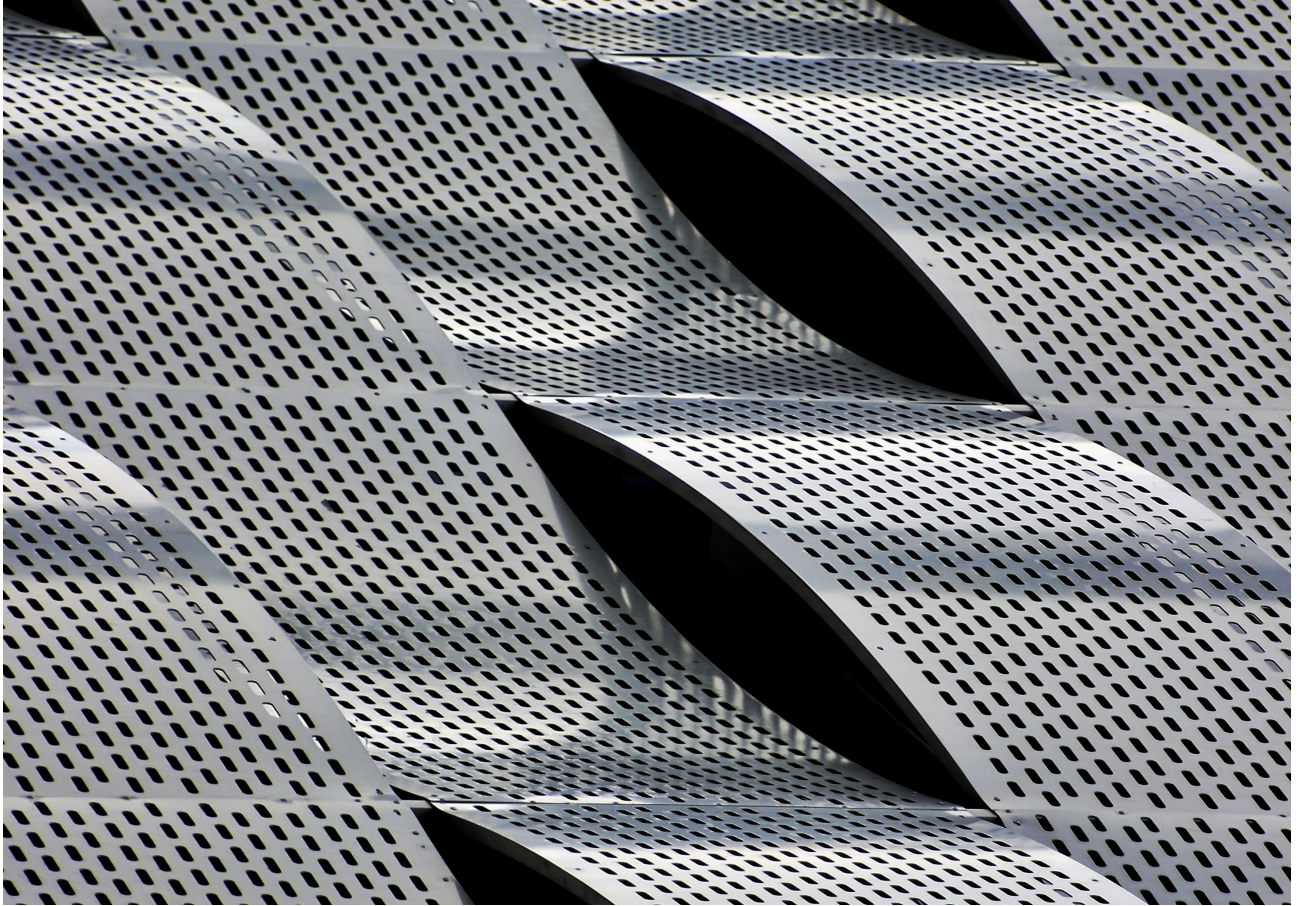




CHALMERS
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Stamping as a service

Business model innovation in the tool and die industry

Master's thesis in Supply Chain Management

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Abstract

Due to increased competition, both with regards to pricing as well as to quality, the European tool and die industry is facing challenges in terms of declining profit margins and cash flow issues. This study aims to investigate the possibility to alleviate these issues in Swedish supply chains manufacturing stamping tools for the automotive industry, through the process of servitization. Specifically, the thesis is concerned with identifying and outlining factors affecting the viability of servitization, providing customer perspectives as well as a discussion on the division of roles, responsibilities and risks within the supply chain.

In order to fulfil the objectives of the thesis, a qualitative case study was performed at three participating companies, denoted as Company A, Company B and Company C. Moreover, the case study includes two customer companies providing additional servitization perspectives of tool users, denoted as Customer X and Customer Y. A theoretical framework with regards to the concept of servitization, service types, as well as the current status of their use within the industry was established, and the data collection was performed through semi-structured interviews, upon the results of which the analysis was based.

The findings of the case study indicate that there are conflicting views among the actors regarding the opportunities and challenges servitization could bring to the supply chain. Further, the results suggest that the inherent characteristics of stamping tools considerably constrains the viability of servitization offerings incorporating the stamping tools themselves, and that customer demand, for this reason, is very limited. These characteristics include the high level of customisation of the tools, the lack of opportunities for remanufacturing and recycling as well as, in most cases, their significant cost in relation to the revenues of the manufacturers. In addition, there are incentive structures in place that favour the current model of stamping tool ownership within the automotive industry. However, additional services and other payment solutions are deemed more realistic to implement, why servitization is considered to be partly feasible.

Keywords: servitization, supply chains, business model innovation, tool and die industry, supplier relationships, automotive components, product service systems.

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Fredrik Voksepp



Linn Wigstrand

Contents

List of Figures	viii
List of Tables	ix
1 Introduction	1
1.1 Background	1
1.1.1 Aim and purpose	2
1.2 Delimitations	3
1.3 Outline	3
2 Theoretical framework	5
2.1 Business model innovation	5
2.2 The servitization concept	6
2.2.1 Types of servitization	6
2.2.2 Service models and revenue structures	8
2.3 Servitization as a strategy	9
2.3.1 Drivers for business model innovation	9
2.3.2 Drivers for servitization	10
2.3.3 Servitization barriers and challenges	11
2.4 Service supply chains	13
2.4.1 Relationship management	13
2.4.2 Provision of advanced services	14
3 Methodology	16
3.1 Research strategy	16
3.2 Research design	17
3.3 Data collection	18
3.4 Data analysis	21
3.5 Research ethics	22
4 Current industry situation and case description	23
4.1 Introduction to the tool and die industry	23
4.2 Industry trends and innovation practices	24
4.3 Supply chain structure and actors	26
4.3.1 Company A - Component manufacturer	28
4.3.2 Company B - Component retailer	29
4.3.3 Company C - Stamping tool manufacturer	30

4.3.4	Customer X - Stamping company	31
4.3.5	Customer Y - Automotive OEM	31
5	Empirical findings	33
5.1	Company A - Component manufacturer	33
5.1.1	Opportunities with servitization	33
5.1.2	Challenges with servitization	33
5.2	Company B - Component retailer	35
5.2.1	Opportunities with servitization	35
5.2.2	Challenges with servitization	36
5.3	Company C - Stamping tool manufacturer	38
5.3.1	Opportunities with servitization	38
5.3.2	Challenges with servitization	39
5.4	Overview of identified factors	41
5.5	Customer perspectives	43
5.5.1	Customer X - Stamping company	43
5.5.2	Customer Y - Automotive OEM	45
6	Discussion	47
6.1	Service supply chains	47
6.1.1	Roles and responsibilities	47
6.1.2	Relationship management	49
6.1.3	Risk factors	50
6.2	Customer perspectives	52
6.3	Factors affecting servitization viability	53
6.3.1	Stamping as a service	54
6.3.2	Services supporting tool operations	55
6.3.3	Leasing	57
7	Conclusion	59
	Bibliography	62

List of Figures

2.1	The Servitization Pyramid (Coreynen, Matthyssens, & Van Bockhaven, 2017)	7
3.1	Qualitative research strategy (Bryman & Bell, 2011)	17
4.1	Stamping tool mounted inside press	24
4.2	Potential of a service vs. percentage of toolmakers planning to offer the service in the future (Schuh, Potente, Schittny, & Wittek, 2011) .	25
4.3	Supply chain structure	26
4.4	Supply chain flows, sub-supplier customer case	27
4.5	Supply chain flows, OEM customer case	28

List of Tables

3.1	Overview of interviews	20
5.1	Servitization opportunities identified by companies	41
5.2	Servitization barriers identified by companies	42

1

Introduction

The following chapter will introduce the context in which the study was performed, describing the background of the research project. Thereafter, the aim and purpose of the study will be discussed, and delimitations will be introduced and motivated. Finally, the overall disposition and structure of the report will be presented.

