (2005) examined how digital tools and procedures are altering the PSM network and procedures and team communication.

According to research by Kohli and Melville (2019), process safety hazards can be detected and forecasted in real time using sophisticated sensors, data analytics, and automation.

Table 1. Current and future aspects due to the adoption of digitalization in PSM

<table>
<thead>
<tr>
<th>Current Competencies</th>
<th>Future Competencies</th>
</tr>
</thead>
<tbody>
<tr>
<td>Analytical skills</td>
<td>Analytical skills</td>
</tr>
<tr>
<td>Basic knowledge of PSM processes</td>
<td>Automation in processes</td>
</tr>
<tr>
<td>Communication skills</td>
<td>Big data analytics</td>
</tr>
<tr>
<td>Cross-functional knowledge and abilities</td>
<td>Basic computer literacy</td>
</tr>
<tr>
<td>Relational interaction</td>
<td>e-Procurement technology</td>
</tr>
<tr>
<td>Negotiation</td>
<td>Holistic SC thinking</td>
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<tr>
<td>Stakeholder relationship management</td>
<td>Process optimization</td>
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<tr>
<td>Strategic sourcing</td>
<td>Strategic sourcing</td>
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<td>Strategic thinking</td>
<td>Strategic thinking</td>
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<tr>
<td>Sustainability</td>
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technologies. Digital twin models can also be used for the simulation and evaluation of process safety scenarios. According to Khan, Dahl, Falkman, and Fabian (2018), Industry 4.0 and digitalization can enhance teamwork and communication while facilitating more effective incident management and response. While Lee, Cameron, and Hassall (2019) emphasize that major investment pressure is a challenge in technology and human resources, as well as adjustments to organizational culture and governance, are needed to apply digitalization and Industry 4.0 in the process of supply management. Moktadir, Ali, Kusi-Sarpong and Shaikh, (2018) also suggest that different digitalization and Industry 4.0 technologies' lack of standardization and compatibility may make it difficult for those technologies to be adopted and integrated.

The below-mentioned literature will present the concept of SM and subtopics that comes under SM that are transformed with the adoption of digitalization:

2.2 Overview of Supply Management

According to Power (2005), supply management is a vital task that is essential to the success of businesses in a variety of sectors. Planning, sourcing, contracting, and delivery are just a few of the processes that are managed and coordinated during the purchasing of products and services. Supply management seeks to guarantee that an organization has access to the appropriate products and services in the appropriate quantities, at the appropriate times and locations, and at the appropriate price. (Prajogo, Oke and Olhager, 2016)

In today's ever-evolving business world, effective supply management is crucial for firms to fulfil their goals and maintain competitiveness (Srai & Gregory 2008). Smeltzer and Siferd, (1998) argue that it necessitates a thorough comprehension of the organization's supply chain, encompassing suppliers, clients, and internal procedures, as well as the capacity to successfully handle supplier relationships, negotiate deals, and keep track of supplier performance.
A vital component of any business is supplying management, which entails the coordination and integration of tasks related to the acquisition of raw materials, the manufacture of commodities, and the delivery of goods to clients (Wu, H., Cao, Yang, Tung, Jiang, Tang, Liu, Wang, and Deng 2019). According to Prago, Oke, and Olhager (2016) and Hennelly, Srai, Graham, and Fosso Wamba (2020), supply management aims to achieve the most effective and economical flow of products, services, and information from suppliers to customers. Increased competitiveness, higher customer satisfaction, and cost savings are all possible outcomes of effective supply management. Furthermore, recent technological developments have made it possible for supply management techniques, such as the use of big data, to be more successful and efficient. (Agrawal and Narain, 2018).

### 2.2.1 Purchasing

The acquisition of commodities, services, and materials needed for the creation and delivery of goods and services constitutes the core responsibility of purchasing (Giunipero, Hooker, and Denslow 2012). The goal of purchasing is to fulfill the requirements for quality and delivery while obtaining the necessary inputs at the lowest cost possible. The selection of a supplier, the negotiating of terms and conditions, the placement of the order, and order administration are typical steps in the purchasing process. For the business to get the inputs it needs, at the appropriate time and the right price, without sacrificing quality or delivery criteria, effective purchasing processes are crucial, as stated by Czyrka, Fr (2019).

Technology advancements including supplier portals, artificial intelligence, and e-procurement systems are transforming how purchasing is organized and carried out. For instance, e-procurement solutions can simplify the purchase process, shorten lead times, and improve data accuracy. Artificial intelligence algorithms can also assist businesses in making the best possible purchase decisions while lowering expenses and boosting efficiency. (Rozario and Vasarhelyi, 2018).
2.2.2 Supply Chain Processes

According to Prajogo, Oke, and Olhager (2016), supply chain processes are the actions taken during the production, delivery, and distribution of goods and services. The effectiveness and competitiveness of the organization, as well as the pleasure of customers and other stakeholders, are all impacted by these processes, making them an essential part of any business, as mentioned by Croxton, Garcia-Dastugue, Lambert, and Rogers (2001).

The supply chain process normally entails several steps, including the acquisition of raw materials, the creation of products, their distribution and delivery to clients, and post-sales support. Each stage's performance depends on the proper management of risk and uncertainty, as well as the successful coordination and integration of activities across the supply chain (Croxton, Garcia-Dastugue, Lambert, and Rogers 2001). The management and execution of supply chain processes are evolving because of technological advancements including the Internet of Things, blockchain, and artificial intelligence, said Koh, Orzes, and Jia (2019). For instance, firms can increase the accuracy of demand projections, lowering the risk of overstocking or supply shortages, by utilizing sensors and real-time data analysis. Additionally, the adoption of blockchain can improve trust and transparency throughout the supply chain, facilitating better organization-to-organization collaboration (Flechsig, Anslinger and Lasch, 2022).

2.2.3 Purchasing and Supply Management

Purchasing and supply management (Schoenherr et al., 2012), is a critical function in organizations that is responsible for acquiring goods and services from external suppliers. Park, Shin, Chang and Park, (2010) explained the goal of purchasing and supply management is to ensure that the organization has the right goods and services at the right time, at the right price, and from the right source. This involves managing the entire procurement process from identifying the need for goods and services to selecting suppliers, negotiating contracts, and managing the delivery and payment of goods and services.
Creswell and Creswell, (2017) argue that there is a need for a deep understanding of the organization's needs and the external market, as well as strong negotiation and relationship management skills. In recent years, digital technologies have changed the field of purchasing and supply management, bringing new opportunities and challenges for enterprises to improve their procurement processes and acquire a competitive advantage, as mentioned by Farmer, (1981).

Johnson, Leenders and Flynn, (2021) describe the concept of proactive purchasing and supply management and its importance in managing supply chain risk. Proactive PSM is the proactive management of supply chain risks through the implementation of various strategies and tools designed to anticipate and mitigate potential disasters. Furthermore, Smeltzer and Sifert, (1998) argued that supply chain risks, such as natural disasters, supplier bankruptcy, or political instability, have become increasingly important in recent years, and that organizations need to take a proactive approach to manage these risks by digitalizing and securing their system.

2.3 Transforming SM through the digital technology

According to Brennen and Kreiss, (2016), digitalization refers to the process of converting analogue information into a digital format. This process enables the storage, processing, and distribution of information through digital technology. The term is often used to describe the widespread adoption of digital technologies in various industries, including the media, entertainment, healthcare, and financial services (Sestino, Prete, Piper and Guido, 2020).

The history of digitalization stated by Danielsen, (2021) can be traced back to the invention of the computer, which marked the beginning of the digital age. The first digital computers were developed in the late 1940s and 1950s, and since then, digital technologies have rapidly evolved and become more sophisticated. With the advent of the internet, digitalization Greenstein, (2019) has been further accelerated, as it has allowed for the creation of a global network of digital devices and the exchange of information on a massive scale. Figure 2.
adopted from (Binomial Innovates), illustrates the stages of the company that optimize their business solution with the use of digitalization and finally incurred the level of digital transformation.

Figure 2. Illustrates three stages of the transformation level, firstly digitalization can be adopted into the business unit, and it transforms the business unit at the operational level. Further, it enhances the optimization level of the organization and combines different business units and lastly, the company touch its growth level due to a fully adopted digitalized system. The digitalized system helps industries to lead the market with innovative and efficient systems.

The widespread adoption of digitalization across numerous businesses and sectors has been facilitated in recent years by the lightning-fast speed of technological progress. This has caused a change in how people acquire information and use it, as well as how businesses function and interact with their customers. Digitalization has consequently impacted society and the global economy significantly, playing a larger role in our daily lives. (Binomial Innovates)
The term "supply chain digitalization" by Seyedghorban, Tahernejad, Meriton, and Graham (2020) describe the application of digital technology to enhance and alter several supply chain operations, including procurement, logistics, and inventory management. Over the years, streamlining and automating supply chain operations can involve the use of technologies like e-procurement systems (Johnson, P. F. & Klassen 2005), enterprise resource planning (ERP) software (Bendoly & Schoenherr 2005), and the Internet of Things (IoT) (Sestino, Prete, Piper, and Guido 2020).

Figure 3. presents the evolution made by digitalization in supply chain management, the supply chain's digitalization enables businesses to manage evolving customer demands, supply-side difficulties, and unmet efficiency improvement expectations, described by Alicke, Rexhausen and Seyfert, (2017).

Figure 3. Supply chain 4.0 adopted from (Alicke, Rexhausen and Seyfert, 2017)
Alicke, Rexhausen and Seyfert, (2017) present the SC 4.0 shift in the supply chain operations entirely which possess essential benefits for example, the delivery time of high runners is minimized by a few hours because of the new methods of product distribution. These services are based on advanced forecasting methodologies, such as the use of AI (in demand) and external (forecasting market trends, and construction indices) data as well as machine status information for spare parts demand, and they offer a much more accurate forecast of customer demand. Real-time planning enables a flexible response to shifting supply or demand conditions. Planning becomes a continuous process that may respond dynamically to changing requirements or restrictions, with the reduction of planning cycles and frozen periods (such as real-time production capacity feedback from machines). Customers are continually asking for products that are more and more customized. That gives micro-segmentation a significant push, and mass customization concepts will eventually be put into practice. The newest generation of performance management solutions offers real-time, complete supply chain transparency.

