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From product provision to advanced service solutions: challenges and enablers in servitization depending on type of Product-Service System

Master's thesis in the Master Degree Program Quality and Operations Management

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Abstract

To avoid the commodization trap and build a long-term competitive advantage an increasing number of companies include services in their offerings. However, for manufacturing firms advancing towards selling service solutions is challenging. The topic of servitization has generated a large amount of research regarding challenges and corresponding enablers that servitizing companies are faced with. Yet, limited research has tried to categorize these challenges into different Product-Service Systems (PSS). This master thesis aims at identifying which challenges a servitizing company is faced with, depending on the type of Product-Service System that is offered. Moreover, the enablers for deploying a servitization strategy are examined. This is done by analyzing the existing literature within the field and conducting an empirical study based on interviews with six embedded case companies.

Our findings suggest that the challenges companies are faced with when servitizing are dependent on the PSS classification. Identified challenges from the empirical study is clustered into five clusters; Culture, Service development, Internet of Things, Business model and Sales process. Each challenge is analyzed and individually categorized into their corresponding PSS category. It is shown that cultural challenges are important for all companies independently on the PSS type, while service development and IoT are most significant for PoPSS-companies. Furthermore, it is suggested that business model as well as sales process challenges are most significant for UoPSS- and RoPSS-companies.

Corresponding enablers to the challenges are identified. Firstly, internal marketing of servitization and education of employees can overcome the cultural challenge. Secondly, it is suggested that a well-defined service development process and service modularity can counteract the challenges related to service development. Thirdly, updating IoT systems continuously, developing IoT standards and partnerships can help overcoming IoT challenges. Fourthly, suggested enablers to overcome the challenges connected to business model is to develop new technical capabilities, introduce new pricing algorithms and methods and increased collaboration between departments. Lastly, education of service sales force, acquiring new external service competence, targeting customer contacts higher up in the hierarchy, increasing communication to customers and educating customers can counteract challenges related to sales process.

Keywords: servitization, servitization enablers, servitization challenges, Product-Service Systems, PSS, Internet of Things, IoT, embedded case study

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1
Introduction

This chapter presents the context and scope of the thesis. The chapter starts with a description of the background, followed by a presentation of the purpose, research questions and limitations.

1.1 Background

The term servitization has in the latest years increasingly gained traction in both the academic world as for different companies in several industries. The term was first introduced in the late 80ths, describing the process of moving from a pure product offer to also include services in the offering (Vandermerwe and Rada, 1988). This shift has since then created a large portion of new opportunities, both in terms of revenue growth and new types of offerings (Baines et al., 2009; Neely, 2008). Rymaszewska et al. (2017) writes that the nature of manufacturing and selling tangible products has limited potential for profit generation, which has led to the shift to combine products and services.

In the last decades the technological development have been so fast that a competitive advantage based on technical differentiation is difficult to maintain. This is because technology is changing so fast and the entry barriers of adopting it have decreased significantly (Gubbi et al., 2013). Thus, building capabilities to easily integrate new technologies into the organization can give a competitive edge (Coreynen et al., 2017). However, a servitization strategy enables a company to differentiate itself from the competition and building a long-term competitive advantage (Gebauer et al., 2005; Michel et al., 2008; Mathieu, 2001a).

However, the movement towards a more service oriented offer has its challenges. The shift requires manufacturing companies to reconsider their organizational structures to enable a more service centered business portfolio (Vandermerwe and Rada, 1988). For example, companies need to address the new competences needed to be able to compete through services. This requires investments in developing organizational capacities such as employee skills, capabilities and technologies (Reinartz and Ulaga, 2008). Neely (2008) also outlines several challenges of servitization, such as shifting the mindset of both internal and external stakeholders, creating long lasting partnerships with other companies, as well as developing the new business models and offerings according to what customers value. The latter requires companies to develop customer-centric competences to successfully provide integrated systems of

products and services (Baines et al., 2009; Miller et al., 2002; Windahl et al., 2004). Servitization can also cause a "service paradox", meaning that the financial returns from it does not cover the investments (Gebauer et al., 2005). As a consequence, this has led to that several servitized companies reduce their service offerings, so called deservitization, through sale, liquidation, or divestment because of poor profitability (Kowalkowski et al., 2017).

During the servitization, companies start to offer products and services as bundles. Tuli et al. (2007) defines a product-service bundle as "an ongoing relational process of defining, meeting, and supporting a customer's evolving needs". As a consequence, developing product-service bundles requires better knowledge about the customer and its needs. This can be achieved through shortening the distance between the provider and customer, and gaining better knowledge of how the product is used (Walters, 2008). In order to gain such knowledge companies can choose to collaborate or acquire companies that operate in proximity with the end customer. However, such strategies are resource demanding which makes it unsuitable for companies with small budgets (Rymaszewska et al., 2017). Other approaches to gain knowledge about customer needs are to involve consultants to do market research or to observe the customers when the products are in use. Nonetheless, such approaches only reveals fractions of the real situation (Rymaszewska et al., 2017). So, this entails that an alternative approach to get closer to the customer is needed.

According to Rymaszewska et al. (2017), Internet of Things (IoT) based solutions are cost-effective methods for bringing the provider closer to the customer. Gaining customer knowledge and increasing customer value can be done through monitoring, controlling, analyzing, information, and collaboration which is enabled by IoT (Lee and Lee, 2015). According to the same author monitoring and controlling will enable a company to gather data that by analysis can be leveraged to identify improvement opportunities, which in turn will decrease operational expenses and improved productivity. Such knowledge can help a manufacturer not only to improve its own operations but also the customer's (Ulaga and Reinartz, 2011). Furthermore, the data collected by IoT can be leveraged to identify customer behavior and market patterns which enables the creation of value-added services (Lee and Lee, 2015). By learning and understanding how the customer use the products, the service and product can be developed in a way that more effectively and efficiently satisfy customer needs (Rymaszewska et al., 2017).

The previous research done in the field of servitization has separately explored challenges and enablers when developing and executing a servitization strategy (Zhang and Banerji, 2017; Alghisi and Saccani, 2015; Neely, 2008; Gebauer et al., 2008; Jovanovic et al., 2016; Reinartz and Ulaga, 2008). However, limited research has investigated which specific challenges and enablers a company face that offers a specific type of service, which is why it is an interesting subject to further investigate.

1.2 Purpose

The purpose of this master thesis is to investigate which challenges a servitizing company are faced with, depending on the type of Product-Service System that is offered. Moreover, the enablers for deploying a servitization strategy is examined.

1.2.1 Research questions

In order to fulfill the purpose of the master thesis, two research question has been formulated.

RQ1. Which are the challenges for companies developing a servitization strategy, depending on the type of Product-Service System that is offered?

RQ2. Which are the corresponding enablers for the identified challenges?

1.3 Limitations

To ensure that the thesis will not be too shallow and will follow the time frame some limitations have been done. Firstly, the report will only focus on companies offering tangible products, hence no pure service companies will be examined. Secondly, the content in the report will only be internally validated, i.e. no external validation of models, frameworks and figures will be made due to time constraints. Thirdly, the number of case companies will be limited to six companies with two interviews in four of the cases and one interview in two of the cases. Only one interview was conducted in two of the companies since the authors had problems finding suitable interviewees. Furthermore, the companies selected are companies that have the potential to servitize with IoT as an enabler.

2
Theory

This chapter presents the theoretical framework of the master thesis. It begins with an explanation of the servitization concept and how services can be classified in manufacturing companies. Further, challenges and enablers for servitization in general are explained. The chapter ends with an IoT specific section containing a general description of the term, different roles of IoT in services, as well as challenges and enablers for IoT enabled servitization.

2.1 Servitization

The term servitization was introduced in the late 80ths and describes the process of moving from a product-centric offer to also include services in the offering (Vandermerwe and Rada, 1988). Baines et al. (2007) defines the term as "an integrated combination of products and services that deliver value in use". The main driver of the shift is, according to Mathieu (2001b), the rapid technological change and diminishing product margins which decreases the opportunities for competitive advantages of a product-centric offer. One frequent response to this challenge is to increase the service business (Gummesson, 1994; Wise and Baumgartner, 1999; Oliva and Kallenberg, 2003; Sawhney et al., 2004)

There are three rationales for extending the service business; marketing, strategic and financial opportunities (Gebauer et al., 2008). Firstly, services creates opportunities for increased product sales due to a larger marketing exposure for its customers. In other words, it enables companies to stay closer to the customers, turning a one-transaction relationship into a long-term relationship (Malleret, 2006). Secondly, the development of services creates larger opportunities for differentiation and competitive strategy (Anderson and Narus, 1995; Oliva and Kallenberg, 2003). That is, servitization is a means for product differentiation, making it easier to retain and attract new customers. Lastly, the financial benefit is explained by the potential service revenue and higher service margins as well as the fact that service sales is a more stable source of revenues compared to product sales (Sawhney et al., 2004). This is because service sales can follow a recurring pattern, generating stable revenue income that cope with fluctuating product sales (Malleret, 2006).

Furthermore, Neely (2008) state that benefits arises from two different perspectives; the supplier and the customer perspective. From a supplier perspective the benefits is mainly increasing revenues, while the customer can experience reduced risks since

the supplier often overtakes customer operations (Neely, 2008). Mont (2002) agrees with the above statement and separate the benefits into the company, government and society, consumers and environment. Benefits arising for the company is new market opportunities, additional value in their product offer, improved relationship with customer as well as a better understanding of the customer. On a governmental level, servitization can help formulate new policies that promote sustainability. For example, by introducing services in the offer, the product life cycle increases and therefore reduces the amount of products consumed (Sorli and Armijo, 2013). Furthermore, the consumers can experience a diversity of choices in the market, added value through customized offers and reduced risk of ownership. Moreover, servitization can reduce the number of products introduced and produced, decreasing the environmental impact (Mont, 2002).

Rolls-Royce, Xerox and Hilti are all companies which have had a successful journey through their servitization efforts (Jovanovic et al., 2016; Opresnik and Taisch, 2015; Baines et al., 2007). Rolls-Royce started their servitization strategy by providing spare parts, then continued with maintenance and overhaul service and finally moved into providing the total solution called "Power by the Hour" (Jovanovic et al., 2016). The customer pays an operating cost per flying hour instead of buying the engines themselves. Similar to Rolls-Royce, Xerox provide their customers with the opportunity to pay a fixed price per paper copy (Baines et al., 2007). Futhermore, Hilti provide their customers with their concept "pay per hole", which means that customers pay a fixed price per drilled hole (Opresnik and Taisch, 2015). Mentioned services are classified as the most advanced type of services and are discussed further in the following section regarding different classifications.

2.2 Classification of services

Kotler (1997) made a distinction between maintenance and repair services, and business advisory services. Such distinction is similar to the distinction made by Gebauer (2007) who divide services between product-related services (PRS) and customer-supporting services (CSS). Product-related services are services that are directly linked to the product and its objective is to ensure proper functioning of the product. This includes services such as maintenance, training, spare parts, and repairs. CSS on the other hand entails that the customer outsource the full responsibility of a functioning product to the provider. Gebauer (2007) mention taking over customers' maintenance function, technical advice for optimizing customers' operating processes, spare part management, and taking over customers' operation processes, as typical customer-supporting services. Furthermore, this classification is supported by the earlier research conducted by Mathieu (2001b) who makes a distinction between services which supports the providers products (SSP) and services which support the customer's action in relation with the provider's product (SSC). Where SSP and SSC is analogous to PRS and CSS respectively.

Baines and Lightfoot (2013) makes a further distinction. They categorize services in base, intermediate and advanced services. Base services are simply providing

the customer with products and spare parts. Intermediate services are similar to products-related services defined by Gebauer (2007) where the service provider offers, for example, scheduled maintenance, technical help-desk, operator training, and in-field service. But, the customer will mostly engage with the provider for more significant repair and overhaul. When a supplier offers advanced services it sells a capability rather than a product (Baines and Lightfoot, 2013). This entails that the product and service is bundled, a so called Product-Service System, which is critical to the customers' core business (Baines and Lightfoot, 2013; Baines et al., 2007).

Such PSS can further be categorized into three categories, namely, Product-oriented PSS (PoPSS), Use-oriented PSS (UoPSS), and Result-oriented PSS (RoPSS) (Tukker, 2004). It can be considered as a continuum where PoPSS is mostly related to the product and RoPSS is mostly related to service (Tukker, 2004). When a company offers its customers a PoPSS it entails that they intend to shift the ownership of the product to the customer while including additional services in the original sale (Neely, 2008; Baines et al., 2007). This is made to guarantee functionality and durability throughout the whole lifecycle (Baines et al., 2007). Example of such services are installation and implementation, maintenance and support, and consulting services. For example, the elevator manufacturer Kone offers their customers maintenance service agreements as an add-on (Kone, 2018).

UoPSS on the other hand does not transfer the ownership of the product to the customer (Neely, 2008). A UoPSS shift the focus from the product to the service where the product is an integrated part. The provider sells the use or availability of a product and the product might be leased, shared, rented or pooled between several users (Baines et al., 2007; Tukker, 2004). An example of a UoPSS is Caterpillar Fleet Management Solution that offer its customer CAT equipment through leasing agreement with additional services such as analytic support to maximize uptime and efficiency while minimizing the cost of ownership (CAT, 2018).

The furthest step towards a pure service is a RoPSS which means that a result or capability is sold instead of a product. The provider owns the product and the customer only pays when pre-agreed results are achieved (Baines et al., 2007). According Tukker (2004) there are three types of RoPSS, namely *activity management/outsourcing*, *pay per service unit*, and *functional result*. Firstly, activity management/outsourcing means outsourcing a part of an activity to a third party. For example, manufacturing companies seldom owns assets to manage transportation of their goods by themselves. This is in many cases solved by engaging with a shipping company that manage the transportation for a pre-agreed price and performance agreement. Secondly, pay per service unit implies that the customer pays for the output of the product according to the level of use (Tukker, 2004) A classic example of pay per service unit is Rolls-Roys who offer their clients a Power-by-the Hour formula which implies that the customer is charged for every hour the product is in use. Thirdly, functional result on the other hand offer the customer a function, and the provider is free to choose how the function is provided. An example is offering the customer a "green lawn" instead of selling a lawn mower. These three categories

of PSS are supported by other authors as well, but named differently (Kowalkowski et al., 2015; Opresnik and Taisch, 2015).

In order to summarize the findings from the literature review a framework were developed, see figure 2.1. *Traditional sales* means that the manufacturer sells a product and no subsequent relationship with the customer is established. For example, when SKF sells its ball bearings with no service agreements.

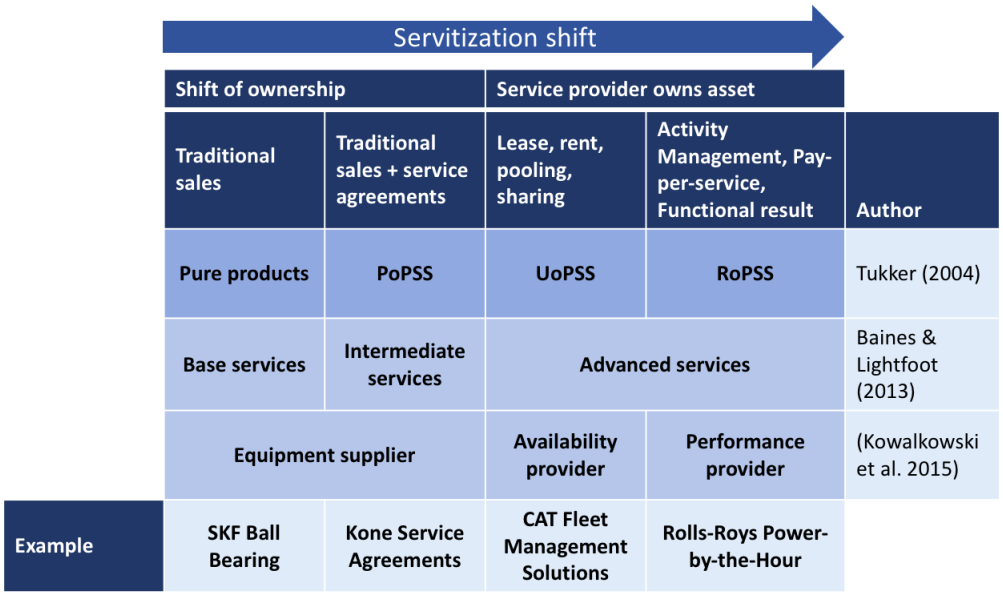

Figure 2.1: Classification framework of Product-Service Systems based on literature

In addition, Neely (2008) identifies two more PSS classifications to fully represent the range of servitization strategies being pursued by firms. Those are *integration-oriented PSS* and *service oriented PSS*. Integration-oriented PSS entails that the service provider seeks vertical integration downstream by, for example, moving into retail and distribution, financial services, and transportation and trucking services. However, Walters (2008) states that such strategy is fast and effective but is resource demanding and therefore not universally applicable. Service-oriented PSS is similar to Product-oriented PSS, but in a Service-oriented PSS the service is incorporated into the product itself, i.e. they are inseparable and can not be offered separately.

2.3 The product-service system transition

As mentioned in the previous section, a PSS can be divided into different categories. The transition between these PSS categories can be described by two different perspectives; as a continuum or as an expansion of the service provided. First, Oliva and Kallenberg (2003) describes the transition between PSS categories as a continuum, meaning a gradual shift from, for instance, a PoPSS to an UoPSS. Ulaga and Reinartz (2011) support the viewpoint by stating that the move into hybrid

offerings typically is gradual. This view of the PSS transition can be seen as the traditional perspective, meaning that companies only offer service solutions in one PSS category at the same time (Oliva and Kallenberg, 2003). On the other hand, Kowalkowski et al. (2015) challenge the continuum perspective and state that companies expand rather than transition into new service roles. That is, for example, a company which offers product-oriented service solutions often remains in this category even if they start offering user-oriented service solutions as well (Kowalkowski et al., 2015). More specifically, if the company provide service solutions such as maintenance, it will continue to do this even if the same company start to offer leasing or rental services. In this master thesis, the continuum perspective will be used when describing the challenges and enablers of a successful servitization strategy.