1.1 Background

In the context of increasing globalisation and increasingly harsh corporate landscapes, businesses are facing new challenges, and manufacturers and retailers need to adapt (Marković, 2008). In the European market, companies find it increasingly challenging to compete with foreign actors who are steadily becoming more competitive, both with regard to pricing as well as to quality (Baldwin & Evenett, 2015; Holmes, Rutherford, & Fitzgibbon, 2005; Schuh, Kuhlmann, Komorek, & Kühn, 2013). The tool and die industry, in which equipment for sheet metal shaping processes in serial production is manufactured, is no exception. While the tool and die industry manufactures tools that enable series manufacturing for end customers, its own manufacturing commonly takes place in single or small batch sizes, making cost control difficult and necessitating the development of differentiating factors in order to remain competitive on the global market (Holmes et al., 2005; Schuh et al., 2013; Stiglitz, 2017).

In an attempt to counter the declining profit margins in the industry, manufacturers have to an increasing extent turned to the concept of *servitization* (Schuh, Frank, Jussen, Rix, & Harland, 2019). The concept was first coined by Vandermerwe and Rada (1988) and refers to the transitioning from selling products to instead provide customers with a service. Managing a shift to a product service system (PSS) entails numerous challenges for manufacturing companies, but can on the other hand provide significant opportunities. There are several reasons behind servitization, and financial, strategic and marketing factors were identified as the most prominent drivers (Baines, Lightfoot, Benedettini, & Kay, 2009; Gebauer, Fleisch, & Friedli, 2005; Oliva & Kallenberg, 2003). Furthermore, Pigosso and McAloone (2016) identified sustainability as an additional motivation behind a shift into service-based operations.

Today, coinciding with the increasing popularity of servitization, more and more companies are actively engaging in business model development. Servitization is an example of business model innovation, a structural and organisational reconfiguration of the company operations (Barquet, de Oliveira, Amigo, Cunha, & Rozenfeld, 2013; Magretta, 2002; Teece, 2010). A business model is contained within every company, either explicitly or implicitly, and can be defined as the combination of ideas about how the company delivers value to its customers (value creation), how they attract customers to the product or service (value proposition), and how they convert customer payments to profit (value capture) (Fielt, 2013).

The business model, as a concept, allows for more effective realisation of a competitive advantage, and, if successful, will allow for future improvement and development of itself. The global market trends mentioned above in themselves constitute a motivating factor for companies to change. In order to remain competitive in dynamic markets, companies need to aim for business model leadership, not merely for imitation of competitors (Casadesus-Masanell & Ricart, 2011; Mitchell & Coles, 2003; Pisano, 2015). The process of transitioning to a service based business model, however, is not free of challenges and issues. Research indicates that a significant portion of companies that servitize fail, and there is a need to carefully evaluate the potential benefits as well as the risks of each specific situation before committing to such a project (e.g. Eggert, Hogreve, Ulaga, & Muenkhoff, 2014; Gebauer et al., 2005).

Within the field of servitization, research activity is high, and the Swedish Energy Agency is currently funding a research project *CirkLev*, coordinated by RISE Research Institutes of Sweden (RISE). The aim of the project is to explore new opportunities for increasing resource efficiency and profitability through the use of servitization concepts in tool component manufacturer business models, which has proven to be useful but challenging in similar industries (Crozet & Milet, 2017; Yang, Smart, Kumar, Jolly, & Evans, 2018). This master's thesis project is part of the CirkLev project, aiming specifically to further investigate opportunities for business model innovation in the tool and die making industry in order to manage the challenges laid out above. The companies studied during the course of the project include Company A, a manufacturer of tool components, Company B, a tool component reseller, and Company C, a tool manufacturer, who collectively form part of a stamping tool supply chain. In addition to the project actors, two customer companies are studied in order to provide additional perspectives on the needs and requirements of tool users.

1.1.1 Aim and purpose

The aim of the thesis project is to investigate the possibilities and opportunities for business model development in the tool and die industry through the process of servitization. Specifically, factors affecting the viability of servitization will be investigated, in terms both of the specific characteristics of the product, the stamping tools, as well as contextual factors such as market conditions and the needs and requirements of OEMs and stamping companies. In addition, based on data collected

with respect to the participating actors and their capabilities, factors affecting the division of roles, responsibilities and risks within the service chain will be studied. Furthermore, the intended outcome of the project is to provide recommendations and insights in order to support strategic planning and decision-making in projects exploring the use of servitization in the tool and die industry. The general aim of the project as described above can further be subdivided into research questions, which will support the development and direction of the project throughout.

Research question

- Could servitization alleviate issues faced by companies in the tool and die industry?
 - What factors affect the viability of servitization?
 - How can roles and responsibilities be distributed in order to support servitization?

1.2 Delimitations

In the course of the project, it is necessary to limit the field of research in order to ensure the achievement of sufficiently reliable results. In the process of evaluating opportunities for future business model development, there are several areas on which one could focus, and the limits of the scope of this project will be further laid out in this section. As this study is focused on a single supply chain, the report has been limited to not investigate and collect data from actors outside the Swedish market. The results of the project will include theoretically anchored recommendations for future development, but specific implementation strategies, such as issues relating to marketing and pricing, will not be covered. In accordance with requests from the case companies, all direct and indirect references to the company identities have been omitted where possible.

1.3 Outline

The report will follow a traditional layout structure often employed in research, and is divided into seven chapters. In the *Introduction*, the background to the project is introduced, and the aim and purpose is defined, along with delimitations. In the second chapter, a literature review is performed, forming a *Theoretical framework*, where previous research within relevant fields will be investigated and analysed. The resulting framework serves as a theoretical basis for the data collection and analysis that follows. Thereafter, in the *Methodology* chapter, the research methodology is described, initially motivated by the establishment of a theoretical framework and its application on the specific project and the its context. Factors such as the research quality and ethical considerations are discussed as well. The structure of the supply chain as well as the operations of the companies involved in the project are introduced in the fourth chapter, *Current industry situation and case description*. The findings of the data collection process, thereafter, are laid out in the fifth

chapter, *Empirical findings*. Here, interview data will be presented and theoretical framework models and concepts are applied to the collected data, the results serving as the basis for the following chapter. The sixth chapter, *Discussion*, provides a comparison and analysis of empirical findings in relation to the theoretical framework outlined in chapter two. In the seventh and final chapter, *Conclusions* and theoretical contributions of the study are presented.

2

Theoretical framework

In this chapter, a theoretical background will be laid out, summarising a selection of literature within the fields of servitization and business model innovation. This will form the foundation for the analysis, in which the empirical data will be related to previous research findings.

2.1 Business model innovation

Historically, services have been considered by manufacturing firms merely as an add-on to physical products, a necessary evil to adopt (Gebauer et al., 2005). Today, services have evolved to become a strategic choice, differentiating the business offering from that of its competitors, and where the product is a part of the total offering, as such providing customers with a "solution" rather than a product (Baines et al., 2009). When a company aims to transition into a new product offering structure, such as in the process of servitization, the organisational and structural changes that take place can be referred to as the implementation of a new business model (Barquet et al., 2013).

Every business enterprise relies on a business model in its operations, established either explicitly through a structured process or implicitly as part of the corporate culture (Teece, 2010). Definitions of what a business model actually consists of vary, and Teece (2010) defines the business model as the way that a company delivers value to its customers, it sets out guidelines for how customers are to be attracted to the product or service, and it describes how customer payments are converted to profit.

Fielt (2013) state in summary that a business model can be represented by a set of elements addressing the customer, the value proposition, the organisational architecture and the economical dimensions of the company. Very similarly, Richardson (2008) as well as Johnson, Christensen, and Kagermann (2008) divide the business model into three parts, the value proposition, the value creation and delivery system, and the value (profit) capture. Briefly described, the value proposition deals with ensuring that the customer is aware of the benefits gained by the consumption of the product or service, the value creation and delivery system sets out the actual process of delivering these, and the value capture is the process of ensuring profitable operations (Richardson, 2008). The business model can be considered as

a representation of a company’s operations, demonstrating what it is that makes it unique and successful. If well defined, it should enable any actor who has access to the same resources and opportunities to replicate the results (Baden-Fuller & Morgan, 2010).

2.2 The servitization concept

The notion of servitization originates from Vandermerwe and Rada (1988), defining the movement as *corporations increasingly offering fuller market packages or “bundles” of customer-focused combinations of goods, services, support, self-service, and knowledge, to add value to their core corporate offerings*. The field has been widely researched since the introduction of the concept in 1988, with articles covering topics ranging from classification and drivers for servitization, to implementation strategies. However, in contrast to the extensive research output, empirical evidence of the extent to which it is introduced in practice, and potential implications for organisations, is relatively restricted (Neely, 2009).