The obstacles and prospects of digitalization in Thailand's food supply chain are covered in Carter and Narasimhan's framework for the food supply chain (1996): lessons from Thailand. The project focuses on the application of digital technology to raise the effectiveness, transparency, and sustainability of the food supply chain (Danielsen, 2021). The literature proposes a framework for the digitalization of the food supply chain that consists of the following elements: digital governance (Leimeister, sterile, and Alter 2014), digital services (Geliskhanov, 2018), digital platforms and digital infrastructure (Kittipanya-Ngam, Tan 2020). According to Milakovich (2012), digitalization can enhance the efficiency, sustainability, and traceability of the food supply chain. To enable the successful adoption of digitalization in the food supply chain, it emphasizes the necessity for adequate governance and cooperation among stakeholders.
2.3.1 Introduction to Enterprise Resource Planning (ERP)

According to Bendoly and Schoenherr (2005) accounting, finance, human resources, procurement, and supply chain management are just a few of the many company operations that are integrated and automated by the software program known as enterprise resource planning (ERP). ERP's goal is to give enterprises a centralized, integrated view of their supply management and purchasing operations so they may make better decisions and increase productivity. Since its first introduction in the 1990s, ERP systems have grown to be an essential tool for businesses of all sizes and in all sectors (Matende & Ogao 2013).

Ehie and Madsen (2005) argue that instead of catering to the demands of a single department or function, ERP systems are created to meet the needs of the entire organization. They often comprise modules for supply chain management, procurement, financial management, and human resources, among others. According to Bendoly and Schoenherr (2005), the adoption of an ERP system can result in better data accuracy, more productivity, and better decision-making, as well as lower costs and higher customer satisfaction.

The development of mobile and cloud computing technologies in recent years has made it possible for supply management departments to adopt ERP solutions more quickly and affordably (Ehie & Madsen 2005). Additionally, new ERP systems have been created because of Industry 4.0 and the Internet of Things, which can now integrate and automate a larger range of business operations, such as manufacturing and logistics (Flechsig, Anslinger, and Lasch 2022).

2.3.2 Introduction to the Internet of Things

The term "Internet of Things" (IoT) refers to the expanding network of interconnected gadgets and sensors that gather and exchange data, defined by Korte, Tiberius, and Brem (2021). By offering fresh and creative approaches to automating procedures, enhancing decision-making, and maximizing resources, IoT can fundamentally alter how businesses
operate IoT devices and sensors can gather data from a variety of sources, such as manufacturing processes, supply chain operations, and customer interactions. (Delgosha, Hajiheydari, and Talafidaryani 2021)

Many different businesses, including manufacturing, shipping, retail, and healthcare, stand to benefit from IoT technologies. IoT devices, for instance, can be used in manufacturing to monitor and optimize production processes, lowering downtime and boosting efficiency. IoT devices can track shipments and keep an eye on inventory levels in logistics, lowering the risk of stock shortages and overstocking. (Korte, Tiberius, and Brem 2021)

Delgosha, Hajiheydari, and Talafidaryani (2021) pointed out that despite the advantages that could arise, IoT implementation has drawbacks as well. For instance, businesses must make sure that the sensors and IoT devices they use are safe against hacker assaults and that the data they get is accurate and pertinent. Organizations must also be conscious of the ethical and legal ramifications of data collection and use, such as data privacy and discrimination (de Vass, Shee, and Miah, 2021).

Manufacturing and logistics sectors are increasingly relying on the Internet of Things (IoT). Smart sensors can be attached to many pieces of equipment to collect a wide range of data, from its position to operational circumstances. The gathered data from these sensors can be automatically transmitted to your systems for processing. For instance, you can determine whether your items have been carried in the appropriate conditions with the aid of IoT or, using predictive analytics, determine when specific pieces of equipment need maintenance and purchase extra parts in advance to prevent expensive breakdowns.

2.3.3 Introduction to Blockchain

According to Morkunas, Paschen and Boon (2019), Blockchain is a decentralized, digital ledger system that enables secure and open data movement and record-keeping. The
technology uses encryption to make sure that data is securely stored throughout a network of nodes and cannot be changed or destroyed. Without the use of middlemen like banks or other financial organizations, it is now possible to produce secure and reliable digital records (Arun, Cuomo, and Gaur 2019).

The development of digital currencies like Bitcoin is one of the most well-known uses of blockchain technology (Morkunas, Paschen, and Boon 2019). The potential uses of blockchain, however, are much larger, and they have the power to drastically alter a variety of sectors, including finance, supply chain management, and healthcare. Rozario and Vasarhelyi (2018) argue that Blockchain can be used, for instance, in supply chain management to produce an unchangeable record of a product's provenance and origin, hence boosting supply chain trust and transparency. Blockchain into practice has its share of difficulties, firms must make sure that technology is safe from cyberattacks, secure, and compatible with current systems and procedures (Arun, Cuomo, and Gaur 2019). To ensure that blockchain technology is accepted and used in a uniform and compatible manner, there is also a need for standardization and regulation, as mentioned by Morkunas, Paschen, and Boon (2019).

2.3.4 Introduction to Robotic Process Automation (RPA)

According to Flechsig, Anslinger, and Lasch (2022), technology's field of robotic process automation (RPA) is expanding quickly, giving businesses a potent tool for automating routine, time-consuming, and high-volume processes. RPA technology is made to imitate human workers' movements, freeing up staff from repetitive manual chores and allowing them to concentrate on higher-value work. The technology is made to integrate quickly into current systems, obviating the need for substantial IT investments or modifications to current procedures.

RPA has the potential to transform the way businesses manage their supply chains, by automating repetitive processes. Robotic process automation (RPA) is changing how firms
run by freeing up critical time and resources for more strategic activity. It emphasizes that a variety of operations, including data input and reconciliation as well as customer support and HR duties, can be automated with RPA. The authors Arun, Cuomo, and Gaur (2019) outline RPA’s advantages, such as improved productivity, accuracy, and cost savings as well as the capacity to scale operations quickly.

To automate a wide range of operations, from data entry and document processing to complicated business processes like invoice processing and customer support, RPA has been employed across a variety of industries, including manufacturing and retail. The need to boost productivity, save costs, boost accuracy, and improve compliance has led to the adoption of RPA, and the technology has proven to be an invaluable tool for businesses aiming to accomplish these objectives. (Flechsig, Anslinger, & Lasch 2022)

2.3.5 Introduction to Artificial Intelligence

The discipline of supply chain management is no exception to the rapid change that artificial intelligence (AI) as Winston (1984) is bringing about in how businesses function. By offering fresh and creative approaches to enhancing the flow of goods, services, and information, AI has the potential to revolutionize the way supply chains are managed (Akerkar, 2019). Demand forecasting, inventory management, and transportation planning are just a few of the supply chain tasks that can be automated using AI technologies like machine learning, deep learning, and natural language processing (Winston, 1984).

The application of AI to purchasing and supply chain management can result in better judgment, more effectiveness, and lower costs. For instance, AI systems can examine a lot of data to estimate demand more accurately, lowering the possibility of stock shortages or overstocking. AI can also be used to streamline transportation timetables and routes, lowering expenses, and speeding up delivery mentioned by Nishant, Kennedy, and Corbett (2020). Integrating AI into purchasing and supply chain management also comes with some difficulties and challenges. For instance, businesses must have enough financial budget to
deploy AI and make sure that the employees are ready for the change user-friendly with AI technology.

2.4 Effectiveness of Digitalization in Supply Management

Seyedghorban, Samson, and Tahernejad (2020) address the reasons for, methods used in, and effects of supply management adoption of digital technology. The author emphasizes the different factors that influence the use of digital technology, such as the necessity for greater effectiveness, more transparency, and improved teamwork. The identification and selection of appropriate technologies is a vital step in the adoption of digital technologies (Brinker, Haasis 2022). Brennen and Kreiss (2016) investigate how the introduction of digital technology may affect SM, including how it may improve visibility and control, increase supply chain agility, and boost competitiveness. According to Seyedghorban, Tahernejad, Meriton, and Graham (2020), using digital technology is essential for businesses aiming to enhance SM operations and stay competitive in the current fast-paced business climate.

According to Bienhaus and Haddud, (2018), SM can become more effective, transparent, and agile by integrating cutting-edge digital technologies like the Internet of Things (IoT) (Korte, Tiberius, and Brem 2021), artificial intelligence (AI), and blockchain (Arun, Cuomo, and Gaur, 2019). Flechsig, Anslinger and Lasch, (2022) highlight the potential benefits of digital process management, such as increased efficiency, agility, and innovation.

However, some challenges might come over in the adoption of digital technologies, Levin-Goldberg, (2012) underlined the necessity of incorporating employees and external partners in the digitalization process and the requirement for proper digital infrastructure assistance. Wu, Cao, Yang, Tung, Jiang, Tang, Liu, Wang, and Deng (2019) contend that the issues associated with the adoption of digitalization can be resolved through the digitization of corporate operations. They offer a framework for managing digital processes, designing, and putting digital processes into place, as well as continuously designing and improving digital
processes (Butler, Sellbom 2002). Levin-Goldberg (2012) underlined the necessity of incorporating employees and external partners in the digitalization process and the requirement for proper digital infrastructure and assistance.

2.5 Adoption of digital tools in Purchasing and Supply Management

One of the primary conclusions is probably that the use of IoT, blockchain, and artificial intelligence (AI) technologies is enabling digitalization to enable a more dynamic and responsive PSM, as stated by Karttunen, Lintukangas and Hallikas, (2023). These technologies enable improved collaboration and communication among PSM partners, real-time visibility and tracking of goods and resources, and the capacity to react swiftly to changes in demand or SM disruptions (Carter and Narasimhan, 1996).

Furthermore, according to Carter and Narasimhan, (1996), automation of PSM aligns the system with the use of technology, such as software and systems, to streamline and automate various purchase-related operations. This can involve tasks like managing suppliers, creating purchase orders, processing invoices, and managing inventories (Power, 2005). According to Mudgal, Shankar, Talib, and Raj (2010), automation can boost productivity, reduce errors, and improve data visibility and reporting. Automation can also help to strengthen supplier ties and boost the purchasing function's overall effectiveness (Carter, Narasimhan 1996).

The results of earlier studies probably concentrate on the technologies and methods that have been discovered to be most successful in accomplishing this goal, as well as any difficulties or barriers that must be overcome to fully realize the potential advantages of digitalization in this field. The management and operation of PSM are evolving because of the age of digital technologies, as highlighted by the opportunities and difficulties that businesses have when they attempt to integrate digitization into their PSM may also be covered (Moktadir, Ali, Kusi-Sarpong, and Shaikh 2018).
A company's performance may be considerably impacted by using Enterprise Resource Planning (ERP) systems and efficient supply chain management techniques (Ince et al., 2013). ERP systems give businesses a consolidated platform for controlling many corporate operations, such as purchasing, inventory control, and financial management. On the other side, efficient supply chain management strategies assist firms in streamlining their supply chains, lowering costs, and boosting productivity (Ehie and Madsen, 2005).

A case study on how Turkish enterprises' ERP systems and supply chain management procedures affect business performance can shed light on how these technologies and procedures operate in the real world. The results of such a study may show that efficient supply chain management methods and the installation of ERP systems can improve business performance, including greater productivity, decreased costs, and increased customer satisfaction (Ince et al. 2013).