2.4 Service paradox and deservitization

As previously mentioned in the Servitization introduction, the advantages of servitization are many. However, most companies find it difficult to extend their service offerings and achieve anticipated returns and increased revenues (Gebauer et al., 2005). The phenomenon is mainly a consequence of increased investments and costs, and inability to achieve corresponding return (Gebauer et al., 2005; Neely, 2008). Gebauer et al. (2005) label this phenomenon the "service paradox" and is illustrated in figure 2.2 as transition line "2".

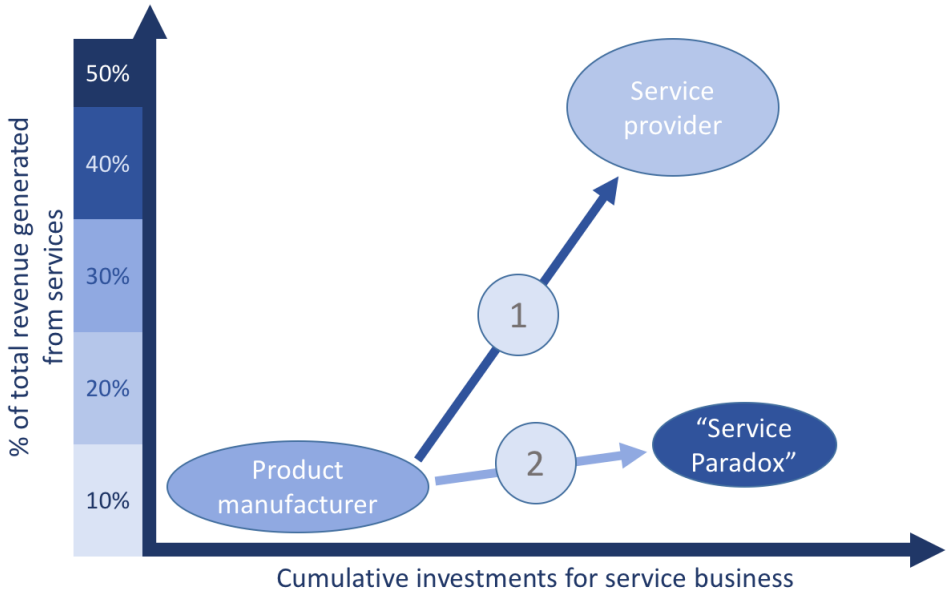

Figure 2.2: Service Paradox phenomena (adapted from Gebauer et al. (2005))

Research done through a case study based on more than 10 000 companies concludes that pure manufacturing companies in general generate a higher profit margin than servitized firms (Neely, 2008). On the other hand, the research also concludes that servitized companies generate higher revenues then their manufacturing counterpart. Neely (2008) concludes that the main reasons for the lower profitability of

servitized firms is a consequence of higher cost per employee, working capital and net asset based. Neely (2008) means that the lower profit margin stems from the fact that offering services require higher skilled personnel and additional assets such as IoT systems, data analytic tools, and additional service personnel.

Most servitization literature builds on the assumption that pure manufacturers transform from offering goods to service dominance (Finne et al., 2013), i.e. neglecting the fact that manufacturers may move in the opposite direction, so called deservitization (Kowalkowski et al., 2017). By for example reducing certain service offerings and developing new, manufacturers can react to changing business environments and thus achieve competitive advantage (Forkmann et al., 2017). Thus, manufacturers need to be able to both servitize and deservitize their offerings.

Even though the research of challenges and risks with servitization is extensive, reports of deservitization is scarce. For example, the servitization journey made by the printer company Xerox is well reported in literature. But, a few years ago Xerox deservitized by splitting the company into two parts, the all new service centric firm Conduent and the hardware centric organization still operating under the Xerox brand (Kowalkowski et al., 2017). Another illustrative example of deservitization is ThyssenKrupp who develop a new strategic business unit with the purpose of reducing the exposure to the cyclic nature of steel production and sales and a tendency towards commoditization. However, ThyssenKrupp found it difficult to generate the expected synergies between the service unit and the firms core businesses and decided to divest the service unit (Kowalkowski et al., 2017).

2.5 Challenges with servitization

The adoption of servitization brings with it significant challenges that can be divided into five main parts; culture, new competences and capabilities, processes, business model, and customer management challenges. This section will explain each of these parts followed by a section discussing how to overcome the challenges. The section ends with figure 2.3 which synthesize the identified challenges.

2.5.1 Culture

There are several challenges connected to the providing companies internal organization which needs to be addressed when transforming into a product-service offer. A main challenge is the change in cultural mindset (TC1) within the organization, which means a change from a product-centric organization to a customer-centric organization (Kowalkowski et al., 2015; Martinez et al., 2010; Oliva and Kallenberg, 2003). The reason for this is that the value creation process changes from the delivery of a product to value delivery based on a bundle of produced goods, service offerings and service personnel (Zhang and Banerji, 2017). The transition requires the providing company to develop a solution based on customer operations, which is challenging since the mindset of internal personnel might not be aligned with the customer perspective. This can therefore lead to offers that is not aligned

with customers' interests (Barnett et al., 2013; Brax, 2005; Pawar et al., 2009; Valtakoski, 2017; Vandermerwe and Rada, 1988). A shift in mindset is also required in the supplier network (TC2), since supplying physical goods and integrated offerings are different since it requires a higher degree of partnership (Oliva and Kallenberg, 2003; Martinez et al., 2010). However, Antons and Piller (2015) explain that the not-invented-here syndrome can create a resistance for knowledge derived from external sources. This means that the people in the organization wants to develop new ideas and technologies themselves rather than getting support from people and organizations outside the company.

2.5.2 New competences and capabilities

According to Baines et al. (2009), the transition to product-service offers requires a change in the competence needed (TCC1). That is, employees in manufacturing companies understand tangible products and its applications, while they lack the understanding of intangible service offerings. For example, it requires new competences in the development of services, maintenance, sales, partnerships, as well as competencies about customer operations (Kowalkowski et al., 2015; Opresnik and Taisch, 2015; Homburg et al., 2003; Reinartz and Ulaga, 2008). This creates the challenge of developing or acquiring the right competences and capabilities within the organization (Opresnik and Taisch, 2015; Homburg et al., 2003).

Posselt (2017) stress that the development of a servitization business model require extensive knowledge about the customer. This is because servitized firms offer more customized and relationship-based value propositions which require a more thorough understanding of the customer needs. Moreover, when developing a product-service system, companies need to build a deeper knowledge about customers' operations (Posselt, 2017). The reason for this is the fact that companies offering more advanced services usually overtakes parts of the customers' operations.

Posselt (2017) also conclude that as a firm gradually becomes more servitized the importance of in-depth customer knowledge increases. This conclusion is supported by Walters (2008) who suggests that the creation of product-service bundles require a better understanding of customer needs which is gained through shortening the distance to the customer and gaining an understanding of how the products are being used. Traditionally, gaining such knowledge is mainly achieved through qualitative approaches, such as observations and interviews or by acquiring organizations that base their operations closer to the end user (Rymaszewska et al., 2017). However, mentioned methods is resource demanding and only reveals a fraction of the real situation (Rymaszewska et al., 2017). Therefore, a challenge is to develop new capabilities (TCC2) which can facilitate the understanding of customers and their needs (Alghisi and Saccani, 2015; Kinnunen and Turunen, 2012).

2.5.3 Processes

Challenges related to processes refers to how value are created in the company, including the development and sales processes. Firstly, the development of services (TPD1) differ significantly from how tangible products are developed, since services cannot be stored and practiced before consumption (Parida et al., 2014). Moreover, customer engagement (TPD2) is necessary to a larger extent for the development of services to ensure that the output meets customer requirements (Brax, 2005). The reason behind this is that services needs to be more customized than an ordinary product offer, making it difficult to achieve scaleability (TPD3) in the development phase (Kowalkowski et al., 2015).

Secondly, the sales process need to be revised during the transformation to a product-service offer. According to Neely (2008), the sales process need to change from focusing on a one-time transaction to sell service subscriptions and capabilities (TPS1). This has been proven to be difficult due to the disbelief that service revenues can contribute to the majority of the total revenue in manufacturing companies (Gebauer and Fleisch, 2007). Compared to selling one tangible product, selling a service often generates lower short term revenues (Gebauer and Fleisch, 2007). Also, initial services such as installation are often given away for free by manufacturing companies in order to sell more products (Gebauer et al., 2005). The challenge is therefore to change both the mindset and processes for sales staff. In addition, Reinartz and Ulaga (2008) stress the issue that salespersons traditionally have sold products with attached service contracts, to contacts lower down in the hierarchy (TPS2). With more advanced service contracts, such contacts have no authority to make decisions about high value solutions contracts with strategic impact (Reinartz and Ulaga, 2008).

2.5.4 Business model

There are several challenges connected to the business model, including changes in pricing, increased risk and cannibalization (Zhang and Banerji, 2017; Greenstein, 2010; Kindström and Kowalkowski, 2014). Firstly, pricing need to be changed (TBM1) since it is mainly connected to the value created by the service, and hence need a new value-based pricing model (Barquet et al., 2013; Mo, 2012; Nudurupati et al., 2016). However, this new approach of pricing can be difficult. For example, Kowalkowski et al. (2017) describes the case of a leading German manufacturer of paint finishing systems that introduced a pay-per-use service, offering the customer possibility to pay for each car painted. The company found it difficult to predict the usage of equipment and therefore also to calculate the pay-per-use fee. As a result the company found it difficult to meet financial targets which eventually forced the company to deservitize by divesting the company. Also, Reinartz and Ulaga (2008) states that traditional sales persons typically have limited experience in value based pricing, making it necessary to replace the sales persons. Secondly, providing companies need to be able to manage and deliver multi-year partnerships (TBM2), which means managing and controlling long-term risk and exposure (Neely, 2008).

Thirdly, servitization can bring with it challenges in terms of cannibalization (TBM3). According to Greenstein (2010), digital services often cannibalize traditional products. This makes it difficult to evaluate the total value of the digital servitization since the new offering may partly cannibalize existing offers (Greenstein, 2010). Kindström and Kowalkowski (2014) also states that the degree to which the company is willing to cannibalize its traditional product business is a indication of how servitized a company truly is. Furthermore, according to Barquet et al. (2012) companies need to develop new business models (TBM4) when starting to offer more advanced services.

2.5.5 Customer management

Challenges related to customer management are those connected to building, managing and maintaining customers in the product-service organization. Firstly, the mindset need to be shifted from a transaction based relationship to a long-term based relationship (TCM1), both for the providing company and the customer (Neely, 2008). It is therefore essential that companies develop an understanding of the cost and profitability implications of such long-term relationships (Neely, 2008).

The changes in the relationship with customers also brings challenges connected to the ownership of products and operations (TCM2). According to Baines et al. (2007), customer might reject the non-transferable ownership when purchasing service offers, as they loose control over the operations. Also, accessing customer data sometimes is important for service providers in order to operate and develop the services properly. However, customers may not trust (CM3) the providing company and therefore reject to share data since they regard it as confidential information (Matthyssens and Vandenbempt, 2008; Gebauer et al., 2005).

Category	Code	Challenge	References
Mindset	TC1	Internal mindset	Kowalkowski et al., (2015), Martinez et al., (2010), Oliva and Kallenberg (2003), Zhang and Banerji (2017), Barnett et al., (2013), Brax (2005), Pawar et al., (2009), Valtakoski (2017), Vandermerwe and Rada (1988)
	TC2	Supplier network mindset	Martinez et al., (2010), Oliva and Kallenberg (2003)
New competences & capabilities	TCC1	Lack of understanding of intangible offers	Baines et al., (2009), Opresnik and Taisch (2015), Homberg et al., (2003)
	TCC2	Gaining customer understanding	Posselt (2017), Walters (2008), Rymaszewska et al., (2017), Alghisi and Saccani (2015), Kinnunen and Turunen (2012)
Processes	TPD1	No storage or practice before consumption	Parida et al., (2014)
	TPD2	Customer engagement	Brax (2005)
	TPD3	Scalability	Kowalkowski et al., (2015)
	TPS1	One-time transaction to subscription	Neely (2008), Gebauer and Fleisch (2007), Gebauer et al., (2005)
	TPS2	New target for sales force	Reinhartz and Ulaga (2008)
Business model	TBM1	Pricing	Barquet et al., (2013), Mo (2012), Nudurupati et al., (2016), Kowalkowski et al., (2017)
	TBM2	Long-term risk	Barquet et al., (2013), Zarpelon Neto et al., (2015)
	TBM3	Cannibalization	Greenstein (2010), Kindström and Kowalkowski (2014)
	TBM4	Business model development	Barquet et al. (2012)
Customer Management	TCM1	Transactional to long-term relationship	Neely (2008)
	TCM2	Asset ownership	Neely (2008), Baines et al., (2007)
	TCM3	Trust issues	Matthyssens and Vandenbempt (2008), Gebauer et al., (2005)

Figure 2.3: Synthesis of identified challenges

2.6 Overcoming the challenges with servitization

In order to overcome the challenges described in the previous section, several actions can be taken. These actions will be described in the following sections. The section ends with figure 2.4 which synthesize the identified challenges.

2.6.1 Commitment and leadership

The commitment and leadership of top management is a crucial factor for a successful transformation (Kotter et al., 1995). This is also true when transforming a company's offering to a product-service system (Gebauer et al., 2005). If the top management is not committed there is a risk that limited investments will be done, leading to a lack of adequate resources for the transformation (Gebauer and Friedli, 2005). A lack in commitment can also lead to unmotivated employees within the organization, harming the possibility for a successful transformation (Nadler and Tushman, 1997). Therefore, this action can be seen as a prerequisite for managing all challenges described in the previous section.

2.6.2 Increased collaboration and communication

In order to overcome the challenges related to the development process (TPD1, TPD2, TPD3), the business model (TBM1, TBM2, TBM3), as well as the challenge related to new capabilities (TCC2), an increased collaboration between different stakeholders need to be developed. The providing companies need to include the customers in the development process in order to secure that the output match customer requirements (Cooper and Edgett, 2003). Also, since the value is delivered through co-creation between the providing company, customers and suppliers, it is necessary that the different stakeholders are highly integrated (Alghisi and Saccani, 2015).

Furthermore, the transition requires more effective communication both internally and with external partners in order to raise awareness of the benefits of service offerings (Alghisi and Saccani, 2015; Kinnunen and Turunen, 2012). This makes the development and adoption of a "new" language important, which can be seen as challenging and an obstacle for effective communication (Zhang and Banerji, 2017). Also, Dubruc et al. (2014) stress the importance of a strong internal marketing of the servitization journey in order to handle the culture challenge TC1, and this has to be encouraged by the managers.

2.6.3 Developing new competence

Servitizing the organization and offers will create a need for new service competences and capabilities (Alghisi and Saccani, 2015; Paiola et al., 2013). The challenges related to the cultural challenge (TC1), limited competence (TCC1), sales process (TPS1, TPS2) and customer (TCM1, TCM2, TCM3) are all part of creating the need of new competences. Dubruc et al. (2014) mention that in order to deliver high quality services, people need to be trained and empowered. This can only be achieved if the employees has a service culture mindset (Dubruc et al., 2014). Moreover, all the different stakeholders which will be connected to the service operations have to be properly trained to handle the promotion of service offers (Alghisi and Saccani, 2015). Sales personnel need to be trained to be able to sell advanced service offers, and customers need to be trained to raise an understanding of the benefits of service. Also, it is necessary to either train the service development staff, or acquire the service competence from outside the organization (Gebauer et al., 2008; Martinez et al., 2010).

2.6.4 Developing new processes and capabilities

New processes and capabilities need to be developed in the organization in order to overcome the challenges related to the development and sales of services (TPD1, TPD2, TPS1, TPS2). First of all, existing research highlight the possibility to either integrate or separate the new service development (NSD) with the traditional new product development (NPD) (Gremyr et al., 2014; Gebauer et al., 2008). According to Gebauer et al. (2008), the degree to which the NSD is integrated into the NPD is determined by the type of service provided. Product-oriented services,

such as maintenance and spare parts, tend to be integrated into the NPD process, while customer services often are separated into a new NSD process (Gebauer et al., 2008). That is, some services need to be developed simultaneously as the product while others can be developed by separately. Furthermore, a set of new tools, methods and techniques is necessary to support the development process (Zhang and Banerji, 2017; Baines et al., 2007; Nudurupati et al., 2016), such as customer integration tools, service blueprint, SERVQUAL, Quality Function Deployment (QFD) and Structured Analysis and Design Technique (SADT) (Kuusisto et al., 2013; Jin et al., 2012).

Moreover, service modularity can be adopted to assist in overcoming the challenge of customization and scaleability (TPD3). Tuunanen and Cassab (2011) defines a service module as "a system of components that offers a well-defined functionality via a precisely described interface and with which a modular service is composed, tailored, customized, and personalized." That is, different components which can be connected in different ways to enable a customized offer. Expected benefits from service modularization are, for instance, more efficient customization and personalization, since it helps managing the heterogeneiry of services (Brax et al., 2017; Pekkarinen and Ulkuniemi, 2008). Furthermore, Pekkarinen and Ulkuniemi (2008) states that platform thinking can be used to identify and use the modular structure, logic of activities and customer offerings in the service production. The same authors presents a conceptual modular service platform, consisting of modular services visible to the customer, and modular organization and modular processes which are used to create the modular service. That is, different organizational modules and process modules are connected to create a service module (Pekkarinen and Ulkuniemi, 2008). Using this thinking will enable the service providers to customize the products to different markets and customers with less cost (Pekkarinen and Ulkuniemi, 2008).

According to Neely (2008), new supporting processes and incentives systems is required for selling service contracts instead of the tangible product offers (Neely, 2008; Kowalkowski et al., 2015). The sales staff also need to initiate new contacts within the customer organization which are higher up in the hierarchy and hence have the authority to decide upon more expensive service contracts that have a strategic impact (Reinartz and Ulaga, 2008). For example, moving up from traditional purchasers to management level.

