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UNIVERSITY OF VAASA

Matias Ristimäki

**Order-delivery process evolution for software
products and services in manufacturing industry**

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Tekijä:	Matias Ristimäki		
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TIIVISTELMÄ:

Teollisuuden jatkuvasti muuttuvalla toimialalla ohjelmistotuotteiden ja -palveluiden tilaus-toimitusprosessin kehitys on noussut keskeiseksi tekijäksi menestyksen määrittämisessä. Tämän maisterintutkielman ensisijainen tavoite on kattava tarkastelu tilaus-toimitusprosessin kehitymisestä teollisuuden sektorilla, erityisesti ohjelmistotuotteiden ja -palveluiden osalta. Tutkielma keskittyy luomaan kattavan benchmark-tutkimuksen selvittääkseen tämän kehityksen vaikutukset yrityksille, jotka toimivat tässä jatkuvasti muuttuvassa ympäristössä.

Teollisuuden ala, joka on perinteisesti liitetty fyysisten tuotteiden valmistukseen, integroi yhä enemmän ohjelmistotuotteita ja -palveluita tarjontaansa. Tämä muutos vaikuttaa merkittävästi tilaus-toimitusprosessiin, erityisesti siihen, miten yritykset vuorovaikuttavat asiakkaiden kanssa ja hallitsevat toimitusketjujaan. Ohjelmistopalvelut, yritysresurssienhallintajärjestelmät sekä ohjelmistoympäristöt ovat keskeisessä roolissa tässä digitaalisessa siirtymisessä, ja niiden vaikutusten ymmärtäminen on olennaista toimialan sidosryhmille.

Tämä tutkielma käyttää monimenetelmäistä tutkimusmetodia, erityisesti hyödyntäen puolistrukturoituja haastatteluja tapausyrityksenä toimivan yrityksen kanssa tietojen keräämiseksi. Analysoimalla näiden tärkeiden sidosryhmien käytännön kokemuksia ja näkökulmia tutkimus paljastaa monimutkaiset prosessit, jotka muodostavat teollisuuden toimialan ohjelmistotuotteiden tilaus-toimitusprosessin.

Nämä haastatteluista kerätyt havainnot yhdistetään tutkielmassa suoritettuun akateemiseen tutkimukseen. Tehokkaan tilaus-toimitusprosessin hallinnan keskeinen tekijä on yhteistyön merkitys, joka ylittää organisaation sisäiset rajat ja kattaa koko organisaation verkoston. Tässä tutkielmassa korostetaan muutuskyvyn ja roolien yhteistyön kriittistä merkitystä, erityisesti organisaatioiden digitaalisessa siirtymässä. Saadut havainnot osoittavat, että on välttämätöntä kehittää sopeutumiskykyä ja yhteistoimintaa, erityisesti organisaatiomuutosten alla. Näkökulmat tarjoavat käytännön suosituksia ja syventävää ymmärrystä alan ammattilaisille.

AVAINSANAT: digitalisaatio, ohjelmisto palveluna (SaaS), ohjelmistoympäristö, palvelullistaminen, tuote-palvelujärjestelmä (PSS)

Contents

1	Introduction	6
1.1	The case company	6
1.2	Research questions and problem statement	8
1.3	Scope and limitations	9
1.4	Thesis structure	10
2	Literature review	12
2.1	Transition to digital products and SaaS sales model	12
2.1.1	Order-delivery process of software sales	13
2.1.2	Pricing models for software sales	14
2.1.3	The role of ERP systems in SaaS order-handling process	15
2.1.4	Challenges of implementing ERP in SaaS business	20
2.1.5	Implications of the evolution of the SaaS ERP order-delivery process	22
2.2	Software ecosystem	24
2.2.1	Platform types	24
2.2.2	Ecosystem business models	27
2.2.3	Digital industrial platforms	29
2.3	Servitization in the manufacturing industry	31
2.3.1	Servitization strategies	33
2.3.2	Opportunities and barriers in adaptation of digital servitization	35
2.3.3	Evolution of digital servitization towards smart solutions	39
2.4	Product-service system	41
2.4.1	Benefits and barriers of PSS	41
2.4.2	Types of PSS	47
2.4.3	Business models of PSS	50
2.4.4	PSS business model framework	52
2.4.5	PSS tactics	54
3	Methodology	57
3.1	Method selection	57

3.2	Data collection and research process	58
3.3	Selection of case companies	63
3.4	Data analysis	65
3.4.1	Company 1	65
3.4.2	Company 2	68
3.4.3	Company 3	71
3.4.4	Company 4	73
3.4.5	Company 5	75
3.4.6	Company 6	78
3.4.7	Company 7	80
4	Results	83
4.1	Adaptation to digital offering and SaaS systems	83
4.2	Critical success factors for order-delivery processes	85
4.3	Long-term relationships in software agreements	86
5	Managerial implications	88
5.1	General development framework	88
5.2	Industry-specific digital strategies	90
5.3	Streamlining the order-delivery process	91
5.4	Adaptability towards industry-specific challenges	92
6	Conclusions	93
	References	96
	Appendices	103
	Appendix 1. Company 1 interview answers	103
	Appendix 2. Company 2 interview answers	104
	Appendix 3. Company 3 interview answers	105
	Appendix 4. Company 4 interview answers	106
	Appendix 5. Company 5 interview answers	108
	Appendix 6. Company 6 interview answers	109
	Appendix 7. Company 7 interview answers	110

Figures

Figure 1. Case company order-delivery process.	8
Figure 2. Typical order-to-cash process in ERP systems.	16
Figure 3. Platform type definitions and company distribution.	25
Figure 4. The evolution timeline of digital servitization.	40
Figure 5. Product-service systems classifications and subclassifications.	48
Figure 6. Parts of the framework proposition for PSS adoption.	53
Figure 7. PSS characteristics organized in Business Model Canvas elements.	54
Figure 8. Research process of the study.	61

Tables

Table 1. Product-service systems benefits.	43
Table 2. Product-service systems barriers.	47
Table 3. Comparison of business models for different PSS type.	50
Table 4. Benchmark interview questions.	59
Table 5. Background information of the interviewees.	64
Table 6. Guidelines for the improvement of software order-delivery process.	89

1 Introduction

The manufacturing industry is on the verge of a significant transformation, in response to the emergence of the digital era. The shift towards digital products and services has led to the integration of software into the very core of manufacturing operations, becoming a defining feature (Bilgeri et al., 2017). This integration, particularly concerning software products and services, has created an environment where success relies on the effective management of the order-delivery process (Cui, 2022). This master's thesis investigates the evolution and optimization of order-delivery processes for manufacturing-industry software products and services.

This research is motivated by the recognition of the digital transformation that the manufacturing industry is undergoing, with software integration at its core. This thesis explores the evolution of order-delivery processes for software products and services in manufacturing, a fundamental response to the changing industrial landscape. The motivation behind this research is rooted in the need to provide manufacturing organizations with a comprehensive understanding of these transformative dynamics. The manufacturing sector is under immense pressure to remain competitive, agile, and innovative, and software integration is a key driver in achieving these objectives (Albukhitan, 2020).

1.1 The case company

The case company, operating as a leading presence in the electrification industry on a global scale, is at the forefront of technological advancements and expertise. This organization, with a notable focus on its business line in Finland, specializes in the development, manufacturing, sales, and marketing of protection relays for electricity distribution networks, as well as control, automation, and monitoring equipment.

The organization places significant emphasis on safety and reliability as it aims to satisfy the constantly evolving needs of intelligent electricity networks. Protective relays, which

the organization both develops and manufactures, are crucial to achieving this objective because they identify faults in electrical networks, enable efficient distribution of information regarding issues, and function as key components for protecting human lives and maintaining continuous electricity supply. In addition, the company's field of proficiency entails remote control and monitoring equipment, which are widely used by enterprises in the energy industry.

The smart grid era is characterized by the incorporation of distributed generation of electricity from renewable sources to conventional centralized production methods. The supervision, control, and protection of electrical systems are of the highest priority within these dynamical grids. The control and protection systems that the organization has developed are important in minimizing downtime and ensuring uninterrupted power supply.

The order-delivery process of the case company is depicted in Figure 1. It operates in a methodical and unified design, effectively directing customers from the moment they place an offer request on the internal marketplace until they receive the shipment of physical or software products. The process begins with an offer request, during which internal stakeholders communicate their requirements. Following that, the customer proceeds to generate a purchase order, which is carefully tracked and managed within the organization's Enterprise Resource Planning (ERP) system. This initiates the generation of the correct sales order. The process then diverges according to whether the product is physical or software.

For physical products, the order-delivery process corresponds to the various stages involved in managing inventory, packaging, and shipping logistics, with a primary objective of enabling the effective and on-time delivery of tangible goods. On the other hand, software products undergo a customized process that enables the secure delivery of digital content, often involving the creation of download links or login information. Im-

portantly, during this process, a comprehensive system of complete traceability is maintained. The implementation of this comprehensive traceability mechanism ensures that all stakeholders receive timely updates and precise details regarding the status of the order. This enhances transparency and provides a valuable tool for efficient problem-solving in the event of any complications or delays.

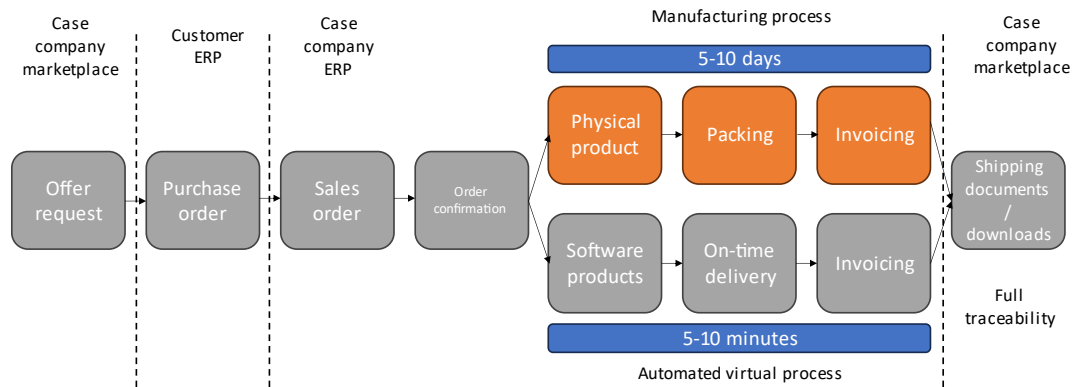


Figure 1. Case company order-delivery process.

1.2 Research questions and problem statement

The core objective of this research is to analyze the transition to digital products and the SaaS sales model within the manufacturing industry. The core of the research is driven by a series of fundamental questions. These questions define the scope of the investigation into how manufacturing organizations adapt to digital transformations, optimize order-delivery processes, and cultivate long-lasting software agreements. The following research questions are derived from the motivation of the study:

RQ1. How have manufacturing organizations adapted to the transition to digital products and SaaS sales models for software products and services?

RQ2. What are the critical success factors for implementing and managing an efficient order-delivery process for software products and services in the manufacturing industry?

RQ3. How do manufacturers ensure the success and longevity of long-term relationships in software agreements?

The fundamental problem addressed in this thesis centers on how manufacturing organizations adapt and optimize their order-delivery processes to effectively incorporate software products and services into their business models. The integration of software into manufacturing operations, facilitated by digital products and the SaaS sales model, presents a multifaceted challenge. This necessitates a deep understanding of how manufacturing companies navigate this transition, and the challenges, opportunities, and best practices they encounter in this dynamic scenario.

The objective is to provide a comprehensive analysis of the challenges and opportunities within this dynamic context. Through the exploration of these research questions, this study aims to offer practical insights to manufacturing organizations striving to excel in the digital era. Additionally, it contributes to the academic understanding of the complex interplay between software products, services, and manufacturing, paving the way for informed discussions and inspiring further research in this rapidly evolving field.

1.3 Scope and limitations

The primary focus of this study is related around an investigation of the internal processes, decision-making factors, and relationship dynamics within manufacturing organizations. The focus of this study revolves around the adaptation, optimization, and management of order-delivery processes specifically related to software products and services within the manufacturing industry. This study focuses primarily on the complex in-

teraction between software integration and manufacturing operations, with the objective of providing a better understanding of the challenges and opportunities present in this dynamic environment.

While this research seeks to provide valuable insights and contribute to an academic understanding of software integration in manufacturing, it operates within certain limitations. It is important to note that the objective of this thesis is not to conduct a comprehensive market analysis or evaluate the competitive landscape of software products and services in the manufacturing industry. The research does not intend to delve into an exhaustive examination of external market conditions, market shares, or competitive strategies of software providers.

These limitations are necessary to ensure the research maintains its focus on the intricacies of software integration within manufacturing, without venturing into comprehensive market analysis, which is an extensive and separate research domain in itself. By recognizing these constraints, the research aims to provide a more focused and meaningful contribution to the specific challenges and opportunities inherent to the digital transformation of manufacturing industry.

1.4 Thesis structure

This thesis is methodically organized to provide a thorough examination of the continually evolving order-delivery process for software products and services in the manufacturing industry. The following chapters have been organized with consideration to provide a comprehensive examination of this dynamic landscape: Chapter 2: *Literature Review* serves as the research's academic guideline. The literature review reveals the fundamental concepts and theories that support the study. This chapter provides an extensive overview of the context against which the dynamics of software integration in manufacturing develop.

The third chapter, titled *Methodology*, lays the methodological framework for the research. It provides an in-depth assessment of the chosen research methodology, including the data collection methods, the reasoning for selecting specific case companies, and the systematic approach to data analysis. This chapter ensures openness and methodical integrity in our efforts to gain understanding.

Chapter 4: *Results* describe the observable outcomes of the case studies. This chapter presents practical findings and insights that highlight the significance of our research in real-life scenarios. It explains the multifaceted nature of software integration in the manufacturing landscape, bridging the gap between theory and practice.

Finally, *Conclusions and Recommendations* in chapter 5 summarizes the huge amount of knowledge obtained throughout the research journey. It categorizes the key findings of the analysis and provides a list of conclusions and practical recommendations. This chapter serves as a guide for industry practitioners and researchers managing the complexities of software integration in the manufacturing industry.

2 Literature review

In this chapter, the literature review investigates four significant subjects: the transition to digital products, the significance of software ecosystems, the concept of servitization in manufacturing, and the emergence of product-service systems. These interconnected topics represent the evolution of businesses as they adapt to the digital age, including modifications to product design, connectivity, and service-oriented strategies. The purpose of the literature review is to provide context on these interrelated areas by utilizing existing research, thereby enhancing comprehension, and establishing the way for future research in these transformative fields.

2.1 Transition to digital products and SaaS sales model

The growing need for on-time delivery and quick availability of solutions for consumers drives the development of sales process of the Software as a Service (SaaS) business and delivery model (Chou & Chiang, 2013). The concept of SaaS is fairly simple on a theoretical level, SaaS service users do not own the software they use. A SaaS service provider rents out the right to utilize the SaaS service. As a result, SaaS service price is typically based on the number of times the service is utilized or the time of usage, also known as pay-as-you-go subscription licensing model. Software sales have been surpassed in the competitive market field by SaaS companies rather than traditional companies, making it an appealing option for the choice of software sales business model (Dubey & Wagle, 2007). The high accessibility of software provides the users with control over their choice of software and as it is uncomplicated to switch service providers, making the industry highly competitive. The growth of is also supported by declining bandwidth prices, which make SaaS affordable for businesses (Satyanarayana, 2012; Dubey & Wagle, 2007).

Digital products and services must be user-friendly and provide an exceptional user experience. User experience is determined by usability, appeal, and interaction. Customer segmentation, product and service aggregation, and channel owner commissions establish the quality of the value proposition. Digital evolution scanning collects data on new

devices and digital channels, such as web services and mobile operating systems, in order to identify and capitalize on innovation opportunities in evolving use contexts and user behaviors. Digital innovation necessitates new skills; consequently, organizations must reevaluate their systems for fostering continuous learning of digital technologies' distinctive characteristics in order to establish dynamic innovation teams (Nylen & Holmstrom, 2015).

2.1.1 Order-delivery process of software sales

In the digital era, the order-delivery process of digital products has revolutionized consumers' access to and acquisition of intangible products. It commences with the placement of orders on online platforms, where users can browse, select, and add digital products to their virtual purchasing carts. Secure payment options protect the privacy of sensitive information and verify it to prevent deception and mistakes. Once verified, consumers gain immediate access to their digital products via a variety of methods, including downloadable content, email delivery, and online streaming. Support following shipment ensures customer satisfaction and addresses any issues. This streamlined process provides consumers and businesses with convenience, immediate access, and a vast selection of products. The order-delivery process of digital products continues to reshape industries and facilitate access to the digital frontier as a result of decreased costs and global reach (Nylen & Holmstrom, 2015; Rauhanen, 2018).

The order-delivery process in SaaS sales plays a vital role in customer onboarding, service activation, and value realization. From order placement to ongoing support, each stage contributes to the overall success of the SaaS journey. By understanding and optimizing these stages, SaaS vendors can ensure seamless customer onboarding, foster engagement, and drive long-term customer satisfaction. In the fast-paced and competitive SaaS market, an efficient order-delivery process is a key differentiator that enables vendors to stand out and create lasting customer relationships based on trust, value, and continuous support (Rauhanen, 2018).

2.1.2 Pricing models for software sales

Software pricing is an important part of a company's strategy as it has a direct impact on revenue generation and customer acquisition. To optimize pricing strategies, software vendors use a variety of models that are tailored to the specific needs of their customers (Al-Roomi et al., 2013). The pricing strategy for the provided software may be based on various factors or their combination. Assessment base pricing, price discrimination, and price bundling are all possible pricing strategies for businesses. Software vendors can better align their pricing strategies with customer preferences and maximize profitability by understanding these models (Ojala, 2014).

The objective of assessment-based pricing is to tailor the price of software to each client's unique demands, requirements, or usage patterns. Instead of offering predefined pricing tiers, software companies conduct in-depth analyses and evaluations of their customers' organizations, infrastructures, and usage data. By analyzing these criteria, vendors can provide a customized pricing structure that ensures consumers only pay for the value they receive from the program. This method increases customer satisfaction and promotes cost-effectiveness by aligning the price with the perceived value (Ojala, 2014).

Price discrimination is a pricing strategy that involves charging different prices for the same software product or service based on various factors. This strategy seeks to maximize revenue by extracting the maximum price from each consumer segment. Software vendors implement price discrimination through various means, including geographic pricing, volume pricing, tiered pricing, pricing for educational or non-profit institutions, and time-based pricing (Ojala, 2014; Laatikainen et al., 2013).

The practice of combining multiple software products, services, or features into a single package and selling them for less than if they were purchased separately is known as price bundling. This model enhances consumer value and convenience by offering all-inclusive services at a lower price. Price bundling is utilized by software vendors in a variety of ways, including product bundling, feature bundling, and cross-selling bundling

(Ojala, 2014). Product bundling is the process of combining multiple software products or licenses into a single package that offers clients a comprehensive solution with enhanced capabilities. Feature bundling is the practice of combining multiple feature sets or modules for a reduced price, thereby granting consumers access to a wider array of capabilities. Bundling software with other related products or services to encourage customers to accept a comprehensive solution that meets their requirements is an example of cross-selling. Customers and sellers benefit from price aggregation because it provides cost-effective solutions while boosting sales through improved value propositions (Derdenger, 2013; Ojala, 2014).