The authors Giunipero, Hooker, and Denslow (2012) contend that purchasing and supply management is essential to organizational success and that more thorough study is required. They list several important areas for future research in purchasing and supply management, such as how digital technologies are affecting procurement procedures (Smeltzer, Siferd, 1998), how procurement contributes to sustainability (Rejeb, Sle, and G. Keogh, 2018), and how new approaches to supplier relationship management are being developed (Lăzăroiu et al. 2020).

AI is being utilized to enhance product quality, streamline production procedures, and streamline supply chains. To decrease downtime and extend the lifespan of equipment, AI-powered predictive maintenance systems are being utilized to track equipment performance and forecast when a repair is necessary (Li et al. 2017). AI is also being used to automate quality control procedures, inspect products, and find flaws using computer vision and machine learning algorithms. Another important use of AI in intelligent manufacturing is supply chain optimization, which uses AI to improve efficiency and cut costs across the board by forecasting demand and choosing suppliers, among other things (Dirican, 2015).
RPA is a fast-expanding field in the technology sector that gives businesses a potent tool for automating routine, time-consuming, and high-volume processes. RPA can change the way businesses manage their supply chains in the context of purchasing and supply management by increasing productivity, cutting costs, and improving the entire customer experience. (Flechsig, Anslinger, & Lasch 2022)

2.6 Challenges in endorsing Digital Tools: barriers in adoption.

Digital tools come with many effective benefits that organizations can avail on a larger scale, but they come up with many challenges that may be a barrier in the initial stages:

Hennelly, Srai, Graham and Fosso Wamba, (2020) address the challenges that organizations face when implementing digital technologies in their supply chain processes. Some of the main hindrances to adoption are resistance to change, as employees may be resistant to change and unwilling to adopt new digital, which can slow down the implementation process. Employees may lack the knowledge and skills required to effectively use digital tools, which can impede their adoption (Yevu, Ann and Darko, 2021). For example, the adoption of AI in operations management is not without challenges, including the need for significant investment in technology and resources, the risk of job displacement, and concerns about data privacy and security, said Kehayov, Holder and Koch, (2022).

Adoption may be hampered by organizations' potential lack of the human and financial resources needed to apply digital tools (Radke, Wuest, and Romero 2022). The complexity of the technology may make it challenging to comprehend and use, which may cause adoption to lag. The adoption of digital tools in supply chain processes may be hampered by a lack of suitable infrastructure, such as internet access (Creswell 2017). In addition, the use of digital technologies may be hampered by a lack of adequate data because these tools need data to operate properly, as mentioned by Yang, Fu, and Zhang (2021). For instance, legal
and regulatory obstacles that organizations may experience may prevent them from implementing digital tools and the adoption of digital tools may also be hampered by an organization’s lack of supply chain coordination (Wu, H. et al., 2019).

According to Croxton, Garcia-Dastugue, Lambert, and Rogers (2001), the biggest obstacles in supply management to adoption include a lack of knowledge about and confidence in technology, a lack of uniformity, and worries about complying with rules and laws. The assessment also points out that there aren’t many real-world applications or case studies of blockchain technology in supply chain management, which might make it challenging for businesses to understand the potential advantages and defend the installation costs. The high cost of implementation, a lack of adequate IT infrastructure and resources, and reluctance to change among employees and other stakeholders are other possible impediments (Bigliardi, Filippelli, Petroni, and Tagliente 2022).

The use of Industry 4.0 technologies, such as the Internet of Things (IoT), artificial intelligence (AI), and blockchain, anticipated to improve purchasing and supply chain efficiency, visibility, and resilience, according to Hartley and Sawaya (2019). According to Fitzgerald, Kruschwitz, Bonnet, and Welch (2014), there are worries about the possible drawbacks as well as the requirement for substantial investments in new technologies and skill sets. Implementation is further hampered by a lack of standardization and concerns over data security and privacy. RPA adoption in deep supply chains is still in its infancy and is hampered by several problems, including a lack of understanding of the technology, resistance to change, and worries about implementation. The effects of various forms of collaboration, such as information sharing, group decision-making, or co-creation, on supply chain performance were examined by Prajogo, Oke, and Olhager (2016).

According to Yang, Fu, and Zhang (2021), purchasing 4.0 refers to the use of digital technologies like automation, artificial intelligence, and blockchain in procurement procedures. It covers the different factors that are driving and impeding digitalization in procurement, such as the demand for enhanced data quality and increased efficiency, as well as the difficulties presented by legacy systems and opposition to change. For instance,
according to Koh, Orzes, and Jia (2019), purchasing is the process of obtaining commodities, services, or works from a third party. It is a crucial component of supply chain management and can involve tasks including determining needs, acquiring estimates or bids, choosing suppliers, settling on a deal, and overseeing the delivery and payment of goods and services.

Kamble, Gunasekaran, Parekh, and Joshi (2019) argue that there may be obstacles to the adoption of digital tools in purchasing such as a lack of knowledge or awareness of the technology, a lack of funds or resources, worries about security or data protection, or opposition to change within the company. In addition, there might be obstacles connected to the kind of technology being used, like a lack of standards or problems with interoperability, as said by Zhen, Yousaf, Radulescu, and Yasir (2021). Roy et al., (2008) identified the key success factors for digitization, including strong leadership, a clear strategy, and effective stakeholder engagement. They conclude that organizations must take a strategic approach to digitization in purchasing and supply chains to realize the full benefits of these technologies and stay competitive in today's fast-paced business environment.

Lack of understanding or knowledge of the technology, an unclear business case or return on investment, employee resistance to change, and a lack of necessary IT infrastructure or support can all be obstacles to the adoption of digital tools in purchasing and supply chain processes, mentioned by Flechsig, Anslinger, and Lasch (2022). The adoption of digital solutions in procurement and supply chain operations can also be hampered by cultural and organizational impediments such as a lack of trust between partners, a lack of collaboration, and a lack of communication (Farmer, 1981). The study also investigates the factors that prevent the adoption of digital tools (AI, RPA, ERP, Block-Chain and IoT) practices in procurement and supply chain processes, including a lack of clear guidelines, a lack of management support, a lack of understanding of sustainability, and a lack of measurement and reporting systems.

The study by Czyrka et al. (2019) focuses on the numerous elements that affect the adoption and application of electronic purchasing systems in the construction sector for example, cost reductions, improved supplier connections, increased productivity, and regulatory
compliance are a few of the important factors. Lack of knowledge and skills, aversion to change, lack of faith in technology, and a lack of standardization are a few of the major obstacles, as mentioned by Butler and Sellbom (2002). Organizational culture, the degree of automation within the organization, and the level of industry competitiveness have all been recognized as additional factors impacting the adoption of e-procurement in the construction sector. Czyrka et al. (2019) argue that adopting and implementing e-procurement systems in the construction sector is a difficult process influenced by a variety of variables and requires a full knowledge of the sector and its unique requirements. For example, RPA implementation costs and the requirement for specific knowledge and experience to use and maintain the system are both issues. The handling of sensitive data by RPA systems may also raise security and privacy issues as a lack of knowledge of technology is one of the major obstacles.

Cost is a barrier that has been examined in research on Enterprise Resource Planning (ERP) systems’ adoption in the purchasing function, highlighted by Ince et al. (2013). Organizations may need to make a substantial financial commitment to implement an ERP system, and many purchasing departments may not have the money to cover this expenditure. Organizations may also be concerned about the ROI because the advantages of ERP systems might not be immediately apparent. The other obstacle else than finances, would be resistance to change, which is a typical impediment to the adoption of ERP in the purchasing function. For instance, If the employees are unsure of how a new system will affect their job, purchasing departments may be reluctant to switch from their current methods and systems since they are familiar with them (Bendoly and Schoenherr, 2005).
3 Methodology and Research Design

This chapter gives an overview of the research methodology and selected research approach for conducting the study. In addition, the principles for data collection and analysis are explained. Finally, the chapter covers the reliability and validity of the study.

This study is exploratory, which means it seeks to learn more about a subject that has received little attention (Saunders et al. 2007, 133). In addition, the research has an abductive approach. The abductive research approach has elements of inductive and deductive reasoning but leans more towards the inductive approach, which reflects theory development rather than theory testing. In abductive studies, theoretical frameworks are modified or extended based on both theoretical and empirical findings. The abductive method is therefore appropriate for identifying previously unresearched aspects of a specific subject. (Dubois & Gadde 2002)

This study aims to identify how multinational organizations could improve their SM system and build transparent networks with their suppliers and with their customers with the help of digitalization. A qualitative research approach is thought to be suitable for this study based on the objective of the investigation and the established research questions.

Although qualitative and quantitative research methodologies are sometimes put in opposition to one another, it is crucial to remember that the methodologies are also complementary (Kihn and Ihantola, 2015). For instance, quantitative research techniques have historically dominated corporate research, the qualitative research methodology is becoming more widely accepted (Seyedghorban, Tahernejad, Meriton and Graham, 2020). However, to ensure the range and depth of academic research, both qualitative and quantitative research methodologies are crucial (Mäkinen, Kähkönen and Lintukangas, 2011).
The goal of qualitative research is to comprehend and investigate the subject in its natural setting and to create a comprehensive understanding of the study problem (Myers, 2019). Theoretical development typically occurs during the data-collecting and analysis phases of qualitative research, but it's equally crucial to test theories in these contexts (Le Luong and Thi Thu Ha, 2011). A key component of qualitative research is the researcher. According to (Myers, 2019) researchers independently gather the data and interpret what they observe, hear, and comprehend.

Since the qualitative research strategy is emergent, the researcher can make changes to the original plan and methodology as needed (Myers, 2019) Consequently, the original study questions can be changed. According to Agee, (2009) claims that research questions are "tools of discovery, clarity, and focus" in qualitative research; as a result, it is feasible to narrow and broaden the initial study topic throughout the process. As a result, the flexibility of qualitative research is viewed as a benefit.

The process of research begins with the will to conduct the research and find a suitable research topic. Wong, (2008) proposes a qualitative research process model, that will start with the literature review, research questions then, method of data gathering, and methodological approach. After data collection and analysis, the researcher can finally make conclusions from the study. Figure 2. presents the research process which also followed in this study:
Following the literature review, a qualitative data collection phase will be conducted to gather insights into the transformation, barriers, and benefits of digitalization in supply management. This phase will involve conducting semi-structured interviews with supply management professionals from a range of industries and organizational types, including both early adopters of digital tools and those who have not yet fully embraced digitalization. The interviews will be recorded and transcribed for analysis.

The data collected from the interviews and surveys will be analyzed using qualitative data analysis techniques. The qualitative data will be analyzed using a thematic analysis approach, identifying recurring themes and patterns across the interviews.
3.1 Data Collection Method

The individuals selected for the study were based on two criteria. The first criterion was that the individual working in the supply chain industry has countable experience in the field. Secondly, the company should be based in Europe to collect data from EU-based industries.