Category	Addressed challenges	References
Commitment & leadership	All challenges	Kotter et al., (1995), Gebauer et al., (2005), Gebauer and Friedli (2005), Nadler and Tushman (1997)
Increased collaboration & communication	TPD1, TPD2, TPD3, TBM1, TBM2, TBM3, TCC2	Cooper and Edgett (2003), Alghisi and Saccani (2015), Kinnunen and Turunen (2012), Zhang and Banerji (2017)
Developing new competences	TPD1, TPD2, TPS1, TPS2	Alghisi and Saccani (2015), Paiola et al., (2013), Gebauer et al., (2008), Martinez et al., (2010)
Developing new processes & capabilities	TCC1, TPS1, TPS2, TCC2, TCC3	Gremyr et al., (2014), Gebauer et al., (2008), Zhang and Banerji (2017), Baines et al., (2007), Nudurupati et al., (2016), Tuunanen and Cassab (2011), Brax et al., (2017), Pekkarinen and Ulkuniemi (2008), Neely (2008), Kowalkowski et al., (2015), Reinartz and Ulaga (2008)

Figure 2.4: Synthesis of approaches to overcome challenges identified in previous section

2.7 The Internet of the Things

In the previous sections the general concept of servitization was discussed. As mentioned, a challenge with servitizing a company is to develop a closer relationship with the customers and to develop customer specific offerings based on the customer usage of the products. The Internet of Things (IoT) plays a central role in such relationship and the remaining sections will discuss the importance of IoT when servitizing the company.

2.7.1 What is IoT?

IoT is defined by ITU (2015) as "a global infrastructure for the information society, enabling advanced services by interconnecting (physical and virtual) things based on existing and evolving interoperable information and communication technologies" (ITU, 2015). A less technical and more comprehensive description is given by Tamborini (2015) who says that at the core, IoT is about things (devices, machines, buildings) that can sense their environment through sensors, have some ability to perform computations through embedded software, are connected to other things or software system, which allows them to exchange data and commands with other things. To simplify even further, IoT provides connectivity between people and people, people and things, and between things (Lee and Lee, 2015).

These "things" have according to Porter and Heppelmann (2014) three core elements, namely, physical components, "smart" components, and connectivity components. Physical components are the product's mechanical and electrical parts, for example tires, batteries, and chairs in a car. Smart components comprise the sensors, microprocessors, data storage, controls, software and embedded operating system and enhanced user interface. Connectivity components such as ports, antennas, and protocols enables wired or wireless connection to the physical component.

2.7.2 The role of IoT in offering portfolios

Even though there is opportunities to transform business operations and enabling new offers by the adoption of IoT, few organizations identify such opportunities (Thoben et al., 2017). IoT is rather identified as an opportunity to increase operational efficiency, mainly on the factory floor. Research regarding the technicalities of IoT is widely explored, however, the opportunities of IoT applications from a business perspective, such as new offerings enabled by IoT and what role IoT play, remains rather unexplored in literature (Gerpott and May, 2016).

Cusumano et al. (2015) developed a framework where services offered by manufacturers are categorized depending on their relationship to the product. Services where categorized into three types, namely, smoothing, adapting and substituting. The taxonomy of services that the framework is based on is very similar to the classification of services by Tukker (2004) depicted in section 2.2 . Based on this framework Gerpott and May (2016) modified it in order to specifically apply it to an IoT context. In the following paragraphs this framework is further discussed.

The IoT adopted framework developed by Gerpott and May (2016) also classifies the role of IoT into three categories, namely, Smoothing (enabler), Adaptation, and Innovation. When IoT have the role of smoothing or adaptation it is considered to complement elements of a firm's current offering portfolio, whereas in the Innovation role it seeks to fully replace the current sales of goods for a firm by generating a new sales category (Gerpott and May, 2016). Figure 2.5 shows their model and in order to make it more comprehensive examples of each role are provided as well.

	Complement		Replacement
Role of IoT	**Smoothing** (enabler)	**Adaption** (adjunct service/product)	**Innovation** (core service/product)
Role Characteristics The IoT component:	• Is pivotal to *initiate transaction* • Potentially *reduces transaction costs* • Is *not* a part of the *core product/service*	• Significantly *increases value* but is *not* the main value driver • Enables *additional functionality* to an otherwise standalone product/service	• Is the *main* value driver of the product/service • Creates product/service features which were *not available in the past*
Examples	• Obike	• Babolat Play Pure Drive • Sonos Cloud control	• Compare-IT smart home • Medtronic CGM

Figure 2.5: The roles of IoT in offering portfolios (adapted from Gerpott and May (2016))

When IoT is not part of the core product or service but have a pivotal role to initiate a sequence or transaction it is characterized as *smoothing/enabling*, and is considered as a complement to the core product or service (Cusumano et al., 2015). One example when IoT has a smoothing function is the bike sharing service provided by Obike in Singapore. Obike offers its customer to rent bicycles that are spread randomly around the city with a pay-per-use formula. To enable a smooth transaction Obike integrates IoT which serves as an enabler for the platform where the user can spot the location of bikes, unlock bikes, and see where the bike should be returned (Obike, 2018). The customer can also pay for the service through the platform via

credit card. So, the basic function of a bike rental is maintained but the transaction cost is decreased by the integration of IoT.

The second complementing role of IoT is the *adaption* role. Similar to an enabler, adaption does not change the core functionality of the product but rather enrich and expands the functionality. One example is Babolat's Pure Drive Play product system that through integrated sensors in the racket collects information about the usage, such as ball speed, impact location, and power (Babolat, 2018). The data can be analyzed to improve the players skill by providing advises and suggestions through a smart phone app. Such adaption of IoT does not alter the main functionality of the racket but significantly increases the value provided to the customer. Another example is Sonos Cloud System that allow the customer to control Sonos portable devices through mobile devices (Sonos, 2018). The main function is not changed but the user experience is significantly enhanced.

When IoT is the main value driver and enables previously unknown offerings it plays an *Innovation* role. Such role entails that IoT enables novel offerings or replace a non-IoT-enabled offer (Gerpott and May, 2016). Compare-IT offers smart home automation systems, with functions such as coordinated controlling of lighting, alarms, surveillance systems, and monitoring of energy consumption (Compare-IT, 2018). Without IoT, these tasks would either be impossible to fulfill or fulfilled by time-consuming manual imposition. A further example is Medtronic's Continuous Glucose Monitoring (CGM) service where a glucose sensor is inserted under the patient's skin to measure the blood glucose level continuously in real-time. The sensor is connected through IoT to a monitor devices that alerts the patient when glucose level require attention (Medtronic, 2018). Without IoT such service would not be possible, hence IoT plays an Innovation role.

2.7.3 IoT implementation challenges

Connecting several different types of devices, technologies, and services to create an integrated system requires the ability to handle different communication capabilities (e.g. data-rates and/or reliability), computational and storage power, availability of energy, and an ability in handling different technologies (Zorzi et al., 2010). Furthermore, the system has to support devices and applications whose characteristics (e.g. bandwith, latency, reliability) differ greatly (Zorzi et al., 2010). The reason behind this problem is partly that there is no universal standard (Bandyopadhyay and Sen, 2011).Mentioned requirements of an IoT system contribute to a technical challenge (TIoT1) that companies needs to address. Furthermore, according to Uckelmann et al. (2011) scalability is a challenge. A contributing reason for mentioned difficulty is the lack of standards, which is also mentioned by Bandyopadhyay and Sen (2011) (Uckelmann et al., 2011).

Sensors or other appliances of IoT generate large amounts of data which current computer systems and architecture of data centers are not capable of managing (Lee and Lee, 2015; Tsai et al., 2014). Data is, for example, generated from digital

sensors applied to industrial equipment, automobiles, and ship craters. As more data is generated, adequate data mining tools become increasingly important. Traditional mining tools is not sufficient to handle the heterogeneity of new type of streamed unstructured data that may consists of images, video data, audio, and monitoring devices (Lee and Lee, 2015; Normandeau, 2013). Data is generated continuously and often in real time from business processes, machines, networks, and human interactions which results in data generated at a great speed (Beulke, 2011; Opresnik and Taisch, 2015). Furthermore, a difficulty with data analytics is that data can be biased, noisy, outdated, inaccurate, misleading, ambiguous and thus being unreliable (Berti-Equille and Ba, 2016; Lukoianova and Rubin, 2014). The volume, heterogeneity, speed, and unreliability of data generated from IoT systems require companies to build capabilities to handle that data and derive useful information that can be leveraged to increase customer value (Opresnik and Taisch, 2015; Lee and Lee, 2015). For example, a cloud connected oil rig with thousands of sensors generated great volumes of data at a great velocity. Sensors measure vibration, temperature, humidity, air pressure, and more while video cameras monitor certain areas. Such data is of fundamentally different forms which contribute to the challenge of heterogeneity. Furthermore, it is challenging to know, for example, if a deviation in temperature is a consequence of something harmful and harmless, and whether it should be acted upon or not, i.e. ambiguous data. This challenge is referred to as Data Management challenge (TIoT2).

As mentioned before, one of the advantages with IoT is that it generates data about product usage. However, this is also problematic since the data generated often is of private character which results in privacy concerns and challenges (IoT3), which also is discussed in section 2.5.5 (Lee and Lee, 2015). The heavily constrained nature of the IoT devices and limited bandwidth results in challenges of providing safety mechanisms to reduce the potential attack surfaces for hackers and other cyber criminals (Lee and Lee, 2015; Zorzi et al., 2010). Many IoT devices lack sufficient transport encryption, secure Web interfaces, adequate software protection, and sufficient authorization (Lee and Lee, 2015). According to HP (2015) 70% of the most commonly used IoT devices contain serious vulnerabilities. Malicious tampering with the system may result in performance drops, operational disruption, theft, and safety hazards (Zorzi et al., 2010). The security challenges (TIoT4) and privacy challenges create resistance to the adoption of IoT, both by firms and individuals (TIoT5) (Lee and Lee, 2015). Bandyopadhyay and Sen (2011). Furthermore, new laws and regulations are continuously put in place and companies need to develop and manage their IoT systems accordingly (TIoT6) (Bandyopadhyay and Sen, 2011). In figure 2.6 challenges related to IoT implementation are summarized.

Category	Code	Challenge	References
Internet of Things	TIoT1	Technical difficulties	Zorzi et al., (2010)
	TIoT2	Data Management	Lee and Lee (2015), Tsai et al., (2014), Normandeau (2013), Beulke (2011), Opresnik and Taisch (2015), Berti-Equille and Ba (2016), Lukoianova and Rubin (2014),
	TIoT3	Privacy concerns	Lee and Lee (2015)
	TIoT4	Security issues	Lee and Lee (2015), Zorzi et al., (2010)
	TIoT5	Resistance of IoT	Lee and Lee (2015)
	TIoT6	Laws and regulations	Bandyopadhyay and Sen (2011)

Figure 2.6: Synthesis of identified IoT implementation challenges

2.7.4 IoT as an enabler for Servitization

Implementing IoT-based solution enables companies to monitor, control and analyze the consumers' product usage, which is a cost-effective approach to increase customer proximity (Rymaszewska et al., 2017; Lee and Lee, 2015; Thornberry, 2017). This may be a beneficial approach to solve TCC2.

Connected products enables monitoring of a product's condition, operation, and external environment through sensors (Porter and Heppelmann, 2014). With IoT it is possible to get real-life data in real-time which can be utilized to get an accurate understanding of how the product is used (Porter and Heppelmann, 2014; Lee and Lee, 2015). Connected products generate huge amount of data that can be transmitted and analyzed to discover customer behavior patterns and patterns in market condition (Lee and Lee, 2015). Such insights can be used to develop new value-added service, new value proposition, business models as well as it enables optimization of assets (Lee and Lee, 2015; Neely, 2008; Porter and Heppelmann, 2014). However, in order to reap the benefits companies need to develop capabilities and continuous processes to gather, analyze and interpret data in order to derive actionable insights (Davenport et al., 2012; Opresnik and Taisch, 2015).

3
Research Methodology

This chapter will describe the research methodology used in the master thesis, including the research strategy, research design, research methods and research quality.

3.1 Research strategy

A research strategy is defined by Bryman and Bell (2015) as "a general orientation to the conduct of business research" and is divided into qualitative and quantitative research. The fundamental difference between the two is whether or not the researcher employ quantifiable measurements or not. Quantitative research emphasize quantification in the collection and analysis of data whereas qualitative emphasize words (Bryman and Bell, 2015). Furthermore, quantitative research is strongly associated with the testing of existing theory, whereas qualitative generally is applied to generate new theory (Bryman and Bell, 2015). The purpose of this master thesis is to investigate which challenges a servitizing company is faced with, depending on the type of Product-Service System that is offered. Moreover, the enablers for deploying a servitization strategy is examined. Firstly, the identification of challenges and enablers is qualitative by its nature and it serves no purpose trying to quantify the data. Secondly, the research on the topic is scarce, hence a contribution to existing theory is desirable. Consequently, a qualitative research strategy is most suitable and has therefore been chosen.

Bryman and Bell (2015) describes two different research strategies; deductive and inductive. The deductive study starts with already existing theory, where the researcher sets a hypothesis on the theory chosen and then conducts data collection, and based on the findings rejects or confirms the hypothesis (Bryman and Bell, 2015). The theory is then revised based on the findings. On the other hand, an inductive study is focused on generation of new theory which often is based on empirical findings (Bryman and Bell, 2015). Inductive strategies is strongly associated with qualitative research and deductive with quantitative research. When both inductive and deductive strategies are used iteratively an *abductive* strategy is used (Dubois and Gadde, 2002). This allows the researchers to continuously move from the empirical world to the model world, in order to successively reorient when new empirical findings surface (Dubois and Gadde, 2002).

The findings in this master thesis is based on a combination of existing theory and empirical findings. Firstly, an initial literature review was conducted to serve as a

base for the empirical investigation. Based on the findings from the initial literature review relevant interview questions could be formulated. During the interviews new findings surfaced which supported the search for new relevant literature. This was done iteratively in order to find patterns and draw conclusions. Such approach enabled the authors to build the conclusions on already existing theory while exploring and contribute to existing theory. Hence, an abductive approach, also called systematic combining, was used. Furthermore, such reasoning will overcome some of the disadvantages of deductive and inductive reasoning (Bryman and Bell, 2015). See figure 3.1 for illustration of the approach.

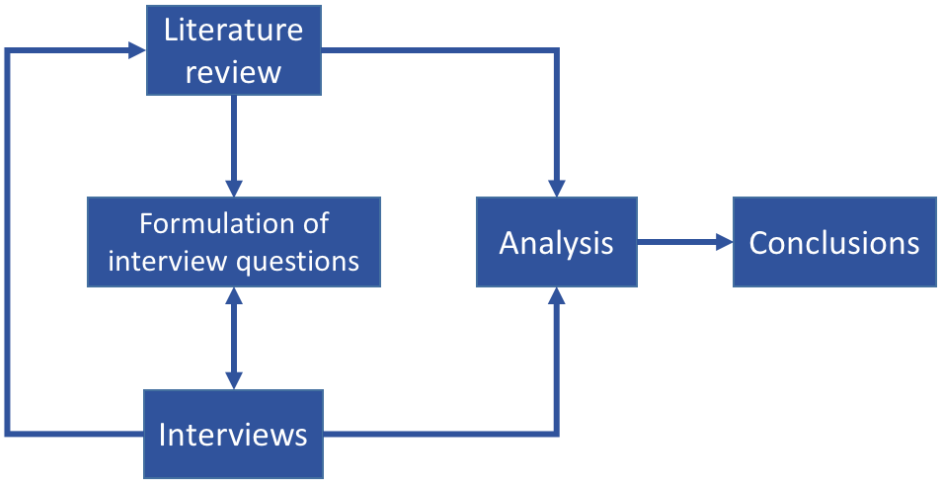

Figure 3.1: Illustration of the research strategy

3.2 Research design

(Bryman and Bell, 2015, p. 26) defines research design as "a framework for the collection and analysis of data". In this master thesis, a case study with six embedded cases is used. According to Bryman and Bell (2015), a case study is defined as a specific study and analysis of a single case. The specific case studied in this thesis is the concept of IoT enabled servitization. In order to get a deeper understanding of the subject and to facilitate the identification of patterns in the empirical world, six embedded cases were studied at six companies. According to Yin (2003), this approach gives the researcher the ability to analyze sub-units which are located within a larger case. The companies were chosen based on their type of service offerings, where two companies were selected for each service type; PoPSS, UoPSS, and RoPSS. Two companies were chosen in each category to increase the generelizability of the findings. However, to make the research applicable in a larger number of settings more companies should be researched, but the time constraints of the master thesis did not allow that. The classification of companies will be further elaborated in section 3.3.

3.3 Research methods

This section will present and elaborate upon the methods used to gather and analyze empirical data and literature. Firstly, a description of how the literature review was conducted is provided, followed by a discussion of how the sampling of the case companies were done. Thereafter comes a discussion of the interview study and lastly a description of how the collected data was analyzed is presented.

3.3.1 Literature review

The literature review was conduced continuously during the whole master thesis. Initially, literature was collected to gain a deeper understanding of the chosen field of study and the research questions. The knowledge gained was used to formulate relevant questions for the interviews with the embedded case companies. During the interview study, new knowledge was gained which needed to be strengthen and compared with theory, hence new literature was reviewed.

Both articles and books were used during the study, which were collected from the Chalmers Libery Database and Google Scholar. The literature was found through searching for keywords such as: “Servitization”, “Challenges with servitization”, “Internet of Things”, “IoT integration” and “Challenges with IoT".

3.3.2 Sampling of embedded cases

The classification used in this study was developed by Tukker (2004), containing the service types PoPSS, UoPSS and RoPSS. There are several other classifications, see section 2.2, but this classification was chosen since the authors considers it to be the most well defined and with the most distinguished boundaries between the categories. Further, the authors were provided with a list of 42 potential companies to interview. This list was provided by an expert in the field of IoT and contained companies where the expert had good connections. This expert will be referred to as EX1 and is further described in section 3.3.3.1. From this list, six embedded case companies were selected, two within each PSS classification. The selection was based on the convenience to access suitable interview objects within the companies, aw well as three criteria presented below.