Products and services are two terms intrinsically related to the concept of servitization. While products refer to a material object, services are more difficult to define. Baines et al. (2009) argue that services generally are defined by what they are not; a physical product. In this report, a service is defined as *an offering or economic activity that does not result in ownership of a tangible asset*, in accordance with Baines et al. (2009).

A range of examples of servitization are available in the manufacturing industry, however, while the term servitization describes the organisational shift from selling product to selling a product service system in general terms, there are a variety of configurations of what type of service the organisation could transition into providing (e.g. Baines et al., 2009). According to Smith, Maull, and Ng (2014) the transition spectrum encompasses a number of product-service combinations, known as product service systems (PSSs). Therefore, a PSS is a result of a servitization process. The two terms have developed separately, where research on the PSS concept has emerged from debates concerning sustainability and reduction of environmental impact, by improving resource efficiency (Baines et al., 2009). However, despite the various origin of the concepts, both encompass the view that manufacturing companies should move towards selling integrated product-service solutions, delivering value in use. As such, Baines et al. (2009) argue that it is suitable that the term servitization also should enclose the topic of PSS.

2.2.1 Types of servitization

There are many categorisations of services available in literature, for example, Tukker (2004) suggests that there are at least eight different PSSs in which the customers value other factors over pure ownership of products. However, these eight categories have been criticised for being too generalised, and it has been stated that they require more differentiation (Coreynen, Matthyssens, & Van Bockhaven, 2017).

Also Oliva and Kallenberg (2003) have provided a popular categorisation where the authors separate between offering of services that support products and products that support customer processes.

Taking these popular categorisation perspectives into consideration, Coreynen et al. (2017) merged the two into what they refer to as the "servitization pyramid" seen in figure 2.1 below. The pyramid consists of two horizontal dimensions, dividing the pyramid into one half representing services that support products, and the other half referring to services supporting customer processes, in accordance with the suggested classification by Oliva and Kallenberg (2003). Vertically, the pyramid is influenced by Tukker (2004) and distinguishes between three different types of value propositions; providing customers with a certain input, a performance agreement or a promised result.

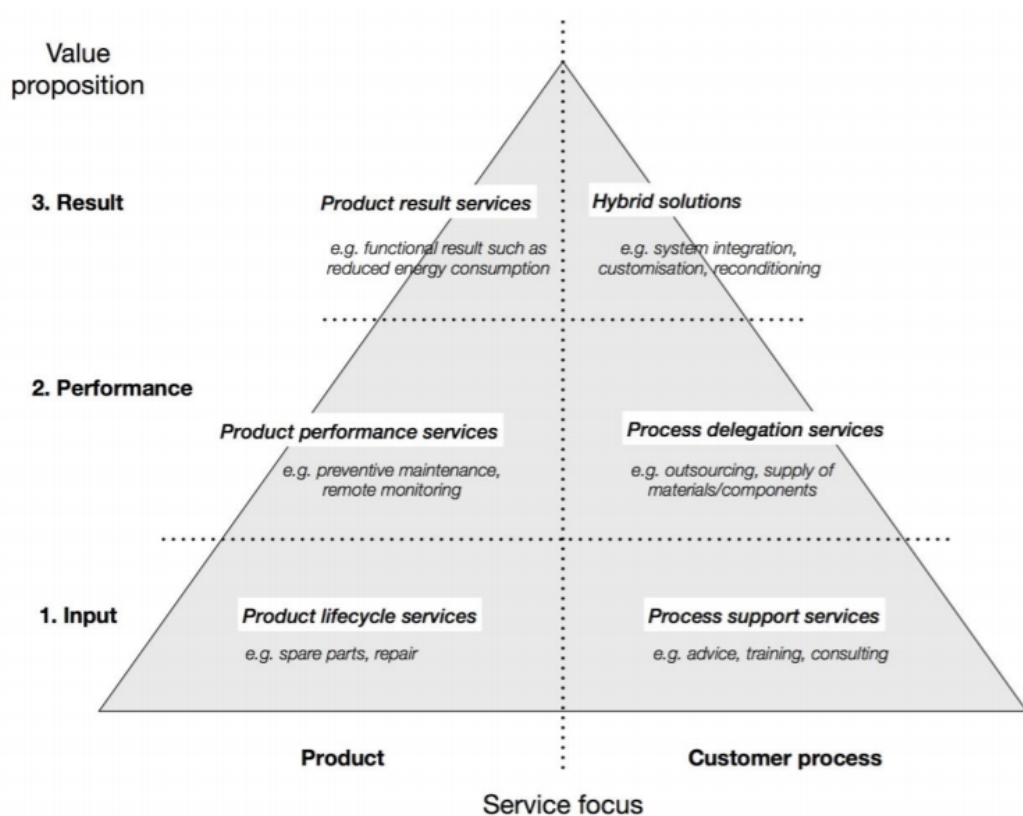


Figure 2.1: The Servitization Pyramid (Coreynen, Matthyssens, & Van Bockhaven, 2017)

The first level of the pyramid relates to an organisation's ability to extend their involvement beyond the point-of-sale and withstand inherent disbelief of the economic potential of services, requiring a corporate culture that supports the shift. A prominent barrier in the first phase is also to overcome customers' tendency of expecting services for free, as well as their disinclination to pay extra for services (Coreynen et al., 2017).

The second level of the pyramid refers to the process of countering problems related to customers being used to receiving ownership over a physical product. This pyramid level also includes customers' fear of engaging in close collaboration with suppliers, because of the risk that valuable and sensitive company information is shared over company borders (Coreynen et al., 2017).

To reach the third and final stage of the pyramid, Coreynen et al. (2017) argue that the organisational structure and design must be aligned with a servitized business model. A common mistake causing companies transitioning into a PSS to abandon the process, is to absorb too many of the risks which previously affected the operations of the customer, in the desire to servitize their business (Coreynen et al., 2017).

2.2.2 Service models and revenue structures

As companies move away from their traditional product offering, the pricing mechanism must be adjusted accordingly. Rapaccini (2015) states that services commonly are under-priced, and as the price has a substantial impact on both revenue streams as well as profitability, adequately choosing a pricing model is a critical decision for servitizing companies. Rapaccini (2015) distinguishes between fixed time-rate fees and variable fees as payment models of product-service offerings. In a fixed time-rate model, the customer acquires the right to utilise the product over an agreed period of time, which can be referred to as a subscription model. A key prerequisite for subscription based services is the availability of data about how the customer actually uses the product (Schuh, Salmen, Kuhlmann, & Wiese, 2016).

Variable fees refer to a payment model where revenues are linked to product use or other operational performances (Rapaccini, 2015). The most prominent examples are pay-per-use and pay-per-outcome models. In these types of contracts, the customer purchases outcomes rather than products, in exchange for that the manufacturer is responsible for functionality of the service, categorising them as result based service models. A pay-per-use model means that the user pays for the output, according to the level of use, instead of buying the product. A pay per outcome model, on the other hand, would entail a solution where a production ready product, tool in this case, is installed at the customer. The customers, here, pay for an agreed result. In both models, the ownership rights remain at the service provider.

According to Rapaccini (2015), variable fee models incentivise the manufacturer to invest in more reliable products and more efficient maintenance and repair systems to increase profitability, and simultaneously increase the perceived value from a customer perspective. In a setting where a company solely supplies a product, the functionality risk is assumed by the customer. When a business servitizes and transition into to a pay-per-use or pay-per-outcome pricing mechanism, the functionality risk is instead, partly or entirely, transferred to the service provider, which according to Rapaccini (2015) is the most significant reason for customers to accept such a contract.

2.3 Servitization as a strategy

Pisano (2015) lays out a number of reasons why it is critically important for companies to continuously monitor their business model and to innovate and develop it considering the specific business context. While it could easily be assumed that companies could benefit from maintaining and managing their previously successful business model and making small improvements when needed, continuous innovation of business models is one of the key factors in consistently achieving competitive advantage in dynamic markets (Mitchell & Coles, 2003). When the core business, that which utilises its core competencies, of a company is maturing, new opportunities may become apparent only through business model innovation (Pisano, 2015). In practice however, few companies succeed in consistently managing change, and often find it challenging to maintain their advantage by doing so before their competitors (Mitchell & Coles, 2003).