The qualitative approach for this study involved the primary data collection from participants with varying levels of experience and adoption of digital tools in supply management. Semi-structured interviews were conducted to elicit insights into the transformation, barriers, and benefits of digitalization in supply management (Myers, 2019). In this research, Thematic analysis will be used to identify patterns and themes in the interview data. Open questions are particularly typical for qualitative research (Creswell, 2009). Finding significant responses that contribute to addressing the research questions and the study's objective is the aim of the interviews (Agee, 2009). Thus, the chosen individuals will best enable the researcher to comprehend the subject of the research and are specifically chosen to provide the research data (Creswell 2009).

The sample companies were chosen randomly from different countries and different industries. The industries included in the data collection are mainly manufacturing, logistics, retailing and supply chain. The questions asked to respondents were all open-ended questions and they were free to answer them concerning their experience, knowledge, and industry. Some questions were asked complementarity to have more information about their knowledge and overlap some previous questions.

Twelve individuals were interviewed in this research. More than 35 people were approached for the data collection interview via LinkedIn, of which 12 agreed to recorded video interviews, 3 of the participants did not fit themselves int the depth of the research question and the rest of the participants did not reply to the interview request. Because the research is strongly tied to its context, the small sample size in the qualitative study supports the chosen
research approach (Myers, 2019). However, it still enables the researcher to identify patterns and discrepancies in the data.

The interview consisted of five themes, participant introduction, their experience of Supply management digital transformation, benefits of digitalization, barriers to adopting digital tools and strategies/skill sets for employees to fit themselves in the chain of technological advancement. Table 2. presents the summary of individuals and their working experience in the industry. The interview questions can be found in the appendices (Appendix 1). The interviews were conducted in March and April 2023 remotely via Microsoft Teams and zoom, and the language of the interviews was English. The length of the interviews varied from 20 to 55 minutes, and all interviews were video recorded with the permission of the interviewees to enable further analysis of the data, except for one interview who gave answers via chat on LinkedIn.
Table 2. Participant details

<table>
<thead>
<tr>
<th>Position of the interviewee</th>
<th>Organization</th>
<th>Experience (In years)</th>
<th>Country</th>
</tr>
</thead>
<tbody>
<tr>
<td>Director-Production technologies</td>
<td>Vaisala Oyj</td>
<td>23</td>
<td>Finland</td>
</tr>
<tr>
<td>Procurement Consultant</td>
<td>Gofore</td>
<td>06</td>
<td>Finland</td>
</tr>
<tr>
<td>Global SC Planning Manager</td>
<td>Amplifon</td>
<td>06</td>
<td>Italy</td>
</tr>
<tr>
<td>Procurement Specialist</td>
<td>GE Renewable Energy</td>
<td>05</td>
<td>France</td>
</tr>
<tr>
<td>Logistics Coordinator</td>
<td>Valmet Automotive</td>
<td>03</td>
<td>Finland</td>
</tr>
<tr>
<td>Digital Program Manager</td>
<td>Verkor</td>
<td>08</td>
<td>France</td>
</tr>
<tr>
<td>Senior Supply chain Consultant</td>
<td>Adesso</td>
<td>08</td>
<td>Finland</td>
</tr>
<tr>
<td>Procurement consultant</td>
<td>Gofore</td>
<td>10</td>
<td>Finland</td>
</tr>
<tr>
<td>Supply chain coordinator</td>
<td>Stora Enso</td>
<td>03</td>
<td>Finland</td>
</tr>
<tr>
<td>E-Business Development Manager</td>
<td>UPM</td>
<td>14</td>
<td>Finland</td>
</tr>
<tr>
<td>Project Buyer</td>
<td>Robert Bosch</td>
<td>03</td>
<td>Germany</td>
</tr>
<tr>
<td>Supply chain specialist</td>
<td>Kia Europe</td>
<td>04</td>
<td>Germany</td>
</tr>
</tbody>
</table>

The research gathered data from 12 interviewees to collect first-hand data and collected diverse points of view from different sources. The sample size is low, but the data gained was purely primary (Myers, 2019). The data collection also collected the respondent’s years of experience, their previous qualifications, and their title in the organization where they work.

3.2 Data analysis

The data analysis in this thesis was based on the thematic analysis approach. Thematic analysis is a method used for analysing audio/video interviews, discussions, surveys, and
audio or visual data. The thematic analysis aims to look for the possible themes, and categories and present the topic in a clear, summarized, and general format with the presentation of the conclusion on the research topic. (Braun and Clarke, 2012)

The research's data analysis procedure started soon after with the transcription of the interviews into written form. The researcher can organize and get the material ready for more analysis by transcribing the interviews (Braun and Clarke, 2012). Following the initial review of the data, each interview was carefully read a second time to code it. The process of coding involves the researcher categorizing and labelling key themes and conclusions from the empirical data (Wong, 2008). Manually, sentence by sentence and question by question, the data was coded, and colour coding was used to identify similarities and discrepancies. Similar themes were found and conceptualized based on the process of coding to provide answers to the study questions.

3.3 Reliability and Validity of the study

Reliability and validity refer to the consistency, stability, accuracy, and relevance of the data collected over time, and to the research questions being addressed. According to Creswell (2014), to ensure the reliability and validity of the qualitative data collected in the study measures such as inter-coder reliability and triangulation of data sources could be employed. Moreover, the use of established and validated research instruments and techniques, as well as the involvement of expert reviewers and peer debriefing, could further enhance the reliability and validity of the data collected (Maxwell, 2013).

Rezapour Nasrabad, (2018) state that qualitative research, consistency, and reproducibility of results are referred to as reliability. It emphasizes how trustworthy and consistent the research procedure and results are. Researchers can increase reliability by giving concise and comprehensive explanations of their study technique, guaranteeing openness in the data collection and analysis processes, documenting their decisions and processes, and utilizing peer review or inter-coder reliability checks (Evans, 2017).
It is important in qualitative research to frequently give priority to other standards of excellence like dependability, generalizability, or rich description, which may be like the idea of validity in quantitative research (Evans, 2017). In qualitative research, dependability and confirmability are occasionally substituted for reliability. Although there may be differences in terminology and precise methods for assuring qualitative research quality, the main objectives are to guarantee rigour, reliability, and trustworthiness in the research process and findings.

Construct validity determines if the appropriate operational measures have been found for the concepts under study. In qualitative research, guaranteeing validity entails using a variety of techniques to confirm the veracity and reliability of the results. According to Rezapour Nasrabad, (2018) utilizing various data sources, research techniques, or researchers to confirm the results is known as triangulation. This research was conducted as a qualitative study and data from twelve individuals were taken which increases the construct validity, triangulation approach can be implemented to check the validity of the study. Another way to check the validity would be member checking. This means that the reader of the study can use the member-checking methods and ask for participants' input for verification. Finally, peer debriefing can also be a measure to check the validity of the study, in this an outsider researcher and expert involved from the same field to give feedback and input on the study (Evans, 2017). Researchers can strengthen the validity of their qualitative study and boost their confidence in the reliability and accuracy of the results by using these metrics.

Explanatory or causal studies that seek to show cause-and-effect correlations must take internal validity into account (Baskarada, 2014). Internal validity cannot be assessed in this study because it is exploratory and does not seek to identify the impact of correlation between variables.

Through a variety of methodologies, this study will examine the external validity (Kessler and Vesterlund, 2015) of qualitative research on digitalization in the context of supply
management. The descriptive and exploratory studies face criticism for their lack of external validity. To answer this critique Kessler and Vesterlund, (2015) argue that transferability can be ensured by providing thorough descriptions of the research background, including the industry and organizational contexts involved. To make it easier to judge the findings' application to other similar situations, detailed descriptions of the participants and their positions are given. Furthermore, the inclusion of several instances that represent various enterprises and industry locations within the supply management area can also improve external validity (Wong, 2008).

Even though the researcher aims for objectivity in the study, unintentional subjectivity is always checked in the qualitative study because the researcher collects and observes the data and concludes the interpretation of the topic (Robinson, 2014). The thematic analysis depends on the researcher, to interpret the data and make possible themes; therefore, the outsider researcher's involvement and expertise in data analysis improve the validity and reliability of the study (Evans, 2017). This was not fully possible in this result but the unconscious bias and possible subjectivity in the researcher's interpretations have been acknowledged.

When the people included in a study are not typical of the larger population or the target group, it is referred to as selection bias (Robinson, 2014). This bias might be relevant in this study where a slightly diverse variety of employment designations, and company kinds are involved. To mitigate the selection bias of the study, the designation, and the country of the company are presented so that the results are not biased towards a certain group of workers and give a more thorough knowledge of how digitalization transforming supply management.

As stated before, reliability in qualitative research is achieved by avoiding biases and errors throughout the investigation (Evans, 2017). In these studies, documenting the list of research processes has a significant role in ensuring validity and reliability. The whole process of the thesis is covered in the methodology chapter thus, the following steps would be the same as presented in this chapter. In addition, the interview questions can be found in the appendices,
so the same question can be presented to the interviewer if the study is repeated. However, it must be noted that the research in a qualitative study is highly dependent on the context, and findings may be varied in repeated studies (Myers, 2019).
4 Empirical Findings

This chapter presents the empirical findings of the study. Firstly, the individual demographics would be highlighted for example their gender and age, the second sub-chapter would highlight the data gathered from the interviews about how digitalization transforming supply management. Then the third sub-chapter would cover the benefits of digitalization concerning participants' business structures, personal experience, and knowledge. Furthermore, the fourth sub-chapter would highlight the barriers and challenges associated with deploying digital tools in supply management. Lastly, more information is being collected from participants to dilute the data collected in the first four sub-chapters and it will cover the subtopics including identifying a digital tool which has the potential to transform supply management, the skill set for supply chain professionals and changes in supply chain patterns.

The qualitative data from twelve individuals were collected through video interviews. All of them are experts from the supply chain, sourcing, and procurement fields. The insights collected through these interviews were invaluable in concluding a deeper understanding of the challenges and opportunities of digital tools present in the supply management context.

A total of 12 interviews were recorded and mainly the focus was on the Finnish, Italian, French and German-based Enterprises. Based on the data collected, it was found that 67% of the data was contributed by men, while the remaining 33% was contributed by women. It is worth noting that this difference in gender participation occurs due to the willingness of individuals to participate in the thesis data collection. The age of the individuals ranges from 25 to 45 years old and mostly they belong to reputed big industries. The language used to collect data from participants was English as they belong to different nationalities and possess different native languages so the common mode to conduct the interview was English. Figure 5. shows the gender diversity in terms of data collected from participants:
As part of the data analysis, it was found that 42.86% of the individuals who participated in the study were Supply Chain experts from a management background but also had experience in IT and digital technologies patterns. The insights provided by these individuals were particularly valuable in assessing the application and validity of digital tools in the supply chain industry. On the other hand, 57.14% of the data was collected from the Supply chain, Purchasing, and Logistics specialists who came exclusively from a management background and did fully recognize the implications of digital tools as mentioned in the analysis. However, they also provide some valuable insight into the different software being used in their department.