2.1.3 The role of ERP systems in SaaS order-handling process

Enterprise Resource Planning (ERP) systems are regarded as a significant business innovation, and the implementation of these systems is anticipated to be advantageous for businesses of all sizes. Under the SaaS model, ERP systems are now offered in the cloud. This is the greatest opportunity to take advantage of an ERP system's capabilities without incurring the investment and management costs of the on-premise model. The SaaS model is rapidly becoming a cost-effective method of delivering business applications, with potential benefits such as reduced costs, ease of access to global innovations, and scalability. SaaS ERP systems offer software sales companies an attractive alternative to their resource constraints and the complexity of business processes embedded in the traditional on-premise solution (Seethamraju, 2015).

The Order-to-Cash (O2C) process of SAP ERP incorporates the entire sales order lifecycle, shown on Figure 2. It begins with the creation of a sales order that includes essential customer information, order quantity, delivery date, pricing, and terms of payment. The system then verifies the product's availability, confirms the order, or initiates procurement processes if the product is not in stock. Once the order has been confirmed, a delivery note is generated that specifies the products to be shipped and the expected de-

livery date. Warehouse personnel select and pack the goods, and then a Post Goods Issue (PGI) is generated to signify that the items have left the company's premises. An outbound delivery document is generated, providing shipping information. After delivery, a sales order-based invoice is generated, and financial entries are recorded. When a consumer makes a payment, the transaction is recorded in the system and the accounts receivable balance is updated. Throughout the process, information and documents are transferred between departments to ensure coordination between the sales, inventory, and finance teams. The integrated system of SAP ERP facilitates seamless data transfer and visibility, thereby enhancing the effectiveness and precision of order processing, delivery, and payment processing (Korotina et al., 2015).

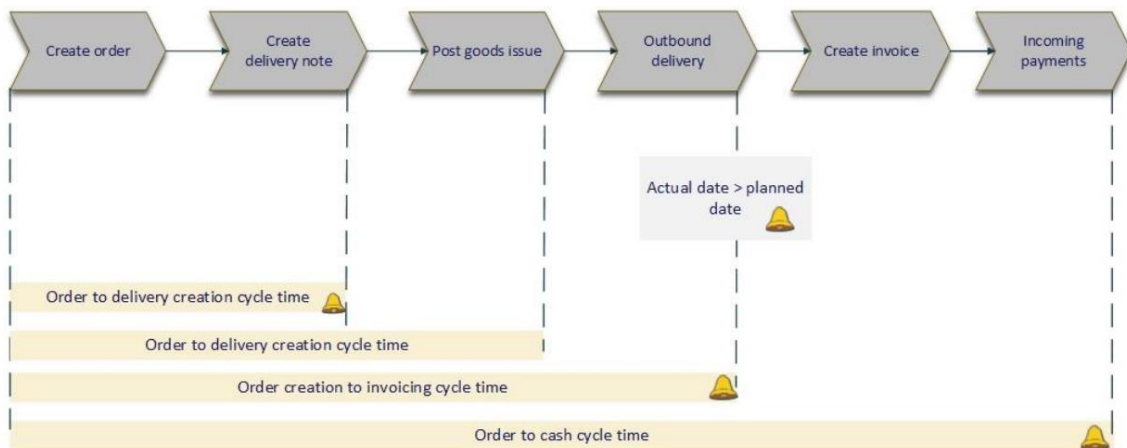


Figure 2. Typical order-to-cash process in ERP systems (Korotina et al., 2015).

Due to the complexity and unpredictability of the current business environment, modern buyers face difficulties in identifying their organization's purchasing requirements and coordinating with the sales team. The interdependent supply chain necessitates close collaboration with sales to comprehend sales forecasts and to align procurement strategies. To recognize emerging requirements and opportunities, they must adapt at data analysis, communication, and relationship management. Proactively seeking out new technologies and solutions can improve procurement processes and supply chain visibility (Lewandowski et al., 2013).

The adoption of SaaS ERP systems is affected by multiple factors, thus needing a significant number of resources, strategic coordination, and cohesive operative objective. Various environmental factors can influence the adoption of SaaS ERP systems. These elements include industry regulations, market competition, and technological progress. Different industries have distinct compliance requirements, and businesses may seek SaaS ERP solutions with built-in compliance features. Businesses operating in highly competitive markets may choose SaaS ERP to increase their agility and keep up with industry trends (Seethamraju, 2015).

Numerous generic benefits offered by SaaS ERP systems can influence adoption decisions. Cost savings are one of the principal benefits. Typically, SaaS ERP systems have lower upfront costs than traditional on-premises ERP solutions. They eliminate the requirement for substantial hardware investments and reduce IT infrastructure and maintenance expenses (Mijac et al., 2013). Scalability is a further advantage, as SaaS ERP systems can be easily scaled as organizations expand or contract. They enable the system's capacity and resources to be adapted to accommodate increased transaction volumes or business expansion (Karabek et al., 2011). Rapid implementation is another important advantage. Compared to conventional ERP systems, SaaS ERP solutions are typically implemented more quickly. They have pre-configured templates and standardized procedures that expedite the implementation process, enabling organizations to begin using the system sooner. Another benefit of SaaS ERP systems is their automatic updates. The regular release of updates and enhancements by vendors ensures that they have access to the most recent capabilities and features without requiring manual upgrades (Seethamraju, 2015).

Reduced IT infrastructure needs are also advantageous. The cloud-based nature of SaaS ERP systems eliminates the need for on-site servers, data centers, and associated maintenance expenses. Organizations can concentrate on utilizing the system as opposed to managing complex IT infrastructure. Organizations must evaluate their current

IT infrastructure and capabilities to ensure compatibility with the SaaS ERP solution (DeSisto, 2009). Network bandwidth, data storage capacity, integration capabilities, and compatibility with existing hardware, operating systems, and web browsers are important considerations. A sufficient network bandwidth is required for streamlined data transfers and system operation. There must be sufficient data storage capacity to accommodate current and future data requirements. Integration capabilities are essential to ensure a seamless data flow between the SaaS ERP system and the organization's existing business applications and systems. Compatibility with existing hardware, operating systems, and web browsers is essential for system performance and user satisfaction (Saini et al., 2011).

While SaaS ERP systems typically have lower initial costs than traditional ERP systems, organizations must consider the total cost of ownership over time. In addition to subscription fees, businesses must evaluate costs associated with customization, data migration, ongoing support and maintenance, and the potential need for additional integrations or upgrades. Typically, subscription fees are determined by variables such as the number of users or transaction volume (Seethamraju, 2015). If an organization requires specific configurations or additional capabilities beyond what the SaaS ERP system provides as standard, customization fees may be incurred. When switching from an existing ERP system to a SaaS ERP solution, data migration costs may be incurred. Consider fees for ongoing support and maintenance, as they cover technical support, system updates, and bug fixes. Future costs associated with additional system integrations and upgrades should also be considered by organizations (Seethamraju, 2015; Benlian et al., 2009).

Any new system, including SaaS ERP, requires effective change management strategies for successful adoption. Organizations must address elements such as change resistance, employee training, and cultural preparedness. When implementing a new system, resistance to change is common; therefore, organizations should address employee concerns and communicate the benefits of the SaaS ERP system. Participating in the deci-

sion-making and implementation processes can reduce resistance and increase employee engagement (Seethamraju, 2015). Training employees is essential to ensure that they can effectively utilize the new system. To acquaint employees with the SaaS ERP system's functionalities and processes, it is necessary to implement training programs (Chan et al., 2007). Cultural preparedness is an additional factor to consider. Organizations should evaluate their culture and change readiness. The organizational culture must encourage innovation and be receptive to new technologies and processes (Seethamraju, 2015).

When adopting SaaS ERP systems, organizations must consider data security as a crucial factor. Organizations entrust sensitive data to the cloud, which necessitates evaluating factors including data encryption, access controls, backup procedures, and compliance with applicable regulations. To safeguard data during transmission and storage, the SaaS ERP provider should offer robust data encryption mechanisms. There should be access controls in place to ensure that only authorized individuals have access to sensitive data. Regular backups and disaster recovery procedures are required to ensure data availability and integrity. Compliance with industry-specific regulations, such as GDPR (General Data Protection Regulation) is essential to safeguard customer and organizational data (Hofmann, 2010; Seethamraju, 2015; Bayrakdar et al., 2019).

A SaaS ERP system's degree of customizability can influence its adoption. Despite the fact that SaaS solutions typically offer less customization than on-premises ERP systems, organizations must determine if the system meets their particular business needs. Important factors include the SaaS ERP solution's configurability and adaptability to unique business processes and workflows. Organizations should assess the available customization options and ensure that the SaaS ERP system can accommodate their unique requirements without compromising system stability and performance (Mijac et al., 2013).

The adoption of a SaaS ERP system can have a significant impact on the business processes of an organization. It is essential to assess the system's ability to support and optimize essential processes such as order management, inventory control, financial management, and reporting. Adoption decisions require an understanding of the potential effects on operations and the ability to achieve desired business outcomes. Organizations should evaluate whether the SaaS ERP system is compatible with their current workflows and whether process reengineering or modifications are required (Molina-Castillo, 2022).

2.1.4 Challenges of implementing ERP in SaaS business

Scalable on-demand software solutions are gaining popularity as organizations shift away from on-premise solutions to minimize overhead costs and provide real-time services. ERP software providers are promoting the adoption of cloud-based solutions to offer well-established business processes. However, adoption rates are not as high as expected, and organizations are wary of adopting cloud-based solutions due to concerns about security breaches (Lewandowski et al., 2013).

Usability, functionality, reliability, compatibility, and serviceability are the major challenges that are associated with the implementation of ERP in the SaaS business model (Lewandowski et al., 2013). Usability refers to the user-friendliness and simplicity of use of the SaaS ERP system. If the system has a complicated interface or requires extensive training for employees to effectively navigate and utilize its features, this may be one of the most significant obstacles for organizations (Asif et al., 2022). Difficulties in system usability can result in decreased user adoption, productivity issues, and a steeper employee learning curve. Priority should be given to selecting a SaaS ERP system with an intuitive user interface, extensive training resources, and ongoing support to surmount usability issues (Elmonem et al., 2016; Lewandowski et al., 2013).

The functionality of the SaaS ERP system is essential for meeting a company's particular business needs. If the system lacks essential features or functionalities for the organization's operations, difficulties may arise. In some instances, SaaS ERP systems may have limited customization options, limiting the ability to customize the system to specific business processes and requirements (Birthare & Sharma, 2020). Organizations should conduct a comprehensive analysis of their functional requirements and evaluate the capabilities of the SaaS ERP system to ensure that it meets their particular requirements. Having communication with the vendor and requesting product demonstrations can assist organizations in evaluating the functionality and suitability of a system (Salum & Rozan, 2016).

Every ERP system requires a high degree of reliability. Organizations rely on the SaaS ERP system for daily operations, and any downtime or system malfunctions can have a devastating effect on business continuity. If the SaaS ERP system experiences frequent disruptions, performance issues, or unreliable service, difficulties may arise (Lewandowski et al., 2013). Organizations must ensure that the vendor offers a reliable infrastructure and service level agreements (SLAs) that guarantee system functionality and reliability (Elmonem et al., 2016). It is essential to mitigate reliability challenges by thoroughly evaluating the vendor's track record, reputation, and disaster recovery and system resilience measure (Lewandowski et al., 2013).

When integrating the SaaS ERP system with an organization's existing software applications and systems, there may be compatibility issues. Incompatibilities and a lack of integration capabilities can impede data synchronization, necessitate manual data entry, and reduce the effectiveness of business processes. It is essential to comprehensively assess the integration capabilities of the SaaS ERP system and to collaborate closely with the vendor to address compatibility issues (Lewandowski et al., 2013). Organizations can ensure seamless integration by engaging in discussions with the vendor, seeking references from other customers who have integrated comparable systems, and conducting exhaustive testing (Elmonem et al., 2016).

The vendor's ability to provide timely support, updates, and maintenance for the SaaS ERP system comprises serviceability. If the vendor lacks adequate support channels or responds slowly to customer inquiries or problems, difficulties may arise. The vendor should have a dependable support system in place to resolve technical issues, provide regular system updates, and guarantee that the SaaS ERP system operates without interruption (Lewandowski et al., 2013). Organizations should comprehensively evaluate the vendor's support procedures, response times, and technical resource availability. Obtaining customer testimonials and engaging in conversations with existing customers can provide insight into the serviceability of a vendor. In addition, they should review the service level agreement (SLA) to ensure that it correlates with their support needs and expectations (Elmonem et al., 2016; Mirani et al., 2022).

2.1.5 Implications of the evolution of the SaaS ERP order-delivery process

The future of SaaS ERP tools is anticipated to be positive. SaaS ERP solutions offer several advantages over traditional on-premise ERP systems, including lower infrastructure costs, increased accessibility, simplified scalability, and streamlined maintenance and upgrade processes. As more businesses become aware of the benefits of cloud-based solutions, it is anticipated that the number of organizations adopting SaaS ERP will continue to rise. SaaS enterprise resource planning software can be particularly advantageous to small and medium-sized businesses due to its adaptability and affordability (Seethamraju, 2013).

It is anticipated that cloud-based apps and services, such as customer relationship management (CRM), human resources (HR) management, supply chain management, and business intelligence, will become more interoperable and integrated with SaaS ERP systems in the near future. If these systems are seamlessly incorporated with one another, it will be possible to gain a more complete understanding of the company's activities and make more informed decisions (Seethamraju, 2013; Dubey & Wagle, 2007).

SaaS ERP solutions are predicted to combine artificial intelligence and advanced analytics capabilities to provide valuable insights and predictive capabilities. This can aid businesses in identifying patterns, enhancing processes, and making more informed decisions based on data (Yathiraju, 2022). Although SaaS ERP systems are already designed to be usable from a variety of devices and locations, the near future may bring further enhancements to mobile accessibility and user experience. Users will be able to access and update ERP data while on the go, courtesy of new features expected to be incorporated into future mobile applications (Hoseini, 2013).

SaaS ERP systems can play a significant role in the process of streamlining and optimizing order delivery procedures when it comes to the use of ERP in the SaaS order-delivery process. Cloud-based order management systems can be used to streamline and organize the order processing procedure. SaaS ERP can centralize order information, including customer and product details, inventory level and pricing data. It can provide real-time visibility into the status of orders, allowing businesses to track and manage the entire order fulfilment process with efficiency (Kumar, 2019).

Management of inventory and supply chain with SaaS ERP solutions can assist in optimizing inventory levels, tracking stock availability, and promoting efficient supply chain administration. Consequently, it is possible to automate reorder points, initiate buy orders, and improve demand forecasting in order to ensure timely order fulfilment (Dubey & Wagle, 2007; Kumar, 2019).

The ability of SaaS ERP systems to integrate with third-party logistics and shipping providers enables the software to generate shipping labels, tracking numbers, and delivery alerts automatically. This connection streamlines the order-delivery procedure, reduces the amount of required manual labor, and improves precision (Minashkina & Happonen, 2023). SaaS ERP systems have the potential to improve customer service by providing a comprehensive purchase history, customer conversation records, and support ticket management. This enables efficient handling of customer inquiries, order revisions, and

problem resolution throughout the entire order delivery process (Minashkina & Happonen, 2023; Seethamraju, 2019). Utilizing ERP in the SaaS order-delivery process can result in greater operational efficiency, increased customer satisfaction, and enhanced decision-making ability for businesses.

2.2 Software ecosystem

The concept of a software ecosystem is a complex network of interconnected software applications, platforms, tools, and services that collaborate and interact to provide users with an all-inclusive and integrated solution. It resembles a digital ecosystem in which diverse software components coexist, complement, and rely on one another to form a cohesive environment. Different proprietary and open-source software products play distinct roles in a software ecosystem, and they frequently interoperate to meet a wider variety of user requirements. This interconnectedness fosters a symbiotic relationship between software components, allowing them to share information, capabilities, and resources, thereby enhancing the overall user experience (Jansen, 2020).

Software ecosystems span industries and domains, ushering in a sharing economy and redefining traditional business landscapes by embracing multiple business models, such as commission-based transactions and subscription models. As transaction and innovation platforms, they enable seamless exchanges and inspire continuous development, encapsulating the essence of digital evolution as they shape the present and future of technology-driven interactions and solutions (Manikas & Hansen, 2013).

2.2.1 Platform types

Software ecosystems have emerged as dynamic and intricate operative methods that drive innovation, collaboration, and value creation across industries in the developing landscape of digital technologies. These ecosystems consist of a wide variety of software components, tools, services, and stakeholders, all of which collaborate to accom-

plish particular goals and objectives. Two distinct platform types have risen to prominence within this expansive domain: transactional platforms and innovation platforms, or their compound type: hybrid platforms (Bereznoy et al., 2021). These platforms are introduced in Figure 3, where largest contributors to the market are distributed based on their type (Cusumano et al., 2019).

BASIC PLATFORM TYPES

In the quest for competitive advantage, companies are combining transaction and innovation platforms into a hybrid model.

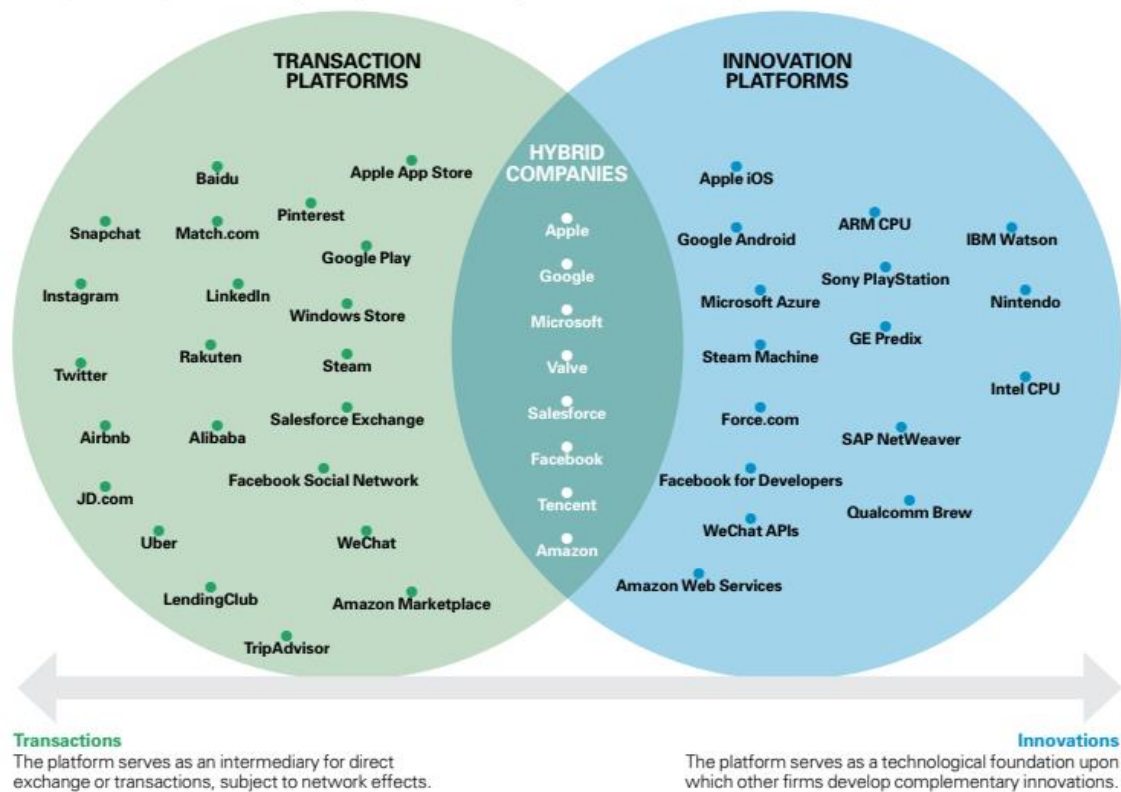


Figure 3. Platform type definitions and company distribution (Cusumano et al., 2019).