Baines et al. (2009) argue that servitization aims to meet the ever increasing complexity of customer needs as well as to counter product competition from developing economies. A shift from a business model focused on selling products, to a customer-centric model focused on providing customers with a service, moves the company up the supply chain and provides opportunities to compete on other factors than cost. According to Neely (2009), manufacturing companies are to an increasing extent turning to servitization, and among the most prominent incentives behind the transformation are improved profitability and the potential of retaining revenue streams (Baines et al., 2009; Teece, 2010).

2.3.1 Drivers for business model innovation

According to Casadesus-Masanell and Ricart (2011), when a business model is well designed, its effects enable further development and improvement of itself. As the company grows, the competitive advantage realised by the implementation of the model grows with it (Casadesus-Masanell & Ricart, 2011). It is likely that the existence of a clearly defined business model, when used appropriately, can provide significant value for the company and its customers (Baden-Fuller & Morgan, 2010; Magretta, 2002). A business model can be considered as a conceptual, rather than a financial representation of a business (Teece, 2010).

A company's ability to innovate is generated through its innovation strategy, a part of the business model, why the importance of the business model construct becomes apparent (Pisano, 2015). Specifically, in the opinion of Mitchell and Coles (2003), the strategy of rapidly shifting the business model of a company in dynamic market conditions complicates any struggling competitors' pursuit of replicating their success, allowing for even greater market penetration. Merely catching up with the competition is not enough, there needs to be improvement to stay competitive (Mitchell & Coles, 2003). In addition, Giesen, Berman, Bell, and Blitz (2007) conclude that business model innovation can be particularly beneficial for older companies, where it is necessary for the chosen strategy to be compatible with the

characteristics of the organisation itself as well as the competitive landscape of its surroundings.

The prevalence of business model innovation in itself is a motivator for competing companies to develop their own processes (Chesbrough, 2010). According to Casadesus-Masanell and Ricart (2011), more than 70% of companies engage in the practice, and almost all are modifying the models to some degree. In any case, it is apparent that in order to remain competitive, companies need to change their business models faster, more often, more extensively, and involving more stakeholders (Mitchell & Coles, 2003). In the same fashion as with business models in general, the focus on customers is essential here, the customer centricity, which includes the collection of both qualitative and quantitative data (Gebauer, Gustafsson, & Witell, 2011).

2.3.2 Drivers for servitization

Benedettini, Neely, and Swink (2015) identified that research on service strategies proposes that servitization can generate recession-resistant, high-margin revenue streams that reduce volatility in cash flow, as well as increase company performance. Especially in economic recession, decreasing product sales can be compensated for by turning an installed product base, the products of the company currently in use by customers, into a service, and as such, stabilising cash flows. Further, Benedettini et al. (2015) argue that services are less vulnerable to commoditisation and pressure to lower prices, and instead provide firms with a possibility to resist risks of imitation in mature industries.

The rationale behind transforming an organisation towards servitization is threefold, consisting of financial drivers, strategic drivers and marketing drivers (Baines et al., 2009; Gebauer et al., 2005; Oliva & Kallenberg, 2003). Shifting from selling products towards instead providing a service entails moving away from the traditional revenue stream model where each sold product corresponds to a one-time payment. Because of the presence of a continuous and predictable revenue stream, a servitized business model is less sensitive to economic shifts in the market, allowing more reliability in revenues, a factor with increasing relevance with longer product life-cycles. Moreover, Gebauer et al. (2005) argue that services are typically characterised as generating higher profit margins than products. Together, these factors constitute the financial incentives behind servitization.

As for the strategic drivers, Oliva and Kallenberg (2003) argue that customers are demanding increased flexibility to satisfy their needs, and that firms are turning to services in the quest of meeting these needs. The authors further argue that there are competitive advantages to be obtained by the inherent characteristics of services, namely that they are labour dependent, less transparent, and harder to imitate, which provides the firm with a competitive advantage. This argument gains support by Teece (1986) stating that if imitation is easy, the innovator risks ending up in an disadvantageous market position due to a follower taking advantage of the innovation and outperforming the original innovator. Oliva and Kallenberg

(2003) also argue that servitization can be a means to evade the declining profit margins the manufacturing industry is facing.

The marketing opportunities related to servitization can, according to Gebauer, Friedli, and Fleisch (2006), be acknowledged as *the use of services for selling more products*. Providing a service instead of a product heavily affects the customers' purchasing options, and Vandermerwe and Rada (1988) state that the service demand from customers within the manufacturing industry and in Business to Business settings (B2B) is increasing continuously. Further, Vandermerwe and Rada (1988) argue that services create customer loyalty, which may eventually increase customer dependency on suppliers. Close customer relationships offer companies the opportunity to acquire valuable insight of their operations and needs, allowing the service provider to tailor their offerings to an even greater extent.

Besides providing opportunities for enhanced financial performance, servitization and PSSs have also proven to be potential concepts for increasing the environmental performance of an organisation (Pigosso & McAloone, 2016). A number of service features contribute to the possibility to reduce the environmental footprint. However, as the addition of a service alone does not necessarily lead to more sustainable systems, the servitization and PSS concepts are not intrinsically linked to increased sustainability. They do however hold the potential to break the correlation between increased production volumes and profit, which in turn enables lower material usage and energy consumption (Pigosso & McAloone, 2016).

The shift of ownership from the customer to the manufacturer extends the service provider's responsibility of the product, creating incentives to enhance the product life cycle and through-life maintenance (Pigosso & McAloone, 2016). Continuous collaboration with end-users can also provide insights of product requirements in customer settings, allowing further optimisation of the service. This gains support by Sharma and Singh (2017), stating that the industry becomes more efficient as the intended use of the service is maximised. Additionally, Sharma and Singh (2017) argue that the increased sustainability in principle affects all stages of a product's life cycle. Selling less products reduces material consumption and waste, and regarding the aftermarket, the manufacturer would instead of selling spare parts provide repair services, which could lead to products instead being designed for durability to a greater extent.

2.3.3 Servitization barriers and challenges

While great benefits potentially can be generated by servitization, the transition also entails many challenges. Vandermerwe and Rada (1988) state that notable cultural and corporate challenges come with servitization, and Eggert et al. (2014) present facts from a study concluding that only 21% of companies attempting to transition into a servitized business model succeed. This is in line with the "service paradox" concept, referring to the phenomenon where extensive investments made by the servitizing company leads to enhanced service offerings and increased costs, but does not generate the anticipated higher returns (Gebauer et al., 2005).

Baines et al. (2009) identified service design, organisation strategy and organisation transformation to be the main areas in which servitization imposes challenges to an organisation. Eggert et al. (2014) investigated the revenue and profit implications of various service strategies. It was identified that creating a willingness for customers to pay for a service, and managing the increased cost of providing the service are two fundamental conditions that must be fulfilled in order for servitization to be successful. Further, Eggert et al. (2014) outline four factors and conditions to consider when servitizing:

- Acknowledging that the financial impact can initially be negative, and that companies require experience in providing services before they can turn the results around is of great importance. To not continuously invest in service offerings is a common cause behind failure, as well as not adequately monitoring the cost structure and compare to targeted numbers.
- The organisation must tailor their service offering according to the context in which they operate. A number of servitization forms are available, and the company must identify which best serve their strategic aims.
- The third factor relates to the organisational structure, where the authors suggest that a business design supporting servitization must be in place in the entire organisation to find synergies and to become profitable.
- Lastly, a loyal customer base is essential in rolling out a profitable service offering, because of the possibility to keep costs related to customer administration and service low.

Benedettini et al. (2015) investigated the correlation between a manufacturing firm's servitization and its exposure to bankruptcy risks, and distinguished between two types of risks; environmental and internal. Environmental risks originate from outside the firm, leaving them beyond managerial control of the firm. Included in environmental risks are external changes affecting the landscape in which the company operate, and drivers are identified to include e.g. technology, globalisation, competition and demand trends (Benedettini et al., 2015).

External factors affect all actors in the same market while internal risks refers to managerial inability or mistakes in constructing and carrying out a firm's strategic servitization plan (Benedettini et al., 2015). In addition, a number of critical mistakes to avoid are brought up, including falling behind competitors in production technologies, having an inadequate inventory control, miscalculating cash flows or engaging in poor customer contracts. Internal constraints such as insufficient resources also prevent managers from taking actions to counter the environmental threats outlined above.

While literature generally claims that servitization reduces the risks manufacturing are facing, Benedettini et al. (2015) challenge this view and conclude that service businesses in fact are subject to increased risk of bankruptcy. The increase is most prevalent for internal bankruptcy risks, why managers must deploy a business strat-

egy that is not only solid, but also effective for the servitization process not to fail. As internal capabilities are means to counter the environmental bankruptcy risk posed to a firm, it is suggested by Benedettini et al. (2015) that adequate managerial practises are crucial in controlling the risks associated with transitioning into provision of services.