1. The offerings of the company can be categorized into one of the PSS categories.
2. The company include, or are striving to include, IoT in the offerings to create value for the customers.
3. The company is striving to offer a more advanced PSS.

The classification done by the criteria above was also validated by the expert EX1. Moreover, when selecting the embedded case companies the continuum perspective, described in section 2.3, has been used. The classification of the case companies were based on the most advanced type of service offered. If the companies offered less advanced service offerings these specific services are not considered in this master

thesis. For example, if a company offer both user-oriented and product-oriented service offers, only the user-oriented service solutions will be analyzed for this specific company.

The following sections will present a brief descriptions of the embedded case companies and their offerings. In order to classify the case companies depending on their size, the categorization by EU (2003) is used. Small enterprises are companies with less than 50 employees, medium employs 50 to 250 persons, and large employ 250 persons and above. Figure 3.2 synthesize the case companies and the criteria used.

3.3.2.1 Case company A

Company A is a large OEM providing pumping solutions across the world. It have a business-to-business strategy where their two main sales channels are resellers and own sales organizations. The company offers various service agreements along with the product, such as maintenance and spare part provision. The main part of the offer is the product while additional services are included to guarantee functionality and durability. The ownership of the product is also transferred to the customer. These characteristics of the service offer is consistent with the classification PoPSS, which is described in the section 2.2. Therefore, the first criterion is fulfilled. Furthermore, the company fulfills the second criterion since they are developing IoT systems to be included in their future products. They are also striving to offer a more advanced PSS, namely RoPSS, hence the third criterion is fulfilled.

3.3.2.2 Case company B

Company B is a large OEM operating in the manufacturing industry and is a provider of building components. The company has a business-to-business strategy where the main sales channels are their own sales department and resellers. Their product portfolio consist of different types of solutions for buildings and they provide the customers with additional services besides the product. Examples of services agreements are spare part provision and maintenance. The content of these service agreements can vary depending on customer needs, and payment can either be subscription based or hourly based. The ownership of the product is shifted to the customer and service agreements are offered. These characteristics of the service offer is consistent with the classification PoPSS, which is described in the section 2.2. Therefore, the first criterion is met. Furthermore, the company is planning on integrating IoT into their products, hence the second criterion is fulfilled. Also, the company has started to discuss new, more advanced service solutions and how this could be integrated in the organization. The third criterion is therefore also fulfilled.

3.3.2.3 Case company C

Company C is a large OEM operating in the automotive industry. The company has a business-to-business strategy where the main sales channels dealers and direct sales. Their most advanced service offer include the opportunity to rent the product for a fixed price per moth. This entails that the company sells the use or

availability of the product, while the ownership of the product is not transferred to the customer. According to the classification by Tukker (2004), discussed in section 2.2, these characteristics reflects a UoPSS offer. Therefore, the first criterion is fulfilled. Moreover, the company integrates IoT in their products to enable remote diagnostics and monitoring. There is ongoing discussions within the company to offer RoPSSs, hence, the third criterion is fulfilled.

3.3.2.4 Case company D

Company D is a large OEM operating in the automotive industry. The company has a combination of both business-to-consumer and business-to-business strategy where the main sales channels are their own sales companies and resellers. One further sales channel is a newly developed digital platform where consumers can purchase the company's products directly. Their most advanced service offer consist of leasing solutions, where the company provide the customer with the opportunity to lease the product for a fixed monthly payment. While the customer leases the product the company owns the asset, which means that the ownership of the product is not transferred. These characteristics is aligned with the classification UoPSS, which is presented in section 2.2. The first criterion is therefore fulfilled. Moreover, the company integrates IoT in the UoPSS in order to offer digital services, monitor the product and enable remote diagnostics. Criterion two is therefore fulfilled. The company also discusses new ways of selling more advanced services and how to integrate these in the organization, hence criterion three is fulfilled.

3.3.2.5 Case company E

Company E is a large OEM operating in the automotive industry. The company has a business-to-business strategy where the main sales channel is their own sales departments. Their most advanced service solution is an up-time guarantee where the company provide the product and the customer pays per kilometre driven. The ownership of the product is in this case not transferred to the customer. This is described by Tukker (2004) as "pay per service unit" PSS, which is one type of RoPSS solution. The first criterion is therefore met. Furthermore, the company integrates IoT in the RoPSS in order to offer digital services, monitor the product and enable remote diagnostic. Since the company already offers the most advanced type of PSS, the last criterion is not applicable.

3.3.2.6 Case company F

Company F is a large OEM operating in the packaging industry. The company has a business-to-business strategy where the main sales channel are through their own sales departments. Their most advanced service solution is a performance based service agreement, where they guarantee up-time of their product. In this service solution, the customer pays a fixed fee for a predefined minimum uptime. If the company fail to fulfill the pre-agreed up-time level, they either get less paid or have to compensate the customer monetarily. The customer is not exclusively charged with a fixed fee for the performance based service agreement, but also a fee for

leasing the equipment. So, this type of contract can be considered as a hybrid between UoPSS and RoPSS. Therefore, the ownership of the asset is not transferred to the customer and the customer is charged based on the performance, hence the offer can be categorized as a RoPSS. Criterion 1 is therefore fulfilled. Furthermore, the company leverage IoT in their machines to monitor and collect data about product usage, hence, the second criterion is fulfilled. Since the company already offers the most advanced type of PSS, the last criterion is not applicable.

	A	B	C	D	E	F
Industry	OEM Pumping Solutions	OEM Building components	OEM Automotive	OEM Automotive	OEM Automotive	OEM Packaging
Size	Large	Large	Large	Large	Large	Large
Sales channels	• Resellers • Sales org.	• Resellers • Sales org.	• Resellers	• Resellers • Sales org.	• Sales org.	• Sales org.
Criterion 1	✓	✓	✓	✓	✓	✓
Criterion 2	✓	✓	✓	✓	✓	✓
Criterion 3	✓	✓	✓	✓	✓	✓
Transfer of ownership	✓	✓				
Most advanced service offered	Service agreement	Service agreement	Rental	Leasing	Uptime guarantee Pay-per-km	Uptime guarantee
Classification	PoPSS	PoPSS	UoPSS	UoPSS	RoPSS	RoPSS

Figure 3.2: Synthesis of the classification of embedded case companies

3.3.3 Data collection

Both primary and secondary data were collected during the master thesis. Primary data was gathered through semi-structured interviews, while the secondary data was collected from the case companies webpages. The data was then analyzed by an approach inspired by Grounded Theory. These three parts will be further described in the following sections.

3.3.3.1 Interview study

The purpose of the interviews was to get a deeper understanding of the PSS offered and investigating challenges the embedded case companies have been faced with in their servitization journey. Furthermore, questions related to enablers for servitization and questions about what role IoT have in the offering were also asked. The interviews were held in a semi-structured manner and pre-defined questions were formulated to serve as the base for the interviews. The questions are presented in

Appendix A. Bryman and Bell (2015) suggests this approach when using an inductive approach, since it enables the interviewees to speak openly and elaborate on topics that arise during the interviews. Bryman and Bell (2015) further state that interviews are compatible with a case study where qualitative data is compared between companies. By using a semi-structured format, the interviews will provide both a broader understanding based on the questions while simultaneously enabling deeper understanding through follow-up questions and discussion (Bryman and Bell, 2015). The interviews lasted between 30 and 75 minutes.

The initial contact persons at the companies were provided by expert EX1. These persons were then presented with the purpose and a short description of this master thesis to get an understanding of the topic. The contact person then guided the researchers to the person he or she considered to have the best knowledge of this specific topic. Thus, the contact person became a 'gateway person' to the company. After the first interview at each company, the researchers asked the interviewee for a person he or she thought was a relevant person to have a second interview with. This type of sampling is what Bryman and Bell (2015) refers to as *Snowball sampling*. In figure 3.3 a summary of all interviews is presented. All interviews were recorded in order to have the possibility to listen to the interview several times to ensure that no important data were missed. During the interviews one interviewer was responsible for leading the interview while the other interviewer was taking notes. These notes were after the interviews complimented by listening to the interview again in order to fill out gaps in the notes.

Interviewee	Case company	Position	Type of interview	Duration	Language
A1	A	Head of Digital Transformation	Skype	50 min	Swedish
A2	A	Group VP Services	Skype	30 min	English
B1	B	CTO	Skype	40 min	Swedish
B2	B	VP Services & Solutions	Skype	50 min	English
C1	C	VP Business Office & Governance	Face-to-face	40 min	Swedish
C2	C	Director Processes & Solutions	Face-to-face	40 min	Swedish
D1	D	VP Mobility Solutions	Skype	35 min	Swedish
E1	E	Director Global Services	Face-to-face	75 min	Swedish
F1	F	Business Development Manager	Skype	60 min	Swedish
F2	F	Manager Advanced Analytics	Skype	35 min	Swedish

Figure 3.3: Presentation of interviewees, company, their position, type of interview, duration, and language

Furthermore, an interview with the expert EX1 were held to gain a deeper under-

standing of servitization and related topics. EX1 has more than 25 years in the field of IoT. EX1 has also experience with business development within the telecom and automotive industry with a strong focus on service development and IoT. Interviews with the expert were held continuously throughout the master thesis. In addition, one more structured interview were held with the expert. This interview was conducted with the same questions and structure as the ones with the case companies.

3.3.3.2 Secondary data

The data collection included secondary data from various companies' web pages. This data was collected to contribute to an understanding of the current service offerings and to classify the case companies into the different PSS types. It also contributed to an overall understanding of the company, which industry they operates in and how large the companies are.

3.3.3.3 Data analysis

The analysis of both the theoretical data and empirical findings have been done in parallel to the data collection. According to Bryman and Bell (2015), this is often the case in a qualitative research study. In this master thesis, the approach to the data analysis has been inspired by the framework grounded theory. The framework is described by Bryman and Bell (2015) as a way of discovering patterns in data, which can be used to develop new theory. The key process in the framework is coding, where collected data are broken down and divided into component parts, which are given names (Bryman and Bell, 2015). The coding of the empirical findings was done continuously throughout the whole process. Examples of codes used is "Role of IoT", "Sales force", "Partnerships", "IoT implementation challenges", "Enablers", and "Challenges". These codes were used to create an understanding of different patterns between articlesand the empirical study. Based on this, the purpose and the research questions were able to be answered.

As explained earlier, notes were taken during the interviews. Each paragraph in the notes was given a short headline that reflected the content of the paragraph, for example "Business model", "Customization and scalability", and "Culture". A workshop was then conducted in order to develop a suitable structure for the result chapter. The workshop was structured as following; firstly, all headlines were written on post-it notes and put on a whiteboard. This enabled the authors to see which headlines were related. Secondly, the headlines that were related were placed in a cluster. Lastly, the clusters were given suitable names that reflected the headlines within the clusters. This approach was done to cluster the current state and challenges. The clusters for the current state are the following; *Organizational structure, Service development, Partnerships, Competence & capabilities, Communication & Collaboration, Sales process*, and *Internet of Things*. The workshop led to the following clustering of the challenges; *Culture, Service development, Sales process, Business model*, and *IoT implementation*.

3.4 Research quality

This section focuses on the evaluation of the research quality based on the four criteria *credibility*, *transferability*, *dependability*, and *confirmability* presented by Bryman and Bell (2015). This section ends with a discussion about ethical considerations.

When evaluating the quality of research reliability and validity is often discussed. But, according to Bryman and Bell (2015) such criteria is difficult to apply to qualitative research. For example, validity require some sort of measurement and since qualitative research mostly is not concerned with measurement, validity becomes irrelevant (Bryman and Bell, 2015). However, Bryman and Bell (2015) proposes alternative criteria to evaluate the quality of qualitative research. The proposed criterion are; credibility, transferability, dependability, and confirmability.

Credibility refers to how 'true' the findings are and boils down to the question "how congruent are the findings with reality?" (Merriam, 1998, p.212). To assure credibility multiple data sources were used, which Merriam (1995) refers to as *triangulation*. The most important practice to assure credibility according to Lincoln and Guba (1985) is Member Checks, which is when the researcher double checks the findings with the members, in this case the interviewees, to assure that the interpretation of data is correct. When the data collected from the interviews had been interpreted and summarized, the interviewees were provided with the summary to validate that the information was correct. Furthermore, the interviews were recorded which enabled the authors to listen to the interviews several time retrospectively in order to assure that the notes taken during the interviews were correct.

Bryman and Bell (2015) stress that qualitative research entails intensive study of a small group or individuals sharing certain characteristics in contextually unique settings. This implies that the research is difficult to generalize and apply in another setting. This difficulty is referred to as *transferability* and can be managed by describing the circumstances as thorough as possible. In chapter 3.3.2 a contextual description of each embedded case company is provided to increase the transferability. However, since the case companies are anonymous the description can not be too detailed since that could jeopardize the anonymity. Furthermore, a description of the specific case studied is provided in section 3.2. Moreover, all studied case companies are large OEMs, which decreases the numbers of contextual variables which in turn increases the transferability within the context.

Dependability refers to the repeatability of the research, i.e. if the same research were conducted in the same context, with the same methods and with the same participants, the result would be the same (Pandey and Patnaik, 2014). To assure dependability Lincoln and Guba (1985) suggest Inquiry Auditing which involves external persons, not involved in the research, to investigate the research process and result. During the research several meetings with the supervisor at Chalmers University of Technology and the experts EX1 were held, which can be seen as a form of auditing. Furthermore, a workshop with the same expert were conducted

to validate the findings which further strengthened the credibility.

Confirmability refers to the objectivity of the research (Bryman and Bell, 2015). As stated before, all interviews were recorded so that the authors could listen to them several time. This assured that the authors' biased memory of the data did not affect the outcome of the research. Furthermore, a transparent description of the research method is provided which according to Pandey and Patnaik (2014) assures confirmability.

3.4.1 Ethical considerations

When conducting research it is important not only to consider the trustworthiness, but also to handle ethical issues (Bryman and Bell, 2015). Diener and Crandall (1978) present four common ethical issues; *harm to participants*, *lack of informed consent*, *invasion of privacy*, and *deception*. Throughout the study all participants are anonymous which significantly decreases the risk of causing any harm. However, even though they are anonymous there is still a risk that the participants are identified. To avoid that, no detailed information about the participants are provided. In order to manage the issues of 'lack of conformed consent' and 'deception' the interviewees where presented with a description and the purpose of the master thesis as well as how the information will be used. In the beginning of the interviews the interviewees were asked if they approved that the interviews were recorded.

4
Empirical findings

In the following chapter the empirical findings are presented. The chapter is divided into three parts based on the classification of the Product-Service Systems. In each part a presentation of the current state is provided, followed by identified challenges. The chapter is based on information collected from the external interviews with case companies and interviews with an expert. Section 4.3 ends with figure 4.1 which synthesize the current state in the case companies. Furthermore, the chapter ends with figure 4.1 which summarizes the challenges identified in the empirical findings.

4.1 Product-oriented PSS

In the following section the findings derived from the interviews with the case companies, A and B, categorized as Product-oriented Product-Service Systems are presented. First a presentation of the current state is provided, followed by a presentation of identified challenges.

4.1.1 Current situation

In this section the current state is presented. The section is divided into seven topics, namely, *Organizational structure, Service development, Partnerships, Competence & capabilities, Communication & Collaboration, Sales process*, and *Internet of Things*.

4.1.1.1 Organizational structure

Before the servitization effort, case company A had several local sales organizations around the globe that offered various types of services. However, according to the Head of Digital Transformation (A1), different services were offered at the different local sales organization around the globe. In order to be able to offer the same services at all locations, and to be able to develop and offer more advanced types of services, a global service organization was established. To lead this transformation a new Vice President Services was appointed. The new service organization has full ownership of profit and loss for their business unit. The split led to conflicts between the sales organization and service organization, since the new service offerings risk cannibalizing on the product sales. The Head of Digital Transformation (A1) provided an example to illustrate this situation "a sales person from the service department visits a customer and says "dear customer, you no longer have to purchase our products, instead you can get it as a function". This means that the service sales person 'steals' this customer from the traditional product sales

department. The same product is offered from another department within the organization“. However, the head of sales is responsible for both the service department and product sales department which means that this person is concerned with the results from both department. Thus, it is this person's responsibility to make sure that the departments are well functioning and no conflicts occur.

In case company B the structure is different since they have no dedicated group that is responsible for service development. According to the CTO (B1), they have a central development unit that is responsible for the development of new IoT systems that is necessary for the service transformation. Furthermore, the VP of Services & Solutions (B2) states that a revenue growth of sales of “4-5% and we would be fine, but 10% is a totally different ball game in terms of investment plans, organization, profit and loss follow-up, and the associated organization with products”. B2 stressed that the CEO has very ambitious growth targets which most likely will require restructuring the organization.

4.1.1.2 Service development

According to the Group VP of Services (A2), the service development process in case company A is totally separated from the product development process. However, as A2 mentioned, "it needs to be close connection to the whole R&D process because all solutions need to have a service component embedded". The Head of Digital Transformation (A1) further stated that the company need close connection to the clients when developing services. A1 said that "the development is conducted with real, paying customers which have asked for these types of services and are a part of the journey [servitization]". Moreover, both A1 and A2 stressed the importance of service modularity in order to handle the challenge of scalability. The company need to build a solution which is both scalable and customized. According to A1, "one way of solving this is to build the offer modular and flexible, so you can *build* it according to the customer need rather than *developing* it according to the customer need".

On the other hand, the CTO (B1) stated that case company B has an integrated service development process where the product owner "is responsible for the development of products and to think about how the product will work with additional services". B1 further mentioned that the company need to avoid having too unique service offers since it will be difficult to manage all the different customer agreements. B1 stressed that "if you build up a system support where customers can monitor their connected products, it would not be favorable to have customized systems when you need to maintain them". The VP of Services & Solutions (B2) further mentioned that they package their services in various types of agreements, and that modularity is not applied.

4.1.1.3 Partnership

Both interviewees at company A stressed that in order to achieve the objectives of the service transformation new partnerships have to be identified and developed.