The transactional platform type of the software ecosystem embodies a modern digital infrastructure designed to organize a broad range of transactions, transcending traditional boundaries and ushering in a paradigm shift in the way individuals and businesses interact (Pauli et al., 2021). A transactional platform, at its core, functions as a dynamic intermediary, connecting diverse stakeholders and enabling them to engage in fluid exchanges of goods, services, or data. It functions as an agent of efficiency, streamlining complex processes, minimizing friction, and optimizing resource allocation, thereby en-

hancing the entire user experience (Bereznoy et al., 2021). These transactional ecosystems transcend geographical limitations, creating global marketplaces where demand meets supply in real time, revolutionizing industries and unlocking new dimensions of convenience and accessibility, as exemplified by Apple App Store, Airbnb, and Instagram (Cusumano et al., 2019). By leveraging cutting-edge technologies, secure payment gateways, and data-driven insights, transactional platforms exemplify the fusion of digital innovation and user-centric design, promoting a transformation in the ways in which commerce is conducted, resources are shared, and economic value is generated within the dynamic fabric of the software ecosystem (Pauli et al., 2021).

The innovation platform type of the software ecosystem is a dynamic environment where creativity, collaboration, and technological advancement converge to promote an extensive evolution in the field of digital solutions. This platform model thrives on the principles of open participation and idea distribution. At its foundation, an innovation platform serves as an entry point for disruptive and transformative ideas (Bereznoy et al., 2021; Pauli et al., 2021), as exemplified by operating systems like Android or collaborative platforms like Predix (Cusumano et al., 2019). It enables innovators to design and refine applications, services, and functionalities that extend the ecosystem's capabilities, resulting in a thriving ecosystem with a wide variety of offerings. Innovation platforms open the way for accelerated development cycles and streamlined production processes by providing solid tools, software libraries, and standard interfaces (Eckhardt et al., 2018). As each addition enhances the ecosystem's value and attracts more participants, they foster a culture of collaboration that drives a cycle of continuous improvement (Jansen, 2020). As a center of innovation, the innovation platform type shapes the future of technology, facilitating breakthroughs and novel experiences that redefine the limits of possibility within the constantly evolving software ecosystem (Yin et al., 2020).

The final platform variety, the hybrid platform, stands out in the complex landscape of software ecosystems due to its compelling presence. This category of platforms represents a seamless fusion of transactional and innovative concepts, connecting the links

between streamlined transactions and ground-breaking innovation (Gawer, 2021). The hybrid model proposes an environment where the fluidity of transactions enhances an ongoing opportunity for advancing the ecosystem itself, as demonstrated by platforms like Amazon, which not only facilitates smooth and secure digital transactions but also fosters a thriving developer community and a diverse array of applications via accessible APIs (Application Programming Interfaces). The hybrid platform type illustrates the intersection of efficiency and inventiveness, utilizing the strengths of both to create a synergy where usability and creative potential coexist (Cusumano et al., 2019).

2.2.2 Ecosystem business models

The concept of software ecosystem business models emphasizes the various ways in which software companies and developers can generate, capture, and deliver value within a larger ecosystem. These models represent various strategies and approaches for developing software platforms and services that generate profits (Paulus-Rohmer et al., 2016). Sarafin (2021) introduced seven distinct business models for software ecosystems:

- Symbiotic ecosystem business model
- Marketplace ecosystem business model
- Scaling ecosystem business model
- Accretive ecosystem business model
- Coopetitive ecosystem business model
- Value chain ecosystem business model
- Integrator ecosystem business model

The symbiotic ecosystem business model revolves around fostering mutually beneficial relationships among various entities within the ecosystem. Companies work together to establish a network in which each participant contributes unique value, thereby enhancing the overall user experience. These partnerships may involve the sharing of resources, information, or technology in order to address emerging challenges (Manikas & Hansen,

2013). By collaborating, participants can amplify their individual strengths and leverage their collective abilities to accomplish common objectives. The symbiotic model fosters a sense of community and interdependence, which promotes ongoing innovation and value creation (Sarafin, 2021).

The marketplace ecosystem business model centers around a platform that connects buyers and sellers, facilitating transactions and interactions. The platform provides a central hub in which users can gain access to a variety of goods, services, and digital products offered by various sellers (Weiblen, 2012; Sarafin, 2021). Frequently the platform handles payment processing, user reviews, and dispute resolution. Revenue is generated through transaction fees, subscriptions, or featured listings. As the market grows and attracts more participants, the value of the platform rises, creating a cycle that benefits both buyers and sellers (Manikas, 2016).

The scaling ecosystem business model is focused on rapid growth and expansion by enabling third-party developers or businesses to build complementary products or services that integrate with the core platform (Becker et al., 2020; Sarafin, 2021). By utilizing APIs and providing developer tools, the platform encourages external innovation. These additional offerings strengthen the ecosystem's overall value proposition, thus attracting a larger user base. Increased user engagement, data insights, and network effects benefit the platform, while developers gain access to a ready-made user base and growth resources (Hammouda et al., 2015).

The accretive ecosystem business model consists of a core platform that provides essential functionalities, with external partners contributing additional features, extensions, and integrations. As the ecosystem grows through the contributions of each partner, it accumulates value and becomes more attractive to users (Walton, 2017). This model frequently results in a "lock-in" effect, in which users become deeply ingrained in the ecosystem due to the increasing value of alternatives and the difficulty of switching to them (Stone & Alarcon, 2019). To maintain a competitive advantage, the accretive model

relies on a continuous cycle of attracting partners and accumulating value (Ciccone, 2017).

The cooperative business model for ecosystem participants combines elements of cooperation and competition. To increase the value of the complete ecosystem, businesses collaborate on certain aspects, such as sharing data and integrating services. Simultaneously, they compete in other areas to distinguish themselves and capture specific market segments (Sarafin, 2021). This dynamic balance between cooperation and competition drives innovation, diversifies products and services, and maintains the ecosystem's responsiveness to shifting demands from the market (Nguyen, 2017).

The value chain ecosystem business model involves integrating multiple participants along a value chain to offer a comprehensive end-to-end solution. Each participant excels in a particular phase of the process, and their contributions collectively provide customers with a seamless and effective solution (Sarafin, 2021). By cooperating and optimizing their individual responsibilities, ecosystem members create a unified experience that reduces friction and increases the value delivered to end-users (Kapoor, 2018).

Finally, the integrator ecosystem business model revolves around a central platform that aggregates diverse services, tools, and functionalities. This platform functions as a one-stop-shop, easing access for users who would otherwise have to interact with multiple providers (Leminen et al., 2018). The integrator model aims to provide a unified and seamless user experience, making it easy for customers to access a wide range of capabilities without navigating complex ecosystems. The platform's value lies in its capacity to streamline interactions and provide comprehensive solutions (Sarafin, 2021).

2.2.3 Digital industrial platforms

Digital industrial platforms are a strategic concept within software ecosystems that facilitate the integration, collaboration, and creation of value among an industry's various stakeholders. These platforms serve as a technological foundation, allowing businesses

to connect, share resources, and innovate in a more coordinated and efficient manner.

At its foundation, a digital industrial platform functions as a centralized hub that provides a set of standardized tools, services, and interfaces that various participants can use to develop, deploy, and manage software applications and services (Pauli et al., 2021).

The modularity and adaptability of digital industrial platforms is their defining characteristics. These platforms are designed to accommodate the dynamic nature of contemporary business environments, allowing users to personalize and expand their functionalities. As industries evolve and new challenges emerge, stakeholders can integrate new software components or update existing ones without difficulty and it enables businesses to swiftly respond to shifting market demands, experiment with novel ideas, and introduce innovative solutions (Gerrikagoitia et al., 2019).

By providing a space for stakeholders to collaborate and share resources, these platforms foster an innovative culture. Manufacturers and suppliers can collaborate to streamline the supply chain, while startups can utilize the infrastructure of the platform to develop and deploy disruptive applications. This collaborative philosophy fuels a virtuous cycle by attracting a wide range of developers, entrepreneurs, and innovators who collectively contribute to the expansion and enrichment of the ecosystem (Hänninen et al., 2018).

Within digital ecosystems, platform ownership stands at the intersection of power dynamics, ethical responsibilities, and economic forces. Owners exert a substantial amount of control over interactions and content distribution, causing discussions about monopolies and information control. Ethical considerations emphasize the need to find a balance between free speech and content safety, whereas economic implications centre on data usage and privacy. Regulatory frameworks play a crucial role in the formation of responsible ownership, fostering innovation while protecting societal interests. In this complex environment, stakeholder collaboration is essential to ensuring that platform

ownership is consistent with equitable power distribution and ethical governance in the digital age (Hein et al., 2020).

2.3 Servitization in the manufacturing industry

Software servitization is rapidly gaining traction as a transformative approach to meet the evolving needs of customers and enhance competitiveness. As manufacturing processes become increasingly digitized and technology-driven, software plays a crucial role in optimizing operations, enhancing efficiency, and providing superior client experiences (Helo et al., 2017). Software servitization is the process in which manufacturing companies extend their offerings beyond physical products and incorporate software-based services to provide customers with comprehensive solutions. These software services are intended to complement and enhance the functionalities of the tangible products, allowing manufacturers to offer more advanced and customizable solutions that meet the specific needs of individual customers (Paschou et al., 2020).

This shift towards software servitization is fueled by the recognition that modern manufacturing customers seek intelligent, connected systems that can adapt, evolve, and continuously improve over time. With the incorporation of software, manufacturers can implement advanced features such as data analytics, artificial intelligence, machine learning, and IoT connectivity into their products, thereby opening up a variety of new opportunities for both manufacturers and customers (Kamal et al., 2020). Software servitization enables manufacturers to collect valuable data from connected devices, allowing them to gain insights into product performance, usage patterns, and prospective maintenance needs. This data-driven approach enables manufacturers to proactively address issues, optimize operations, and provide predictive maintenance services, which can substantially improve the overall product reliability and efficiency (Paschou et al., 2020).

On the client side, software servitization offers numerous advantages. Manufacturers can now offer customized software configurations, modifications, and ongoing enhancements to meet the specific requirements of businesses. This not only maximizes the value of the purchased products, but also enables customers to remain on the cutting edge of technological advancements without making substantial hardware investments (Hsuan et al., 2021). Moreover, by adopting software servitization, manufacturers can strengthen their relationships with customers. Through ongoing software updates, technical support, and customized solutions that address the unique challenges encountered by customers, long-term relationships are fostered, ensuring the success and loyalty of customers (Stauffer, 2022).

The terms digitalization and servitization have recently been merged to establish a new phenomenon referred to as digital servitization. The purpose of this new phenomenon is to motivate companies to make significant adjustments to the ways in which they conduct their operations by offering enhanced services that are enabled by digital technology. Digital servitization should be regarded not only as a method for delivering digital services, but also as a method for utilizing servitization's foundations, value creation to both consumer and the provider (Favoretto et al., 2022; Paschou 2020). Digital servitization enables businesses to acquire a deeper understanding of customer preferences and behavior. These insights facilitate the customization of services to satisfy the specific needs of customers, thereby increasing customer satisfaction and loyalty. Digital servitization facilitates the transition of business models from traditional product-centric approaches to hybrid models that combine physical products and digital services. This change enables businesses to establish long-term relationships with customers, thereby generating new revenue streams and enduring competitive advantages (Favoretto et al., 2022).

2.3.1 Servitization strategies

Digital and software servitization strategies in the manufacturing industry involve a variety of methods for transforming traditional manufacturing businesses into service-oriented models. Industrial servitization, commercial servitization, and value servitization are the three main strategies utilized in the manufacturing industry. Each strategy focuses on specific aspects of digital and software servitization, enabling manufacturers to adapt to changing market dynamics and enhance their competitiveness (Favoretto et al., 2022).

Industrial servitization revolves around utilizing digital technologies and data-driven insights to enhance equipment and asset performance, optimize operations, and offer proactive maintenance services. Predictive maintenance services are one of the crucial components of this strategy. On apparatus and equipment, manufacturers install sensors and Internet of Things (IoT)-enabled devices, allowing them to monitor real-time data. By analyzing data, manufacturers can accurately predict maintenance requirements, allowing them to proactively resolve potential problems before they escalate. This predictive strategy minimizes customer equipment downtime and maximizes equipment availability, resulting in increased customer satisfaction and enhanced operational efficiency (Coreynen et al., 2017).

Another essential aspect of industrial servitization is remote monitoring and diagnostics. Manufacturers can remotely monitor the efficacy of equipment and systems through digital connectivity. This allows for the remote detection of anomalies and diagnosis of problems, reducing the need for on-site interventions. By providing such capabilities, manufacturers can improve response times and provide customers with more efficient service. In addition, performance-based contracts are used to cultivate long-term customer relationships (Grubic, 2018). Under these arrangements, consumers pay for the desired output or performance, as opposed to the product itself. This strategy aligns manufacturers' and customers' incentives, ensuring that manufacturers are motivated to deliver optimal performance and outcomes (Coreynen, 2018; Paschou et al., 2020).

Commercial servitization incorporates expanding the range of services and experiences surrounding the primary product in order to add value for customers and differentiate them from competitors. By offering software, upgrades, or additional services, manufacturers provide customers with continuous access to the most recent features and services, thereby encouraging customer loyalty and generating predictable revenue. Personalization and customization are also important practices in commercial servitization. Customer satisfaction is increased, and the manufacturer-customer relationship is strengthened through the provision of custom-tailored solutions that satisfy the specific needs and preferences of the customer. This customer-centric strategy enables manufacturers to obtain a competitive advantage by providing distinctive value propositions (Coreynen et al., 2017). Furthermore, these partnerships are established to create a comprehensive offering for customers. Collaboration with other businesses to develop an ecosystem of products and services enhances the overall consumer value proposition. By incorporating complementary services into their portfolio, manufacturers can provide an extensive solution to meet the diverse requirements of their customers (Toth et al., 2022).

Value servitization elevates the customer-centric approach by emphasizing the delivery of outcomes and results as opposed to merely products or services. Manufacturers who employ this strategy prioritize customer needs and pain points to provide tangible value. Contracts based on outcomes are an essential component of value servitization. Manufacturers offer contracts in which they are compensated based on the customer's results. This strategy aligns the interests of both parties and incentivizes manufacturers to produce optimal results. Continual value co-creation is a crucial component of the value servitization strategy. Manufacturers collaborate continuously with consumers to identify opportunities for co-creating value. Manufacturers can tailor their offerings to deliver the most pertinent and valuable solutions by involving customers in the solution development process (Coreynen et al., 2017; Frank et al., 2019; Fu et al., 2022).

2.3.2 Opportunities and barriers in adaptation of digital servitization

The dynamic nature of digital servitization has a high impact on the business decisions and models, thus demanding manufacturers to allocate resources and time towards the adaptation process of servitization (Xing et al., 2022). Integrating products and services seamlessly is the essence of servitization, initiating in a new era of customer-centricity. By combining physical products with customized and innovative services, businesses can establish strong and long-lasting customer relationships, resulting in increased customer satisfaction and loyalty. As the emphasis transfers from one-time transactions to continuous service interactions, manufacturers can not only optimize revenue streams but also ensure more sustainable growth prospects through this strategic pivot (Hsuan et al., 2021).

Digital servitization adaptation allows for predictive maintenance, remote monitoring, and asset optimization, in which digital technologies enable manufacturers to provide proactive services that reduce downtime, optimize operations, and increase productivity. In addition, it utilizes the domain of subscription-based models, personalization, and customer support, delivering customized experiences that resonate more deeply with customers. Moreover, value-based servitization establishes outcome-based contracts, data-driven insights, and continuous value co-creation, redefining the customer-manufacturer relationship by emphasizing the delivery of tangible and measurable outcomes (Paiola, 2018). Although servitization offers a variety of opportunities, it is not without challenges. The path to successful adaptation may be restrained by cultural resistance to change, the requirement to acquire new skill sets, and the need to make a substantial initial investment. In addition, manufacturers must establish a delicate balance between product and service offerings in order to prevent market cannibalization and address concerns to data privacy and security (Xing et al., 2022).

Considering the opportunities that are promoted by the adaptation of digital servitization, five significant opportunities were discovered: new revenue streams (Linde et al.,

2022), strengthened customer relationships (Li & Found, 2017), increased competitiveness (Xing et al., 2022), data-driven insights (Kowalkowski et al., 2022), and sustainable growth (Kowalkowski et al., 2022).

Servitization allows businesses to diversify their revenue streams through the addition of service offerings to their core products. This can result in more stable and predictable revenue streams, since service-based revenue is typically less susceptible to economic fluctuations. These services may consist of maintenance, repairs, upgrades, training, and consulting, among others. By providing these additional services, businesses can establish recurring service contracts, subscription models, and payment plans based on usage. This transition from a one-time transactional relationship to an ongoing service-based engagement not only provides a more stable and predictable income, but also fosters customer loyalty over the long term (Linde et al., 2022).

Digital servitization enables businesses to develop deeper and more meaningful customer relationships. By becoming strategic partners, businesses distinguish themselves as more than just product suppliers. Instead, they become providers of comprehensive solutions that address the unique needs of their customers. As businesses collaborate closely with customers to provide personalized services and support, they gain invaluable insight into their clients' preferences, obstacles, and objectives. This increased customer intimacy fosters trust and partnership, resulting in increased customer retention and repeat business (Li & Found, 2017).

In a business environment that is becoming increasingly dynamic and competitive, digital servitization is a potent tool for gaining a competitive edge. By adopting this model, businesses differentiate themselves from product-centric competitors. Instead of simply selling products, they provide customers with comprehensive solutions that address their broader needs. The ability to provide bundled products and services distinguishes these businesses as providers of comprehensive solutions. Such integrated offerings attract

customers because they simplify their decision-making process and provide a more holistic approach to addressing their challenges. Consequently, businesses that adopt digital servitization can differentiate themselves from their rivals, potentially attracting a larger market share and ensuring their long-term success (Xing et al., 2022).

The products and services offered by digital servitization generate a large amount of data. This data can provide valuable insights that companies can use to enhance their operations, customer experiences, and overall performance. By gathering information on product utilization, customer behavior, service utilization, and performance metrics, businesses can gain a comprehensive understanding of how their products and services are utilized and experienced by customers. This data-driven strategy enables companies to make informed decisions regarding product enhancements, service optimization, and business strategies. In addition, it enables them to recognize trends and patterns that can lead to innovative solutions and enhanced customer satisfaction (Kowalkowski et al., 2022).

Digital servitization offers opportunities for sustainable growth that benefit both businesses and the environment. By providing services that extend the lifespan of products, such as routine maintenance, repairs, and upgrades, businesses contribute to the circular economy principles. In a traditional product-centric model, products frequently reach the end of their life cycle with limited options for extension or reuse, resulting in increased waste. Digital servitization, on the other hand, encourages businesses to focus on maintaining products' optimal performance and durability, thereby reducing the need for premature replacements. This not only results in cost savings for customers, but also satisfies the rising consumer demand for environmentally responsible practices (Kowalkowski et al., 2022). In addition, the data-driven insights obtained through digital servitization can assist businesses in optimizing resource utilization, minimizing waste, and streamlining operations. By identifying efficiency improvement opportunities, businesses can simultaneously reduce their environmental impact and achieve sustainable growth (Chen et al., 2022).

The digital evolution is widely regarded as a means of adapting to a dynamic and competitive business environment, but it also presents its own difficulties. Digitalization is not an obvious pathway for businesses as it has barriers due to the complexity of digital systems (Le-Dain et al., 2023). Main challenges linked to digital servitization are financial (Marcon et al., 2019), technological (Peillon & Dubruc, 2019), organizational (Le-Dain et al., 2023), strategic (Marcon et al., 2019), and human resources (Peillon & Dubruc, 2019).