2.4 Service supply chains

A service supply chain is a sequence of actors that collaborate to provide a service to a customer, that is, where servitization has been performed. Ellram, Tate, and Billington (2004) argue that understanding and managing these structures are fundamental components contributing to improved outcomes and financial results of organisations. In the research history of supply chains, the aspect of services has largely been set aside in favour of focusing the attention on the traditional provision of products (Ellram et al., 2004). The increase in global competition causes a shift in the competitive landscape of organisations, where businesses can gain competitive advantage by focusing on supply chain development instead of solely optimising their own operations.

2.4.1 Relationship management

In complex supply chains, where the provision of services involves several actors and possibly diverging flows of information, physical products and payments, there is a need for structured management and coordination. When the value proposition attracting the end customer includes elements provided by several actors, the need for an alignment structure, setting the rules and requirements for how partners collaborate in the value delivery process, becomes apparent. This is what is referred to as an *ecosystem* (Adner, 2016). Within the research field of supply chain relationships and business strategy, the ecosystem construct has been used to describe structures surrounding the focal company (Adner, 2016). Whereas the business model focuses on one specific company, ecosystems constitute network systems, and a structured overview of the context allows for successful strategic planning and analysis. In practice, the responsibilities of participating companies tend to be unequally distributed when companies intentionally or unintentionally adopt leading or following roles, increasing the risk of conflicts or challenges within the collaborative system (Adner, 2016).

According to Ziaee Bigdeli, Bustinza, Vendrell-Herrero, and Baines (2018), the establishment of partnerships within service supply chains generate a better understanding of a product-service value proposition. An ecosystem perspective can be beneficial in analysing the terms employed within the partnerships (Adner, 2016). This, together with the finding by Benedettini et al. (2015) stating that a high percentage of partnerships are unsuccessful, constitute two prominent reasons behind why it is essential to find the best partner to join forces with to achieve a successful servitization process. This gains support by Ayala, Paslauski, Ghezzi, and Frank (2017) stating that inter-firm knowledge increases, and performance can

be enhanced, by utilising respective actor's knowledge. However, many challenges are related to engaging in close relationships, why it is crucial to choose the right business partner for your operations to avoid problems such as information leakage.

Management of upstream supplier relationships incorporating information sharing and cooperation are prerequisites to delivering servitized offerings (Saccani, Visintin, & Rapaccini, 2014). The authors distinguish between different classifications of services, ranging from product supporting services ensuring through-life functionality, to process related services aimed at optimising customer processes. The more complex the service offering, the more investment in the relationship is required to develop trust and commitment. Consequently, when engaging in new supplier relationships, it is critical to shape the relationship according to the characteristics of the services being provided (Saccani et al., 2014). Supplier relationships already engaged in by an organisation should be evaluated to investigate how well the relationship characteristics correspond to the requirements posed by the service offerings, and to identify potential areas of improvement.

2.4.2 Provision of advanced services

The notion *advanced services* is an integral part of the servitization debate and is defined as *services whose outcome focuses on capability delivered through product performance* by Ziaee Bigdeli et al. (2018). The authors argue that advanced services change the relationship characteristics between customer, supplier and network actors by forcing the service providing company to implement new technologies and organisational structure. As identified by Benedettini et al. (2015), adoption of advanced services incur high risks on the servitizing organisation. Ziaee Bigdeli et al. (2018) argue that the perceived risk can be lowered by acquiring more knowledge and information about the value of advanced services. In this objective, companies have identified that partnerships with key actors in the supply chain, aimed at providing a PSS offering, can be a strategic move facilitating increased value capture.

Adopting advanced services can result in intertwined operations of the manufacturing company and its customers, caused by the extensive need for trust and co-operation between the parties (Vaittinen & Martinsuo, 2019). Comparably to the argumentation above where it is stated that it is critical to choose the best supplier to engage in a close relationship, it is also important to acknowledge the implications servitization impose on the customers. Vaittinen and Martinsuo (2019) argue that customers may not be susceptible to the advanced services provided, without extensive adaption to their organisation.

Vaittinen and Martinsuo (2019) discuss how a complicating factor when introducing advanced services is to fully understand the rationale behind customer decisions, including an example where a customer is reluctant to share sensitive information about their processes, and hesitate to tell the service provider that there is a lack of trust. As such, the reason behind not adopting the service originates in the customer readiness to externally source services. Therefore, manufacturers must be able to assess and ensure customer readiness for their service offering.

To mitigate the risk of discrepancies where the customers needs do not match the offering of advanced services, manufacturers need to know the processes of their customers well. Customer understanding allows manufacturers not only to meet customer demands, but also to identify their latent needs, to optimise the service offering with a long-term objective (Vaittinen & Martinsuo, 2019). Further, there is a need to gain a significant understanding of how the customers implement services to assist sales and service representatives in their work, as they can align their approaches according to specific customer needs. As such, it is essential to view the servitization from both a sales and customer perspective, as well as supplier perspective to fully understand its implications on a supply chain and its inherent relationships (Vaittinen & Martinsuo, 2019).

3

Methodology

In this chapter, the methodology employed in the thesis project will be introduced. This includes the theoretical background to the research design of the study, as well as the fashion in which the collected data is analysed. In addition, ethical factors will be discussed.

3.1 Research strategy

The methodology used during the process of a study is of significant importance, essentially setting the structure of the entire project, allowing for the creation of a structured plan of the work to be conducted (Bryman & Bell, 2011). A research strategy is defined by Bryman and Bell (2011) as *a general orientation to the conduct of business research*, and the distinction between quantitative and qualitative research is usually considered to be how this concept is implemented in business research strategy development. Briefly described, the former refers to a research strategy that employs quantification in the collection and analysis of data, while the latter refers to a strategy emphasising the use of words instead of quantification when analysing and collecting data (Bryman & Bell, 2011).

A qualitative research approach is used to generate an understanding of, and interpret, the world as perceived by participants. Emphasis is also placed on generation of theories rather than on testing them (Bryman & Bell, 2011). Based on this, as well as considering the aim and purpose of the study, a qualitative research strategy was determined to be most appropriate. This decision was based on factors including the supply chain structure and related flows, the fact that the project includes a single focal supply chain and the ambition to gain an in-depth understanding of underlying opinions and ambitions of the participating companies.

3.2 Research design

The general structure of a qualitative research structure is laid out in figure 3.1 below. The research design that will be described below follows the guidelines that are visualised. To outline the process briefly, the research questions that are defined provide a general sense of direction, guiding the research design process. As participants of the CirkLev project, the participating companies and their sites were already predefined, however, a process of determining suitable interviewees was conducted. The collection and interpretation of data was then performed in parallel with the theoretical research process as shown in the diagram below.

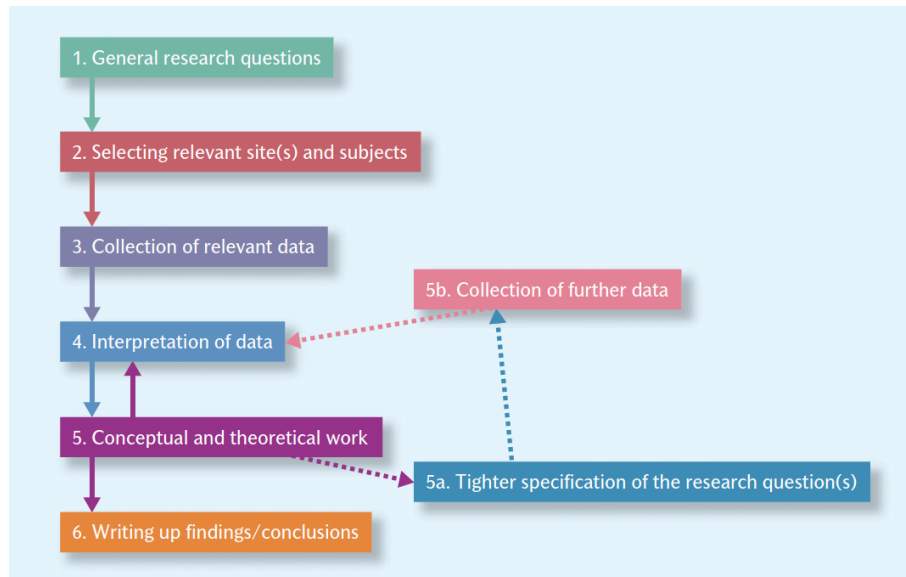


Figure 3.1: Qualitative research strategy (Bryman & Bell, 2011)

Considering the circumstances of the specific situation, that the research subject is a single supply chain, as well as the characteristics of the research questions, it was determined that a case study research design was most appropriate, in line with the recommendations of Bryman and Bell (2011), together with Yin (2018) stating that a case study is suitable when the research questions are of "how" and "when" characteristics, when the authors have little control over behavioural events and when the study focuses on a contemporary event rather than historical. The research questions posed in this thesis are considered to belong to the same category.