The Head of Digital Transformation (A1) also stated that “we are firm believers that the winners of the future will be defined by ecosystems, and not few big traditional actors. Thus, we need to partner up with different types of actors to build an attractive offer”. This view is also supported by the Group VP of Services (A2) that stated “because our customer base is also going to change during this journey where we are trying to get better end user relationships. Then we need new partnerships to bring us down that road”. A1 further stressed that “in the future we will be better at identifying niche expert actors that have built, for example, an algorithm or solution that could fit into our solution, instead of spending years on developing it in-house”. In order to manage this, they have established a team that is responsible for identifying and developing new partnership from an ecosystem perspective. Currently, they have partnerships with two giants in the IoT industry that deliver a platform for the IoT systems.

Case company B is also looking at establishing new partnerships. However, the partnership strategy is more on a “case to case basis rather than a true strategy” as the CTO (B2) put it. Company B focus more on making the products compatible with the ecosystem of which the products are to be integrated into.

4.1.1.4 Competence & capabilities

Case company A has during the servitization journey needed new capabilities and competences within service development and IoT. According to the Head of Digital Transformation (A1), these new competences have both been developed in-house and acquired externally by recruiting new talents from companies that have come further in their servitization efforts. The Group VP of Services (A2) also stated that "different countries have different levels of skills [...] so we are trying to build up a framework to be used when developing skills in technical, commercial, solution and leadership skills".

Case company B has not yet acquired any new competence. However, both the CTO (B1) and the VP of Services & Solutions (B2) stressed the need of new competence in order to continue developing new services. According to the VP of Services & Solutions (B2), new skillsets will be required in packaging and selling solution based service offers. As B2 mentioned, "it is more about a business case, more about an output and outcome rather than a transactional cost of a labor or price of spare part [...] and we are questioning ourselves if we have this capability". The CTO (B1) agreed with the statement and said that "selling services are very different from selling products, thus new sales competence is necessary". Furthermore, a workshop has been conducted with all service managers to discuss how the price for each service should be set. However, after the workshop it was evident that new capabilities will be needed to price the value and benefits drawn from data collected by IoT. According to the VP of Services & Solutions (B2), case company B will invest in all the mentioned competences by both recruiting new talents and developing it in-house.

4.1.1.5 Communication & Collaboration

Both interviewees at case company A mentioned that a focus for them is a clear internal communication, telling the whole organization why they are doing the transformation and also what they are doing in each stage. According to the Head of Digital Transformation (A1), this is a focus since the company want to change the culture and at the same time express how each department can contribute to the servitization. The Group VP of Services (A2) also expressed that "a lot of time has been spent on explaining why we need to do this, for example with roadshows, communication material, workshops, and sharing success stories". Moreover, company A has also changed their relation to some of their customers during the servitization. The Group VP of Services (A2) expressed that the relation to their customers have become tighter in the more successful markets, since they "add more value and get closer to the customer".

Case company B emphasizes on the need to educate the customer about the benefits with more advanced service solutions. The CTO (B1) mentioned that this is done by "showing user cases and metrics for similar customers to highlight the differences between less advanced services and more advanced services". The VP of Services & Solutions (B2) also said that the company are trying to educate the customer about "the win-win situation", where both parties can enjoy benefits. The VP of Services & Solutions (B2) also mentioned that "the servitization strategy as such is not communicated broadly within the organization. Partly on purpose as we currently regard it as more of direction than actual tangible action points".

4.1.1.6 Sales process

Company A sells both their products and services through distributors. The sales force target the distributors and tries to persuade them to buy their products. However, both interviewees stressed that when selling services, a new sales approach has to be taken. The Group VP of Services (A2) said that “we are currently investing and building a dedicated service sales force in selected countries. We recruit service sales engineers which focus on the after-market”. Furthermore, pilot projects are used as a lobbying mean, by demonstrating success stories and trying to get the customer to understand the value of their offer.

Case company B has divided the sales organization into two parts, namely, product sales and service sales. In the service sales department, service sales force, service planners, and service technicians are included.

4.1.1.7 The Internet of Things

Both interviewees at company A stressed that IoT is a prerequisite for servitization. The Head of Digital Transformation (A1) stated that “Digitilization and IoT plays a crucial role and is essential for the servitization”. A1 further stressed that “without a complete commitment into IoT and digitalization you will not have enough data or tools in your toolbox to manage that type of offer [Result-oriented PSS]”. However,

currently company A is not utilizing IoT in their main portfolio. But, according to the Head of Digital Transformation (A1) they are planning on integrating IoT into their products to be able to collect operating data about the product usage which then can be used as input into algorithms that generate actionable insights. Furthermore, when developing these new IoT systems the Group VP of Services (A2) stressed that they focus greatly on security.

Currently, IoT is not integrated in company B's offer. However, they are developing IoT systems that will collect data about products usage and also enable new types of offerings. The CTO (B1) stated that there are three main roles IoT will play in their future portfolio. Firstly, the data generated from the IoT systems can be leveraged by the R&D to develop improved products based on the insights gained from the data. Secondly, the company can operate more efficiently internally. For example, it is possible on beforehand to know what components in the products that have to be replaced so no unnecessary trips to the customers are made. This will decrease the cost for company B as well as increasing the quality of the service. Lastly, IoT enables new types of services to be delivered which will increase the customer value. Examples of such services are monitoring and valuable statistical insights. The VP of Services & Solutions (B2) also mentioned that their current IoT development is conducted outside of the existing IT systems of the customers in order to avoid having to integrate it. Furthermore, according to the CTO (B1) the company is trying to develop a central system to be used by all smaller organizations within the company.

4.1.2 Challenges

In the following section the challenges identified during the interviews with case company A and B are presented. The main topics are *Culture, Service development, Sales process, Business model*, and *IoT implementation*.

4.1.2.1 Culture

Both case companies A and B stressed the cultural challenge with the servitization journey. The Group VP of Services (A2) expressed that "in a conservative industrial company such as company B, this is a massive cultural change. The DNA of the company is proud of products and past performance. Now moving into services and digitization, where the speed, momentum and agility need to be different, it is very difficult to understand and accept that you need to think differently" (EC1). The Head of Digital Transformation (A1) agreed and said that the "not invented here" view is strongly incorporated in an industrial engineering company such as company A (EC2). This means that the employees want to invent new technologies by themselves rather than outsourcing it to an external part, even if the external part has a higher knowledge in the specific field. For example, A1 explained that the company has started to investigate how to use IoT to monitor their products in real time, and that there probably are start-ups with suitable solutions. Furthermore, the VP of Services & Solutions (B2) mentioned the challenge EC1 and said that this

is "a big change management effort", since the sales personnel for instance is used to operate in a product-oriented environment and not with service-oriented offers.

4.1.2.2 Service development

The Group VP of Services (A2) in case company A stressed the challenge of the service development and explained that the "processes in old product development companies have old processes around R&D, such as stage gate models, which are working but slow moving". Therefore, bringing digitalization, IoT, and service development into the organization is a challenge since it requires more speed in the processes (EPD1). The Head of Digital Transformation (A1) in the same company also mentioned the challenge to build a solution that is both scaleable and adaptable to each specific customer, since different customers have different needs (EPD2). A1 said that "they have noticed that the 80-20 rule is applicable. That is, a generic solution works on 80 % of the cases and 20 % needs further customization."

4.1.2.3 Sales process

One challenged mentioned by the Head of Digital Transformation (A1) is that some customers have limitations and/or policies that prohibits them from purchasing in a subscription based manner (EPS1). A1 said that “for big customers it can take a long time to adapt to buying in that new way”. The same interviewee further elaborated “we have met customers that want to buy in this new way but they cannot. [...] that is very difficult to influence so the best thing to do is to give the best possible offer and try to convince that this is the best way to purchase”.

Further challenges related to the sales process was mentioned by both the CTO (B1) and the VP of Services & Solutions (B2) who said that when selling solutions, the sales force have to approach higher up in the hierarchy (EPS2). The CTO (B1) stated that “when selling services, you have to approach higher up in the hierarchy and other stakeholder, and not utilize our current channels. For example, maintenance managers and CFO who is concerned with Total Cost of Ownership”.

4.1.2.4 Business model

Both interviewees at company A mentioned that one major challenge is the business model. The Head of Digital Transformation (A1) further stated that new subscription based business models needs to be developed (EBM4). According to both the Head of Digital Transformation (A1) and the Group VP of Services (A2), a consequential challenge is to integrate such new business model into existing ERP systems (EBM1). A2 further stressed that “recurring revenue in this kind of way is not something supply chain operations, finance, systems or processes are used to handle”. A1 also mentioned that there is a need for developing pricing algorithms that continuously can calculate accurate prices for the services (EBM2). Another challenge mentioned by the Head of Digital Transformation (A1) is that the new service offerings can cannibalize the product sales (EBM3). An example of such

situation was provided in 4.1.1.1.

One challenge regarding the business model according to the VP of Services & Solutions (B2) is "how our products and services will be packaged in an outcome/output based solution" and "how to package these things into getting recurrent revenue from the customer? How do I transform that into true value that the customer recognizes and is willing to pay for?" (EBM4). Another challenge is also presented by B2 who said "how do we price the benefits and the value of those benefits?", i.e. the same challenge mentioned by A1 which is referred to as EBM2. The VP of Services & Solutions (B2) further emphasized on this challenge by stating that "for one customer there may be a different value than for another customer" which means that "perhaps the same tool [service] would provide different benefits for the customer and thereby different pricing".

4.1.2.5 IoT implementation

The development of the IoT systems necessary for the servitization is mentioned by both interviewees at company A as a challenge. The Head of Digital Transformation (A1) stressed that the IoT market is immature and that there is no universal standard which makes it difficult to know how to build the system. To illustrate this challenge A1 posed several hypothetical questions such as "What radio technology to use? Shall we have 4g? 2g? Narrow band? Lora? Sigfox?". This challenge is referred to as EIoT1. The Group VP of Services (A2) built further on the technical challenge and stated that the IoT systems have to be online at all times and not only monitor, but also be able to react according to the status of the product (EIoT2). The Head of Digital Transformation (A1) also mentioned a challenge to integrate the cloud connected IoT platform to the existing ERP and CRM system (EIoT3). The Group VP of Services (A2) further said that they can develop pilot projects on real customers successfully, "but then to transform it into something scalable, something we can launch worldwide, or retail wise, that is the next challenge" (EIoT4). Data security was also put forward by the Group VP of Services (A2) as an important challenge (EIoT5).

The integration of the IoT system into existing IT and ERP systems is mentioned by the VP of Services & Solutions (B2) (EIoT3). B2 further elaborated upon the challenge of integrating the company's IoT system into the existing IT system of the customer by posing a set of hypothetical questions that the customers' IT department may ask "Is this secure? Does it need to be part of our network? How do we get the data from our network to you?" (EIoT6). The VP of Services & Solutions (B2) also mentioned that a challenge is to develop a capability to absorb and transform data into commercial value (EIoT7). EIoT1 is also mentioned by the CTO (B1) who said "the control units in the products are not standardized and generate various amounts and types of data which make it difficult to standardize the data management". Challenge EIoT5 was also stated by the CTO (B1) as an area that is considered during IoT development.

4.2 Use-oriented PSS

In the following section the findings derived from the interviews with the case companies, C and D, categorized as Use-oriented Product-Service Systems are presented. First a presentation of the current state is provided, followed by a presentation of identified challenges.

4.2.1 Current situation

In this section the current state is presented. The sections are *Organizational structure, Service development, Partnerships, Competence & capabilities, Sales process*, and *Internet of Things*.

4.2.1.1 Organizational structure

Both the VP of Business Office & Governance (C1) and the Director of Processes & Solutions (C2) at company C mentioned that they have a separate service unit that is responsible for the development of new services. Furthermore, the Director for Processes & Solutions (C2) mentioned that the company has a central development unit that develops connectivity solutions. When a successful project at this unit is completed the deliverables can be integrated into the company's offer. C2 further stated that this is a way for the connectivity solutions to be developed "without being pinioned to the solutions of today". Moreover, each service has a Service Area Owner that is responsible for the development of a specific service. According to the Director for Processes & Solutions (C2), there is a separate finance department that is responsible for the development of the leasing contracts.

According to the VP of Mobility Solutions (D1) at company D, the development of UoPSS was initiated by a small team who developed a concept definition and business case for the new leasing offerings. The business case then got acceptance from the board and an operating model was developed and was then launched in seven countries. When the launch proved successful the organization restructured "from a project organization to a functional organization whose only responsibility was the new leasing service". According to D1 a new company was then created to manage and develop the new service. However, full support, such as financial services, from the mother organization was still provided. The VP of Mobility Solutions (D1) further mentioned that they have a separate development unit that is responsible for developing connected solutions.

4.2.1.2 Service development

According to the VP of Business Office & Governance (C1), company C is utilizing a new development process called Service Global Development Process (SGDP) when developing new services. C1 mentioned that SGDP is used since their service development requires "faster development cycles of six to nine months in comparison to product development cycles which can have three to five year cycles". C1 further elaborated and explained that "the difference between service development and

product development is the shorter cycles, more iterations and agility in service development and different gate systems". The Director of Processes & Solutions (C2) agreed with above statement and said that "the product development process is too slow for service development which requires faster loops, hence the SGDP was developed". C2 further mentioned that the SGDP "consist of five different phases and starts with an innovation phase and ends with a complete service". Moreover, the VP of Business Office & Governance (C1) explained that new more agile methods are used when developing services, such as SAFe and scrum. However, C1 said that "the specific methods are not important, instead we try to focus on more iterations, co-location of employees to handle the customer problem and to work in faster development cycles". The Director of Processes & Solutions (C2) also mentioned that the company is using Business Model Canvas in order to to determine how to build the services. Lastly, company C is applying a modular design to their service offers. According to the VP of Business Office & Governance (C1), the company has a base of different service offers which can be combined into a service package. C1 explained that "the local sales departments can therefore meet local demands by picking and choosing different service parts".

The VP of Mobility Solutions (D1) at company D stressed that they are adapting an agile way of working when developing new services. D1 further explained that "we are working with smaller sprints instead of traditional waterfall models. You work in smaller modular teams and develop solutions which are improved in an iterative manner". The service development also include a higher degree of customer interaction, where "the team deliver a solution to the customer which then provide the team with feedback in order to adapt the solutions to meet customer requirements". Furthermore, the VP of Mobility Solutions (D1) mentioned that the company has a number of different development processes, including a process for R&D, digitalization, and new service development. Lastly, the VP of Mobility Solutions (D1) explained that the company is applying new methodologies for pricing the services. As D1 said "we test different pricing strategies on our customers to understand the customer's willingness to pay".

4.2.1.3 Partnership

Both interviewees at company C mentioned that there is a growing need for developing new partnerships. The Director of Processes & Solutions (C2) further stressed that "the trend is unambiguously pointing towards more partnership in the future". C2 further said that they are "continuously trying to scan the market for potential partners, with good solutions within our industry". According to the VP of Business Office & Governance (C1), company C is in an exploration phase of partnerships and that they test various types, some successfully and some not. The Director of Services & Solutions (C2) further mentioned that big technology companies may be more suitable for IoT systems and data analysis, whereas smaller companies and start-ups may be more suitable for the service development and new ideas.

The VP of Mobility Solutions (D1) at company D mentioned that the company have established new partnerships with large technology providers to be able to deliver

the new types of services.

4.2.1.4 Competence & capabilities

During the interview the VP of Business Office & Governance (C1) mentioned that new competence is a necessity when servitizing the product portfolio. The same interviewee said that the company has focused on converting existing competence into more service oriented competence. For example, C1 mentioned that they have converted product sales personnel into selling services. Another example is that the company has converted employees that previously have worked with trouble shooting the products to selling services, since they already had a close connection to the customers. In order to handle this conversion, all services have a training program which is a part of the service delivery process. The VP of Business Office & Governance (C1) also stated that they are looking for new competence as well, mostly software and service competence. However, C1 said that "we already know a lot of this. We know our customers, we know how a repair shop works and we understand customer pain points. It is from this you develop new services, it has to be more customer-oriented, you cannot just sit and make up new services". The Director of Processes & Solutions (C2) agreed and mentioned that the company is recruiting a lot for the new services and technologies which include connectivity solutions.

According to the VP of Mobility Solutions (D1), the development and management of new services such as leasing and other digital solutions have required the company to acquire new competences. Examples are competences within software development, digital management and more financial competences such as financial risk and credit risk. The VP of Mobility Solutions (D1) further mentioned that the company has acquired these new competences both through recruiting new personnel and internal development in the organization.

4.2.1.5 Sales process

The service sales process is according to the VP of Business Office & Governance (C1) different in comparison to the sales process for products. C1 mentioned that "in order to strengthen the sales network we are trying to put together a sales team consisting of a product sales person and a service sales person. So, we are approaching customers with two sales representatives which is specialists in their field. This strategy has generated a boost in our service sales, since we don't give away services anymore". The Director of Processes & Solutions (C2) also said that "we have specific sales persons for services which are trained to be experts in selling services". Moreover, company C is using a different incentive system in the service sales process. According to the VP of Business Office & Governance (C1), this has been an enabler for handling the problem with sales persons giving away services for free in order to sell more products. As the VP of Business Office & Governance (C1) said "this happened since services were not included in the product specific incentive system".

The VP of Mobility Solutions (D1) stressed that the sales efforts of selling services is different from selling products, since it is more important to express the customer value when selling services. As the interviewee said "it is more about selling a complete solution rather than selling smaller parts of a solution. For instance, you don't just sell a product, you instead sell what the product will be used for. This is something we have worked on for quite some time". Therefore, the VP of Mobility Solutions (D1) expressed that it is "important that the sales persons understands how the customers will use the product".

4.2.1.6 The Internet of Things

According to both the VP of Business Office & Governance (C1) and the Director of Processes & Solution (C2), IoT has a crucial role in the company's service offerings. According to the Director of Processes & Solutions (C2), current focus is on "monitoring and to detect problems before they become materialized, i.e. preventive maintenance". C2 further mentioned that the data collected through IoT are used as input into algorithms that can identify the status of the products and to identify if maintenance is needed. The VP of Business Office & Governance (C1) further stressed that the data generated from the IoT systems can be leveraged to build and develop new service offerings. Moreover, interviewee C2 mentioned that "the data of product usage is a good source for the R&D engineers to know how the customer uses the products, and which and how parts are being worn out. This is good since the engineers can improve the next generation of products".