The adoption of digital servitization can be hindered by various financial barriers. High initial investments in technology infrastructure, software platforms, and talent acquisition can strain budgets. Transitioning from a product-centric to a service-oriented model incurs restructuring expenses that add additional financial burdens. Predicting the return on investment for digital servitization initiatives can be difficult, causing uncertainty and reluctance. Companies face pricing strategy complexities when balancing customer appeal and profitability, while competing financial priorities necessitate careful resource allocation (Marcon et al., 2019; Abou-Foul et al., 2019).

The implementation of digital servitization is highly dependent on the integration of multiple technologies, which can present several obstacles. Complexity issues may arise when attempting to integrate multiple systems and guarantee seamless communication. In addition, the cost of implementing new technologies and upgrading existing infrastructure can be a significant obstacle, especially for smaller enterprises with limited financial resources (Weerabahu et al., 2019). When dealing with enormous quantities of information generated by IoT devices, analytics, and other sources, data management becomes crucial. Moreover, as reliance on digital systems and data sharing increases, cybersecurity risks become more pronounced, necessitating the implementation of stringent security measures to safeguard sensitive data (Peillon & Dubruc, 2019).

Digital servitization can be impeded by internal factors within an organization. Employees may be comfortable with the traditional product-centric approach and may resist

new processes or roles. The integration of products and services across an organization can be hindered by departmental silos and a lack of collaboration, thereby preventing a seamless customer experience (Le-Dain et al., 2023). In addition, obsolete processes and organizational structures may not be compatible with the requirements of digital servitization, necessitating a reevaluation of internal operations (Marcon et al., 2019).

Strategic challenges can arise during the planning and execution of the digital servitization strategy. A lack of leadership vision and support can result in a directionless approach that hinders the digital transformation. In addition, the value proposition of adopting digital servitization must be defined and communicated to consumers to demonstrate the advantages over traditional product-centric models. As the company shifts its focus from products to services, market positioning becomes crucial and requires effective communication of the new offerings and their value to target consumers (Marcon et al., 2019)

Human resources have a crucial role in the successful implementation of digital servitization. When seeking employees with expertise in fields such as data analytics, software development, and customer support, businesses may face a skills and talent gap. In addition, it can be difficult to find and retain talent with the required skill sets (Peillon & Dubruc, 2019). To adapt to changing roles and responsibilities in a service-oriented environment, it is necessary to train and upskill existing employees. Effective change management practices are necessary for overcoming resistance to transformation and fostering a positive, motivated workforce (Peillon & Dubruc, 2019; Le-Dain et al., 2023).

2.3.3 Evolution of digital servitization towards smart solutions

Over the years, the manufacturing industry has witnessed a remarkable transformation of digital servitization into smart systems. Initially, digital servitization entailed integrating digital technologies and services into conventional product-based manufacturing and providing value-added services such as maintenance, updates, and customer support.

Nonetheless, as technology progressed, the manufacturing sector adopted a more interconnected and intelligent approach: smart solutions. The journey of transitioning from servitization to digital servitization to the current phenomena of smart solutions (product-service-software systems) is established in Figure 4. (Kohtamäki et al., 2022).

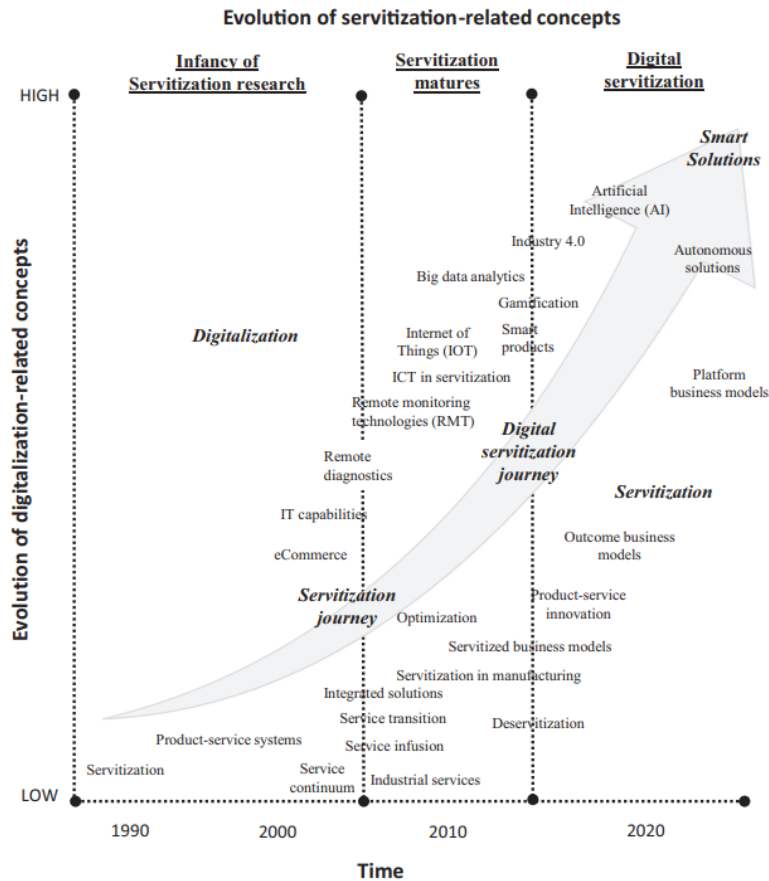


Figure 4. The evolution timeline of digital servitization (Kohtamäki et al., 2022).

The evolution of digital servitization towards smart solutions is driven by a number of key technologies. The Internet of Things (IoT) plays a central role in the manufacturing environment by connecting devices and sensors and enabling real-time data collection and analysis. This enables manufacturers to monitor product performance, anticipate the need for maintenance, and optimize processes for greater efficiency. IoT is complemented by Artificial Intelligence (AI) and Machine Learning, which process the vast amounts of data generated. Trends and anomalies can be identified by AI-powered algorithms, providing manufacturers with valuable insights for process optimization, quality

control, and predictive maintenance. The integration of these technologies into the business models of the manufacturing industry has enabled numerous advantages. By providing personalized services and prompt support, smart systems enhance the overall customer experience. Predictive maintenance reduces downtime and improves operational efficiency, thereby reducing manufacturing costs (Chen et al., 2021).

2.4 Product-service system

Product-service systems (PSS) are defined as being a solution that is competent to satisfy user's demands by providing simultaneously a set of both physical products as well as services. The need-fulfillment system is intended to have a significantly lower environmental and social impact, as well as to provide alternatives to product design and manufacturing for generating competitive advantage (Annarelli et al., 2016). Prolonging the product life cycle and manufacturing cost-effective and material-efficient products boosts the firm's profitability and generates incentives to operate in this manner. By utilizing circular economy strategies such as rental and leasing agreements, a product-service system provides alternate forms of product usage and lowers consumption rates (Beuren et al., 2013).

2.4.1 Benefits and barriers of PSS

The advantages of implementing product-service systems have the potential to benefit users, manufacturers, the environment, and society in a variety of ways, as shown on Table 1. PSS increases competitiveness and generates consumer loyalty through strategic alliances between consumers and service providers by forming long-term partnerships (Beuren et al., 2013; Moro et al., 2020). The external advantages that are created by PSS generate benefits for customers, society, and environment. Customers benefit from the disconnect from ownership because it relieves them of the responsibility of physical products, allowing resources to be directed into other areas and reducing the need for

operational excellence. Customers can have more customized solutions that meet their needs more precisely because of these benefits (Moro et al., 2020).

When it comes to the societal benefits of PSS, the main advantages are solutions to public pressure of the growing environmental issues. Furthermore, as the demand for service supply and reverse logistics applications grows, PSS creates new job opportunities. Because the PSS phenomenon employs advanced technologies in its operations, it has the capability to improve societal well-being (Beuren et al., 2013; Moro et al., 2020). In addition, PSS encourages a societal shift towards 'leasing society', which is described a shift in mindset of consumers and manufacturers and creates a relationship based on innovation and more service-oriented business models to meet customer needs through advanced approach to ownership (Tukker, 2015).

The environmental benefits of PSS are seen as one of its most influential features. The advantages are realized by both the manufacturer and the user of PSS. Product utilization rates rise with PSS applications, and environmental policies are allowing products to enter the circular economy loop, in which products complete their life cycles and use fewer resources (Moro et al., 2020). Manufacturing waste and energy consumption is reduced, resources are optimized to a higher standard, since PSS encourages resource-efficiency through decreased production rates. Frequently the solutions are based on techniques that are completely distinct from the existing product concept. Sensible material usage is also crucial in PSS business strategies, and because utilizing more resources does not yield more revenue, there is an incentive to reduce manufacturing costs by using fewer materials (Tukker, 2015).

The internal benefits of PSS can be divided into two sections, design, and economic benefits. One of the primary benefits of PSS is differentiation, as it is distinctly uncommon that competitors have the capability of offering similar solutions in both physical products and services. Design advantages of PSS are based on the centralization of infor-

mation and relationships between service provider and customer, as the system facilitates the collection of product usage data and close communication with customers (Moro et al., 2020).

PSS provides tangible economic benefits, but it can also promote intangible value in the form of brand value generated and easy access to services. As PSS captures high value in the value chain through its wide network, it also leads to brand loyalty, knowledge about clients (Tukker, 2015), image enhancement and dependency between service provider and customer (Moro et al., 2020). Tangible benefits such as remanufacturing and energy recovery are providing alternative revenue sources for companies, thus making PSS systems scalable and financially efficient (Vezzoli et al., 2015). PSS minimizes costs in energy and materials consumption throughout the manufacturing channels, as the materials are in circular economy loop and overall utilization of materials is greater. Constant cash flow is achieved in the system through constant service contracts and long-term relationships (Moro et al., 2020).

Table 1. Product-service systems benefits (Moro et al., 2020).

External benefits	Societal	Job creation	Facilitate reverse logistics	Use more advanced and efficient technologies	Improve well-being of society	Provide access to more people									
	Environmental	Greater use of products	Reducing environmental impact	Efficiency in consumption	Closing the life cycle	Waste reduction	Reduced resource use	Facilitate reuse and recycling	Dematerialization	Production of more durable good					
	Customers	Disconnect from the responsibilities of ownership	Reduction of costs	Disconnect from consumption needs	Offers professional maintenance	Reduced effort for production operation	More customized solutions								
Internal benefits	Economic	Customer loyalty	Increase in profit margin	Image enhancement	Reduction of costs (energy and materials)	Efficient use of equipment	Increase in value added	Increase customer satisfaction	Creation of dependency between provider and client	Improve the position in the value chain	Constant cash flow	Elimination of seasonality	Value delivery throughout the supply life cycle	Development of new markets	
	Design	Ease of collecting product use information	Greater contact with the customer	Differentiation against competition											

Table 2 shows how product-service system barriers can be divided into two categories: external and internal. PSS's external barriers are societal, environmental, and customer-related, while its internal barriers are operational, economic, and design-related. The challenges arise especially in the business-to-consumer context because the phenomenon is still regarded as a niche, and cultural resistance to alternative consumption methods causes difficulties in the acceptance of PSS (Moro et al., 2020).

The societal transformation required for PSS to succeed demands a structured rearrangement in social infrastructures that would support the product-service system. If such infrastructure does not exist, it must be designed, requiring highly skilled personnel, large costs, and extended time-to-market (Annarelli et al., 2016). Social impact costs are a critical component of the complete PSS solution price and as they are not included in the product market price, it is making it challenging for the PSS solutions to compete with industrially manufactured products (Vezzoli et al., 2015).

Environmental factors that impede PSS implementation include a lack of incentives for environmentally friendly operations, resulting in a decrease in environmental innovation (Ceschin, 2013), while the absence of proper regulations and their support is causing issues of standardizing PSS procedures and operations (Moro et al., 2020). It is also necessary to note that PSS is not an automatic result for environmental benefits, as it needs to be specifically designed for eco-efficiency (Vezzoli et al., 2015). The rebound effect of new technologies, such as PSS, is defined as a phenomenon in which increases in resource efficiency or sustainability measures are offset by increased consumption or demand, resulting in reduced environmental benefits. When a technological or behavioral change increases efficiency or lowers costs, it frequently encourages increased consumption or utilization of the resource in question. This increased consumption may outweigh the initial efficiency gains, resulting in a net increase in resource consumption or environmental impact. Managing the rebound effect in PSS necessitates a combination of developing sustainable system models, educating customers, and aligning PSS with broader sustainability strategies (Alfarisi, et al., 2022).

The lack of technical know-how and environmental consciousness is a barrier to customers adopting the PSS. The system also requires technological capabilities, which a lot of companies may not have, resulting in a learning curve and substantial initial expenses (Annarelli et al., 2016). Understanding and capturing customer value is especially difficult because they are influenced by a variety of factors, including psychological factors

and social norms. Resistance to consumption without possession and lower tangible value necessitates a shift in consumer mindsets for PSS growth to be successful. Customers are hesitant of ownerless-based consumption solutions because they prefer functional sales to product ownership. Ownership is viewed as a psychological indicator of status and a measure of success, and the trend of individualism in which consumers prioritize ownership over collaboration is lowering the potential success of PSS, but the growth of the sharing economy is widely seen as a possibility for PSS acceptance among consumers (Moro et al., 2020; Vezzoli et al., 2015).

As for the internal barriers, the main challenge is the management and adaptation of PSS, since it is significantly more complex than the traditional product delivery system and necessitates an internal culture shift. Companies with a prior history of service transactions are more likely to implement PSS in their operations, as the capabilities required for successful service solutions differ from traditional approaches. It is particularly difficult to capture consumer acceptance of new systems because consuming patterns are typically embedded and difficult to modify (Vezzoli et al., 2015; Annarelli et al., 2016).

Operational barriers in the PSS are mostly related to refusal of transformation of operative methods. Because PSS is a multi-level service solution, these adjustments must occur across various stakeholders (Moro et al., 2020). Acceptance from stakeholders is critical because PSS development requires their ongoing support. The collaboration benefits all the system's primary members (supplier/producer/consumer) (Annarelli et al., 2016). The complexity of the networks causes difficulties regarding relationships, since supplier involvement, system management, and reverse logistics performance must be maintained. In PSS-based businesses, the corporate mindset should be receptive to systematic innovation, which may produce internal disputes between business units due to a lack of an internal common language and mindset alignment (Moro et al., 2020; Vezzoli et al., 2015).

Economic constraints to PSS are one of the most critical and include high initial implementation costs of and because the market is still restricted, it is currently difficult to be profitable (Moro et al., 2020). Education, staff training, and the necessity for a large number of workers due to the complicated network all result in expensive expenses. Maintenance of information systems and infrastructure facilities necessitates continuous cash flow payments. The involvement of the extended network creates financial risks and uncertainty of success (Barquet et al., 2013; Annarelli et al., 2016). Costs that do not occur in traditional manufacturing are typical in the price formation of PSS. An example of this is transaction costs, as PSS is often involving multiple partners, the contracts and payments are increasingly complex, increasing the risks and costs (Tukker, 2015).

Design-related barriers in product-service systems refer to challenges that can arise during the design process or implementation of a PSS. These barriers can hinder the successful integration and functioning of the combined product and service elements. Designing a PSS often involves integrating diverse components, such as physical products, digital interfaces, and accompanying services. Ensuring smooth integration and interaction between these elements can be challenging, especially when different teams or stakeholders are involved. PSS often requires the effective management and exchange of information between the product and service components (Beuren et al., 2013). Designing robust information systems and interfaces that facilitate seamless communication and data sharing can present challenges, especially when dealing with large amounts of real-time data. Developing the necessary infrastructure to support the service elements of a PSS can be complex. This includes designing the service delivery processes, establishing service networks, and ensuring scalability. Lack of proper planning and infrastructure can limit the viability and effectiveness of the service component. Addressing these design-related barriers requires a holistic approach, involving interdisciplinary collaboration, user-centered design, and careful consideration of the integration between product and service aspects of the system (Moro et al., 2020; Vezzoli et al., 2015).

Table 2. Product-service systems barriers (Moro et al., 2020).

External barriers	Societal	Resistance to established local habits	Cultural acceptance	Lack of knowledge related to PSS					
	Environmental	Lack of legal and regulatory support	Rebound effect						
	Customers	Resistance to consumption without possession	Lower tangible value	Low environmental awareness of users					
Internal barriers	Operational	Resistance to change by stakeholders	Necessary changes in organization processes	Low level of maturity of providers and lack of knowledge related to the provision of this type of offer	Difficulty of supplier engagement	Difficulty in maintaining the system	Difficulty in performing reverse logistics	Lack of an effective information management system	Risk of use with little care of products by customers
	Economic	High risks involved and difficulty in measuring results	Need for high initial investment	High costs, mainly due to the high intensity of labor use	Lack of profitability/restricted market				
	Design	Difficulty in evaluating how to charge for solutions	Lack of information and knowledge	Lack of experience in service design	Increased time to market				

2.4.2 Types of PSS

Figure 5 depicts the three different product-service system classifications with their sub-classifications, where the level of service increases the more the concept is on the right. These classifications are based on the provider-customer relationship, revenue model, and product or service tangibility. These classifications differ in their customer offerings, as their end-product is dependent on the PSS model type (Barquet et al., 2013; Tukker, 2004).

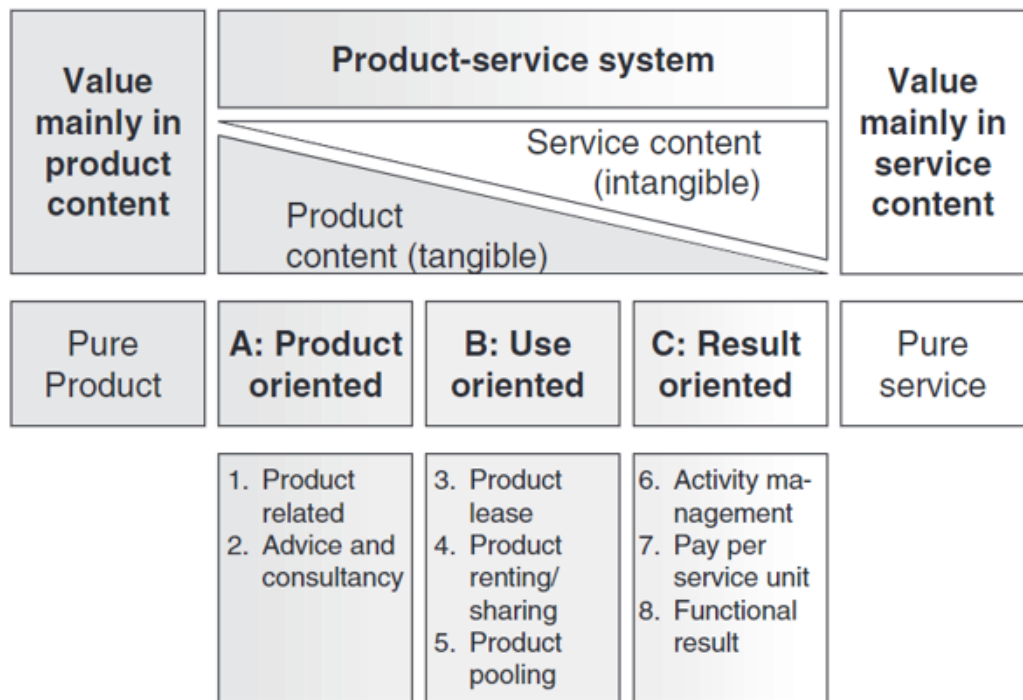


Figure 5. Product-service systems classifications and subclassifications (Tukker, 2014).

The classification of product-oriented services (POS) in which traditional sales are the primary focus. In POS, the customer receives ownership of the sold product, and the provider provides additional services for it. The revenue model is based on the profitability of physical goods and is supported by supplemental services (Barquet et al., 2013). Product-related services and consultancy are subcategories of POS. Product-related services facilitate product utilization by providing services that are used during the product's use-phase, such as maintenance contracts or consumables. End-of-life contracts in which the product will enter the circular economy loop are utilized in POS. Consultation refers to advice offered by the supplier regarding the best way to use or utilize the physical product, such as organizational structure around the product or production planning (Tukker, 2004).