The case study can be defined as an empirical method that *investigates a contemporary phenomenon (the "case") in depth and within its real-world context, especially when the boundaries between phenomenon and context may not be clearly evident* (Yin, 2018). Case studies can be conducted in a number of ways, including for example by varying the number of cases studied or the type of data used. Other core characteristics of case studies include that triangulation, the process of using several methods and/or data sources to ensure validity (Deacon, Bryman, & Fenton, 1998), is carried out among various sources of data (Bryman & Bell, 2011).

Dubois and Gadde (2002) propose a methodology referred to as *systematic combining*, that aims to describe ways of dealing with these issues. In essence, systematic combining approach involves the collection and organisation of data related to four areas: frameworks, theory, the case and the empirical world. During the research process, the empirical data collected is allowed to reorient the research issues as well as the framework in order to provide suitable conditions for meaningful analysis (Dubois & Gadde, 2002). In line with this, Eisenhardt (1989) found that case study processes often result in an overlap between data analysis and data collection.

In this process, the initial theoretical framework merely serves as a preconception, evolving over time based on observations and analysis. This is partly represented by the diagram above, in figure 3.1, but the concept allows for the return even to the very first step of the process, the redefinition of the research question (Dubois & Gadde, 2002; Eisenhardt, 1989), a process which was performed regularly during the study.

While the preliminary framework consists essentially of the preconceptions of the authors, the observations of the study are used in its development, allowing for a thorough understanding of the theory that forms its basis (Dubois & Gadde, 2002). According to Eisenhardt and Graebner (2007), the use of case studies to develop theory is an increasingly popular research strategy, and that while there are a number of inherent difficulties resulting from its unique characteristics, these can be managed by ensuring the use of an appropriate research design, which is the reason why this strategy was chosen.

3.3 Data collection

The data collection phase of the project was conducted through an empirical study consisting of interviews. The data collected during the course of the project can be categorised as primary, meaning that which was collected only for the purpose of the study (Bryman & Bell, 2011). According to Eisenhardt and Graebner (2007), interviews are efficient means to gather rich, empirical data. As mentioned above, interviews constitute the primary data source for this project and were held with three companies representing three tiers of the stamping tool manufacturing supply chain.

The RISE-coordinated project, of which this thesis is a part, was the platform in which the initial thesis concept was developed. As a specific research area within the more general field of automotive industry circularity and sustainability, the CirkLev-project aims to research the case of a machine tool component manufacturer, their distributor and their exploration of business models with a focus on circular economy, specifically through the process of servitization. Companies A and B were participants in the CirkLev project when the thesis was initiated, and this is how contacts were established with both companies. These preconditions formed a basis to compose the aim of this thesis; to study the opportunities for various types of servitization and their viability with regards to which actor serves as the ser-

vice provider. In addition, as servitization theory tends to focus only on a single supplier, this study further aims to investigate the viability of servitization considering all levels of the supply chain, from the component manufacturer to the tool manufacturer, requiring the collection of data from various perspectives, focusing not only on the company which would eventually provide the service but also how the remaining actors are affected by the servitization process. In order to gain the perspective of the final supply chain stage, this thesis extends from the CirkLev participating actors to also include a tool manufacturer, Company C, with which Company B already has a long-term close business relationship.

From a validity perspective, it is worth commenting upon the fact that RISE did not specifically search for Company A and Company B as partners but the project is a result from these two actors expressing interest in exploring new business models. As such, there could be a risk that the opinions and thoughts expressed by these companies are more open-to-change and thus not representative for every actor in the tool and die industry performing the same activities. However, the ambition of this thesis is not to evaluate the feasibility for a specific company to servitize based on their predetermined standpoint, but to collect data and identify factors applicable and valid for the entire industry. To accomplish this, we aimed to explore with company representatives during interviews whether their operations were comparable to their competitors or if there were any major deviations. Performing a case study about business model development in companies which are resistant to change would, naturally, defeat its purpose, further justifying the methodology employed in selecting the participating companies. Serving as an empirical example of how function-based service innovation happens, and its associated challenges and barriers in an industry where business characteristics tend to be similar, the specific characteristics and identities of the companies are considered to be of lesser importance.

In addition to this, interviews were conducted at two customer companies in order to gather information about the needs and requirements of the tool end users. These were used as a tool to further ensure the validity of the statements by Companies A, B and C as well as to identify inconsistencies between the actor's viewpoints. As a complement, regular meetings were held with representatives from the project coordinating company RISE, to answer project-specific questions and to ensure that our thesis followed the scope of the parallel project funded by the Swedish Energy Agency. The interviews followed a semi-structured approach, where a set of questions had been prepared on beforehand but complementary questions was allowed during the interviews. The choice of a semi-structured approach was derived from the the argument by Dubois and Gadde (2002), stating that a more passive role by the interviewers allow more active answers by the interviewees. This corresponds to the authors' aim to create a flexible interview environment where the interviewees were allowed to elaborate their opinions, and for the authors to be able to follow up on unforeseen questions that arise during the interview.

Interviews were held with employees at various positions, to generate a holistic view of the organisations and gain a comprehensive understanding of their operations

as well as the supply chain characteristics. According to Eisenhardt and Graebner (2007) it is essential to interview informants from various areas within an organisation, with diverse perspectives of the focal problem to limit bias. The research questions acted as guidelines to outline interview questions, and selection of interviewees was performed by the authors and in consultation by the project companies to find the interviewees with best knowledge related to the tool and die industry as well as the project scope. The interviews lasted on average about 50 minutes where both authors were present, together with one interviewee. The roles during the interviews were distributed by having one person taking extensive notes and observing the interviewee, while the other person asked questions and had a relatively passive role focused on listening to the interviewee. This approach allows, according to Bryman and Bell (2011), the passive interviewer to have better control over the interview in terms of topics covered and the possibility to change the direction of questions if needed.

A continuous information sharing process was established with the project participant representatives in order to ensure that their views are represented fairly and that factual statements are correct. During interviews, the company representative was given the opportunity to confirm or contradict facts and statements by the authors asking whether or not the information was interpreted correctly. In the construction phase of the report, written material was sent out to the project companies, with the objective to ensure the validity and correctness of the facts by adjusting the information according to their comments. All interviews have, with interviewee consent, been recorded to make the data available in later situations, and a daily journal has been kept as a means to further visualise the process. In table 3.1 below, the number of interviews held are presented, together with role within the organisation.

Table 3.1: Overview of interviews

Company A	Number of interviews
Sales Manager Europe	2
Global Sales Director	1
CFO	1
Company B	
CEO	2
Sales Director	2
Quality and Sustainability Manager	2
Company C	
CEO	1
Customer X	
Stamping Tool Workshop Manager	2
Customer Y	
CEO	1

3.4 Data analysis

In assessing the quality of the research conducted, it is necessary to consider multiple perspectives on the design, research methods, the data collected and its analysis within the project (Bryman & Bell, 2011). As this thesis consists of a qualitative research methodology incorporating a case study, the social settings in which the study was performed are dynamic and constantly changing over time. Because of this, it is unlikely that a later researcher will arrive at the exact same results. However, the research methodology have been thoroughly documented to generate a transparent process.

The process of analysing the collected data consisted of several stages, and a structured approach to the process is necessary in order to ensure that the results are valid and reliable (Bryman & Bell, 2011). The interview data collected represented the viewpoints of specific individuals employed at the supply chain actor and customer companies, who each have varying interests and opinions with regards to the topics studied. These were performed in accordance with the general procedures associated with semi-structured interviewing as discussed in section 3.3. The structured approach where extensive notes were backed up by voice recordings ensured that the viewpoints of the interviewees were represented accurately (Bryman & Bell, 2011).

During the analysis phase, the authors first independently reviewed the collected data and thereafter compared the resulting categorisation. Specifically, the data relating to issues regarding general business transformation processes and business model innovation were separated from that which focused specifically on servitization. The data remaining after the initial sorting process was thereafter codified with respect to the theoretical framework that was previously established. Moreover, regular meetings were conducted with researchers working within the project, in order to discuss relevant issues. More generally, as presented in section 3.2, the methodology of systematic combining enabled several categories of data to be taken into account, utilising the theoretical framework to generate a theoretical understanding of the empirical world.