4.1 Transformation of Supply Management through Digitalization

All the interviewees asked this question as it was the main core of the thesis analysis part, they all agreed with it and gave answers differently with due respect to their industries. Interviewees highlighted different perspectives by mentioning different very positive benefits of digitalization which enable transformed supply management.

Table 3. depicts the information that the participants disclose via an interview about their response to how digitalization transformed supply management. The data presented is the primary firsthand collected data and a thematic analysis approach has been chosen to identify
possible themes in the data. The table gives an overview of the data in a simplified form but does not reflect the detail of the data. All participants gave answers according to their job specifications, the nature of the organization, and their prior experience. The experts belong to different big organizations mainly working in Finland, Italy, Germany, and France.

Table 3. Response Categories

<table>
<thead>
<tr>
<th>Transformation Categories</th>
</tr>
</thead>
<tbody>
<tr>
<td>Digital Transformation</td>
</tr>
<tr>
<td>Streamlining</td>
</tr>
<tr>
<td>Improved Customer Service</td>
</tr>
<tr>
<td>Interoperability</td>
</tr>
<tr>
<td>Digital Procurement</td>
</tr>
</tbody>
</table>

In general, SM transformation through digitalization is the central topic of the thesis. Many interviews highlighted the transformation by expressing different ideas and sharing their knowledge and examples. Most participants specified transparency and visibility as one of the main reformations of supply management through digitalization.

“Previously, when working with supply chain, we needed to do a lot of stuff manually, we needed to do follow-ups manually. And it was just manual work. Now it’s going mostly automatized”.

“For example, we had software that is connected to our customers and our logistics providers, so it was more actually supervising the whole process, rather than doing the manual work, it saves a lot of time, it saves human resources”.

-Participant A
It was evident in the interviews that there were tasks handled manually in the SC department and took many resources and time. One of the interviewees disclosed information that they needed to do follow-ups manually but now most of the tasks are automatic, this is considered it to be the biggest transformation which serves as the basis for the digitalization acceptance. The participant also mentioned an example of automatized tasks which they are handling like one software working as a medium between logistics service providers and customers, which led to only supervision of the process not doing anything manually. This reformation comes with many benefits which later will be discussed in theme 3.

Some interviews pointed out that digitalizing supply management is a big achievement which led to more transparency, more visibility, few manual errors, and satisfied customers:

“I think automation is one of the biggest things. This leads to many outcomes, like more visibility and transparency, fewer manual errors, more thought-out processes, and all in all more effectiveness. The ones able to use more modern systems probably have better processes and customer satisfaction.”

-Participant C

“There are a lot of productivity and administrative efficiencies that can be caught by digitizing the tools. And, you know, the more connected, the more visibility you have on your inventory levels on your demand on your integrated business planning on your demand-driven MRP, all these systems help bring visibility”.

-Participant J

So, the impact of digitalization on supply management is so obvious and many respondents mentioned transparency, visibility and fewer human/manual errors are the core achievements. Participant C highlighted the outcomes of digitalization like transparency and visibility which help achieve trust and accountability, it also increases the organizational
culture of collaboration which led to effectiveness overall. The concept of a few manual errors also minimized the need for physical intervention which can be achieved through the RPA which helps in automatizing the repetitive occurrence of tasks and add the value of time. Participant J’s interview evident that there are many productivity and administration-related efficiencies which can be resulting in digitalization impact on SM because it helps enable faster and more accuracy in data processing. Additionally, the participant mentioned that technology systems like demand-driven MRP, integrated business planning, and inventory management software can also give corporate operations more visibility. Organizations can use this visibility to make more informed choices about inventory levels, demand forecasting, and production scheduling. Businesses can also streamline processes, cut waste, and boost performance by having access to real-time data and insights.

A few of the participants pointed out the point of market conditions, traders, and market visibility due to digitalization:

“Improvement of the overview of the market since now our trader of course depends on the market we’re talking about, but a lot of traders are now going online, so it is way easier to see what is available on the market”.

-Participant H

It is being overviewed that mostly all of the traders are available and dealing online and the system has been better due to digitalized systems and software. Participant H highlighted the ease of access to information about products, services, and prices online, this incorporates a wealth of data and information about the customers and traders. Market trends are accessible, and it is easy to forecast consumer behaviour with market fluctuations. The trading platforms offer transparency, real-time analysis and trends, which help organizations to find new opportunities across the border as well, the Traders are available online and more visibility is part of that content and that provides better control over the suppliers as well. One category was made about the retail industry as digitalization helps improve customer experience because it shifts the trend of supply management to serve clients better.
There was also a high emphasis seen, participants mentioning the low human errors due to digitalization:

“Increasing automation decreases the number of errors that human makes”.

-Participant B

One of the respondents with 23 years of experience working and dealing with the digital side of business concluded that there is an increase in the level of automation and with that, there are fewer errors. The manufacturing industry is completely automated and progresses at high speed now as there is more data availability, and it also targets the end customer, as digital content is available to customers. Streamlining was also identified by Participant as it increases efficiency and can be used as a multipurpose tool.

4.2 Transformation of Supply Management with Digital Tools

As mentioned before, the participants emphasise transparency via the digitalized system, thus companies are using different digital tools in their processes. Overall, it is evident that increasing the level of automation enhancing SM transparency overall and devoting resources to transparency enhancements are beneficial. Every industry and organization use digital tools according to the need of the organization and the nature of their operations. The tools mentioned in Chapter 2 were AI, IoT, BC, RPA, and ERP and the respondents were asked about the tools they are utilizing in their organizations, the data were not equally distributed as different organizations use different digital tools.

As mentioned in research data the respondents who have huge experience with digital technologies and working in big organizations mentioned that they are utilizing NetSuite,
ERP integration, and testing platforms in their operations. Their supply management department is utilizing ERP Integration digital tool:

“ERP systems are extremely important for businesses even though people may not engage with them directly. They serve as the main system for handling key business operations, such as ordering, and are frequently accessed through other tools or interfaces”.

Participant G

“SAP was used, and it was so handy that customers online can see these orders deliveries and so on and then the customers can also see it has been available for the customers and that they are happy that they can see all these details in online 24/7”.

Participant C

The interviews revealed that ERP is deployed by nearly all the big and small organizations in terms of automation, most of the organizations use ERP systems, especially SAP, to manage crucial company processes like ordering. Businesses can receive and enter data through ERP integration, resulting in a two-way integration process. Customers may access their purchases and deliveries online at any time thanks to the system's features, which also leads to a high degree of customer satisfaction. This digital tool was the most used digital tool in different companies.

Some evidence was also collected for AI but not all the organizations are using it like a well-known system like ERP but most of the companies are trying to get their ways to deploy AI:
“We are working a lot with artificial intelligence above all to improve the service to our clients. So, we are deploying many super customized tools to manage the target stock and the service level because we are a big retailer. So basically, we are developing this software since terminally yeah with our knowledge”.

-Participant D

“For example, only thing artificial intelligence, with that kind of thing we can have the potential to use that's amount of data that huge company has and make somewhat accurate forecasts for sales for production, optimizing production in factories and finding the most efficient and environmentally friendly logistic solutions”.

-Participant B

Moreover, two of the participants from the retail and automation industry said that they are utilizing AI in their operations and these digital tools transform their supply management structure. AI improves the service to their clients and the company can forecast sales for production which leads to a reduction of many future demand fluctuations. The AI software helps them to reduce their number of returns and they are saving huge costs in terms of logistics also they have been utilizing Power BI and Machine learning for forecasting. AI software helps them improve their services and customize tools to manage target stock and service levels and they have been using 3D printing technologies and building charts for their decision-making as well as for customizing some of their products.

One of the respondents responded that they are not using any tools mentioned in the theoretical framework, but they are utilizing different tools in their operations. The tools they have been utilizing in their operations are Supplier Connect, I-Procurement, and Quantification. Supplier connects stores and shows all supplier's details like banks detail information and INCO terms. Suppliers use these digital tools to transform their supplier management by maintaining Supplier/Vendor management relationships.
Furthermore, only one respondent from the digital equipment manufacturing industry mentioned that they are using Robotic Process Automation in their supply chain operations. RPA manage their production planning and shipping. It also keeps records of all monthly transactions. This tool helps them increase efficiency and cost savings in their supply management process due to reducing labour costs.

Lastly, in terms of Blockchain, there was no evidence found that industries (from which data was collected) are utilizing Blockchain as a digital tool in their operations other than one piece of evidence from the retail industry. As they are using Blockchain to maintain supplier relationships and to increase transparency with them. Blockchain is being used for scanning and assigning a digital bar code to inventory for better tracking. It was also mentioned by one of the respondents that it was a popular tool years ago to provide transparency, but companies did not invest much in it. On the other hand, IoT has also been utilized by organizations to manage stock levels and connect devices with systems.

4.3 Benefits of Digitalization

The next theme discussed in the interviews covered the topics of the benefits of digitalization in the supply management context. The importance of the benefits taken by organization processes was discussed in the interviews. Many advantages were highlighted in an interview about digitalization benefits which shows the very positive trend of high-value creation due to it. Participant A mentioned that it is very easy to track if the process is digitalized as it is cost-saving and helps in risk management as well, the customers friendly which increases the value and happiness of the customers as it shows the current stage of the production processes:
“When it's digital, everything is easier to track, it saves money and its risk management. It makes it easier to track the orders, which also makes it more customer friendly when it's easier for them also to see the production progress.”

-Participant A

Even though the customer perspective is crucial in the end, process visibility is a big advantage for the supply chain, many participants also emphasized the benefit of better collaboration with suppliers and better management of the first-tier suppliers. More collaborative relations with suppliers, for example, increase supply chain data visibility, transparent relations with suppliers, and ease in tenders. A better relationship with suppliers is a vital role played by digitalization, and it allows making a collaborative relationship with the suppliers as well. Some of the participants highlighted that there is an ease in forecasting and ease in quality issues handling as well. They can easily organize their inventory levels, production timetables, and transportation demands. A good supply chain management solution should make it easy for businesses to forecast demand, monitor inventory levels, and adjust their supply chain strategies accordingly. This could involve features such as demand planning, inventory optimization, and real-time visibility into inventory levels and customer demand.

A few of the participants also mentioned that good digital tools which are suitable for business processes provide real-time visibility and they can manage the quality issues at any point of the process. Furthermore, the system of order processing and real-time tracking of shipments are also wonderful experiences which companies have now and can maintain transparent, visible and collaborative relationships with their suppliers.

One advantage came into perspective from the public sector supply chain management, which was highlighted by one of the participants and discussed the possible positive outcomes:
“Overall digitalization increases efficiency and accuracy in public sector supply chain management as it would in any sector. These lead to possible savings when the process gets faster and more reliable. In public procurement visibility to information is one very big benefit to consider. It is important legally wise but also provides bases to a better and more informed decision making”.