Use-oriented services (UOS), in which the manufacturer owns the product and provides use of the product in the form of leasing, sharing, or renting. The product life cycle is being extended as the manufacturer invests in higher quality, longer-lasting materials,

and routine maintenance procedures (Barquet et al., 2013). Product lease, product renting and product pooling are all subcategories of UOS. In product lease, the manufacturer is responsible for maintenance, repair, and control, and the fees are typically paid for unlimited access to the product. Product renting and leasing are essentially the same concept, with the main difference being that in product renting, the product has multiple users rather than unlimited access by a single consumer. Product pooling is the third subcategory, and it is similar to the previous concepts, with the primary difference being that it is the practice of meeting demand for numerous separate products with a single, universal product capable of satisfying the needs of multiple customers simultaneously (Tukker, 2004).

The most complex of the PSS classifications is result-oriented services (ROS), in which the end-product is a complete solution for the customer rather than just products. The critical point of ROS is that the emphasis is on delivering an outcome rather than the process, and the produced value primarily emerges through service delivery, with the producer taking responsibility for the entire product life cycle (Barquet et al., 2013). The subcategories of ROS are activity management, pay-per-service units, and functional results. Activity management refers to outsourcing activities and processes of a company to a third party meaning the end-result is not dependent on certain technology or means. Many other PSS classification model types share similarities with pay-per-service units. The pay-per-service notion still uses a common PSS concept as its foundation, but the user no longer purchases the product itself, but rather the output of the product based on the level of use. In functional results subcategory the provider and the client agree on the delivery of a result. Functional results are used to describe an end-result in rather abstract terms that are not directly related to a specific technological system. In principle, the provider has complete control over how the result is delivered (Tukker, 2004).

2.4.3 Business models of PSS

Business models depict a company's core strategies, as well as how it delivers and captures value through its operational decision-making process. It takes a holistic approach to how internal and external partners' values align with their representation of objectives and relationships (Barquet et al., 2013). Implementing a PSS strategy in an organization typically leads to increased service or product elements in their operations, which is why companies have varying levels of success while implementing PSS operations. Table 3 shows how the different types of PSS classifications are creating, delivering and capturing value in their business models (Reim et al., 2015).

Table 3. Comparison of business models for different PSS types (Reim et al., 2015).

	Product-oriented	Use-oriented	Result-oriented
Value creation	Provider takes responsibility for the contracted services.	Provider is responsible for the usability of the product or service.	Provider is responsible for delivering results.
Value delivery	Provider sells and services the product sale and service (e.g., maintenance or recycling).	Provider assures the usability of the physical product along with service.	Provider actually delivers result.
Value capturing	Customer pays for physical product and for the performed services.	Customer can make continuous payments over time (e.g., leasing).	Customer payments are based on outcome units; that is, they pay for the result.

The critical output in the form of process or content that an organization is able to create that leads to successful business operations is referred to as value creation. Value creation is critical, particularly in competitive markets, because it enables companies to integrate sustainability and collaborative methods while producing competitive advantage (Moro et al., 2022). Value delivery is described as the method of how the created value is delivered to the customers by the company. These activities include critical processes, resources, and relationship management with stakeholders in order to meet and exceed customer expectations (Thomson et al., 2003). Successful value capture converts the value created and delivered into tangible benefits such as revenue. Successful value capture is required for long-term profitable business operations and creates opportunities for long-term relationships, viable organizational structures, and cost-effective operations (Moro et al., 2022).

The different types of PSS business model classifications are creating, delivering, and capturing value differently, based on their strategic decisions and capabilities. In POS

models, value is created primarily by the product itself, which is supplemented by additional services. The core offering is the product, and the associated services improve its functionality or provide additional benefits. The value delivery process entails delivering the product to the customer along with any additional services that enhance the value proposition, such as installation, maintenance, repairs, upgrades, and training. In POS models, value is typically captured through the sale or lease of the product and the charging of fees for the associated services. Product sales, service contracts, and ongoing maintenance agreements generate revenue (Reim et al., 2015; Barquet et al., 2013).

The value of ROS models is focused on delivering specific outcomes or results to customers. The provider commits to meeting specific targets or predefined performance metrics. Value creation entails comprehending the customer's desired outcomes and devising a strategy to achieve them. The provider assumes responsibility for delivering the desired results, frequently using their expertise and resources. To achieve the desired results, they may use a combination of products, services, and technology. The value captured in ROS models is typically based on the outcomes and the pricing is determined by performance metrics (Reim et al., 2015; Moro et al., 2022).

Value is created in UOS models by allowing customers to access and use a product or service without the need for ownership. The emphasis is on meeting the needs of the customer rather than selling a specific product. Value creation entails designing the service offering to meet customer demands and making the product or service easily accessible. Facilitating the customer's access to the product or service, which can involve leasing, sharing, or providing access to a shared pool of resources, allowing customers to use the product as needed, is an example of value delivery. Value capture in UOS models is typically based on the usage or utilization of the product or service. Customers are charged based on factors such as time, quantity, or level of service utilized. The provider generates revenue through usage fees, subscriptions, or pay-per-use pricing models (Reim et al., 2015; Barquet et al., 2013).

2.4.4 PSS business model framework

For a successful PSS business model adoption, the development of products, services, infrastructure, and networks must be developed continually to remain competitive and satisfy customer needs. Baines (2007) introduced six critical success aspects that have been included for this proposed PSS adoption method:

- Mindset shift from a product-based to a system-based approach.
- Establish direct customer relationships to increase contact or frequency.
- Increased customer and company involvement.
- Design, production, and delivery on a case-by-case basis.
- Increased company involvement and accountability throughout the product life cycle.
- Increased stakeholder involvement

The adoption of PSS becomes more accessible as a result of these aspects, and the framework illustration introduced in Figure 6 provides support through proven operative methods with three parts: business context, PSS types and PSS characteristics (Barquet et al., 2013). Sustainable business models for PSS are driven by interactive collaboration between the stakeholders, co-creation, and service-dominant business mindset. Continuous market adaptation is required for the development of the PSS adoption process. Because PSS is still considered a niche, the business environment is competitive, and the market field situation is changing, it is necessary to be able to experiment with various business models in order to find the most appropriate one (Moro et al., 2022).

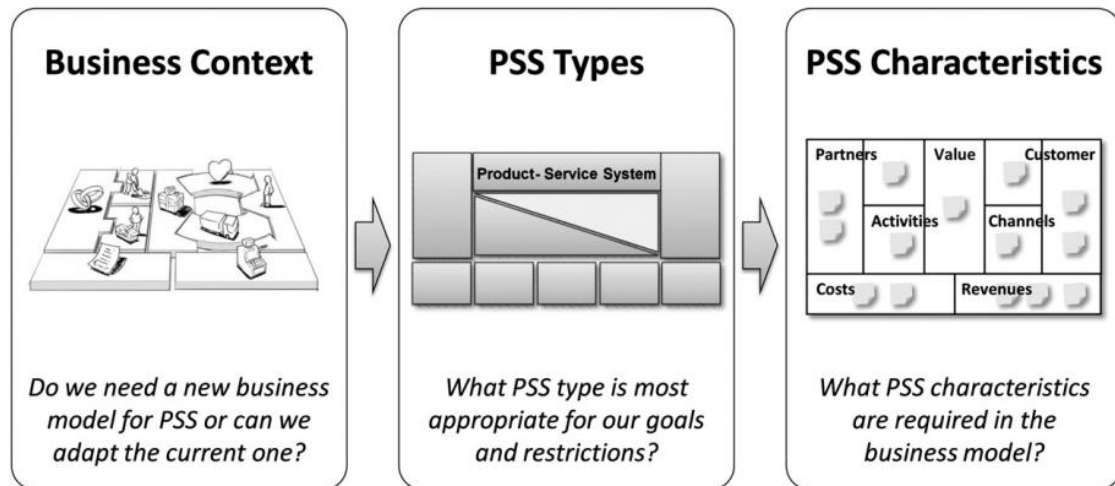


Figure 6. Parts of the framework proposition for PSS adoption (Barquet et al., 2013).

Business context, referring to analysis of the current business model and its potential application to the PSS model and creating either a restructure to current model or scheme to initiate a process to create a new business model. The second section identifies the link between the business context and the PSS characteristics. It defines the primary objectives of the business model and enables the selection of the most appropriate PSS characteristics. The final section, the PSS characteristics is a description of the characteristics, also included in the Business Model Canvas (Figure 7) that the new or modified business model should incorporate in order to create a specific type of PSS strategy. These business model elements are key activities, key partners, key resources, cost structure, customer relationships, customer segments, value proposition, distribution channels and revenue streams (Baines et al., 2007; Barquet et al., 2013).

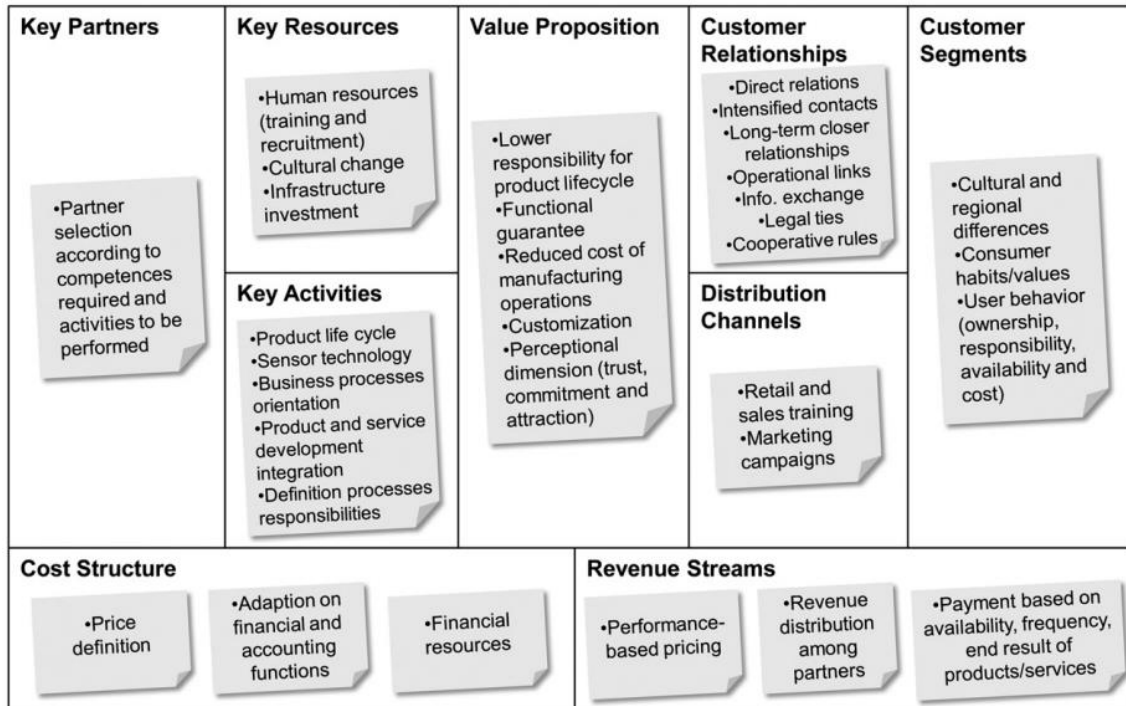


Figure 7. PSS characteristics organized in Business Model Canvas elements (Barquet et al., 2013).

2.4.5 PSS tactics

PSS business models can be used for PSS tactics implementation. Tactics are the operational decisions that a company makes after determining which business model to use. The PSS business model used will determine the available tactics, and tactics determine how much value is created and captured when a specific business model is implemented. PSS employs five distinct tactics: contracts, marketing, network, product and service design, and sustainability (Reim et al., 2015).

The contracts tactic examines how rights and liabilities are appointed among stakeholders, defining the responsibilities and capabilities of said partners. Contracts form the basis for representing and implementing a specific business model. As they administer the incentives and risks of the business model, contracts have a significant impact on creating value and generating revenue while operating under a given business model (Richter et al., 2010). The responsibilities of providers grow as their involvement with stakehold-

ers grows more complex through complex contracts. Contracts are riskier the more complex they are, creating opportunities and challenges. Contracts should also align stakeholders' interests through revenue-sharing models or performance-based incentives, encouraging mutual benefits and incentivizing collaboration (Reim et al., 2015).

Marketing tactics refer to how they communicate and use market insights in their PSS business model. Long-term relationships formed through marketing strategies allow for greater insight into the operations of the customer as well as an understanding of their needs and preferences (Reim et al., 2015). Because PSS business models combine both physical products and services, it is becoming increasingly important to create value through communication. Additionally, because target customers can be quite diverse when using PSS business models, different offers must be developed for different customers. Collecting customer market data enables innovative solutions to their needs, and because PSS is heavily reliant on co-creation, it creates value for both parties involved (Ulaga & Reinartz, 2011).

Building and managing a strong network of partners, suppliers, and service providers is an important aspect of PSS implementation. The network is used to ensure the proper operation of the chosen PSS business model. Because PSS solution offerings are complex and require collaboration with external partners, collaborative relationships with external businesses can enhance the overall PSS offering and expand the customer base. Effective network communication and coordination mechanisms are critical for seamless integration and successful PSS delivery (Reim et al., 2015). The networking tactic refers not only to the chosen partnerships, but also to their types, which are dependent on the required solution that the provider provides. Many resources are required to maintain relationships through effective communication and coordination (Schuh et al., 2008). Network partners should typically be included early in the business strategy to ensure a well-organized infrastructure and value chain (Maxwell & Van der Vorst, 2003).

Product and service design tactic is the manner in which the PSS provider is meeting the diverse needs of customers and implementing the design in their business models. This requires aligning the product and service characteristics with each other (Reim et al., 2015). The products and services should be designed to be functional and add value to the customer (Williams, 2007), while the customizability of the products allows for flexibility of the solution for unique customer needs, breeding innovation and advancing society forwards (Azarenko et al., 2009).

The final PSS tactic is sustainability, which aims to improve sustainability and create environmental benefits by integrating sustainability practices throughout the PSS's entire life cycle. This includes responsibly sourcing raw materials, reducing energy consumption, minimizing waste generation, and promoting environmentally friendly practices. Communication of the PSS's sustainability features aids in attracting environmentally conscious customers and stakeholders who value sustainable offerings (Tukker, 2004). PSS improves sustainability in two ways: improved resource utilization and innovation. PSS increases product utilization by extending the life cycle and incentivizing resource use. Innovative solutions have the potential to have a significant impact on sustainability by improving product durability and usability (Manzini & Vezzoli, 2003).

3 Methodology

Research methodology is a term that typically encompasses the structured approach or series of methods and strategies employed by researchers in order to design, execute, and evaluate their research strategies. The collection and analysis of data, as well as the consideration of ethical principles, are integral components of the research process. In sum, it refers to the overall strategy or approach used in the study (Saunders et al., 2009).

3.1 Method selection

This thesis utilizes benchmarking as its research methodology. Benchmarking is the systematic comparison of an organization's performance, processes, or products to those of industry leaders or other high-performing entities in order to identify areas for improvement and gain insights into best practices. It involves defining key performance indicators, selecting benchmarking partners, collecting and analyzing data, identifying best practices, setting performance goals, implementing changes, monitoring progress, and maintaining an iterative improvement process (Dattakumar & Jagadeesh, 2003). The practice of benchmarking has become a near necessity for organizations seeking to enhance their products, services, or processes in order to effectively cater to customers and enhance business outcomes (Jetmarova, 2011). The type of benchmarking conducted in the study can be seen as a mix of both functional benchmarking and strategic benchmarking, in which the goal is to compare industry-specific processes as well as focusing on long-term strategies and broad goals (Anand & Kodali, 2008).

As this thesis is conducted as a case study, it is necessary to evaluate the content from the perspective of the case company, understanding their strengths, weaknesses and strategy potential through benchmarking interviews. The collected data should be thoroughly analyzed in order to derive meaningful insights, identify recurring patterns, and generate knowledge that can be utilized for problem-solving or decision-making purposes.

The benchmark interviews were conducted as a part of the research to aid in the gathering of relevant information correlated to the research questions. The research interviews followed a semi-structured agenda in order to collect information about the research topic and further investigate the findings. The theoretical framework and expectations from the case company served as the basis of the interviews conducted. The versatility of semi-structured interviews enables the exploration of emergent issues throughout the interview process, thereby facilitating the acquisition of in-depth and dynamic insights (Doody & Noonan, 2013). Evidently, the previously mentioned condition benefited the interviews conducted for this study. The direction and atmosphere of the interview determined the order and wording of the questions.

3.2 Data collection and research process

This study involves the collection, analysis, and interpretation of data to gain a comprehensive understanding of a phenomenon within the case company. During the research process, objectives and findings are systematically defined in line with established frameworks. There are three primary categories of research methods: quantitative, qualitative, and mixed. Quantitative research entails the collection of numerical data and the application of statistical analysis to identify patterns and relationships, resulting in objective, precise answers. Through in-depth analysis of narratives, interviews, or observations, qualitative research investigates meanings, perspectives, and context with the goal of comprehending complex human behaviors and social phenomena. Depending on the research questions and objectives, mixed methods research combines quantitative breadth with qualitative depth to provide a comprehensive understanding of a research problem (McCusker & Gunaydin, 2015).

This study is conducted as mixed research methodology. Qualitative methods were chosen as they provide support to the researcher in the form of experiences of the interviewees. Qualitative methods allow for understanding complex phenomena by providing a stronger relationship between the data and the observer (Doody & Noonan, 2013),

whilst quantitative methods permitted generalization to a larger population and facilitated the exploration of patterns and specific points of information, thereby enhancing the overall relationships within the data and the overall depth of the research (Morgan, 2013).

In this thesis, the benchmark question process is essential in shaping the research inquiry and methodology. Each of the 17 thoughtfully selected benchmark questions was chosen based on its direct relevance to the field of study and its potential to significantly contribute to the research objectives, shown on Table 4.

Table 4. Benchmark interview questions.

Question ID	Related field of the question	Questions
1	Systems	What systems is the company using in their software order-delivery process?
2		Are you using the same order processing system for both physical and software products?
3		Are you utilizing 3rd party tools in any form? For example, outsourcing data security or financial data storage.
4		How are you ensuring the traceability of your financial statements (invoices/contracts) and other critical documents/information, for example by centralizing your operations on a single system such as SAP.
5	Process	Describe your software order-delivery process in depth.
6		What do you consider your strengths and weaknesses regarding this process?

7		Where are you directing resources and what is critical success factors for the product-service system
8		What is your order handling time of software sales?
9		What is your lead time in your order-delivery process? Meaning, the time it takes from customer order to software availability
10		What is your automatization level – how much of your order-delivery processes is automatized and which functions?
11	Financial	Financial metrics – ratio of software/physical products in sales
12	Security	What is your approach to sensitive data - two-step authentication/access management?
13		Cyber security KPI's - number of security incidents, MTTD/MTTR
14	License agreements	How do your software license renewal processes work - are you in close communication with customer upon their license release date getting close?
15	Customer relationships	Are you able to build long-term relationships with customers? (rate of returning customers and long-term contracts)
16		What are you customer satisfaction/service levels?
17	Future	What is in your scope in the software delivery field - what needs to be developed further?

These guiding questions serve as the framework for the entire research project, defining its scope, purpose, and direction. They were carefully constructed to address specific aspects of the topic, with the intent of evaluating and comparing performance, practises, or processes. They provide a structured and systematic method for assessing perfor-

mance and drawing meaningful conclusions. Using these benchmark questions, this thesis aims to contribute valuable insights and knowledge to the field through a targeted and purposeful investigation of the chosen topic.