4.2.2 Challenges

In the following section the challenge identified during the interviews with case company C and D is presented. The main topics are *Culture, Service development, Sales process, Business model*, and *IoT implementation*.

4.2.2.1 Culture

Both interviewees at case company C mentioned that one challenge is the cultural change from a product-oriented organization to a service-oriented organization (EC1). According to the VP of Business Office & Governance (C1), company C is still a product-oriented company and "this is a big challenge, our product revenues are still very high and it is therefore easy for the organization to prioritize development of products instead of services". The Director of Processes & Solutions (C2) also stated that the culture at company C still is very "self-invented", meaning that there is a challenge to develop new partnerships since the company wants to invent everything by themselves, even though there is a lack of competence in the specific fields (EC2). As C2 mentioned "I still feel that the culture is characterized by a "we can do it better ourselves" mindset".

4.2.2.2 Service development

During the interviews with company C, both the VP of Business Office & Governance (C1) and the Director of Processes & Solutions (C2) expressed the challenge of faster development cycles for service development (EPD1). According to the VP of Business Office & Governance (C1), the company "tried to develop services in the traditional product development process, but it didn't work due to the difference in the development cycles".

4.2.2.3 Sales process

According to the VP of Business Office & Governance (C1), one challenge related to the sales effort is that the product sales persons have not had the right competence nor any incentives to sell services (EPS3). C1 further explained that "a consequence of this is that we have given away services for free in order to sell more products". Furthermore, the challenge for company C has been to express the benefits of new services to the customers. The Director of Processes & Solutions (C2) mentioned that "our customers are still traditional. So it's much about motivating the advantages of the services, both internally in the organization and externally to the customers. The communication is therefore very important".

During the interview with company D, the VP of Mobility Solutions (D1) stated that "a lot of our customers don't understand how big the total cost of ownership of the product is and therefore they might not see the complete value of the leasing solution". A challenge is therefore to change the mindset of the customer to understand that the new services could be beneficial (EPS4).

4.2.2.4 Business model

One challenge mentioned by both the VP of Business Office & Governance (C1) and the Director of Processes & Solutions (C2) is the increased financial risk with advanced service offers (EBM5). C2 provided an example "we promise that we will take care of your product no matter what happens, and if the product starts to break down often, that is a great risk for us and probably financial losses". C1 further mentioned the challenge of pricing (EBM2) and said "we have to focus and work a lot with Risk Management so that the subscription fee is set accurately. Of course, some customers are a profitable whereas some are not, but as a whole the business is financially sustainable".

Partnerships were mentioned as a challenge by the Director of Processes & Solutions (C2) who said "we have to be better to identify partners and also develop the businesses and commercial parts together" (EBM6). The VP of Business & Governance (C1) emphasize the challenge with partnerships and posed two hypothetical questions "What is core and non-core in our business? And where do we draw the line so that the partner do not steal our business?".

4.2.2.5 IoT implementation

The VP of Business Office & Governance (C1) mentioned that one challenge that company C is faced with is Information Management. C1 elaborated and said that they need to develop new capabilities in order to handle the large amount of data generated from their IoT systems. The challenge is to derive commercially valuable insights from the data (EIoT7). C1 also mentioned that new laws and regulations are established continuously which have to be considered when developing and managing IoT systems (EIoT9). The Director of Processes & Solutions (C2) further emphasize "now when we connect all our products huge amounts of data is generated. Thus, the infrastructure must be developed at a great pace. The more we collect, the faster the infrastructure have to be developed", meaning that the IoT systems need to be scaled as more data is generated (EIoT4).

4.3 Result-oriented PSS

In the following section the findings derived from the interview with the case companies, E and F, categorized as Result-oriented Product-Service Systems are presented. First a presentation of the current state is provided, followed by a presentation of identified challenges.

4.3.1 Current situation

In this section the current state is presented. The sections are *Organizational structure, Service development, Partnerships, Competence & capabilities, Communication & Collaboration, Sales process*, and *Internet of Things*.

4.3.1.1 Organizational structure

According to the Director of Global Services (E1), company E has restructured its organization a few times in order to see which structure is best to manage the development and delivery of services and products. Currently, there is no separate service department and the service functions are integrated in the existing departments. Furthermore, company E introduced a new role called Service Area Owner whose responsibility is the delivery and development of a specific service. This role makes sure that there is a clear responsibility for each service, even though the organizational structure is changed. The Director of Global Services (E1) further explained that the motivation for not separating service and product development is to enable products and service to be developed tightly.

The Manager of Advanced Analytics (F2) described the servitization journey of company F and said that before the transformation the service functions were integrated into the existing departments. However, when the transformation was initiated a new development & service organization was established. The service organization were then separated, and formed a separate service department. So, currently products and services are developed separately. The Business Development Manager

(F1) further stated that the company have a central unit that is responsible for the IoT development.

4.3.1.2 Service development

The Director of Global Services (E1) described case company E's service development process as an "agile development process for services based on design thinking". The process is built up on 5 different phases; exploration, conceptualization, building, pilot and deploy. The company tries to include the customer in all the phases in order to secure that the customer needs are met. The Director of Global Services (E1) further explained that company E uses different tools and methods for service development, including Shadowing, Business Model Canvas and Service Blue Printing. Furthermore, the Director of Global Services (E1) mentioned that the company currently offers standard service contracts and complete packages, which is a combination of different service contracts.

Company F has created a new service development process which is different from a traditional product development process (F2). According to the Manager of Advanced Analytics (F2), the process is different in the verification and validation phases, where the service development process has a pilot phase instead of a prototype phase. Moreover, the Business Development Manager (F1) stated that the company is applying service modularization when developing services. As the Business Development Manager (F1) said "it is important not to start on a blank page, instead develop different Lego parts of services and combine them into a final service". F1 further explains that they have a well established pricing method for the performance based contracts. The customers' cost saving enabled by the service is digitally simulated and company F then charges the customer with a percentage of that saving.

4.3.1.3 Partnership

The Director of Global Services (E1) mentioned that company E has a few established partnerships, and emphasizes that more and more partnerships with niche actors will be necessary. Company F also has established partnerships in order to enable faster development and delivery of their services. As the Business Development Manager (F1) put it "if you can do it together with a partner, you will reach your goal much faster", emphasizing the importance of partnerships in the development and delivery of services. Furthermore, company F has partnerships with technology platform providers.

4.3.1.4 Competence & Capabilities

Case company E has during their servitization acquired new competences within service development, especially service designers. According to the Director of Global Services (E1), this competence has been acquired through both external and internal recruitment, as well as hiring consultants.

Case company F has also needed new competence during their servitization. During the interview, the Business Development Manager (F1) mentioned that both new sales competence and service competence have been needed. These competences were acquired by recruiting new talents with the specific skills needed for selling and developing services. Moreover, the Manager of Advanced Analytics (F2) also stated that new IoT competence was needed and explained that "we collected all employees internally with the competence, and recruited the rest".

4.3.1.5 Communication & Collaboration

The Business Development Manager (F1) mentioned that case company F has during the servitization increased the internal communication in the organization. The company are continuously working on including the staff in workshops and meetings, where the topic of servitization is discussed. The Manager of Advanced Analytics (F2) further elaborated that top management commitment is a very important building block when it comes to increasing the knowledge of services. As the Manager of Advanced Analytics (F2) said "the service transformation started high in the hierarchy but eventually spread across the organization". F2 also stated that the company has an internal communication department which function is to spread new initiatives and news inside the organization. They are also inviting their employees to seminars in order to communicate and educate the personnel (F2).

4.3.1.6 Sales process

The main sales channel for company E is direct sales and efforts are made in order to educate the sales force in value based pricing. This is approach, in combination with modifications to the incentive systems for the sales force, has increased the sales of services in the sites where it has been practiced. The Director of Global Services (E1) further stressed that it is essential to ”understand the customer and understand the customer viewpoint and point out the values our products and services delivers”.

According to the Manager of Advanced Analytics (F2), case company F has deployed a slightly different approach to sell their services, where they partly utilize their service engineers and their tech key account managers. To support these non-traditional sales persons, a portfolio of tools, arguments, and other material has been developed. Furthermore, a traditional sales force is deployed to sell products. The Business Development Manager (F1) elaborated and said that they are educated to understand the service contracts on basic level so that the sales persons can identify that a customer has a problem and may be interested in a service contract. If such interest is identified, the sales person can arrange a new meeting with a team with better knowledge about the service contracts. When a customer need has been identified, an audit is performed at the customer sight to identify where the greatest gains and opportunities are. Based on the audit, potential service agreements can be developed and discussed further with the customer.

4.3.1.7 The Internet of Things

Company E has several components connected through IoT integrated to their products. Furthermore, they are part of an initiative to develop a standard for their products so that the customer easily can integrate several different types of systems to the products. Currently, the IoT is leveraged to enable remote diagnostics and monitoring. According to the Director of Global Services (E1), ”it can enable us to decrease cost as well as the customer can get more uptime”.

According to the Business Development Manager (F1), IoT is an enabler for the performance-based service agreements. Furthermore, IoT is utilized to monitor the products, for example to see uptime and usage. According to the Business Development Manager (F1), the data generated from IoT can be leveraged by benchmarking operating data to identify best practice. The initial development of IoT systems was, according to the Manager of Advanced Analytics (F2), managed by a team that had an almost unrestricted budget and no other limitations. This enabled a fast development of the system architecture and the systems could be tested on real customers. However, when trying to scale the systems the cost became an issue. But, the Manager of Advanced Analytics (F2) stressed that considering the cost in retrospect, probably was a faster approach, rather than considering the cost from the beginning. F2 further mentioned that the data generated by the IoT systems can be leveraged by the product development department to develop better products. F2 further mentioned that company F have a department for advanced analytics that is responsible for transforming the data into actionable insights.

4.3.2 Challenges

In the follow section identified challenges are presented. The section is divided into five topics, namely, *Culture, Service development, Sales process, Business model*, and *IoT implementation*.

4.3.2.1 Culture

Both case company E and F stressed the cultural challenge when it comes to servitizing the product portfolio. The Director of Global Services (E1) explained that it is challenging to change the culture in a company that traditionally has been focused on physical product development (EC1). For example, E1 mentioned that "the mindset of developing and selling solutions are different between a product oriented culture and a service oriented culture." In a product oriented culture the focus is on a physical product which has a high one-time value, while the value for a service contract often is scattered in time by recurring revenues (E1).

4.3.2.2 Service development

Both interviewees at case company E and F mentioned the service development process as a challenge in the servitization journey. The Director of Global Services (E1) stated that one challenge that case company E has experienced is the fact

that service development cycles are much shorter than product development cycles (EPD1). This means that the development of their new services is more incremental while new products are released less frequent but with greater advancements (E1).

4.3.2.3 Sales process

There is a difference between selling services and products according to the Director of Global Services (E1). E1 further elaborated and said that ”the sales force is used to selling soft aspect such as quality, performance, handling, how luxurious the product feels and so forth. It is a different thing to sell services and you have to discuss how the product is used, rather than the product itself” (EPS3). Another challenge mentioned by the Director of Global Services (E1) is that some customer are used to practice tender purchasing which entails that some customers are not mature enough to purchase a service through subscription (EPS4).

The Business Development Manager (F1) mentioned that to sell performance based service contracts it is necessary for the sales force to approach employees higher up in the customers' organizational hierarchy (EPS2). Another challenge mentioned by the Business Development Manager (F1) is that “sales persons may be good at selling physical products by offering different mixes, prices, and volumes. It is very difficult for the same persons to sell a competence, for example, increased efficiency. It is unfamiliar and scary so they often fail” (EPS3). The Manager of Advanced Analytics (F2) further mentioned that many customers are too small and immature to think in terms of performance based service contracts and paying a subscription fee (EPS4).

4.3.2.4 Business model

According to the Director of Global Services (E1), case company E has experienced two challenges regarding the business model of services, namely, the different payment model, and the higher risk associated with more advanced service contracts. Firstly, a challenge associated with the payment model is that the ERP systems used for product sales is not applicable when it comes to selling services (EBM1). The reason is that the payment systems need to be able to handle monthly payments, which traditional systems usually cannot manage. According to the Director of Global Services (E1) "it easily becomes a forest of invoices" if the system is not updated accordingly. Secondly, more advanced service contracts brings with it increased risks for company E since they guarantee that the product will function properly (EBM5). The Director of Global Services (E1) explained that "as soon as they include reparations in the contracts, they are exposed to high risk". The same interviewee also mentioned that "as the service become more advanced the company experience a higher level of risk". The Director of Global Services (E1) further explained that "it [RoPSS] can be considered as an insurance for the customer", and this is something the customer pays a premium for. The Manager of Advanced Analytics (F2) mentioned that "when offering performance based contracts our risk is higher and the customer's lower, and that is a premium the customer is charged for". Hence, company F also has experienced the challenge EBM5.

4.3.2.5 IoT implementation

A challenge related to the implementation of IoT solutions according to the Director of Global Services (E1) is to integrate products and components from other manufacturers which utilizes different standard onto the company's product (EIoT1). This is because there is no universal standard for IoT solutions. Furthermore, a second challenge is brought forward by both the Director of Global Services (E1) and the Business Development Manager (F1) who mentioned that lack of connection for wireless devices at customer's sites (EIoT8).

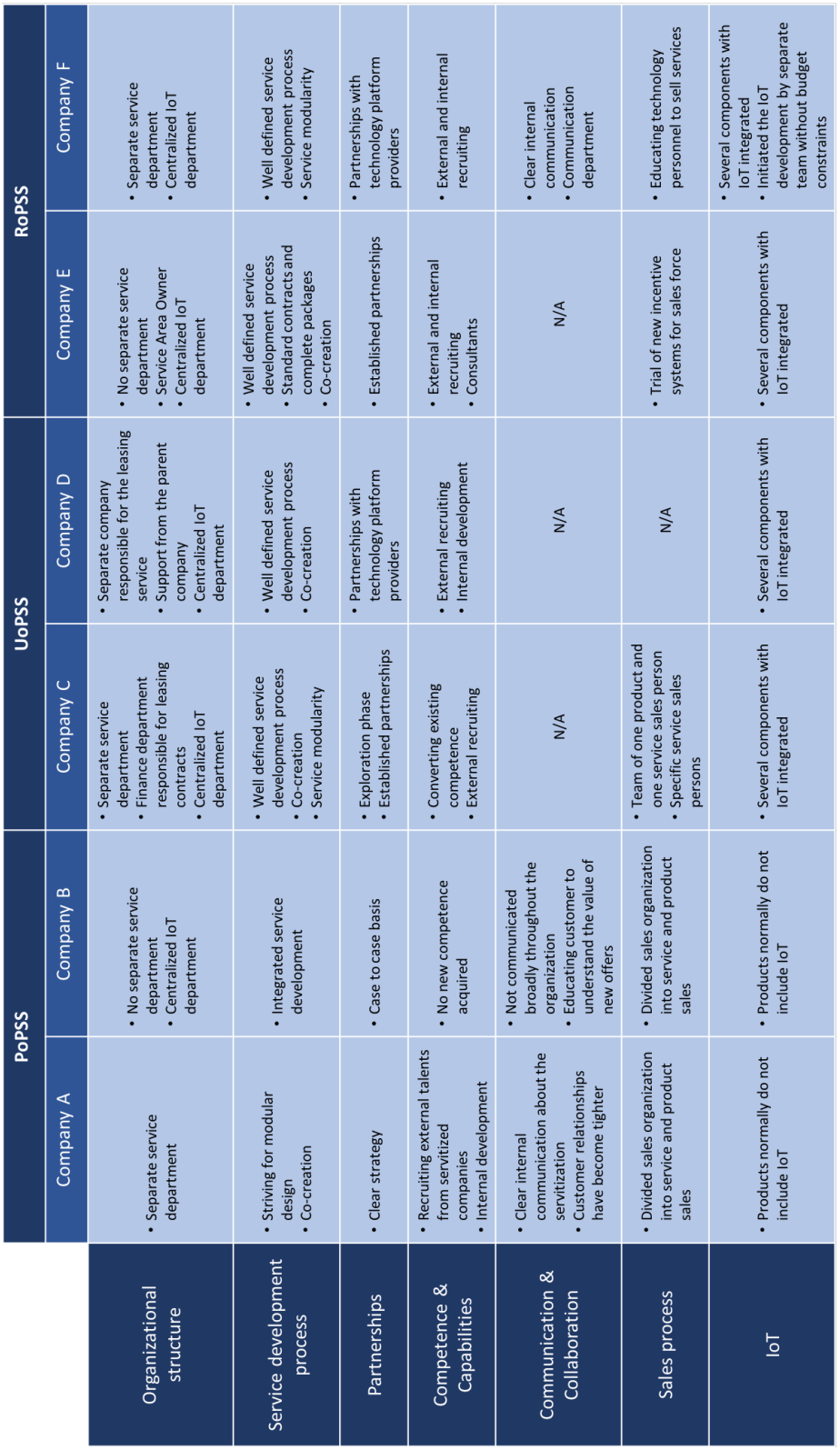

Figure 4.1: Synthesis of Current state

4.4 Expert interviews

Expert EX1 stressed that "new competences are required since services are totally different from developing and producing good". Such competences can according to EX1 be acquired by recruiting, internal development, partnerships/consultant, or by acquiring companies. Furthermore, the sales force needs to be updated since traditional product sales person are equipped with the wrong tools to sell services, meaning that they do not have the right competence to sell service solutions (EPS3).

Expert EX1 mentioned four challenges that servitizing companies need to manage. Firstly, the cultural difference within the organization between producing goods and selling services (EC1). Secondly, the customer may find it difficult to accurately calculate the actual cost of purchasing a product versus buying it as a service. Hence, the customer may believe that purchasing a product is cheaper than buying it as a service, when in many cases the opposite is true. EX1 further emphasizes that this is a maturity issue (EPS4). Thirdly, the development cycles for products and services are different (EPD1). This entails that a new approach is needed and EX1 suggest that a more agile approach is applied. Traditional OEMs are used to working with water fall models, hence new service development processes needs to be developed. Lastly, identifying suitable partners and integrating them adequately was put forward as a challenge.