-Participant C

As the public sector has deployed many of the digitalized tools in their processes, they are also having a good edge on the benefits. For procurement officials to make better judgments, digitalization can offer real-time access to data on suppliers, orders, shipments, and inventory levels. From a legal standpoint, this increased visibility must improve transparency and accountability in public procurement. Electronic procurement platforms and portals can improve the sharing of information and enable suppliers to submit bids, track orders, and receive payments electronically, which improves the accuracy and speed of procurement transactions.

Furthermore, many of the respondents mentioned that data is easily available and wise decisions can be made, forecast about the plan for next month's inventory volume, quality issues handling and integration with suppliers are some prominent benefits of digitalization. The shipment cost is also reduced, and the usage of robotics increased the speed of material flow because the use of robotics shifted the production cell from manual to automation as product manufacturers in the production cell immediately shifted to finished good cells by robots which saves time. The time saved from these operations can be used for value-adding. The benefits of any digital tool’s measurement can be seen after the proper deployment of that tool.

Lastly, one participant also mentioned that cloud-based tools like COUPA are quite popular nowadays for collaboration with suppliers. Digitalization facilitates the connection of different networks and platforms, improving integrated business planning. It helps B2B
businesses and enables platforms to increase the level of data and visibility. This, in turn, helps maintain good and transparent relationships with suppliers. For example, there is no need to send them drafts when having a contract with them, as pre-approval trends are now prevalent. Organizations and departments know in advance what they are ordering, and the specifications and the written contract serve as proof digitalization makes tendering convenient and time-saving.

4.4 Challenges/Barriers to the Adoption of Digital Tools in Supply Management

The previous theme has described what are the possible benefits the companies are acquiring from deploying digitalization in their supply management processes that include developing transparency throughout the supply chains and helping in building collaborative relationships with their suppliers. This theme combines the topics and describes what are the barriers to the adoption of digital tools in supply management. The interviewees identified several diverse challenges that how it is somehow difficult to deploy digital tools in the SM:

Firstly, all the respondents emphasized that the biggest obstacle to the adoption of digitalization in supply management is “Change management” as employees and the work environment do not get fit and align with the new digital tools:

“Young work workforce is very keen on using technologies and we don’t have issues. They are very willing to use them. While for maybe let's say older people it becomes a bit more difficult. So, the curve of the change is of course longer and then you need to give much more training to convince them that”.

-Participant D
“The biggest challenge is faced by supply chain and procurement experts in terms of digitalization, I think it’s for the best of my experience, it’s the change management part that is the most difficult.”

-Participant K

Change can be challenging for people and necessitates a substantial adjustment in how they behave and think. This can lead to resistance to change, lack of buy-in, and fear of the unknown. The generational gap in technology adoption can present many challenges from the perspective of change management. On the one hand, younger workers can serve as champions of digitalization efforts and help encourage acceptance inside the firm. They can also help teach and support older workers in embracing new technologies and systems. Older people may feel reluctant to be friendly with digital tools and it may require departments to arrange them for expensive and time-consuming training.

One of the participants also highlighted the obstacle of convincing suppliers to the better relationships and collaboration with them:

“One of the barriers we see, all the challenges are convincing, explaining, and convincing. Convincing, especially when sometimes you are 1000 times smaller than the supplier and you must convince them that your way of working is the right way”.

-Participant J

The participant described the very different but crucial barrier that represents the many small enterprises. The data from the interviews emphasizes the difficulty in getting suppliers to embrace new working practices or to collaborate more effectively and efficiently. When the supplier is significantly bigger than the business or organization trying to implement changes or improvements, this can be especially challenging to convince your suppliers that you are working rightly. To overcome this challenge, it’s important for companies to develop strong relationships with their suppliers and to communicate the benefits of collaboration and
process improvements. This may require demonstrating how adopting new ways of working can lead to cost savings, higher efficiency, and improved quality, all of which can benefit both the company and the supplier.

Some of the participants also mentioned the related challenges related to mom collaborative upper management attitude:

“And common barriers, I think would be the resistance within the company, A little support from the management, then lack of resources, people, or money. So, in cases where they just throw out the task and never, never come back to help you again with poor strategy so not well planned out”.

-Participant H

“I would say that the system landscape gets complicated, there are a lot of tools in the single company already and the number of interdependencies and interactions between the systems is heavily increasing So we need to connect to one system already within one company”.

-Participant B

Internal opposition to change is very common and can hinder the adoption of digital tools. The lack of management support is the first obstacle which refers to circumstances where firms lack clear leadership and direction in executing improvements to their supply chain procedures. It can be difficult to put new systems or procedures into place and to acquire the funding and resources required to support these changes if management does not provide guidance and support. The absence of resources is the second obstacle, and it is frequently necessary to invest in resources like human capital, technology, and finance to improve supply chain management.

Furthermore, Participant B highlighted the barrier of an increase in the complexity of the system. The increasing dependency on digital tools has increased the interactions with digital
tools, procedures somehow get complex. This surely is a big obstacle where digital tools are deployed into the procedures and people must work with many tools together, the participant mentioned that we need to cut down the extra hard work by having one main digitalized system. Furthermore, if the system and tools are easy to understand, then it is easy for the people to accept the tool but if it is not then it may be very difficult:

“So, if the tool is very simple to use, the adoption option is high. If not, it becomes difficult because if it's too complicated, it means you need to give very high maintenance training to the people that are going to use them”.

-Participant D

A tool will be adopted and accepted by employees if it is simple and user-friendly. However, if the tool or system is complex and challenging to use, extensive training will be necessary to ensure that people can use it effectively. Given that supply management comprises numerous stakeholders, such as suppliers, logistics service providers, and customers, this is especially pertinent. It is essential to have tools and procedures that are simple to use and comprehend so that everyone can collaborate productively. As a result, communication will be improved, errors and delays will be decreased, and the supply chain's efficiency will ultimately rise.

The previous theme discussed the digitalization benefits, but everything comes with a cost and many challenges hinder the adoption of digital tools in supply management. These challenges and barriers come up in a way in many parts of supply management, like purchasing, logistics and supply chain processes. Figure 6, presents the barriers discussed by the participants that could be in the way to achieve supply management excellency through digital tools:
Figure 6. Potential barriers to the adoption of digital tools
5 Discussion

The discussion chapter includes an analysis and interpretation of the research data collected from all conducted interviews about the thesis research objectives, and research questions and a chapter on theoretical background. All the below-mentioned sub-chapters present the answers to the research questions starting from the sub-questions, followed by the main research question.

5.1 What are the digital tools transforming supply management?

The first sub-question of this study aimed to find out, what digital tools different companies and enterprises are utilizing in their supply management departments. The empirical findings pointed out that individuals from different enterprises are utilizing different digital tools and are aware of using these digital tools because the adoption rate is on a worldwide level. The empirical findings were in line with the view that the widespread adoption of digitalization across numerous businesses and sectors has been facilitated in recent years by the lightning-fast speed of technological progress, as Greenstein, (2019) has stated. In addition, the adoption of these digital tools arises in various industries, including the media, entertainment, healthcare, and financial services, need and pressure of being competitive in the market came up from the empirical findings (Sestino, Prete, Piper and Guido, 2020). Furthermore, the adoption of digital tools and technologies in purchasing and supply chain processes has the potential to greatly improve efficiency, reduce costs, and enhance decision-making was acknowledged, as in the studies by Farahani, Meier and Wilke, (2017).

The interviews highlighted and disclosed much information about the different tools and the challenges associated with them. Companies are using different digital tools concerning their processes and need for the tools. The most significant evidence was found for ERP, which is almost in all the supply management departments. The tools used related to ERP were ERP integration, NetSuite, and SAP software programs. Secondly, AI has been used by two
organizations and the main thing for the departments to use AI was predicting demand-related problems and customer preference, so in that way, organizations are saving costs because the accurate information about consumers minimizes the returns rate. The adoption of Robotics process automation was also mentioned in the interview, as it helps in the automation of repetitive tasks. In addition, IoT and blockchain are also being used by organisations, not many details were found for these digital tools as evidenced by the two supply chain specialists, who mentioned that block-chain was in a few years ago, but companies did not invest much in it and now other tools are being utilized which best suit them. A few of the participants also mentioned other tools which they are utilizing in their departments and achieving supply management excellency with them. Finally, the findings suggest that the companies have developed digital tools and employees can adapt to those tools and successfully manage their everyday operations.

The theoretical background of this thesis introduced different digital tools which include a total of five tools:

- Artificial intelligence
- Enterprise Resource Planning
- Robotic Process Automation
- Block Chain
- Internet of things

Evidence was found for the adoption of these tools, but many departments also utilize other tools which are discussed in the interviews and are mentioned in Table 4. The finding indicates that these tools have a positive impact on the excellency of the organizations being interviewed and they are achieving their SM excellency through them as well.
Table 4. Summary of other tools being used in SM departments.

<table>
<thead>
<tr>
<th>Other tools being utilized in the supply management departments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Data Visualization</td>
</tr>
<tr>
<td>Power BI</td>
</tr>
<tr>
<td>Cloud-Based tools</td>
</tr>
<tr>
<td>3D printing technologies</td>
</tr>
<tr>
<td>I-Procurement</td>
</tr>
<tr>
<td>Supplier-Connect</td>
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</tbody>
</table>

In addition to digital tools and SM excellency through these tools, empirical findings revealed the importance of high management support to be user-friendly with these tools. The interviews mentioned that with these tools relationships with suppliers are more transparent and companies can manage their relationships accurately. Furthermore, these digital tools help be more collaborative with suppliers and this finding is in line with the theoretical background of digital tools in supply management and how the relationship is being processed with suppliers with the help of digital tools (Smeltzer and Siferd, 1998).