The interview structure adopted for this research is intentionally designed as semi-structured, offering a balanced approach that combines elements of flexibility and a predefined framework. This strategy acknowledges the importance of adaptability in capturing rich and nuanced data, while ensuring that key research objectives and benchmark questions are consistently addressed.

The research process undertaken for this study follows a systematic path, involving several critical stages that contribute to the fulfilment of the research objectives. These stages can be summarized in Figure 8. Critical thinking, attention to detail, ethical considerations, and adaptability are required throughout the research process. The research process is not linear, but often changes in response to new insights and unexpected challenges.

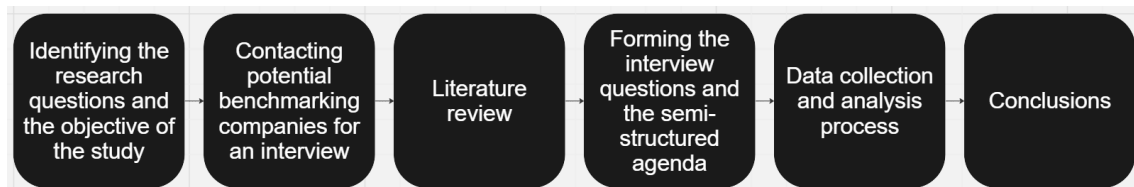


Figure 8. Research process of the study.

Beginning the research process is a comprehensive review of the overall research objectives. This includes defining the specific research questions that the study intends to answer and outlining the research's goals. These questions and objectives serve as the research's guidance, ensuring that the research project remains focused and purposeful.

After establishing the research questions and objectives, the next step involves identifying and reaching out to potential benchmarking companies or organizations for participation in the study. This phase requires effective communication and networking to secure the collaboration of relevant stakeholders who can provide valuable insights and data.

To gain a thorough understanding of the topic and the existing body of knowledge, a comprehensive literature review is conducted. This step involves examining academic publications, industry reports, and other relevant materials in order to better understand the research design and identify knowledge gaps around benchmarked practices.

With insights from the literature review, begins the formulation of the interview questions and developing a semi-structured agenda. These questions have been carefully crafted to align with the research questions and objectives while allowing for adaptability during the interviews. The semi-structured format ensures that the essential benchmark questions are addressed while also allowing for unexpected insights.

The core of the research methodology resides in the collection of data, which involves conducting interviews with benchmarking companies. Data collection for this study involves conducting interviews with participants using online platforms such as Microsoft Teams. The interviews are arranged and conducted within a virtual setting, enabling the possibility of remote communication and data gathering. During the course of these interviews, participants are actively encouraged to openly discuss and share their personal experiences, typical methodologies, challenges encountered, and recent developments related to the subject matter under research. The utilization of a semi-structured approach allows for a comprehensive examination and the potential discovery of nuances.

After collecting data from online interviews, data analysis is the next critical step. Interview transcripts and other qualitative data are thoroughly categorized to identify recurring themes and patterns. Quantitative data is subjected to statistical analysis in order

to identify patterns or associations. For mixed methods, both types of data are combined to form a comprehensive picture. Throughout the analysis, researchers maintain transparency and diligence while ensuring alignment with research questions. Results are documented to communicate key findings effectively. Data analysis is a crucial step that transforms raw data into meaningful insights that contribute to the overall conclusions of the research.

In the vital final stage, results and conclusions, the researcher generates and comprehends the results of data analysis. Methodically comparing qualitative and quantitative findings with existing literature to identify patterns and themes. The research's practical implications and applications are investigated from the viewpoint of the case company, and its limitations are acknowledged. The study's contribution to the field is supported by the conclusions, which directly address research questions. This phase highlights the transformative potential of the study to positively impact both understanding and execution.

3.3 Selection of case companies

The procedure for selecting case companies for benchmarking was complicated, as the initial criteria for the case companies were difficult to obtain and even unrealistic. Initially, the companies were required to have their own physical manufacturing, self-developed software, and operations in Finland. As an early-career occupational researcher, I encountered limitations in terms of networking opportunities. The utilization of email and LinkedIn messages as a means of reaching out to prospective companies resulted in a relatively low rate of positive results. Cold calling and prospecting via social media are generally associated with a relatively low rate of success. According to Shastri (2023), even for highly qualified professionals, the success rate of cold calling stands at approximately 2%. This discovery prompted us to adopt a fresh point of view, and we had to adjust the criteria to companies that are actively working with software in their sales portfolio and having their own order-delivery process. Contacting a larger number of

companies and utilizing the network to find qualified interviewees led to a successful process. The selection of interviewees was a key component of the research procedure, as their roles and expertise were crucial in providing valuable insights into the software order-delivery process. Each interviewee played a unique and essential role in ensuring that the research captured a comprehensive understanding of the topic. The specifications of the participants' backgrounds for the benchmarking process are presented in Table 5.

Table 5. Background information of the interviewees.

ID	Company industry	Specification	Interviewee role
Company 1	Motion and Drive products	Smart motion products, drives, motors, and generators	Digital Business Operations Manager
Company 2	Motion service	Service solutions for physical products	Information Systems Development Manager
Company 3	SaaS solutions	Data analytics solutions	Partner, Product Development
Company 4	Software consultancy	Development of online services, mobile applications and IoT projects	Sales & Account Manager
Company 5	Technology sales	Automation and business solutions	Data & AI Software Sales representative
Company 6	Electrification	Smart electrification & infrastructure solutions	Global Ability Marketplace Lead
Company 7	Manufacturing	Stainless steel manufacturer	Customer Experience and Commerce Solutions Director

3.4 Data analysis

The data was collected through semi-structured interviews between September and October 2023. Due to the protection of sensitive information and critical business practices, the names of the participants, as well as any critical information are anonymous. It was necessary for the interviewees to have process knowledge of the software-delivery process, despite the fact that their roles varied significantly in order to gain a variety of perspectives. Generally speaking, the interviews were conducted in a conversational manner in order to provide a comprehensive understanding of the processes. The interviewees all had a significant quantity of experience, allowing them to provide insight from an extended period of time. Eight individuals were interviewed via Microsoft Teams. The method for conducting interviews was selected based on Covid-19 restrictions and participant distance. Each interview lasted between 45 and 60 minutes and was conducted in either English or Finnish. After conducting the interviews, the data was collected, transcribed, and presented. The process of data analysis would entail conducting a comparative examination of the obtained data in relation to that of other entities, establishing connections to the presented research questions, and determining the applicability to the development of the case company's processes.

This study examines the software order-delivery processes within the manufacturing industry, focusing on the key domains that influence this ever-evolving field. These encompass the technological systems and infrastructure that serve as the foundation for the process, the complexities of operational procedures, financial factors such as metrics and data protection, the intricacies of software license agreements, the importance of developing enduring customer relationships, and an eventual investigation of future developments in this innovative industry.

3.4.1 Company 1

The first company to be interviewed for this benchmarking procedure is a global leader in the electrification industry with a formidable presence in industries around the world.

Company 1 specializes in the production and distribution of innovative Motion and Drive products, concentrating on smart motion products, drives, motors, and generators. Their mission is to provide industries, infrastructure, and machine builders with world-class drives, drive systems, and packages, all of which are designed to increase energy efficiency, asset reliability, productivity, safety, and performance for their customers, partners, and equipment manufacturers.

The participant of this benchmarking interview is currently employed as the Digital Business Operations Manager at Company 1. They bring a wealth of software industry experience, making them an asset to the company's growth and innovation. It is necessary to note that they are relatively new to the company, adding a new perspective to our investigation. Through this benchmarking interview, we intend to leverage the interviewee's software expertise and recent onboarding experience to glean insights that can be used to drive innovation and excellence in the industry.

The interviewed company distinguishes itself in the dynamic realm of the software order-delivery process within the manufacturing industry, due to its notable and continuous transformation. One notable transformation is the shift from conventional product sales to a subscription-oriented framework, characterized by the provision of digital products via email and ongoing billing. The implementation of this strategic change is indicative of a more extensive industry pattern favoring recurring revenue models, which is in line with the company's objective of improving customer engagement.

One significant observation relates to the company's separation between the systems utilized for processing physical products and those utilized for software products. This differentiation emphasizes their commitment to effectively meeting the requirements of each product category. Additionally, it underscores the importance of modifying order-delivery procedures to the unique attributes of software products, which frequently require totally different lifecycles and distribution methods in comparison with tangible goods. The company places a strong focus on data control and traceability, recognizing

the critical importance of securely managing financial documents and sensitive information in current era. Although the company does not explicitly centralize operations on a single system such as ERP, it states that it retains complete control over its documents, thereby enhancing the security and traceability of vital information.

The company's order-delivery process is characterized by its ability to promote synergy between its development divisions, which in turn contributes to a collaborative approach that can result in a competitive advantage. Nevertheless, the interview also highlights a potential vulnerability, namely the lack of speed of the development cycle. The previously mentioned factor has the potential to impact on the organization's capacity to swiftly meet market requirements and deliver software products within specified timelines.

The allocation of resources is recognized as an important measure of the product-service system's effectiveness, wherein developers assume a key role in the organization's goals. The company is proactively monitoring and improving the procedures for order-delivery, acknowledging the significance of effectively allocating resources in order to maintain competitiveness within the software industry.

The development of the order-delivery process in the future is initiated to revolve around automation. The company acknowledges that, although automation is not yet prevalent, it aims to achieve complete automation of the entire process to optimize operations and improve efficiency. The objective of minimizing the duration required for order handling to a range of 2-3 hours highlights their dedication towards achieving their specific goal. Regarding cybersecurity, the company demonstrates a proactive approach in ensuring the protection of its systems and sensitive data. The implementation of two-step authentication serves as an additional safeguard, and the lack of documented security breaches serves as evidence of their dedication to ensuring the security of data.

The company's strategy for software license renewals is in accordance with current subscription models. The company provides a continuous service until the customer takes the initiative to cancel, thereby simplifying the customer experience and potentially enhancing long-term customer retention. Company 1 utilizes channel customers to gain a larger amount of market share, making their operations B2B2B. Although this particular approach may possess certain merits, it presents complexities in establishing customer satisfaction while creating enduring, direct connections with the end-users of their software. Company 1 strategically leverages channel customers to expand its market share, effectively transforming its operations into a multifaceted B2B2B model. While this approach holds certain advantages, such as broader market reach and potential for increased sales, it introduces unique challenges in ensuring customer satisfaction and creating enduring, direct relationships with the end-users of its software products.

Despite these challenges, the company has a positive mindset regarding the future. Expectations are held for substantial changes, specifically in the transition from outdated systems to innovative platforms. The preceding transition exemplifies the general industry pattern of adapting to the digital era and demonstrates a dedication to remaining at an early stage of technological progress in the manufacturing industry.

In summary, the company's evolving order-delivery process exemplifies an adaptive strategy to the evolving software industry landscape in the manufacturing industry. The proactive position of the organization is evident through their dedication to data security, resource optimization, and automation. The imminent transition to innovative platforms is anticipated to serve as a pivotal driver for the company's potential success in the domain of software delivery.

3.4.2 Company 2

Company 2 operates within the same organization as the previously interviewed company, but it functions as an independent division. The company is committed to support-

ing customers in optimizing operational time, prolonging the lifespan of products, improving functionality, and increasing energy efficiency for motors, generators, and drives. The customized services and digital solutions provided by the company are strategically designed to optimize operational efficiency, enhance profitability, and maintain a high level of safety and reliability. The company possesses a substantial legacy of expertise in the field of motors and generators. Additionally, they possess extensive knowledge and proficiency in the areas of drive systems within manufacturing, servicing, and optimization, that extend various industries.

The individual being interviewed for this benchmarking interview within Company 2 is a highly valued expert who possesses several years of experience within the organization. The individual in question has played a crucial role in the advancement of their digital systems over a significant period, gathering an extensive amount of industry expertise and valuable practical perspectives.

The interviewed company employs a combination of in-house systems and third-party solutions to manage its software order-delivery process. Notably, a separate add-on has been developed to manage software products, enabling recurring billing, a fundamental aspect of the subscription-based model. This demonstrates a commitment to adapting their systems to meet the specific needs of software product delivery. In addition, the fact that local sales companies utilize their own ERP systems suggests an approach that effectively meets local requirements, but it also introduces complexities that may need to be addressed. A significant component is the balance between internal and external tools. While billing is facilitated by SaaS system for efficient invoicing, sales order creation and invoice generation occur within the ERP system, indicating a hybrid approach to third-party tools. This demonstrates a strong commitment to data control and security.

The software order-delivery process involves multiple components, including local sales units, a user interface for subscription management, and integration with a digital ser-

vice platform. This complicated strategy emphasizes the need for adaptability and efficiency in the management of software products, which require a different approach than physical products. The mention of a feature for sending license login-keys via email demonstrates a forward-thinking approach to digital delivery, which is consistent with industry shifts towards more streamlined digital solutions.

While Company 2 acknowledges the success of their software delivery process, they also emphasize the complexities of their sales model, especially given their intention to develop an end-to-end solution. This recognition of both strengths and weaknesses indicates an awareness of improvement opportunities, especially as they navigate the challenges posed by legacy systems. It should be noted that the integration of new products is a slow and challenging process, highlighting the need for system modernization and adaptation to changing market dynamics.

Resource allocation within the company is dedicated to manual processing, indicating that automation efforts are still underway. The manual involvement of local sales units could offer opportunities for streamlining and optimizing the order-delivery process. The efficient management of these manual processes could be a key focus of the company's ongoing development efforts. Company 2 is still in the testing phase for order processing and delivery times, making it difficult to provide precise figures. However, they anticipate the possibility of order processing within a few minutes, which aligns with the industry's push for faster and more efficient software product delivery.

Regarding software license renewal, the interviewed company takes a proactive approach. They have implemented a "traffic signal" system to notify them of expiring customer agreements and are developing an email reminder system to ensure that customers are effectively contacted when their license agreements expire. This dedication to customer participation in the software renewal process demonstrates a forward-thinking attitude towards maintaining customer relationships. The organization has not yet

begun tracking customer satisfaction and service levels. The importance of customer relationships and the need to track customer satisfaction could be explored and developed further in the future. This presents an opportunity for data collection and analysis to assess and enhance software delivery, customer satisfaction and engagement.

In conclusion, Company 2's approach to the order-delivery process combines in-house and third-party systems, demonstrating adaptability and a dedication to efficiency. While they recognize the need for development and enhancements, their capacity to manage software license renewals and foresee rapid order processing are notable strengths. However, there is room for improvement, especially in areas like cybersecurity, customer satisfaction tracking, and legacy system integration. The company's commitment to further development suggests well for its future in the software order-delivery industry.

3.4.3 Company 3

Company 3 operates within the SaaS solutions and data analytics industries. Analytics Development Accelerator (ADA) is their primary SaaS solution. ADA is intended to expedite the efficient use of data assets for business purposes. This solution is a valuable asset to businesses because it enables them to maximize the potential of their data assets. As a natural byproduct of their operations, all businesses in the modern business environment generate vast amounts of data. Nonetheless, this data frequently requires classification, consolidation, and refinement to reveal its true value, and this is where Company 3 comes in. Company 3 is at the forefront of the data-driven journey, bridging the gap between raw data and actionable insights. Their dedication to enabling data-driven decisions and maximizing the value of data assets makes them an indispensable partner for businesses that wish to fully capture the potential of their data.

The interviewee for this benchmarking interview for Company 3 holds the role of Partner, Product Development. They bring extensive experience to the table, having had a distinguished career in software and consultancy. While relatively new to Company 3, their

wealth of experience in the software and consultancy industry positions them as a valuable asset to the company's mission. Company 3, a specialist in SaaS solutions and data analytics for the manufacturing industry, employs a distinctive business model that provides valuable insights into their software order-delivery process. Applying a number of systems, including an internal system for consumption monitoring and the Azure Marketplace, while outsourcing the billing process with the exception of Azure Marketplace transactions. This blend of in-house and third-party solutions demonstrates their adaptability while maintaining a streamlined approach to financial management. They specialize in software products, focusing their order processing system on this niche to enable processes that are tailored to the specific characteristics of software delivery. The company also efficiently manages functions like accounting and invoicing through outsourcing, minimizing internal workload, and embracing a lean operational model. The emphasis on transparency ensures the traceability of financial documents, thereby reinforcing their dedication to fiscal accountability and data transparency.

The software order-delivery process of Company 3 is divided into two approaches: orders through partners and a Marketplace order process in which customers are invited to establish customership within the environment. This flexible, partner-centric strategy accommodates varying customer needs. The company highlights its strengths, which include customer ownership of the product, consulting services, and a deep understanding of customer needs. The allocation of resources is geared towards a comprehensive SaaS service with consulting capabilities, keeping the business competitive in a dynamic industry.

Their goal is to initiate the order process within the same day, with activities lasting between 3 and 15 minutes, demonstrating their dedication to providing timely solutions. Despite a clear emphasis on efficiency, Company 3 currently employs no automation and has no plans to automate any processes in the foreseeable future, a deliberate choice that aligns with their emphasis on personalized customer service. Their exclusive source of sales revenue is software, demonstrating their expertise in software delivery to the manufacturing industry.

Their approach to sensitive data and cybersecurity is robust, as customer data is stored outside the Azure environment, login privileges are managed by customers, and proactive security measures are implemented. Despite the fact that specific cybersecurity KPIs are not disclosed, this presents an opportunity for further investigation and development. In terms of software license renewals, they typically utilize a monthly billing system to ensure consistent customer communication. However, they currently report a 100% return rate, suggesting that long-term customer relationships are developed, although it's important to consider the dynamics of their SaaS model in this context. The company acknowledges that customer satisfaction has not been measured, suggesting that this is a potential area for future evaluation and enhancement. Looking to the future, Company 3 is optimistic about Azure Marketplace's growth potential and intends to leverage automation and marketplace expansion for continued success in the software delivery industry.

3.4.4 Company 4

Company 4 brings a unique perspective to the benchmarking process. Operating as a software consultancy company, their core focus is on providing customers with the development of online services, mobile applications, software development, and IoT projects. This area of expertise enables them to provide customized solutions to clients who are seeking to leverage technology for their business operations. Although their profile differs slightly from the established criteria for the interview, we acknowledge the significance of their inclusion in the benchmarking process as it offers a unique perspective. Company 4's mission is to serve as a catalyst for digital transformation, helping businesses adapt to the rapidly evolving technology landscape. While their profile slightly diverges from the criteria for the interview, we recognize the value they bring as a different point of view in the benchmarking process.

The interviewee for this benchmarking interview within Company 4 holds the position of Sales & Account Manager. With an extensive and impressive career in software development, they are well-versed in the complexities of the industry. Their extensive knowledge of software development and technology trends adds a unique and valuable dimension to our process. Their position as a Sales & Account Manager positions them at the forefront of client interactions and business growth, offering a perspective that blends technical expertise with a client-centric focus. Through this benchmarking interview, we hope to tap into the interviewee's extensive software development experience and gain a deeper understanding of industry best practices, client interactions, and how technology is reshaping business.

Company 4, a software consultancy firm, offers a unique perspective on the software order-delivery process, putting an emphasis on the human element and customer engagement. They do not handle physical or software products, but instead utilise CRM systems to identify potential customers, demonstrating a strong customer-centric approach. Their adoption of third-party tools and cloud-based infrastructure, hosted on Google and Amazon platforms, demonstrates their agility and efficiency by streamlining the order-delivery process through cloud technology. They entrust their accounting firm to ensure financial document traceability, demonstrating a pragmatic approach to financial accountability.