IoT is also put forward as challenge by EX1 since "technology is constantly developed. Developing IoT systems that is safe now almost anyone can do. But, developing the systems to be safe 10-15 years in the future is much more difficult" (EIoT5). According to Expert EX1 the wireless network technology that the IoT system utilizes to communicate, for example GSM, have to be in use several years in the future or the IoT system will stop to function (EIoT10). EX1 elaborates "for example, the GSM network in USA where a big telecommunication provider started to demount the whole GSM network and all devices based on GSM stopped to work".

According to Expert EX1, if a service transformation is to be successful three things are essential. Firstly, the management have to realize that without servitizing, the business will mostly likely fail. Secondly, the initiation has to come from the very top in the organization and spread across the whole organization. Lastly, a separate service department have to be established, otherwise the servitization effort will "suffocate and die".

		PoPSS		UoPSS		RoPSS		Expert
		A	B	C	D	E	F	
Culture	EC1: Product oriented mindset	✖	✖	✖		✖		✖
	EC2: "not invented here"	✖		✖				
Service development	EPD1: Faster development process	✖		✖		✖		✖
	EPD2: Scalability	✖						
Sales process	EPS1: Customer restrictions	✖						
	EPS2: New target for sales force		✖				✖	
	EPS3: Sales force competence			✖		✖	✖	✖
	EPS4: Customer maturity				✖	✖	✖	✖
Business model	EBM1: Integration of BM into ERP systems	✖				✖		
	EBM2: Pricing	✖	✖	✖				
	EBM3: Internal cannibalization	✖						
	EBM4: Business model development		✖					
	EBM5: Increased risk			✖		✖	✖	
	EBM6: Partnerships			✖				
Internet of Things	EIoT1: No universal standard	✖				✖		
	EIoT2: Reaction to product status	✖						
	EIoT3: Integration to ERP system	✖	✖					
	EIoT4: Scalability	✖		✖				
	EIoT5: Data security	✖	✖					✖
	EIoT6: Integration of IoT solution in customer IT system		✖					
	EIoT7: Transform data into commercial value		✖	✖				
	EIoT8: Lack of connection					✖	✖	
	EIoT9: Laws and regulations			✖				
	EIoT10: Future communication network							✖

Figure 4.2: Synthesis of challenges identified in the empirical findings and by which company it was mentioned

5
Analysis

In this chapter the analysis of the empirical result is presented. The chapter is built upon five sections; Culture, Service development, IoT implementation, Business model, and Sales process. Each specific challenge in each area are analyzed based on the empirical study and the theoretical framework. Corresponding enablers are also identified and analyzed. The chapter ends with a summary of the challenge categorization and overall trends in the data are presented.

5.1 Culture

Companies in all three PSS categories, as well as expert EX1, mentioned the cultural change as a major challenge in the servitization journey. This is aligned with Zhang and Banerji (2017) which stated that the reason for the cultural challenge is the change in the value creation process, from product delivery to value delivery. In order to handle this challenge, Dubruc et al. (2014) stress that a strong internal marketing of the serivitzation has to be executed, as well as education of the employees. This is aligned with the efforts done by company F which has established an internal communication department that is communicating why and how the servitization journey take place. Company A, C and D are also handling the challenge and work on developing service competence internally in the organization. The change in cultural mindset can therefore be consider as a challenge for all the PSS categories, even though the more advanced service providers have come a longer way in handling it. However, the RoPSS-companies still need to continue to focus on the challenge, otherwise they could risk falling back to old habits. Moreover, another challenge connected to culture is the challenge related to the "not invented here" mindset (EC2), which is mentioned by both a PoPSS-company and a UoPSS-company. According to Antons and Piller (2015), this mindset can in fact inhibit the establishment of new partnerships, which can be be necessary for offering advanced services. An explanation to why the RoPSS-companies do not mention this challenge can be that they already have well established partnerships and thus have managed the challenge. Because of this, the challenge EC2 is regarded as more significant for the companies with less advanced service solutions, namely PoPSS and UoPSS. In figure 5.1 the categorization of challenges mentioned above is summarized.

		PoPSS	UoPSS	RoPSS	Theory	Expert	Enablers
Culture	EC1: Product oriented mindset	✖	✖	✖	✖	✖	• Internal marketing (Dubruc et al. 2014) • Educating the employees (Dubruc et al. 2014) • Internal communication department
	EC2: ”not invented here”	✖	✖		✖		

Figure 5.1: Synthesis of challenges related to culture and their corresponding enablers

5.2 Service development

During the empirical study, companies in all PSS categories stressed that service development is a challenge since service development cycles are shorter than product development cycles (EPD1). On the other hand, literature in the field mention that the reason for this challenge is the intangibility of services and that customer engagement is more important in the development of services (Parida et al., 2014; Brax, 2005). Gremyr et al. (2014) mention that service development either can be integrated into product development or separated, depending on the service type and how product-centric the services are. Based on the empirical study, it appears that the more advanced service providers such as UoPSS and RoPSS handle this challenge by utilizing a well defined service development process, while the PoPSS-companies integrate service development into traditional product development processes. This implies that for more advanced services, it can be necessary to separate the development process. The same trend can be seen for the challenge of scaleability (EPD2) (i.e. companies offering more advanced services have enablers in place), which is stated by a PoPSS-company. In order to handle this challenge, Brax et al. (2017) and Pekkarinen and Ulkuniemi (2008) suggest that companies can apply modularization and platform thinking when developing services. This is something company C, E and F have done, while the PoPSS-companies still have not done it. This can thus be the reason why the UoPSS and RoPSS-comapnies did not mention EPD2 as a challenge. Therefore, both challenges EPD1 and EPD2 can be considered as challenges for all the three PSS categories. However, both challenges are most significant for PoPSS-companies that are in the beginning of the servitiation journey because the UoPSS- and RoPSS-companies have enablers in place to manage these challenges. In figure 5.2 the categorization of challenges mentioned above is summarized.

		PoPSS	UoPSS	RoPSS	Theory	Expert	Enablers
Service development	EPD1: Faster development process	✖				✖	• Well-defined service development process • Agile processes
	EPD2: Scalability	✖			✖		• Modularization • Platform thinking (Pekkarinen & Ulkuniemi 2008;Brax et al. 2017) • Standardized contracts and complete packages

Figure 5.2: Synthesis of challenges related to service development and their corresponding enablers

5.3 IoT implementation

Zorzi et al. (2010) mentions that it is difficult to develop IoT systems since it requires the ability to integrate different types of devices, technologies, services, and applications. Bandyopadhyay and Sen (2011) means that this is because there are no universal standards, which has been experienced by both company A in PoPSS and company E in RoPSS. Due to the fact that this challenge is mentioned by one company in PoPSS and one company in RoPSS, as well as it is supported in literature by Bandyopadhyay and Sen (2011), it is indicated that the challenge is relevant for all PSS categories that include IoT in their solutions. Bandyopadhyay and Sen (2011) and company C mentioned that new laws and regulations related to IoT are constantly being developed and put in place. The challenge of changing communication networks mentioned by expert EX1, is similar to the challenge of changing laws and regulations. This is because both challenges are related to changes that is out of reach for the companies to affect and have long time horizons. An illustration of such situation was mentioned by Expert 1, and is described in section 4.4. However, if this challenge is to be applicable to a PSS, IoT have to be integrated. Hence, this challenge is relevant for all PSS categories.

Furthermore, lack of wireless connection at customer sites was put forward as a challenge by both RoPSS-companies. A possible explanation that only the RoPSS-companies mentioned this challenge may be that their business model is so dependent on that their IoT solutions are up and running. For example, if the IoT system is malfunctioning it prevents the company to accurately see the status of the product. It may lead to that malfunctioning components are not replaced in time, and thus resulting in a product failure that can cost the company greatly in terms of fines and loss of financial income. On the other hand, if, for example, a monitor service in a PoPSS fails it is probably a less significant financial income that is lost. So, even though the challenge is relevant for all PSS categories it is most important for RoPSS-companies to manage it, since their entire revenue stream is dependent on a functioning IoT system.

Reaction to product status (EIoT2), integration of IoT system into ERP systems (EIoT3), data security (EIoT5), and integration of IoT systems in to customer IT

system (EIoT6) is mentioned by companies categorized as PoPSS. These challenges are aligned with the difficulties mentioned by Zorzi et al. (2010), which states that companies need to develop capabilities to manage different types of technologies, devices, services, and applications. The PoPSS companies are currently developing their IoT systems, whereas the companies offering more advanced services already have IoT systems that is up and running. A reason for this can be that when offering UoPSS and RoPSS, IoT can be considered as a prerequisite for these more advanced services, which is mentioned by both interviewees at company A and one in company F. Hence, the UoPSS- and RoPSS-companies may have developed the capabilities mentioned by Zorzi et al. (2010) and consequently do not see the technical difficulties as a challenge. EIoT2, EIoT3, EIoT5 and EIoT6 are thus most significant for PoPSS-companies. To manage these technical challenges company F deployed a team with almost unrestricted budget, which according to the Manager of Advanced Analytics was a successful approach. Furthermore, Zorzi et al. (2010) mentions that to manage this challenge companies need to develop the ability to handle different communication capabilities and different technologies. However, expert EX1 said that IoT systems need to be safe several years into the future as well. Thus, even though the IoT systems developed by RoPSS-companies may be safe in the near future, they may not be safe several years into the future, hence, RoPSS-companies need to consider this challenge as well.

Company A in PoPSS and company C in UoPSS have experienced difficulties when scaling their IoT systems and Uckelmann et al. (2011) means that the lack of standards contributes to this difficulty. In the empirical study it was identified that two approaches to manage this challenge has been undertaken by both RoPSS-companies and one company in UoPSS. Firstly, company E have made commitments to an initiative to develop a new standard applicable to their products. Secondly, company F and company D have partnered with technology platform providers. A possible explanation to why none of the RoPSS-companies experience this challenge is because they have mentioned enablers in place. Thus, this challenge is most significant for PoPSS and UoPSS.

Furthermore, when company C scaled their IoT system a new challenge surfaced, namely, managing all the data generated from the system. Lee and Lee (2015), and Tsai et al. (2014) says that the challenge occurs since current systems and architecture of data centers normally are not capable of managing such large amounts of data. To manage this challenge, Lee and Lee (2015) suggests that as more data is generated, adequate data mining tools becomes increasingly important, and hence needs to be developed. According to the Manager of Advanced Analytics at company F in RoPSS, this mining is managed at a department called Advanced Analytics. At this department the data is transformed into commercially valuable insights. This transformation is mentioned as a difficulty by companies B and C. Davenport et al. (2012) and Opresnik and Taisch (2015) means that to transform the data into actionable insights companies need to develop capabilities and continuous processes to gather, analyze, and interpret data. Since none of the RoPSS-companies mentioned this challenge, and one of them explicitly mentioned that they have processes in

place to manage it, it is indicated that this challenge is most significant for PoPSS- and UoPSS-companies. In figure 5.3 the categorization of challenges mentioned above is summarized.

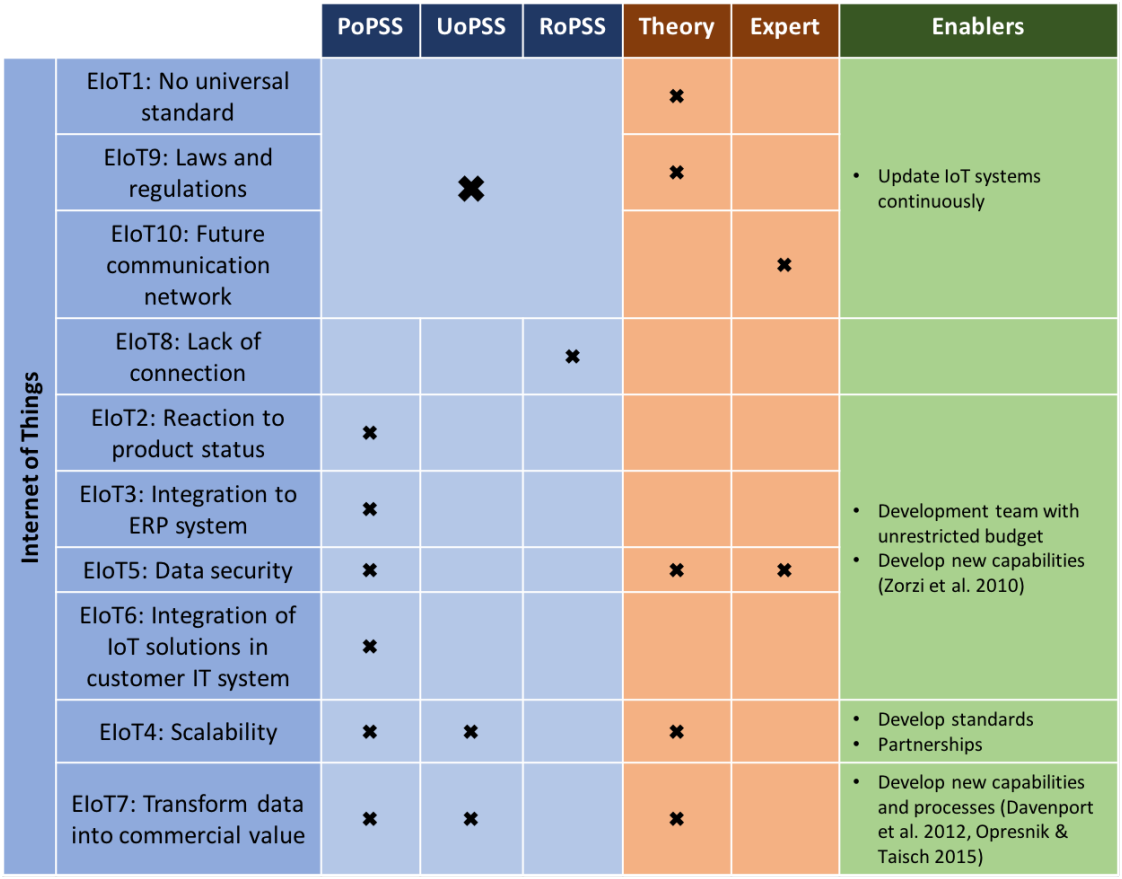

Figure 5.3: Synthesis of challenges related to IoT implementation and their corresponding enablers

5.4 Business model

Both companies categorized as PoPSS and company C in UoPSS mentioned the challenge of pricing services, this is because pricing services require a value-based pricing model (Barquet et al., 2013; Mo, 2012; Nudurupati et al., 2016). Reinartz and Ulaga (2008) further states that traditional sales persons typically have limited experience value based pricing, hence making it necessary to acquire new competences. However, in order to manage this challenge, company D in UoPSS test different pricing strategies in pilot projects to understand customer's willingness to pay. Company F in RoPSS have successfully dealt with this challenge by developing pricing algorithms. Thus, it is indicated that pricing services is most relevant for companies offering less advanced service, i.e. PoPSS-companies.

Zorzi et al. (2010) states that connecting several different devices, technologies, and services to create an integrated system is challenging. This problem is aligned with

the challenge to integrate new business models with existing ERP systems mentioned by, one company in PoPSS and one in RoPSS. However, when company A discussed that challenge, the focus was on future subscription based business models. Nonetheless, it should be noted that less advanced services, for example PoPSS, also can include reoccurring revenues, for example fees for monitoring systems. However, even though such revenues have to be dealt with for PoPSS, this challenge is considered to be most significant for UoPSS and RoPSS since their revenue stream is entirely based on reoccurring revenues. To manage this challenge, companies currently offering PoPSS and striving to offer UoPSS or RoPSS need to update their ERP systems by developing the capability to handle different communication technologies (Zorzi et al., 2010).

Both companies categorized as PoPSS problematize around the development of new business models. On the other hand, none of the UoPSS or RoPSS-companies mentioned this challenge, and a plausible explanation is that the companies that offer more advanced services already dealt with this challenge. Nonetheless, it should be noted that both PoPSS-companies talked about future UoPSS and RoPSS offerings when discussing this challenge. When offering PoPSS the business model is similar to traditional product providers, whereas when offering UoPSS and RoPSS the business model is significantly impacted (Barquet et al., 2012). Hence, it is suggested that the challenge to develop new business models is most significant for companies in UoPSS and RoPSS.

Furthermore, Neely (2008) states that when companies start to offer more advanced services they need to manage and control long-term risk and exposure, which is in line with what both RoPSS-companies and one UoPSS-company have experienced. Moreover, none of the PoPSS-companies mentioned this challenge. It is thus indicated that when offering UoPSS or RoPSS, one challenge is increased risk. The Manager of Advanced Analytics (F2) at company F stated that "our risk is higher and the customer's lower, and that is a premium the customer is charged" which implies that with a correct pricing method the challenge can be managed and offering advanced services can be lucrative.

Furthermore, company A has separated their service and product sales department and will in the future start to offer UoPSS and RoPSS. As a consequence, the new service offerings risk cannibalizing on the product sales. Greenstein (2010) emphasize this challenge and states that it is difficult to evaluate the total value of the new offer since it may cannibalize the old offer. On the other hand, offering services can lock-in customers and increase knowledge, which in turn can increase sales of both products and services. One peculiarity with company A is that the Head of Sales is responsible for both the service sales department and product sales department, and thus is concerned with each departments' result. However, even though none of the other companies have mentioned this challenge it is still important for companies that want to move from PoPSS to UoPSS or RoPSS, and have separated service sales department and products sales department, to consider the challenge of cannibalization. As noted in the beginning of this paragraph, when company A

mentioned this challenge it was future UoPSS and RoPSS that was discussed, hence this challenge is most significant for UoPSS- and RoPSS companies. Furthermore, to overcome this challenge increased collaboration between the departments need to be developed (Cooper and Edgett, 2003). This approach is aligned with company C who sell their offerings by sales teams consisting of one person from product sales and one from services sales. In figure 5.4 the categorization of challenges mentioned above is summarized.