The data analysis process enabled an organised approach to the construction of the results and discussion chapters, where the general circumstances and contextual factors affecting the industry were described first, investigating trends and practices, after which the companies studied were investigated in further detail. The circumstances supporting and posing as barriers to servitization were analysed with respect to each company separately as well as the supply chain as a whole. Additionally, the analysis was performed separately with regards to different types of services, relating to the theoretical framework, summarising the perceived opportunities for future development within the supply chain as well as the industry overall.

3.5 Research ethics

In business research, ethical issues and considerations may become relevant at several stages during the study. Diener and Crandall (1978) classified the main ethical issues into four areas:

- whether there is *harm to participants*
- whether there is a *lack of informed consent*
- whether there is an *invasion of privacy*
- whether *deception* is involved

In considering the likelihood of these ethical issues having occurred within this study, it is necessary to consider the impact of each individual step in the research process upon each of the actors involved. The boundaries between ethically acceptable and unethical practices are often difficult to determine, which is why these concepts require specific attention in the study design process (Bryman & Bell, 2011). As a natural consequence of the nature of the study, where no physical experiments or implementations of any changes are performed, its impact to the operations of the companies and/or the participants and researchers is considered to be non-existent. Specifically, the four categories will be analysed below.

The risk of causing harm to study participants is regarded to be minimal, considering that all participants are volunteers and that no potentially sensitive personal data is involved. For the same reasons, the risk of not ensuring the establishment of informed consent can be ruled out as the entire study methodology was explained to and approved by the company representatives in advance. Guidelines with regards to the scope of the study have been explained to all participants on several occasions, as well as in writing. With regards to privacy matters, the procedures of consent establishment as well as the definition of the project scope similarly ensure that the risk of sensitive information being released is minimised. Furthermore, deception will not be used in the study as all participants are fully aware of its purpose and the processes involved (Diener & Crandall, 1978).

4

Current industry situation and case description

In this chapter, the specific context of the tool and die industry will be described, and research investigating current servitization processes within the industry will be studied. Additionally, the specific companies of the case supply chain will be introduced in further detail.

4.1 Introduction to the tool and die industry

The process of shaping sheet metal by applying force, moulding the metal between two tool halves (see figure 4.1 for example), is referred to as *stamping*. This process is used heavily in the automotive industry, and it is steadily increasing in popularity (Technavio, 2017). The global tool and die industry market is expected to grow by 8.0% annually from 2019 to 2026, reaching a market size of approximately 470 billion USD (Allied Market Research, 2016). The automotive industry is the largest consumer of its products and services, accounting for around 70% of their revenue. Traditionally, the industry has been dominated by North American, European and Japanese actors, but today competitors in other Asian and Pacific (APAC) countries are gaining market shares (Allied Market Research, 2016).

In series production, it is estimated that approximately 60% of the cost of performing the relevant tool-employing processes originate from the cost of the tool itself, thus companies are highly incentivised to reduce tool costs in order to increase production efficiency (Schuh et al., 2016). This trend can be observed within the automotive industry specifically, where automotive suppliers tend to reduce the number of tools required for the manufacturing of each vehicle type. This, however, requires the ones that are used to be more complex (Tang, Eversheim, & Schuh, 2004). The automotive industry has become known for the high demands placed on suppliers by vehicle manufacturers with regards to pricing (*price deflation*) and payment terms (Holmes et al., 2005). These vehicle manufacturers can be referred to as Original Equipment Manufacturers (OEMs), and serve as final owners of the stamping tools.



Figure 4.1: Stamping tool mounted inside press

4.2 Industry trends and innovation practices

Within the tool and die industry, a number of projects where servitization concepts are introduced have been conducted. In this section, a number of these examples will be presented, serving as guidance for the interpretation of theoretical frameworks in relation to the empirical data collected as part of this study. The market trends of globalisation, changing financial conditions as well as increasing competition from Asian suppliers pose a significant risk to the current business models of Swedish toolmakers, according to Company B and C representatives, and in order to remain competitive there is a need for innovation (Schuh et al., 2013). When the financial stability, mainly with regards to cash flow, of industry actors is jeopardised, this allows for new entrants to challenge traditional industry business patterns, taking advantage of the inherent market power imbalance in the industry (Holmes et al., 2005).

Schuh et al. (2016) introduce a number of characteristics of the tool and die industry, describing market trends and emerging challenges which are highly relevant to the case in question. Traditionally, Western European tool manufacturers have had a significant competitive advantage with regards to tool quality compared to Chinese and Eastern European competitors for example. However, as these actors steadily improve their products, it is becoming increasingly difficult for the Western European manufacturers to maintain market shares considering the price advantage that their competitors can achieve in countries where labour is significantly cheaper (Schuh et al., 2016). Thus, there is a clear need for differentiator development within the Western European tool and die industry, if the competitive advantage is to be retained.

Within the product-service continuum, there are varying degrees of service complexity, ranging from value adding services such as tool maintenance contracts to the provision of the entire tool itself as a service (Coreynen et al., 2017; Schuh et

al., 2016). Schuh et al. (2016) provide a number of examples of PSS applications within the tool and die industry, including relatively conservative measures such as the provision of maintenance services as well as more innovative solutions including involvement in component development, prototyping, installation and testing. Tang et al. (2004) introduce a number of proposed strategies for development of the tool and die industry product-service offerings, focusing specifically on the principles of cooperative development, aiming to integrate supply chain actors in value co-creation. Services integrating these concepts could include for example involvement of upstream supply chain actors in design and optimisation of tool layouts and component selection (Tang et al., 2004).

Schuh, Potente, Schittny, and Wittek (2011), in a study of European tool manufacturing companies, investigated business model development processes and intentions within a number of different categories. The data shows that the customers value guaranteed tool availability (up-time) the most, followed by services such as real-time optimisation and monitoring of the production processes. It is apparent that a large proportion of toolmaker companies are studying opportunities for business model development, however there is a mismatch between what the customers demand and what the toolmakers are planning to provide. This, of course, could be caused by valid factors such as the unfeasibility of what the customers demand, or it could originate from a misunderstanding of how customer value is created. Most toolmakers, in any case, focus their service offering development on providing design assistance, spare part and preventative maintenance availability (Schuh et al., 2019; Schuh et al., 2011). The full data set can be found in figure 4.2.

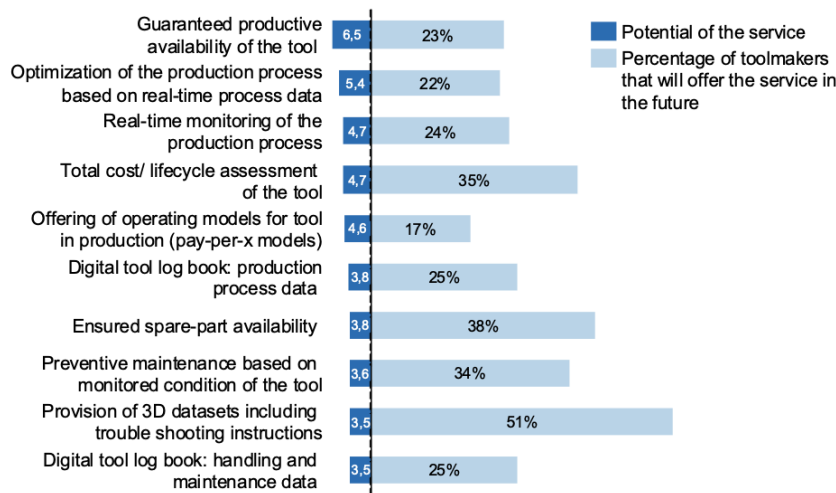


Figure 4.2: Potential of a service vs. percentage of toolmakers planning to offer the service in the future (Schuh, Potente, Schittny, & Wittek, 2011)

4.3 Supply chain structure and actors

In a supply chain, naturally, every company is a customer of each upstream actor. However, in this report, the term *customers* will be used to describe companies which manufacture sheet metal details using the final stamping tool. When these details are then sold to their customers (automotive manufacturers) in turn, that company is referred to as an OEM. In this section, the overall structure of the supply chain will be presented, and for clarity it is visualised in figure 4.3 below. In addition, two customer companies are introduced, and their relevance to the project supply chain is described.