Their software order-delivery process revolves around long-term assignments, wherein initial customer contact, whether inbound or outbound, leads to the selection of the most qualified professional consultant for the client's particular requirements. They place adaptability and responsiveness to customer needs ahead of established resource allocation and success factors. While factors such as order processing time and level of automation are not applicable, their primary focus is on providing customized consulting services and adapting to client requirements.

Company 4 implements diligent data security and cybersecurity measures, requiring consultants to sign non-disclosure agreements with clients. Data protection is ensured through the use of Google 2FA and digital hardware with virus protection and firewalls. No security incidents have been reported, demonstrating their strong cybersecurity. Their proactive approach to software licence renewals includes regular customer communication, which supports continuous development and enhancement of customer relationships. Approximately 87% of their customers have maintained professional relationships with the company since its inception, demonstrating the company's strength in fostering long-term relationships. They measure customer satisfaction through routine satisfaction questionnaires, and their all-time satisfaction rate is an impressive 4.75/5. Their forward-looking strategy focuses on employee satisfaction, the creation of a positive working environment for consultants, the redefinition of their business based on customer feedback, and the further development of soft skills to excel in the consulting industry.

3.4.5 Company 5

Company 5 is a prominent and influential technology sales enterprise with a focus on automation and comprehensive business solutions. Their expansive operations and global reach position them as a key player in the technology industry. They specialize in providing innovative solutions that streamline business processes, improve efficiency, and enable organizations to grow successfully in the digital age. Automation and business solutions are central to their mission, allowing their clients to adapt, grow, and prosper in a constantly evolving technological environment.

The interviewee for this benchmarking interview is a Data & AI Software Sales Representative at Company 5. They have an extensive background in digital sales and bring a wealth of knowledge to technology sales. Their in-depth understanding of digital sales, coupled with their emphasis on data and AI software, provides a unique perspective that enriches our benchmarking procedure. They are uniquely positioned to provide insights into the dynamics of the technology industry, including the nuances of selling data and

AI solutions, having navigated the complicated environment of digital sales. In this context, their role as a Sales Representative demonstrates their capacity to translate technological benefits into tangible value for customers. This variety of viewpoints contributes to a well-rounded understanding of the importance of technology sales in the business world.

Company 5, an established organization in technology sales, automation, and business solutions with a significant emphasis on software sales, has developed a streamlined order-delivery process that utilizes a centralized ERP system. This integrated system serves as the basis of their operations, ensuring a consistent order processing strategy for both physical and software products. Their efficient utilization of this system demonstrates their dedication to operational excellence and resource optimization. In addition, the organization integrates third-party tools for billing and account management, thereby enhancing the financial efficiency of the ERP system solution as a whole. Moreover, their advanced data retention capabilities enable the traceability of financial statements and vital documents, demonstrating their dedication to data management and accessibility.

The company's software order-delivery process is particularly versatile, involving three distinct sales models that are adapted to meet the needs of customers. These models consist of perpetual licensing, cloud-based licensing, and a hybrid model tied to the product life cycle. A centralized system handles the order process, with an order handling unit verifying the alignment of tender offers with Purchase Orders. This guarantees accurate and reliable order fulfillment. Their strengths are the open-source software store, which allows customers to download software with accessibility and collaboration, and their centralized system, which facilitates cross-functional collaboration and data utilization. However, they recognize potential weaknesses resulting from the complexity of their systems, especially when there are multiple stakeholders involved.

Given the complexity of their operations, resource allocation is an important factor to consider. Typically, their order processing time for software sales is only one or two days, which demonstrates their dedication to prompt customer service and product delivery. Their commitment to almost fully automating their order-delivery process is an indicator of their experience and long-standing processes. While automation streamlines their operations, they recognize that human participation can introduce operational difficulties. Over fifty percent of their sales are software-related, highlighting the importance of software to their revenue stream.

The company's development of two-factor authentication for improved data security demonstrates their dedication to protecting sensitive information. Focus is placed on proactive management of software license renewals, with agreement tracking and customer communication initiated three months before the renewal date. This proactive strategy ensures the retention of long-term customer relationships, a fundamental component of their business model. The business model of Company 5 revolves on building long-term customer relationships, and their impressive customer retention rate demonstrates their capacity to maintain professional partnerships with a significant portion of their customer base. Although they do not provide specific numerical data, the acknowledgement that their customer satisfaction levels are above average demonstrates their dedication to providing outstanding customer service.

In conclusion, Company 5's streamlined order-delivery system, centralized ERP system, diverse software sales models, quick order handling, and a high degree of automation demonstrate their dedication to operational excellence. Their emphasis on data security and proactive customer engagement positions them as an industry leader. Additionally, they place a premium on long-term customer relationships and actively embrace open-source software to achieve a balance between accessibility and efficient management in the software delivery industry.

3.4.6 Company 6

Company 6 is a major player in the electrification industry, with a strong emphasis on smart electrification and infrastructure solutions. Their innovative approach to electrification encompasses a broad range of solutions designed to maximize efficiency and sustainability in a constantly evolving energy landscape. Their Marketplace, a unified subscriber portal that provides customers with a seamless experience to discover, subscribe, manage, and scale Company 6's ecosystem of SaaS services, is an essential part of their offerings. This innovative platform contributes to their mission to provide electrification solutions that are not only intelligent but also highly accessible and adaptable to the constantly evolving needs of their diverse customer base. Company 6 plays a crucial role in addressing the challenges presented by an expanding energy landscape and provides infrastructure solutions that promote sustainability and efficiency. Their dedication to innovation and accessibility through the Marketplace is instrumental in transforming the delivery and consumption of electrification services.

The interviewee for this benchmarking interview works as a Global Ability Marketplace Lead. Given their extensive and distinguished career in engineering and e-commerce, they are in a unique position to provide helpful insights on electrification and digital marketplace strategies. The interviewee has an in-depth understanding of how technology can be utilized to drive electrification solutions and make them accessible to a global audience. Their unique perspective bridges the gap between electrification and digital markets, providing a comprehensive understanding of how Company 6 is pushing the limits of innovation and accessibility.

Company 6 has a big emphasis on smart electrification and infrastructure solutions, they have designed a well-structured software order-delivery process that emphasizes efficiency and customer satisfaction. Their Marketplace, a unified subscriber portal that serves as the front-end interface for customers, is central to their strategy. It makes the ordering procedure more user-friendly and effective. On the back end, they utilize a subscription and monetization program that works in unison with an internal ERP system.

This combination of systems ensures an uninterrupted flow of orders from initial customer interactions to the processing stage, resulting in an integrated and streamlined process. Company 6's ability to use the same order processing system for both physical and software products through the Marketplace system is a key component of their strategy. This integrated system not only simplifies the ordering process, but also demonstrates the company's dedication to providing customers with an end-to-end solution.

The company's use of Salesforce for customer interactions and an ERP system for internal operations likely contributes to data traceability, ensuring that vital information is transparent and easily accessible. Company 6's software order-delivery process is centered on their Marketplace. It requires registration and account information from customers, and orders are processed using a configuration code that links software and hardware components. This entire process takes place within the application, with sales data integrated seamlessly into their ERP system. This method guarantees customers a seamless and efficient ordering experience.

Even though the interviewee identified a need for process management improvement, specifically addressing the difficulties channel partners face during the registration process, this acknowledgement demonstrates the company's commitment to providing an effortless process for all stakeholders. As the company is in a growth phase and expanding its team and operations, resource allocation and management are crucial to ensuring the scalability and success of its product-service system. Company 6 has achieved a straightaway order processing time for software sales, ensuring immediate customer service and product availability. This promptness is consistent with their dedication to providing effective and timely customer service. Their order-delivery lead time is also immediate, except for circumstances involving vouchers, which may require additional processing time. This ensures that customers can access and use their software immediately, thereby enhancing the overall customer experience.

The high level of automation incorporated into Company 6's order-delivery process is one of their greatest strengths. The interviewee confirmed that the process is fully automated, demonstrating the company's dedication to expediency and precision in fulfilling customer orders. The interviewee estimated that 5-10% of their sales are derived from software sales, highlighting the importance of software in their product portfolio. Regarding data security, the organization opts for a username and password authentication method for system access, abstaining from two-factor authentication. This strategy seeks to strike a balance between user security and convenience. In addition, Company 6 reported no security incidents, indicating a proactive approach to cybersecurity and the protection of customer data. Their automatic software license renewal notification system demonstrates their commitment to maintaining customer engagement and ensuring customer satisfaction. The business model of the company is based on long-term customer relationships. Although they do not currently calculate churn rates, they offer long-term licenses, and their customers are committed to their company. While the interviewee mentioned that the company does not currently have customer satisfaction measurements in place, they are actively investigating potential solutions.

3.4.7 Company 7

Company 7 is a global leader in stainless steel manufacturing, playing a critical role in providing solutions for infrastructure, automotive, marine, and commercial products. Their commitment to providing high-quality stainless steel solutions has established them as an industry leader. Company 7, while not directly involved in the software domain, provides valuable insights for our benchmarking process, particularly through their remarkable order-delivery system. This system plays an important role in efficiently managing orders and ensuring the on-time delivery of their stainless steel products to clients across the world.

Within Company 7, the interviewee's role for this benchmarking interview is a Customer Experience and Commerce Solutions Director. They bring a wealth of experience to the table, having had an extensive and distinguished professional career in management and

information technology. Their management and IT expertise positions them as a valuable source of insights into the complexities of commerce solutions in a manufacturing context.

Company 7, a well-established global manufacturer of stainless steel, offers exclusively physical products, making their requirements for the benchmarking interview a little different but still offering valuable insights from their order-delivery process for the case company. Their operations are made possible by an ERP system, and operational management is centralized through both an internal customer portal and ERP systems. Integrated production and warehouse management systems increase the overall effectiveness of their operations. The organization employs Azure Cloud to enhance the user interface and overall customer experience in the purchase order process.

External partners of the organization manage the development process in collaboration with the company's development team. The implementation of traceability for critical documents and financial statements is achieved through a customer portal, which offers convenient accessibility and ongoing updates. By utilizing ERP systems to automate transactions, the ongoing transition from manual to digital solutions in the purchasing process hopes to streamline and accelerate operations.

Company 7's strengths are faster transactions and a simple process that allows customers to initiate purchases on a digital platform. However, the identified weakness is the complexity inherent in digital systems, which is especially relevant to B2B sales. Resources are being directed towards improving software architecture and the customer experience, with an emphasis on streamlining and automating the order-delivery process.

Due to time constraints, specific details about order handling time, lead time, automation levels, financial metrics, sensitive data practices, cybersecurity KPIs, software li-

cense renewals, long-term customer relationships, customer satisfaction, and future developments in the software delivery field were not discussed in depth. Nonetheless, the company's dedication to technological advancements and process improvements is clear, and further investigation would provide a more complete understanding of their software-related development.

4 Results

This chapter provides an in-depth look at the benchmarking interviews conducted with seven different manufacturing companies. The results will be viewed from the viewpoint in relation to research questions. Each interview provided unique insights into the companies' digital transformation strategies, challenges, and successes, providing insight on their distinct approaches to adopting SaaS models and navigating the evolving digital product landscape.

4.1 Adaptation to digital offering and SaaS systems

A review of transition strategies revealed a diverse range of approaches. Company 1, a traditional manufacturer, detailed a comprehensive migration process that emphasized ERP system integration. This strategic move is consistent with research that emphasizes the critical role of ERP systems in synchronizing order-delivery processes, ensuring efficiency, and facilitating a smooth transition to digital business models. The focus on ERP integration demonstrates a dedication to systemic harmony and streamlined operations.

Company 6, on the other hand, demonstrated a dynamic approach through their marketplace, providing customers with a unified portal for discovering, subscribing to, and managing SaaS services. This novel approach is consistent with existing literature on digital industrial platforms, emphasizing the importance of platform types and ecosystem business models in facilitating digital business transitions. The marketplace not only serves as a platform for SaaS services, but it also embodies servitization principles, in which digital solutions play a critical role in improving customer experience and engagement.

Companies 2 and 3 shared insights into the evolution of subscription-based order-delivery systems, demonstrating the constantly changing landscape of implementing SaaS

models in both physical and software product contexts. This is in accordance with literature on the challenges and implications of shifting to SaaS ERP order-delivery processes, which emphasizes the importance of adaptability in response to changing market demands. Within the SaaS, framework these companies provide diverse perspectives on the intersection of physical and software product offerings.

Companies 4 and 5, which specialize in software consulting and technology sales, respectively, provided insightful perspectives on the challenges and strengths of their respective industries. Their perspectives contribute to a better understanding of the different facets of software delivery, providing understanding of the complexities of software consultancy and the importance of technology sales in driving software adoption. Company 4's challenges, such as the complexity of digital systems in B2B sales, reflect findings in the literature and highlight the need for streamlined processes.

The inclusion of Company 7, a stainless steel manufacturer, revealed fascinating insights into their ongoing digital transformation, emphasizing the importance of diverse industries in the context of digital adaptation. This adds a unique dimension to the research, which aligns with the literature on digital servitization and the benefits of integrating digital solutions in traditionally physical product-focused industries. Despite the fact that the interview was cut short, the preliminary data indicates a shift towards a more streamlined and customer-centric order-delivery process within the stainless steel manufacturing domain.

In conclusion, the interviews not only provide a snapshot of the various strategies used by manufacturing companies to adapt to digital products and SaaS models, but they also provide valuable insights into the challenges, strengths, and intricacies specific to their respective industries.

4.2 Critical success factors for order-delivery processes

The investigation of critical success factors for an efficient order-delivery process provided diverse insights from the companies benchmarked. The emphasis placed by Company 1 on thorough migration and ERP integration is consistent with literature highlighting the critical role of ERP systems in ensuring the efficiency of order-delivery processes. This strategic focus demonstrates a dedication to systemic cohesion and streamlined operations, which serves as a foundational success factor.

The dynamic approach of Company 6 via the marketplace platform is a critical success factor in providing a unified, customer-centric portal for SaaS services. This is consistent with research on the importance of digital industrial platforms and ecosystem business models, which emphasize customer experience and engagement as critical success factors. The marketplace not only allows for more efficient order processing, but it also improves the overall customer journey, in line with the evolving landscape of digital business models.

Company 2 and 3's insights provide insight into the critical success factors in the evolution of subscription-based order-delivery systems. Adaptability to changing market demands emerges as a critical success factor, reflecting literature on the challenges and implications of implementing SaaS ERP order-delivery processes. These businesses indicate the importance of adaptability and responsiveness in ensuring the effectiveness of their order-delivery systems.

Companies 4 and 5, provide perspectives on critical success factors in the industries they operate in. Company 4's challenges, such as the complexity of digital systems in B2B sales, highlight the importance of streamlined processes and efficient project management as critical success factors. Meanwhile, Company 5's emphasis on centralized ERP systems and high levels of automation emphasizes the importance of integrated systems and streamlined processes in technology sales.

4.3 Long-term relationships in software agreements

The investigation of the procedures by which software agreement manufacturers ensure the success and longevity of long-term relationships with their customers reveals a wide range of approaches and strategies. Although not all organizations offered explicit insights regarding long-term relationships, several significant trends surfaced.

Companies 2 and 3, that operate on a subscription-based system, placed a high priority on maintaining the process of customer needs adaptation. This is consistent with the existing body of literature on servitization strategies, which underscores the importance of customer-centric approaches and continuous development. Their dedication to comprehending and fulfilling customer needs plays a role in fostering long-lasting relationships.

Within the software consulting industry, Company 4 emphasized the criticality of establishing and maintaining enduring customer relationships. The fact that they have observed an 87% rate of returning customers demonstrates the effectiveness of establishing and maintaining long-lasting professional relationships. This is consistent with the literature regarding the advantages of relationship building and customer satisfaction in consulting services.

Although Company 5 did not actively discuss long-term relationships, their emphasis on customer satisfaction and implementation of automated renewal processes indicates an active approach towards maintaining positive relationships. The implementation of automated notifications and ongoing customer communication serves to improve customer retention, which is an essential element in cultivating enduring relationships.

In summary, the observations made by the benchmarked companies suggest that maintaining a customer-centric perspective, being flexible in response to changing requirements, and prioritizing customer satisfaction are factors that contribute to the achievement and sustainability of enduring partnerships in software agreements. The differing types of relationships across various sectors of the manufacturing industry appear in the different strategies.

5 Managerial implications

The managerial implications of the case company's transformative journey, which emerged as a global leader in the electrification industry, have importance to organizations that are presented with the opportunities and challenges that come with the digital transition. The organization is a key player in a continuously evolving sector due to its expertise in developing, manufacturing, and marketing protection relays for electricity distribution networks, as well as control, automation, and monitoring equipment.

The investigation of these different approaches and experiences provides a foundation for manufacturers seeking to navigate the complicated environment of digital adaptation. According to the managerial implications, embracing digital tools tailored to specific industry needs can improve operational efficiency and customer experience. To remain agile in the evolving digital landscape, businesses should consider seamlessly integrating ERP systems, exploring unified portals, and adapting subscription-based models. As industries converge in the digital realm, these lessons serve as a road map for smooth transitions and highlight the importance of industry-specific strategies in the age of digital transformation.

5.1 General development framework

The benchmarking insights provide a strong framework for improving the case company order-delivery system in the electrification industry, the results are shown on Table 6. As observed in Company 1, prioritizing ERP system integration can significantly improve communication between the internal marketplace and ERP, enhancing tracking and management capabilities. Cloud-based solutions, as demonstrated by Company 1, enable scalability; automation technologies, as demonstrated by Company 6, should be used for immediate order processing; and effective customer communication, as demonstrated by Company 6's notification system, can improve the overall customer experience. Learning from Companies 4 and 5, the case company should improve management by

optimizing processes, addressing challenges, and capitalizing on strengths. Simplifying the purchasing process and improving the user interface will contribute to a greater level of customer experience. Proactive strategies for long-term relationship building, anticipating sustainability trends, and cultivating a culture of continuous learning position the case company for long-term success in the digital transition.

Table 6. Guidelines for the improvement of software order-delivery process.

ID	Related field	Guidelines
1	Integration of ERP systems	Improve ERP system integration to streamline the order-delivery process. To ensure efficient tracking and management, ensure seamless communication between the internal marketplace and ERP.
2	Cloud-based solutions	Utilize cloud-based solutions, similar to Company 1, to improve flexibility and scalability. Cloud platforms can improve the overall customer experience and help with real-time inventory views.
3	Automation and immediate order-handling	Invest in automation technologies to help with order processing. To meet customer expectations and improve overall efficiency, prioritize immediate handling times.
4	Customer-centric communication	Implement an automatic notification system for license renewals, following the example of Company 6. Proactive communication, including reminders and updates, fosters customer satisfaction and ensures timely contract renewals.
5	Process optimization	Continuous process optimization should be prioritized in order to address challenges and capitalize on strengths. To improve process management, learn from the experiences of Companies 4 and 5 in software consulting and technology sales.
6	Customer satisfaction metrics	Introduce customer satisfaction metrics to track and improve overall customer satisfaction. Assess customer feedback on a regular basis to identify areas for improvement and to ensure alignment with changing customer expectations.
7	Simplification of purchasing process	Focus on simplifying the purchasing process. Address the complexity of digital systems to reduce friction in registrations and order processing. Enhance the user interface to make it more intuitive and user-friendly.
8	Proactive relationship building	Create a proactive approach to long-term relationship building. To encourage loyalty, implement strategies for proactive communication, understanding customer needs, and tailoring services.

9	Focus on sustainability	Anticipate future industry trends by focusing on sustainability, especially in the context of smart electrification. Consider solutions that reduce energy consumption rates while keeping up with changing environmental expectations.
10	Continuous learning and adaptation	Foster a culture of continuous learning and adaptation. To stay ahead in the rapidly evolving digital landscape, keep up with technological advancements, customer preferences, and industry best practices.