5.2 What are the benefits of Digitalization?

The second sub-question aimed to discover the potential benefits companies or SM departments are getting after deploying digital tools in their operations and processes. The research data explicitly explains the benefits that come from being operative in a digitalized network. Table 5. presents the advantages that come from the research data and provides a detailed explanation of each advantage.
Table 5. Identification of potential benefits of digitalization

<table>
<thead>
<tr>
<th>Benefits</th>
<th>Detail</th>
</tr>
</thead>
<tbody>
<tr>
<td>Collaboration with suppliers</td>
<td>An integrated base to develop collaborative relationships with suppliers.</td>
</tr>
<tr>
<td>Improve integrated business planning</td>
<td>By providing greater agility in response to market conditions and allowing better decision-making with the availability of real-time data.</td>
</tr>
<tr>
<td>Increase the level of data and visibility</td>
<td>Digitalization enables departments to access and analyze large amounts of real-time data.</td>
</tr>
<tr>
<td>Allow transparent relationships with suppliers</td>
<td>Organizations have real-time visibility into supply chain operations and maintain two-way communication.</td>
</tr>
<tr>
<td>Tendering is convenient and time savings</td>
<td>The automated procurement process saves time due to digitalization which also improves accuracy and efficiency.</td>
</tr>
<tr>
<td>Ease in Forecasting/ Quality issues handling/ Integration with suppliers</td>
<td>The availability of data for predictive analytics and a transparent relationship with the supplier allow collaborative problem-savings with suppliers.</td>
</tr>
<tr>
<td>The usage of Robotics increases the speed of material flow</td>
<td>Utilization of robotics reduced lead times and saves time in finished goods handling.</td>
</tr>
<tr>
<td>Decrease in human error/Increase in value-adding</td>
<td>Value-adding can be achieved by automating manual and repetitive tasks so human intervention is minimized due to digitalization which saves time.</td>
</tr>
</tbody>
</table>

The benefits that the interviews identified consist of mostly similar benefits that the prior research on digitalized supply chains and the benefits of digital tools has covered. Firstly, transparent, and visible relationships can be maintained with suppliers via digitalized system highlighted in the empirical findings. For instance, Farahani, Meier and Wilke, (2017) also highlighted improved efficiency, minimum cost, and better decision-making through digitalization. Wu, L., Sun, Chang, Zhang and Qi, (2022) have defined that the increased level of technological integration and digital solutions has reformed the way supply
management is handled and with that organizations are achieving greater efficiency, transparency, and agility.

One key element that was mentioned in the interviews was the availability of suppliers and ease in tendering process due to digitalized system. More and more suppliers are available online which improves the operational performance due to a decrease in the process steps. The importance of operational performance has been covered in the previously mentioned literature by Koh, Orzes and Jia, (2019). Operational performance can be achieved by simple, visible, and available information about suppliers and tendering process which helps in cost saving, as Farahani, Meier and Wilke, (2017) mention.

As well, integration with suppliers has a significant role played by digitalization. Integration and transparent relationships are a way to exchange information and knowledge with suppliers. Wu, L., Sun, Chang, Zhang and Qi, (2022) define the increased level of digital transformation played a critical role in supply chain collaboration which helps in maintaining the transparency level. Moreover, Czyrka and Frąś, (2019) mention that IT-e purchasing platforms help in the automation of the purchasing process with the suppliers. However, with these benefits, there are many barriers and challenges with digitalization which will be covered in the next sub-section of the research question.

The previous research has covered the many benefits and advantages attained from deploying digitalization into supply management. It was notable that even though the interviews reported having cost-effective, operational excellence, visibility, and transparent relationship with suppliers, none of the interviewees defined supplier development through these increased levels of technological integration with suppliers. However, even though the interviewees did not mention any benefit of supplier development or the inauguration of supplier development programs through these technological bases, the interviews revealed many elements that can be considered in better management of supply management. It has been evident that digitalization provides a transparent relationship with the suppliers as well as with the customers, so companies now have real-time data information about their
suppliers and their customer preferences, so they can audit their suppliers for better management of the resources and can predict their customers demand behaviours as well.

5.3 What might hinder the adoption of digital tools in Supply management?

The third sub-question of this study aimed to find out the challenges and barriers that hinder the adoption of digital tools in supply management. The empirical findings highlighted that the interviews mentioned many barriers and challenges that possibly come out of using any digital tools or when companies deploy any new digital tool. The major problem occurs at the operational level with the employees who must maintain the daily operations. The empirical findings supported the perspective that supply management departments must be comfortable with their current processes and system and may feel hesitation to be user-friendly with the new system, as Bendoly and Schoenherr, (2005) stated. In addition, internal resistance to change, lack of investment and inadequate skills have been identified in the empirical findings and the findings were aligned with the previously identified studies by Giunipero, Hooker and Denslow, (2012).

The research data indicated many barriers and challenges that come in the way of successfully deploying digital tools in supply management. Table 6. Presents the challenges that emerged from the research data and provides the perspective for each of them:
Table 6. Challenges and barriers that hinder the adoption of digital tools

<table>
<thead>
<tr>
<th>Change management</th>
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<tbody>
<tr>
<td>Resistance to change</td>
</tr>
<tr>
<td>lack of buy-in</td>
</tr>
<tr>
<td>fear of the unknown</td>
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<tr>
<td>Lack of support from higher management</td>
</tr>
<tr>
<td>Poor Planning</td>
</tr>
<tr>
<td>Lack of strategy and support</td>
</tr>
<tr>
<td>Financial barriers</td>
</tr>
<tr>
<td>lack of resources</td>
</tr>
<tr>
<td>Little support from</td>
</tr>
<tr>
<td>Complications in the landscape</td>
</tr>
<tr>
<td>Due to high interaction with digital tools</td>
</tr>
<tr>
<td>High dependency on digitalized system</td>
</tr>
<tr>
<td>Non-simplicity of tools</td>
</tr>
<tr>
<td>Difficult to use a digital tool</td>
</tr>
<tr>
<td>Lack of training</td>
</tr>
<tr>
<td>Convincing</td>
</tr>
<tr>
<td>Convincing suppliers to invest in digital tools</td>
</tr>
<tr>
<td>Convincing suppliers to collaborate via digital tools</td>
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</table>

The interviews highlighted and disclosed many barriers regarding the adoption of digital tools. The most significant barrier was the change management, employees feel reluctant to accept the change and feel hesitation to work differently. Thus, the most hit people from the change management perspective are old people who faced generational gaps with the new employees. Thus, making these digital tools user-friendly with them requires time and expensive training. The aspect of lack of higher management support was also mentioned in the interviews, as it makes employees in isolation condition and feel hesitant to adopt digital tools. In addition to the lack of higher management poor planning was also mentioned in the interviews, as it minimizes efficiency due to a lack of automation and integration. Finally, the findings suggest that the high investment cost associated with the adoption of digital tools is also a big obstacle for the organization to adopt them.
In addition to barriers, employees should be updated about the digital tools that organizations want to introduce so that they can prepare themselves for the future and what impact that tool will be. Mental preparation of the employees is also an important aspect and if the employees are not mentally prepared, that might affect the adoption of that tool. This finding is in line with the theoretical background of the challenges in the adoption of digital tools, as the author emphasizes the internal resistance to change where the human problem is a barrier (Hennelly, Srai, Graham and Fosso Wamba, 2020).

5.4 How digitalization transforms supply management?

The main research question is intended to find out how digitalization transforms supply management. The research data highlighted numerous aspects that create a basis for the successful transformation of supply management. These aspects are classified into five themes:

- Digital Transformation
- Streamlining
- Improved Customer service
- Interoperability
- Digital Procurement

The themes that were discovered provided the base for the successful implementation and development of digitalization in supply management. The themes are all related to the transformation of supply management and related to each other as well and the detail of each theme may overlap with the details of the rest of the themes.
Everything begins with **Digital Transformation**, how the companies are achieving excellence through digital transformation. Many departments fundamentally shift the way organizations operate and deliver value to their customers. By integrating digital technologies in supply management, professionals may achieve excellence through an increase in data automation, while others perceive transformation by integration in their manufacturing units. It is also important that digital transformation comes up with improved visibility that helps in more collaborative relationships with the suppliers while maintaining the process accuracy by few errors.

The following acknowledged theme is a **Streamlining**, towards optimizing and simplifying business processes to increase efficiency and productivity with reduced waste. Streamlining can be used as a multipurpose tool with many aspects of benefits for the supply management departments. The transformation involves eliminating unnecessary steps and automating manual tasks with the adoption of digitalization. For instance, streamlining provides companies with better control over their suppliers by reducing the number of suppliers, using real-time data tracking for the improvement of delivery times and automating order processing. In addition, developing a digitalized supply management network gives access to online traders and allows open communication with them.

The third theme that emerged from the research data is **Improved customer service** through digitalized supply management network. By implementing AI technologies, organizations can better manage their supply chain processes which helps them improve visibility into their supply management which serves as better collaboration with suppliers. Thus, this, in turn, provides information about better consumer behaviour and improved product quality, all of which can lead to improved customer service and customer satisfaction.

The following identified theme is **Interoperability**, which refers to the ability of devices and software to work together and exchange information accordingly. It can communicate and share data with other systems in a standardized way. It helps in public health care systems, for example, to retrieve patients’ data access across different health record systems without any restriction of vendor and software usage. In addition, it allows data sharing,
better communication, and collaboration among supply chain partners with reduced errors and better decision-making with real-time data tracking. Lastly, interoperability between inventory management systems and procurement software can enable automatic inventory updates and real-time stock level monitoring, improving inventory accuracy and lowering the risk of stockouts.

**Digital procurement** is the last component that permits the application of digitalization in supply management transformation. All the previously identified themes enable the successful transformation of digitalization in supply management. Digitalization helps to use digital tools and help manage procurement processes such as purchasing, sourcing and supplier relationship management. It improves transparency, and efficiency and reduces costs in activities with the suppliers. In addition, the cloud-based system helps in the management of operative procurement and automation of repetitive tasks.

Supply chain departments acquire and share information via digital technologies and serve best the customer's needs while maintaining a good edge on the automation processes. E-Procurement platforms serve as a digital marketplace to complete deals and oversee procurement activity between buyers and suppliers. In addition, electronic invoicing is achieved by digitalization, which reduces manual data entry and it also allows transparent dealing between suppliers and buyers.

Table 7. presents the identified themes and their detailed perspective from the research data in the summarized form. The research data highlighted many aspects that have been improved in the supply management processes including supply chain efficiency and procurement efficiency. Some companies are utilizing this transformation according to their departmental and operational level. Therefore, different aspects of the transformation have been identified and categorized further into basic and advanced levels of supply management operations. This categorization is the only method to illustrate the simplification of the data, but it illustrates two things. Firstly, the basic level of transformation shows how the company was dealing with their supply management without deploying digital technologies. Secondly, the companies and departments that adopted digital tools show the advanced level
of their excellence and automation. As this study focuses on the supply management perspective, the actions mentioned in the tale are as well presented in terms of supply management efficiency through digitalization.