		PoPSS	UoPSS	RoPSS	Theory	Expert	Enablers
Business model	EBM2: Pricing	✖			✖		• Develop pricing algorithms
	EBM1: Integration of BM into ERP systems		✖	✖			• Develop new technical capabilities (Zorzi et al. 2010)
	EBM4: Business model development		✖	✖	✖		
	EBM5: Increased risk		✖	✖	✖		• Adequate pricing method
	EBM3: Internal cannibalization		✖	✖	✖		• Collaboration between sales departments • Head of Sales responsible for product and service sales

Figure 5.4: Synthesis of challenges related to business models and their corresponding enablers

5.5 Sales process

In the empirical findings, it can be seen that a number of challenges connected to the sales process appear when starting to offer more advanced services; these are the challenges EPS1, EPS2, EPS3 and EPS4. Firstly, both RoPSS-companies and one UoPSS-company experience that the sales force has inadequate service sales competence (EPS3). Expert E1 express that the reason for this is that traditional product sales persons are equipped with the wrong tools. Kowalkowski et al. (2015) also states that this is because traditional sales personnel understand tangible products and lack the understanding of intangible service solutions (CC1). In order to address this challenge, Neely (2008) mention that the sales process need to change from one-time transactions to selling subscription-based solutions and capabilities. Gebauer et al. (2008) mention that this can be done by training the sales force or acquiring new competence externally, which is in line with company E and F's initiatives. Secondly, companies B and F mentioned that when selling advanced services a new target for sales force is necessary (EPS2). This is in line with Reinartz and Ulaga (2008) which stress that the sales force need to approach customer contacts higher up in the hierarchy when selling more advanced services. In order to do so, new competence will need to be established to be able to interact with these contacts. However, when company B mentioned this challenge the interviewee spoke in terms of new RoPSS offerings. Due to these aspects it is suggested that challenge EPS3 is most significant in UoPSS and RoPSS, while challenge EPS2 is most significant for

RoPSS.

Thirdly, companies in both the UoPSS and RoPSS categories stated customer maturity as an important challenge. This is also elaborated upon by Baines et al. (2007) which stress that the reason why some customers might reject to purchase more advanced services is that the ownership of the product is not transferred, meaning that they still want or are required to own the asset. The addressed challenge is therefore most significant for companies classified as UoPSS and RoPSS, since more advanced services often does not transfer the ownership of the product. A similar challenge (EPS1) was also mentioned by company A, who said that some customers have policies that prohibits them from purchasing UoPSS and RoPSS. On the other hand, this challenge can also be seen as a customer maturity challenge, since the same company mentioned that these restrictions can change over time. However, when company A mentioned this challenge, the interviewee spoke in terms of future challenges when offering more advanced services. Because of this, both the challenges EPS1 and EPS4 can be categorized as challenges for UoPSS and RoPSS. According to Alghisi and Saccani (2015), these challenges can be managed with more effective communication with the customer. This is aligned with company B's statement that it is important to educate the customer to understand advanced services. It is also connected to the UoPSS-companies' and RoPSS-companies' initiatives of having dedicated service sales personnel which is focused on selling advanced service solutions. In figure 5.5 the categorization of challenges mentioned above is summarized.

		PoPSS	UoPSS	RoPSS	Theory	Expert	Enablers
Sales process	EPS3: Sales force competence		✖	✖	✖	✖	• Training sales force (Gebauer et al. 2008) • Acquire new external competence
	EPS2: New target for sales force			✖	✖		• Approach higher up in the hierarchy (Reinartz & Ulaga 2008) • New competence
	EPS4: Customer maturity		✖	✖	✖	✖	• Effective customer communication (Alghisi & Saccani 2015) • Educate customer
	EPS1: Customer restrictions		✖	✖	✖		

Figure 5.5: Synthesis of challenges related to sales process and their corresponding enablers

5.6 Summary of identified challenges and enablers

In figure 5.6 a consolidation of all identified challenges and their corresponding enablers, as well as their categorization are presented.

		PoPSS	UoPSS	RoPSS	Theory	Expert	Enablers
Culture	EC1: Product oriented mindset	✖	✖	✖	✖	✖	• Internal marketing (Dubruc et al. 2014) • Educating the employees (Dubruc et al. 2014) • Internal communication department
	EC2: "not invented here"	✖	✖		✖		
Service development	EPD1: Faster development process	✖				✖	• Well-defined service development process • Agile processes
	EPD2: Scalability	✖			✖		• Modularization • Platform thinking (Pekkarinen & Ulkuniemi 2008;Brax et al. 2017) • Standardized contracts and complete packages
Internet of Things	EIoT1: No universal standard	✖			✖		• Update IoT systems continuously
	EIoT9: Laws and regulations				✖		
	EIoT10: Future communication network					✖	
	EIoT8: Lack of connection			✖			
	EIoT2: Reaction to product status	✖					• Development team with unrestricted budget • Develop new capabilities (Zorzi et al. 2010)
	EIoT3: Integration to ERP system	✖					
	EIoT5: Data security	✖			✖	✖	
	EIoT6: Integration of IoT solutions in customer IT system	✖					
	EIoT4: Scalability	✖	✖		✖		• Develop standards (Uckelmann et al. 2011) • Partnerships
	EIoT7: Transform data into commercial value	✖	✖		✖		• Develop new capabilities and processes (Davenport et al. 2012, Opresnik & Taisch 2015)
Business model	EBM2: Pricing	✖			✖		• Acquire and develop new competence • Develop pricing algorithms
	EBM1: Integration of BM into ERP systems		✖	✖			• Develop new technical capabilities (Zorzi et al. 2010)
	EBM4: Business model development		✖	✖	✖		
	EBM5: Increased risk		✖	✖	✖		• Adequate pricing method
	EBM3: Internal cannibalization		✖	✖	✖		• Collaboration between sales departments • Head of Sales responsible for product and service sales
Sales process	EPS3: Sales force competence		✖	✖	✖	✖	• Training sales force (Gebauer et al. 2008) • Acquire new external competence (Gebauer et al. 2008)
	EPS2: New target for sales force			✖	✖		• Approach higher up in the hierarchy (Reinartz & Ulaga 2008) • New competence
	EPS4: Customer maturity		✖	✖	✖	✖	• Effective customer communication (Alghisi & Saccani 2015) • Educate customer
	EPS1: Customer restrictions		✖	✖	✖		

Figure 5.6: Revised synthesis of all challenges identified in the empirical study and theory. Corresponding enablers are also presented.

According to figure 5.6, cultural challenges are important to consider for all PSS categories, independently on how far the companies have come in their servitization journey. However, it has been shown that more advanced service providers have come further in managing the challenges by educating the employees and increasing internal communication. Furthermore, it can be seen that service development is an area that all companies sees as challenging, but is only yet managed by companies offering UoPSS and RoPSS. PoPSS-companies therefore need to consider whether they need to follow UoPSS- and RoPSS-companies' initiatives and establish a well defined service development process. Next, another insight which can be drawn from figure 5.6 is that PoPSS-companies mentioned the challenges related to IoT more frequent than the UoPSS- and RoPSS-companies. This observation gives an indication that IoT is fundamental for UoPSS and RoPSS service solutions, since these companies already have well established IoT solutions. Moreover, it can be seen that PoPSS companies do not need to consider the challenges connected to the business model, except for the pricing challenge. It is only when companies are starting to develop new advanced business models for more advanced service solutions that these challenges need to be considered. A last insight which can be drawn from the figure 5.6 is that the sales process need to be radically changed when selling UoPSS and RoPSS. Thus, companies that want to advance to the next level of service solutions need to consider the challenges related to the sales process.

6
Discussion

In this chapter the discussion is presented. The chapter is divided into three sections; theoretical implications, managerial implications and future research. In the theoretical implication the contribution of this master thesis to existing theory is discussed, while the managerial implications section discuss the practical implications of the findings. The chapter ends with suggestions of future research.

6.1 Theoretical implications

The purpose of this master thesis was to investigate which challenges servitizing companies are faced with, depending on the type of Product-Service System that is offered. The purpose was also to examine corresponding enablers to the identified challenges. Previous literature, by for instance Zhang and Banerji (2017), have presented clusters of challenges with servitization, but limited literature has categorized challenges depending on the relevance for different PSS types. Our research suggest that this categorization is possible by applying the PSS classification framework developed by Tukker (2004). This categorization enabled patterns to be seen and identified challenges could be categorized in the following clusters; culture, service development, IoT, business model and sales process.

Previous research stress that culture is an important challenge to consider when servitizing (Kowalkowski et al., 2015; Martinez et al., 2010; Oliva and Kallenberg, 2003; Zhang and Banerji, 2017), which this master thesis also has identified. However, previous theory has discussed the "not invented here" syndrome (Antons and Piller, 2015), but limited research has discussed it in a servitization context. Our research suggest that this challenge is very important in the beginning of the servitization journey, since it inhibits the establishment of partnerships, which is an important piece in an IoT enabled servitization. This can therefore be seen as an elaboration of the cultural challenge. Moreover, previous research state that service development need to be considered when servitizing, because of the intangablility of services and that customer engagement is important, even more than for products (Parida et al., 2014; Brax, 2005). Our research indicate that service development cycles are faster than product development cycles. Therefore, it can be necessary to consider establishing a new service development process. Also, previous research has mentioned that a separate service development process can be used depending on the service type and how product-centric the service is (Gebauer et al., 2008; Gremyr et al., 2014). However, this study suggests that UoPSS and RoPSS-companies to a

larger extent have a separated service development process, while PoPSS-companies more often have integrated service development into traditional product development processes.

Furthermore, there are limited research about the importance of IoT when offering advanced types of services. However, it is indicated by the empirical findings that digitalization and IoT is a prerequisite for advanced services such as UoPSS and RoPSS. This is further supported by the fact that all the companies in this study that offer UoPSS and RoPSS have integrated IoT systems into their PSSs. Lastly, business model challenges that have been identified in the empirical study have already been discussed in previous theory (Zhang and Banerji, 2017; Barquet et al., 2013; Mo, 2012; Kowalkowski et al., 2017; Reinartz and Ulaga, 2008; Neely, 2008), except for the challenge of integrating new business models into the existing ERP systems.

6.2 Managerial implications

By bundling products and services into PSSs, companies can escape the commoditization trap and gain a competitive advantage. However, to do so successfully there are a number of challenges that need to be addressed. Also, depending on what type of PSS companies are striving for, the challenges they face are different. In the remaining part of this section each PSS category and their most significant challenges are discussed.

Even though PoPSS is the least advanced PSS studied, there are several associated challenges and the following five challenges are among all identified challenges the most significant. Those are; culture, faster development, scalability, Internet of Things, and pricing. Firstly, when a company start to servitize the culture need to change from a product-oriented culture to a customer oriented culture. Secondly, new service development processes need to be in place in order to manage the fast development cycles required for service development. Thirdly, to manage the challenge of scalability companies might adopt platform thinking and modular design. Fourthly, new technical capabilities need to be developed in order to manage the technical difficulties of developing capable IoT systems. Initiatives to establish new partnerships may also be beneficial. Lastly, when companies start to offer new services pricing of the services becomes an issue. To manage this challenge companies, need to acquire or develop competences in value based pricing as well as developing pricing algorithms.

Companies offering the most advanced PSS, namely RoPSS, face four main challenges. Those are; culture, lack of connection, business model, and sales process. Firstly, the culture is important for all companies offering any sort of PSS. However, to offer RoPSS a customer oriented culture is fundamental. Thus, it is crucial that the company communicate the importance of such culture internally. Secondly, lack of connection at customer site may become an issue since the RoPSS requires a functioning IoT system, and without connection it may start to malfunction. Thirdly,

the business model change drastically when offering RoPSS hence new competences needs to be developed. Lastly, the sales process needs to be changed since the sales force now need to be able to sell value based service solutions rather than products. Furthermore, selling RoPSS solutions also requires the customer to be mature enough to be receptive to such offer.

As seen in figure 5.6 there are no challenges identified in the research that is unique for UoPSS. However, for UoPSS-companies this study suggest that they are faced with challenges associated with both PoPSS and RoPSS. To avoid reiterations, it is suggested that managers of companies offering UoPSS to look for identified challenges in figure 5.6 and their related enablers. It should also be mentioned that all challenges related to PoPSS also need to be managed for companies offering UoPSS or RoPSS. Overcoming the challenges of PoPSS can be considered as a prerequisite for UoPSS and RoPSS.

6.3 Future research

This master thesis has only examined large OEM companies that are servitizing. The identified challenges and their corresponding enablers are therefore effected by this limitation, and another result could have been generated if small or medium sized companies were examined. Therefore, an interesting area for future research is to examine challenges and enablers in a SME context.

Moreover, the master thesis has been limited to only including six companies in the empirical study. In order to validate the result of the categorization of the challenges and their corresponding enablers, it is suggested that research with a larger sample size is conducted.

7
Conclusion

The purpose of this master thesis was to investigate which challenges a servitized company are faced with, depending on the type of Product-Service System that is offered. The purpose was also to examine corresponding enablers to the identified challenges. The purpose was addressed by conducting an embedded case study including ten interviews at six companies. The thesis was divided into two research questions, and by answering these questions the purpose is fulfilled.

RQ1: Which are the challenges for companies developing a servitization strategy, depending on the type of Product-Service System that is offered?

From this research it can be concluded that there are some challenges that are independent from the PSS classification. Firstly, when servitizing, the culture need to change from a product-centric culture to a customer-centric culture. Furthermore, companies in the PoPSS and UoPSS category experienced challenges related to "not invented here" which may inhibit organizations to develop partnerships that may be necessary for servitization. Secondly, three IoT challenges, namely, the lack of universal standards, laws and regulation, and future communication networks, needs to be considered independently of the PSS classification. However, based on the analysis it is suggested that there are challenges that are related to a specific PSS category. Those are presented below in the following order; PoPSS, UoPSS, and RoPSS.

For PoPSS two main clusters of challenges have been identified, namely, development of IoT and service development. Firstly, several challenged related to the development of IoT were mentioned by companies classified as PoPSS. Identified challenges are; data security, integration of IoT system into ERP systems, integration of IoT solutions in customer IT systems, scalability, data analysis, and to react to the product status. Secondly, faster development cycles for services compared to products, and scalability were identified for companies offering PoPSS.

Three clusters of challenges were identified for UoPSS, those are; IoT, business model, and sales process. Firstly, this research suggests that when starting to offer UoPSS scalability and the capability to transform data into commercial value becomes an issue. Secondly, the business model change dramatically when offering UoPSS, consequently new challenges surface. Integration of business model into ERP systems, business model development, increased risk, and internal cannibaliza-

tion have been identified as challenges related to the new business models. Thirdly, and lastly, when selling advanced service such as UoPSS the sales process need to change. As a consequence, new sales force competence needs to be developed or acquired since value selling is required. Furthermore, customer maturity and customer restrictions is also identified as challenges when offering more advanced services.

Companies offering RoPSS experience mostly the same challenges as companies offering UoPSS. However, there are some differences. Firstly, the IoT challenges identified for UoPSS is not applicable for RoPSS. Secondly, there are two challenges which have been identified as unique for RopSS, those are; lack of connection at customer site and new target for sales force.

RQ2: Which are the corresponding enablers for the identified challenges?

By analyzing the identified challenges using both existing theory and current state of the case companies, the following corresponding enablers have been identified. Main enablers to overcome the identified challenges are; increased internal communication, new service development process, modularization, partnerships, IoT capabilities, new sales competences, and educating the customer.

Culture - The cultural challenges can be addressed by internal marketing through an internal communication department in the organization. It can also be handled by giving the employees necessary education to understand the benefits of the servitization.

Service development - These challenges can be managed by establishing a well-defined service development process, including more iterative and agile work. Also, service modularity, platform thinking and standardized contracts and complete packages of service can be applied to manage the challenge of scaleability.

Internet of Things - A solution to handle the challenge of introducing IoT in the product and service offerings could be to set up a team with unrestricted budget, which is focused on solely develop new IoT solutions. Moreover, in order to handle the challenges related to IoT it is important to update the IoT systems continuously. It is further important to work on developing IoT standards in the organization and to develop new partnerships if necessary capabilities do not exist in the company.

Business model - In order to manage challenges related to the business model, new technical capabilities need to be developed, as well as new pricing algoristhms and methods. Furthermore, in order to handle challenges related to internal cannibalization, increased collaboration between departments need to be developed.

Sales process - Challenges related to the sales process can be handled by training the service sales force, acquiring new external service competence, target customer contacts higher up in the hierarchy, increase communication to customers and to

work on educating the customers to understand the benefits of services.

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Appendix 1 - Interview questions

Introduction
1. Can you describe your background? Education, jobs etc.
2. What is your role in the company?

Description of service offers
1. Can you describe the services you offer today?
2. Through which channels are your products and services sold?
3. Are you or the customer owning the products?

Servitization journey
1. Why did you start to servitize? What was the motivation?
2. What type of services are you striving for?
3. How was the transformation initiated?
4. How do you manage the development of new services?
5. Have you acquired new competencies or did you develop them internally?
6. Have you introduce any new methods, processes, tools or techniques?
7. How do you set the price for the services you offer?
8. Have you done any organization changes connected to the transformation?
9. Have you changed the process for the sales force?
10. Did you have to change the culture when transforming into offering services? If so, how?

Challenges
1. What challenges did you have in the transformation stage?
2. How do/did you address these challenges?

Successfactors
1. Have your transformation been successful?
2. Is the service division profitable?
3. If so, which aspects do you think enabled this success?

IoT specific questions
1. What is the role of IoT in your service offering?
2. Were there any challenges when implementing the IoT solution?
3. Where new IoT competences needed?
4. How do you use the data collected through IoT to deliver value to the customer?

5. What are the difficulties/challenges when managing the IoT solution?

Customer management
1. Have the relationship to your customer changed? If so, how?
2. Have you gained more knowledge about the customer?
3. Was there any resistance from the customers?
4. Have you encountered any trust issues?

New partnerships
1. Have you developed new partnerships to enable the delivery of the new service offerings?