The case company can improve technological integration, optimize processes, and prioritize customer-centric strategies by aligning with the benchmark. The case company can streamline order-delivery processes for both physical and software products by integrating ERP systems, implementing cloud-based solutions, and leveraging automation technologies. An improved customer experience is made possible by effective customer communication, automated license renewal notifications, and a simplified purchasing process. Learning from Companies 4 and 5, optimizing processes, addressing challenges, and capitalizing on strengths are all important aspects of effective management. Prioritizing long-term relationships, anticipating sustainability trends, and cultivating a culture of continuous learning position the case company for long-term success in the rapidly changing electrification landscape.

5.2 Industry-specific digital strategies

With an emphasis on safety, reliability, and responsiveness to the evolving needs of intelligent electricity networks, the electrification industry necessitates industry-specific digital strategies. The commitment of the case company to the development of protective relays is in line with the industry's demand for precision and adaptability. Protective relays, which are essential in detecting faults in electrical networks, are critical components in ensuring human safety and an uninterrupted supply of electricity. Organizations should strategically align digital initiatives with the unique demands of electrification as the sector advances into the smart grid era, which is characterized by the integration of distributed renewable energy sources. The focus of the case company on control and

protection systems becomes critical, contributing to reduced downtime and the assurance of a continuous power supply.

It is critical for the case company's success to tailor digital strategies to the electrification industry's unique dynamics. One key recommendation is to prioritize advanced data analytics in the electrification domain. Using data analytics tools, the company can gain valuable insights into power distribution, improve decision-making processes, and optimize operational efficiency. Collaboration with industry-specific technology partners, as well as active participation in industry-specific communities, may be beneficial in the improvement of the company's digital strategies within the electrification landscape.

5.3 Streamlining the order-delivery process

The case company's unified order-delivery process, illustrated in Figure 1, emerges as a practical model for organizations seeking to streamline their digital adaptation. Beginning with the critical stage of an offer request, the organization prioritizes clear communication with internal stakeholders in order to thoroughly understand specific requirements. The following stages, which are systematically managed within the ERP system, highlight the importance of a centralized and streamlined approach to order processing.

In terms of physical products, the case company's process exemplifies efficient inventory management, packaging, and shipping logistics, all with the goal of ensuring on-time delivery. The organization implements a customized process for software products that ensures the secure and efficient delivery of digital content. This entails creating download links or login information, as well as incorporating a comprehensive system with complete traceability. The traceability mechanism not only improves transparency, but it also provides stakeholders with timely updates and precise details about the order status, making it a useful tool for efficient problem-solving in the event of complications or delays.

Order-delivery processes that are efficient are critical to the case company's competitiveness. Optimizing the use of existing ERP systems to streamline order processing, inventory management, and shipment tracking is a targeted approach. Putting an emphasis on centralized order management via cloud-based solutions can improve coordination and communication while reducing lead times and increasing overall operational efficiency. This is consistent with research highlighting the importance of integrated and centralized systems in modern order-delivery processes.

5.4 Adaptability towards industry-specific challenges

As the electrification industry develops, the case company's experience emphasizes the value of adaptability in the face of industry-specific challenges. Continuous improvement and a willingness to adapt to technological advancements that align with the industry's particular needs are required for the digital transition. Organizations that embrace adaptability can respond proactively to changing market dynamics, emerging technologies, and evolving customer expectations.

To be adaptable to industry-specific challenges in electrification, a focus on targeted employee training programs is required. It is critical to ensure that the workforce has the necessary skills in areas such as cybersecurity, digital literacy, and industry-specific technologies. Furthermore, establishing an innovation hub dedicated to research and development in electrification technologies will allow the company to address challenges in a proactive manner and stay abreast of industry advancements. This is consistent with literature emphasizing the importance of continuous learning and innovation in the manufacturing industry for adaptability.

6 Conclusions

The primary objective of this thesis was to thoroughly investigate the transition strategies and critical success factors in the manufacturing industry's adoption of digital products and Software as a Service (SaaS) sales models. The investigation was methodical, involving benchmarking interviews with various software-related companies and a thorough review of relevant literature. The findings provide valuable insights that directly address the research questions that were identified.

By connecting theoretical frameworks with real-world practices, the study adds significantly to existing knowledge. In-depth analyses of specific transition models, the impact of digital strategies on financial metrics, and the role of emerging technologies are all suggested for future research. The findings have practical implications for industry experts, as well as actionable recommendations for optimizing order-delivery processes and improving long-term customer relationships.

In answer to RQ1, *“How have manufacturing organizations adapted to the transition to digital products and SaaS sales models for software products and services?”*, to navigate the transition to digital products and SaaS sales models, manufacturing organizations have used a variety of strategies. The benchmarked companies offered insightful approaches ranging from detailed migration processes with a strong emphasis on ERP system integration to innovative Marketplace models that provide a unified portal for discovering, subscribing to, and managing SaaS services. The findings illustrated the evolution of subscription-based order-delivery systems, highlighting the dynamic landscape of adopting SaaS models in both physical and software product contexts. Overall, the adaptations varied across sectors, highlighting the importance of flexibility and innovation in order to thrive in the changing digital landscape.

In response to RQ2, *“What are the critical success factors for implementing and managing an efficient order-delivery process for software products and services in the manufacturing industry?”*, the benchmarked companies identified critical success factors for

implementing and managing efficient order-delivery processes for software products and services in the manufacturing industry. The findings emphasized the importance of streamlined ERP systems, cloud-based centralization, and strategic automation. Companies operating in software-related industries but not directly having software order-delivery systems provided valuable insights into the challenges and strengths of their niches, highlighting the importance of efficient process management. Automation emerged as a critical factor, with faster order processing and shorter lead times contributing to the overall efficiency of the order-delivery process. The study addressed the significance of optimizing processes in order to improve customer satisfaction and streamline operations.

Finally, regarding RQ3. *“How do manufacturers ensure the success and longevity of long-term relationships in software agreements?”*, through consistent communication, cyclical customer engagement, and satisfaction surveys, manufacturers ensure the success and longevity of long-term relationships in software agreements. The benchmarked companies demonstrated a dedication to cultivating long-lasting customer relationships through the implementation of automated software license renewal notification systems and an emphasis on customer satisfaction metrics. Although barriers such as the intricacy of digital systems were recognized, the commitment to fostering enduring partnerships was evident in the focus on enhancing the customer experience and streamlining the purchase process. The results indicated that maintaining enduring relationships in software agreements within the manufacturing industry requires a proactive strategy towards customer engagement, in addition to transparent communication and accountability for satisfaction.

The findings from the benchmarking interviews are interconnected with and complement the findings from the literature review. In response to RQ1, the identified strategies for transitioning to digital products and SaaS sales models in manufacturing organizations closely align with the theoretical frameworks explored in the literature, reinforcing

the dynamic nature of the digital landscape. In response to RQ2, the critical success factors identified in the benchmarking findings are consistent with the literature's focus on ERP systems, ecosystem business models, and the implications of SaaS ERP order-delivery processes. Automation, a key theme in the benchmarking findings, is consistent with the literature's acknowledgement of technology's role in improving efficiency and customer satisfaction in order-delivery processes. Finally, in response to RQ3, the findings into ensuring the success of long-term relationships in software agreements reflect the customer-centric approaches discussed in the literature, emphasizing the changing nature of customer relationships in the digital era. The benchmarking findings supplement and reinforce the theoretical foundations of the literature, providing a more comprehensive and practical understanding of the manufacturing industry's digital transformation.

Future research endeavors could delve into exploring the impact of emerging technologies, such as Artificial Intelligence (AI) and the Internet of Things (IoT), on the transition to digital products and the order-delivery process. The dynamics of customer relationships in an evolving technological landscape also presents an opportunity for in-depth examination. Moreover, a comparative analysis across industries could uncover transferable strategies and best practices.

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Appendices

Appendix 1. Company 1 interview answers

Question ID	Answer
1	We are developing a new subscription-based order-delivery system, in which we are transitioning our digital products into a new digi-platform. The billing is continuous and digital delivery is done via email.
2	No, they are sent and processed in different systems.
3	Not really, pretty much everything is in our own control in our ERP system.
4	We have full control of our own documents thus security and traceability is secured.
5	The order-delivery process sets off by the channel customer initiating order in the external marketplace, and the order is transitioned to our ERP system. Through the ERP system, will send our production unit tool an activation message to confirm the order. The ERP system activates invoicing and the order is sent back to the marketplace, from where an email is sent to the customer which includes the subscription and login credentials.
6	The synergy of the development work between the divisions is used, which is a clear advantage. One potential weakness is in the development cycle, this is slow for us.
7	Resource allocation is of utmost importance in the field of planning. Developers are in central role, and we are aiming to actively handle processes
8	The goal is to automate the entire process, delivery in 2-3 hours
9	Answered previously
10	Currently not that much we are aiming to automate the whole process
11	No clear data but I estimate a maximum of 1%
12	We have utilized a two-step authentication in our all systems
13	No security incidents
14	Presently, the service operates on an ongoing basis until the customer initiates cancellation.
15	We are offering software to our customer, which sells the software further to end-customer, so difficult to say.
16	Not measured, as we are not offering software solutions to end-customers

17	Right now, it looks bright. Big changes are underway and will serve for a long time. The migration from legacy systems to new platforms poses a significant challenge.
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Appendix 2. Company 2 interview answers

Question ID	Answer
1	Order through our own system, a separate add-on has been built for software products with recalling billing, a direct SaaS service. Local sales companies operate in their own ERP systems
2	Software products have their own processing system.
3	The billing process is facilitated through a Software-as-a-Service (SaaS) model, which allows for efficient and timely invoicing as required. The sales order is initiated within the Enterprise Resource Planning (ERP) system, and subsequently, the invoice is generated and dispatched through the same ERP system.
4	Everything critical is outsourced, and we have full access.
5	The software product is procured through a local sales unit. The user interface for managing subscriptions has been developed. Assets can be accessed via the user interface. The concept of our own-developed digital service platform refers to the integration of intelligent technologies within digital services. A future feature will enable integration in which the license key is transmitted via email.
6	The software delivery process is built and works, which itself is a positive. The sales model is challenging, because we are trying to create a start-to-end solution. The legacy system is a weakness, because the integration of new products is slow and difficult
7	Resources spent on manual processing of software products. Local sales units still have to do it manually.
8	We are still only in testing phase, but the potential for our lead time is couple minutes
9	Not tested yet
10	Currently being developed
11	Software sales are approximately 1-2% of total sales
12	No information
13	No information

14	We are utilizing a "traffic signal"-system in which our system informs us of customer agreements that are close to the end of contract. Also, we are developing an email reminder system, in which we are approaching customers upon the end of their license agreements
15	Not applicable to my role, so I can't comment on the matter
16	Not yet tracking
17	The need for development is huge and we are still scoping out our full potential

Appendix 3. Company 3 interview answers

Question ID	Answer
1	Our internal system monitors consumption. Another method in Azure Marketplace, which involves sending billing information from one's own system. The billing process has been outsourced, excluding the Marketplace where billing is done through Azure.
2	Our company only has software products in our business model
3	Accounting and invoicing is outsourced
4	Transparency is shown as seeing individual transaction through the outsourced system
5	The process can be divided in two distinct ways, ordering through partners or Marketplace order in which an invitation is sent to the customer to create a customership and thus the customer is invited to the environment. Training, if necessary, parameterization of the environment (things are generated in the Azure environment, the products are owned by the customer after that)
6	Strengths: Customer ownership of the product, provision of consulting services, comprehension of customer requirements. The product undergoes continuous evolution. The SaaS service in question stands out in the market due to the absence of similar products offered by its competitors in the form of SaaS services.
7	A complete SaaS service with consultancy capabilities, which is keeping us up-to-date in the changing industry.
8	Goal is to initiate a order process within the same day. The duration of the activity ranges from 3 to 15 minutes.

9	Pretty much hand-in-hand as in previous question.
10	Currently our automatization level is zero, and there is no vision to apply automatization processes.
11	100% software sales.
12	The customer's information is not stored in the Azure environment. The complete login privileges are encompassed within the capabilities of the customer. The Azure security stack is capable of real-time security monitoring. Furthermore, we are employing Penetration tests (PEN-tests) within our own systems.
13	No comments
14	Typically, our billing system operates on a monthly basis.
15	Currently our customer return rate is 100%
16	Our customer satisfaction has not been measured.
17	We believe in the growth of Azure Marketplace, which basically aids our business automatically

Appendix 4. Company 4 interview answers

Question ID	Answer
1	The "order-delivery process" happens through human action, but we are utilizing CRM systems to find potential customers
2	We have neither physical nor software products as we are offering software consulting
3	You could say that pretty much everything is in 3rd party. We have no own infrastructure and everything is based in a SaaS cloud system. CRM is in a SaaS business environment and all of financial documents and contracts are based in the Google and Amazon cloud service.
4	Our accounting company ensures the traceability of our documents.
5	The majority of the assignments are long-term, mainly several years. Customer contact, whether it be outbound or inbound, leads into matching the best match of professional consult with the company needs. After this the company interviews and approves the external worker for the duration of the contract.

6	Not applicable
7	Not applicable
8	Not applicable
9	The lead time of the point of contact to getting the professional on-site differs lot initiates from contact of proposal, which is often times answered the same day. Typically, the whole process lasts approximately 1-2 months.
10	Not applicable
11	Neither, full consultant-based software business
12	The consultants are required to sign NDA's with their external companies. The documents are protected by the Google 2FA and digital hardware are protected by virus defense and firewall.
13	No incidents thus far
14	We want to be a company that operates in way that we are not contacting the customer only at the end of contract, but rather having close communication in cyclical time, approximately every 1-3 months. This supports constant development and improves the relationship with customer
15	The majority of our customers have been long-term in contact with our company since we started 8 years ago and have never left the professional relationship. Approximately 87% of all of our customers are still in business with us.
16	We send every 3 months a satisfaction questionnaire with 6 numerical questions and 2 written questions. The all-time satisfaction rate is currently 4,7/5.
17	Personnel is everything in our industry. The next big steps are to figure on how we ensure the employee satisfaction and create a pleasant working environment for our consultants. But as we are growing it is necessary to ask our customers what they want from a software consultancy company. We are still in the process of redefining our business as we are not focusing in any specific industry, but rather gaining growth in all software development industries. Developing our soft skills require improvements, as our main focus has been in establishing and showcasing our hard skills.

Appendix 5. Company 5 interview answers

Question ID	Answer
1	This is an easy one, we have a centralized system in ERP systems, in which we are handling pretty much everything.
2	Yes, we have same ERP for both order systems.
3	Our billing and accounts ledger is separate from other functions, and invoicing is done through this system
4	As pretty much everything is in ERP outside of invoicing, it is fairly easy to follow the traceability, even documents from 10 years ago are traceable and we have data about them.
5	We have 3 different models: perpetual model in which the software is a one-time-payment, and the customer has usage rights forever. The second model is a license, in which the software is in cloud-based systems. The final model is a combination in which the software license is tied to the life cycle of a physical product, and they are billing of software ends upon the physical product reaching the end of its life. About the process, we have a separate tender system. The customer places orders through ERP and in our order handling unit we check that the tender offer matches the Purchase Order - after this it is quite simple order fulfillment. The license key is generic and through licenses we handle the correct disposition with the correct customer.
6	I find it a strength that we have almost all our software in an open-source software shop, in which the customers can download software and then the license key is handled through collaboration with us. Another major strength is centralized system, which makes cross-function collaboration and data utilization easy. One noticed weakness is the complexity of systems, and as many people are involved it can get messy and tough to operate.
7	Following up on the previous question, it is really complex and requires input from many people. We could think about what actually necessary and which functions could be left behind.
8	Day or two.
9	This is pretty much dependent on customer rights and stuff related to software access. Ideally not much time is added from the number from the previous question
10	Automation level is high. Close to 100%, as we are an old company, we have developed these things for a long time. The process is well put, but as people are involved it may cause challenges.
11	More than 50% of sales are related to software.

12	Not yet, but there is development to apply two-step-authentication
13	No, this is classified information to even us employees
14	We are actively following early the end of the license agreements. This is a major focus point for us, and we are in communication with customer as far as 3 months before.
15	Our business model is centered around long-term customers and managing them is critical. A lot of our customers have been with us for a long time.
16	It is tracked but can't give you a number. I know it is fairly above average.
17	Well, I think open source is critical and will drive change forward. I think everyone should have access to software, but usage and license agreements should be manageable.

Appendix 6. Company 6 interview answers

Question ID	Answer
1	In the front-end we are using a Salesforce application that is used by our customers, back-end is a subscription and monetization program. ERP is used internally
2	Yes, you can, through our Marketplace program.
3	This info is not applicable for my role, so I cannot answer this
4	Same answer as for the previous question
5	The ordering through our Marketplace requires a registration and it requires account information, the order requires a configuration code that connects software and hardware together. The customer completes the order through this application and the sales information comes to our ERP system. From here the order handling it automatically completed.
6	We need to improve upon process management. I find it frustrating that our channel partners have issues with registrations and the process is too complex.
7	We are currently working with a small team, but we are expanding, which will require more resources or resourcing.
8	It is pretty much immediate.

9	Also immediate, except if we are selling vouchers, which requires some time
10	The process is fully automatized.
11	I would assume 5-10% of sales are software sales
12	There is no 2-step authentication, the customer logs in with their own username and password
13	No incidents
14	We have an automatic notification system which reminds the customers via email 30-days, 7-days and one day before the end of contract
15	Our licenses are often long-term, and our customers are committed to our business. Currently we are not able to calculate churn rates.
16	We do not have any customer satisfaction measurements but are looking at some solutions.
17	As sustainability is an important topic nowadays, energy consumption rates and optimization will be important in the near future and requires solutions from us.

Appendix 7. Company 7 interview answers

Question ID	Answer
1	We only have physical products, so our solution differs a bit from the benchmark questions and we will go through it from the perspective of physical order-delivery process. ERP is in a central role in the process, and the operational management is centralized through ERP systems and an internal customer portal. We have integrated warehouse management and production management systems in the process. These are the components that we are using. In the user interface and experience we are utilizing Azure Cloud to provide our customers with the optimal experience.
2	Not relevant
3	We have used external partners in our development team, the development process is done by them.
4	The access for customers is easy as the documents are in the customer portal. We are continuously updating it and incrementally adding relevant documents for the customer to the portal
5	Traditionally the purchasing process has been manual and personal, but we are moving towards digital solutions. The process is extremely complex and requires a lot of data from the customer to initiate the purchase. We are moving towards a simpler model in which the process is less time-consuming and increase customer volume, as the process requires less manual labor. The custo-

	mer portal allows for real-time inventory view and improves the customer experience. For the process itself, we are using a lot ERP systems for the order-delivery process to automate.
6	Our strenghts are definitely the improvement of faster transactions and straight-forward process. The process is more on the hands of the customer, making them initiate purchase, as the process is digital, you can make orders whenever you self feel is suitable. The weakness is the complexity of digital systems, as usual for B2B sales.
7	Well, we are focusing a lot on the software arcitecture and it requires a lot of resources. We are actively trying to improve the experience for the custoemr to make it a simpler purchasing process.
8	The interview had to be cut short due to time challenges.
9	Well it differs a lot, as some products are make-to-order, making the process more complex and increases the requirements for our own systems.
10	We are actively working towards streamlining and automating the order-delivery process to get rid off any "unnecessaty" manual labor.
11	The interview had to be cut short due to time challenges.
12	The interview had to be cut short due to time challenges.
13	The interview had to be cut short due to time challenges.
14	We have no products with license agreements.
15	The interview had to be cut short due to time challenges.
16	The interview had to be cut short due to time challenges.
17	The interview had to be cut short due to time challenges.