Table 7. SM transformation through digitalization from basic to advanced level

<table>
<thead>
<tr>
<th>Basic Level</th>
<th>Advance Level</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Digital Transformation</strong></td>
<td></td>
</tr>
<tr>
<td>Manual time taking processes</td>
<td>Increase in Level of automation</td>
</tr>
<tr>
<td>Limited use and implementation of technology</td>
<td>Data automation progress</td>
</tr>
<tr>
<td>More human intervention</td>
<td>Integration into manufacturing units</td>
</tr>
<tr>
<td>High risk of errors</td>
<td>Fewer errors due to low human intervention</td>
</tr>
<tr>
<td><strong>Streamlining</strong></td>
<td></td>
</tr>
<tr>
<td>Inefficient processes</td>
<td>Increase in efficiency!</td>
</tr>
<tr>
<td>Lack of standardization</td>
<td>Access to online available traders</td>
</tr>
<tr>
<td>Non-transparent relationship with suppliers</td>
<td>Better control over suppliers</td>
</tr>
<tr>
<td><strong>Improved Customer Service</strong></td>
<td></td>
</tr>
<tr>
<td>Lack of information about customer demand</td>
<td>Better service to the customer</td>
</tr>
<tr>
<td>Limited interaction with the customer</td>
<td>Access to demand patterns and consumer preferences</td>
</tr>
<tr>
<td>More returns and high expense</td>
<td>Integrated communication system</td>
</tr>
<tr>
<td>Lack of feedback systems</td>
<td>Less return due to better service</td>
</tr>
<tr>
<td><strong>Interoperability</strong></td>
<td></td>
</tr>
<tr>
<td>Very limited interaction between systems</td>
<td>Administrative connectivity</td>
</tr>
<tr>
<td>More errors due to insufficient information</td>
<td>Integrated business planning</td>
</tr>
<tr>
<td>Lack of information flow</td>
<td>Collaborative digital data platforms</td>
</tr>
<tr>
<td><strong>Digital procurement</strong></td>
<td></td>
</tr>
<tr>
<td>Manual procedure for dealing with suppliers</td>
<td>Cloud-based system for operative procurement</td>
</tr>
<tr>
<td>Lack of supplier visibility</td>
<td>Online Contract management</td>
</tr>
<tr>
<td>No real-time data tracking</td>
<td>Automation in repetitive tasks and Online meetings</td>
</tr>
</tbody>
</table>
Finally, when the companies gained a successfully developed digitalized network, they have the potential to manage, achieve and enhance their supply chain processes, as there has been a very positive good trend of transformation of supply management with initial barriers and challenges. In addition, to this information, the interviews provided valuable insights into the changes in supply chain patterns that have been observed because of digitalization. According to many respondents, digitalization has improved supply chain visibility and transparency, enabling better control of inventory levels, manufacturing schedules, and supplier relationships. Additionally, digital tools have enabled greater collaboration and communication among supply chain partners, leading to more efficient and effective decision-making.

As this study presented and identified several aspects and themes that enable the successful implementation and development of supply management with better collaboration with buyer-supplier relationships through digitalization. The empirical results also indicate that there are different strategies explained by all the respondents to emerge digitalization into supply management operations and minimize the barriers. Table 8. Presented the list of strategies that helps in the transformation of digitalization:

<table>
<thead>
<tr>
<th>Strategies for digital transformation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Paying attention to the architecture of the system so that information and data connect carefully.</td>
</tr>
<tr>
<td>Training of employees/mental preparation.</td>
</tr>
<tr>
<td>Openness/understanding methodology/Basic training/Common well-being/Being agile.</td>
</tr>
<tr>
<td>Computer literacy/Work on the young workforce who is keen to use technology.</td>
</tr>
<tr>
<td>Identify needs and find appropriate digital tools fit for the need.</td>
</tr>
<tr>
<td>Motivation/Enforcement to change.</td>
</tr>
</tbody>
</table>
Lastly, evidence from data shows that there should be a skilful workforce who can integrate change management and new digital technologies with their routine. The skills mentioned in the data were a digital-friendly attitude, adaptability, openness to using different tools, curiosity, open-mindedness, and being agile.

A digital-friendly attitude refers to the willingness and ability to work with technology and digital tools. Adaptability is the ability to adjust and change in response to new circumstances. Openness to using different tools means being receptive to using new software and tools as needed. Curiosity implies a willingness to explore and learn new things. Open-mindedness refers to an ability to consider new ideas and perspectives while being agile means the ability to move quickly and effectively in response to changing conditions.

This research topic is still understudied, not many researchers have studied the same topic yet from the same perspective. There have been many topics related to the digital supply chain which has contributed good literature in this research as well and explains that the operation of supply chains is evolving because of the rising usage of digital technologies, as highlighted by Rejeb, Sle, and G. Keogh (2018). In addition, for example, Moktadir, Ali, Kusi-Sarpong, and Shaikh (2018) have acknowledged the opportunities and difficulties that businesses have when they attempt to integrate digitization into their supply chain processes. These elements were identified in this research and many elements cross contribute to the literature with similar results, but many more factors and themes also emerged from the interviews.

Based on the research results theoretical framework for implementing and improving supply management through digitalization. The revised version of the conceptual framework is presented in Figure 7. The figure illustrates the identified themes that show the transformation of supply management. These elements together build a base for benefits for the supply chain and purchasing processes.
Figure 7. Revised conceptual framework.
6 Conclusion

To address the study's goal, the concluding chapter of this thesis tries to summarize the key findings. In addition, included the study's managerial and theoretical contributions. The chapter concludes by discussing the study's limitations and introducing fascinating areas for future study.

6.1 Main findings of the study

This study aims to identify how digitalization transforms supply management by adopting different digital tools. To attain the objective of this, three sub-questions and one main research question were developed.

This study revealed that digitalization transforms supply management in a variety of ways. The transformation ways are subject to both inbound and outbound supply management streams. In addition, different digital tools' adoption into different functions of supply management becomes the driver for digital transformation. Furthermore, different strategies help in achieving better acceptance of the digital tools into SM function.

Additionally, the study presented the different digital tools that help in the better digitalization of the supply management function. Different research data highlighted that AI and ERP have great potential to transform supply management. As well, the data shows that different other digital tools help in transforming the purchasing and supply chain processes.

Finally, the results of this study indicated that companies that adopt digital tools into their function of supply management are subject to achieving different benefits. These benefits led companies to lead the market with better consumer demand analysis and greater visibility
through the supply chain. It will enable a better flow of information to both extremes of the supply chain from suppliers to end customers and more collaboration with suppliers with the help of digital connectivity. Subsequently, with many benefits this digital transformation comes up with many barriers and challenges that seem to be hard in the initial stages of adoption of digital tools, these include financial issues, change management, age barriers and many more. Successful strategies like training employees and motivation can lead to the successful adoption of digitalized systems in supply management functions.

6.2 Theoretical and managerial contributions

As stated before, there is a need for managerial and technological perspectives to address the SC problems with the change of the new technological environment. Thus, both technological and managerial research on this topic has been increasingly needed (Garay-Rondero et al., 2020). Additionally, the gap highlighted by Karttunen, Lintukangas and Hallikas, (2023), has been fulfilled that this paper focuses on the applications of digital transformation including many challenges and barriers.

The findings of this study highlighted how small and big industries are adopting digitalization into their PSM function and how they gradually transform by airing different benefits and challenges. Therefore, it can be viewed that the study succeeded in fulfilling the research gap, defined by Seyedghorban et al. (2020). Moreover, this study followed the research gap identified by Henao-Hernández, Muñoz-Villamizar and Solano-Charris, (2021), who identified that there is a research gap in studying that what are the impacts of digital technologies adoption and how they impact SM performance. From a theoretical perspective, the revised conceptual framework (Figure 7) presents the potential outcoming of the research data and answers to the defined research gap.

From a managerial perspective, this study provides practical strategies and challenges that may become part of the journey to digitize the SM function. Table 7. The discussion chapter presents the strategies from the interviews and provides practical ideas for the development
of digital tools adoption. These strategies can be opted by the managers to further enhance the adoption of the digital tools by creating a positive and motivated environment, also better tools which are fit for the operations should be recognized in the organization. Continuous support from the upper management can also help to integrate digitalization into the work environment.

In addition to strategies for digital transformation, the companies can benefit from the revised conceptual framework presented in the study. The conceptual framework provides a detailed foundation for the company to build digital transformation in SM. It helps to illustrate the potential digital tools that can help the organization to fully digitalise their PSM and SM systems to fully integrate their system with the digital technology to avail transparency and visibility throughout their supply chains.

6.3 Limitations and suggestions for future research

This study has some limitations. First limitation is research design and methodology, as this research topic is still understudied. This research has been conducted on the qualitative research approach with a focus on thematic analysis. As was already mentioned, the thematic analysis study method enables the researcher to gain a thorough understanding of a particular subject rather than produce conclusions that can be generalized. Even though the research’s data has been collected from several individuals serving in different industries, the sample size of twelve individuals is small but the interview conversation covered the research topic in depth. It would be advantageous to repeat the study with a larger sample size to develop more robust generalizations.

The context in which the study was conducted is its second limitation. All the case companies were based in the EU region and mostly were Finnish and others were Italian, German, and French. The outcomes of the study would most likely differ if it were conducted in a different setting because qualitative studies are very context-dependent.
The limitation of this research creates many opportunities for future research. A fruitful research topic would be to research a narrower level to analyse the impact of each digital technology on supply management. Generally, the case companies used in this research have different supply management functions and structures, so a study on the same SM function can be valuable.

This study focused only on the internal functions of PSM with slight interference from customer and suppliers’ perspectives concerning some benefits. Further study could consider the supplier perspective or customer perspective to analyse deeply the theoretical framework and practical implications of digitalization.

Because this study is based on research data from different industries based in EU states with different organizational levels, a more in-depth study of a single company and its suppliers and customers would be rewarding to conduct. The research could investigate the barriers, and advantages faced by a single company in achieving transparency and visibility through digitalization in a supply management function.

As mentioned in the identified research gap the research on empirical study on digitalization and supply management is still understudied. A longitudinal study that aims to find the contribution of Organizational Culture to Supply Management's Digital Transformation would be productive. It would be beneficial to study the employee’s behaviour and the organization's internal culture in adapting to the digitalized culture of SM.
REFERENCES

Available at: https://www.binomialconsulting.com/post/3-stages-of-digital-transformation-where-are-you-now.


Myers MD (2019) Qualitative research in business and management. *Qualitative Research in Business and Management*: 1-364.


Appendices

Appendix 01. Interview Questions

This interview covers the topics of Supply Management and digitalization. This interview will focus on the barriers to adopting digital tools benefits of digitalization and skill set for SM professionals.

BACKGROUND

- Can you please introduce yourself?
- A brief overview of your Qualification?
- How about your experience in supply chain management?

DIGITALIZED TRANSFORMATION OF SUPPLIER MANAGEMENT

- How is digitalization changing the landscape of supply management?
- How can digitalization enable improved customer experience within the SM?
- What are the most successful strategies for implementing digitalization in supply management?
- How can digital tools help companies to improve their supplier relationships?

DIGITAL TOOLS

- In what ways do digital tools offer improved efficiency and cost savings in supply management?
- What roles do artificial intelligence, RPV, IoT and Block-Chain play in the digitalization of supply management?
- What Digital tools your department is utilizing in the organization?
- What digital technologies have the greatest potential for transforming the supply chain management of your department?
- What are the most common barriers to the adoption of digital technologies in supply chain processes?
- How can organizations successfully overcome those barriers to integrate with digitalization?

SKILL-SET FOR SM PROFESSIONAL

What are the most important skills necessary for supply chain professionals to effectively use digital tools?