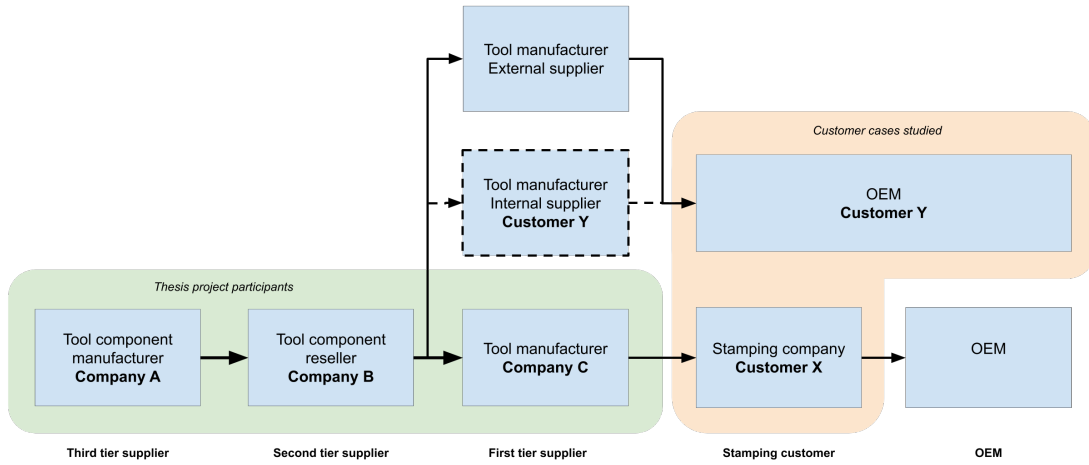


Figure 4.3: Supply chain structure

Starting from the upstream end of the considered supply chain, Company A manufactures tool components. In stamping processes, the tools used can contain a large amount of components, several hundred in some cases, where Company A products account for some of them, according to Company A representatives. As a tool component reseller, Company B purchases tool components from Company A along with a wide variety of components and products from other suppliers as well as those from its own production, keeping them in stock. These components collectively constitute what is necessary to construct a complete tool, and toolmakers are able to order what they require for each of their customer orders. Thereafter the tool manufacturer, Company C, manufactures complete tools, machining metal blocks and mounting all required components ordered from the reseller, after which the tool is complete and can be delivered to the stamping customer.

In figures 4.4 and 4.5 below, the flows of materials and communication in the supply chain are outlined in further detail. The figures display two supply chain configurations identified within this study. The first figure describes a situation where the stamping company sells the tool further to an OEM, while the second figure relates to the situation where the stamping company is the end consumer of the sheet metal detail, i.e. is also the OEM. These configurations are considered by

the project actors to be representative of the industry as a whole, on the Swedish market. In figure 4.3 above, these are represented by the path from Company A to Customer X and Customer Y, respectively.

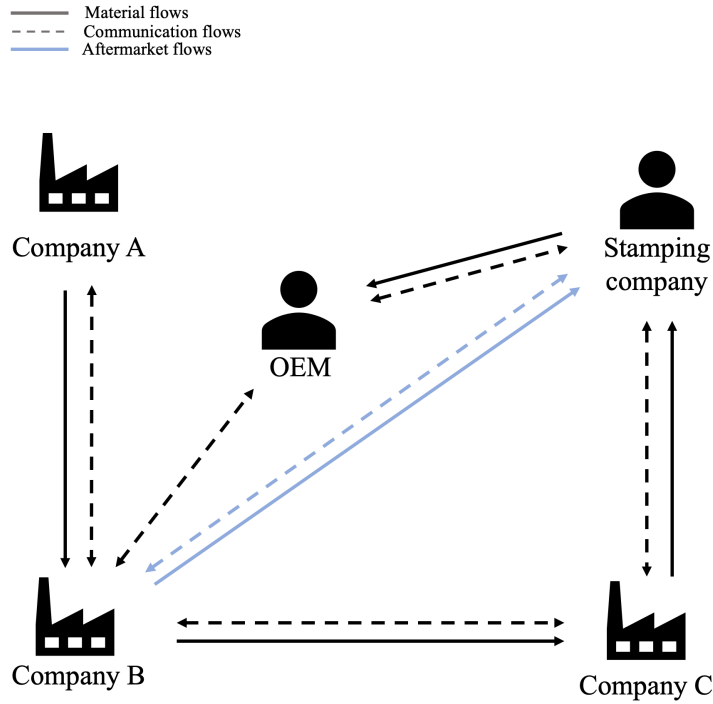


Figure 4.4: Supply chain flows, sub-supplier customer case

Company A is situated furthest upstream in the supply chain, as the supplier of stamping tool components. The materials flow follows a linear course, where the component is sold to the retailing Company B, before being assembled in a tool and sold to the customer. Monetary transactions are in line with the materials flow, however in the opposite direction. In the first case, displayed in figure 4.4, the stamping is performed not by the OEM but by one of their suppliers. The stamping tool, however, is still owned by the OEM. The figures also display aftermarket flows, where spare components are sold directly to the stamping company, who may perform internal repairs and maintenance.

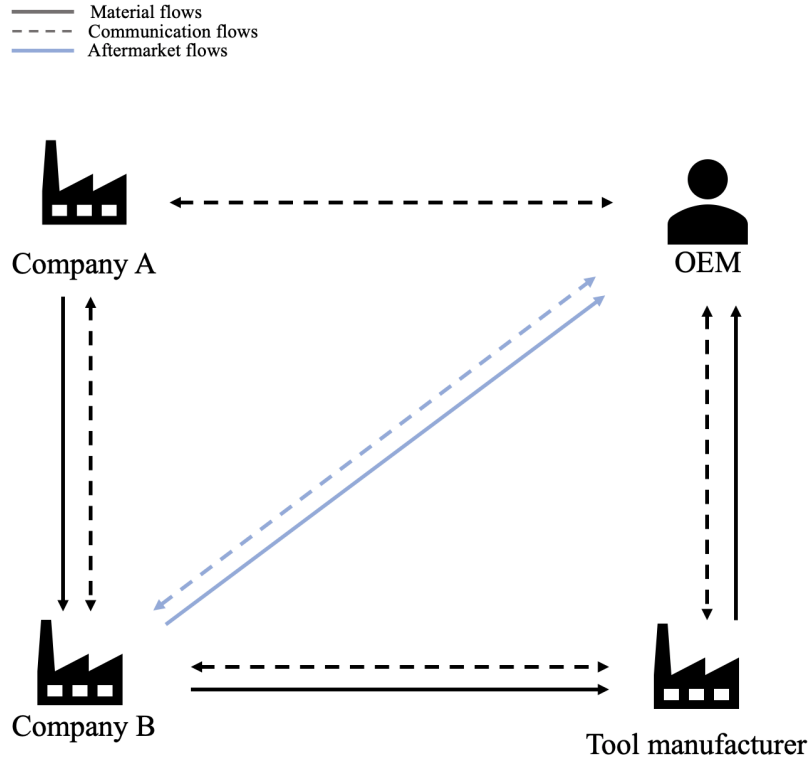


Figure 4.5: Supply chain flows, OEM customer case

In the second case, as displayed in figure 4.5, the OEM is also the customer, and will therefore utilise the sheet metal details in their own production. In this case, the OEM is the actor ordering the tool from the tool manufacturer, meaning that they are in contact with the tool component retailer, influencing the selection of components. This is in contrast to the first case displayed in 4.4 where the OEM does not participate in component selection and the tool ordering process. Otherwise, the flows are similar.

4.3.1 Company A - Component manufacturer

Company A is a Swedish company manufacturing, among other products, components used in mass production of sheet metal forming tools. The company employs approximately 350 people, with manufacturing and assembly based in Sweden. Their yearly turnover is 870 MSEK, their export ratio amounts to 90-95%, and their market share is approximately 40-50% in the European and Chinese specific tool component industries, according to Company A representatives. Among manufacturers of their specific type of stamping tool component, Company A is world leading.

Quality and safety are important company objectives and focal areas for continuous development, according to the representatives. The company representatives also expressed how customer relationships, i.e. to wholesalers and retailers, are very close and usually have developed over a long period of time, as in the case with Company

B. The relationships reach past the first tier customer perspective, as Company A communicates directly with end-customers and participates in maintenance training sessions, in this case for example with the automotive industry (Customer Y), along with Company B.

It was emphasised by several of the Company A representatives during the interviews that while the company previously has been able to retain their competitive advantage based on the quality and reliability of their products, increased competition mainly from other European and Asian companies who steadily improve their quality has caused more customers to opt for lower cost components. The interviewees unanimously argue that this in turn requires the company to increase the competitiveness of their pricing structures, and these trends are the basic reasons behind the challenging market conditions that define the situation of the company today.

4.3.2 Company B - Component retailer

Company B was founded in 1985 in Sweden, has grown continuously since then, and today they have 23 employees. The yearly revenue of the company is approximately 80 MSEK, stated by Company B representatives. The company holds approximately a 50% market share in Sweden. The market has historically been stable, where the number of tool component retailers have been relatively static, and the target customer segment has remained the same. The manufacturing process of stamping tools has remained the same over the past decades, where the most significant change is that the tools are becoming increasingly advanced in terms of function and size, where larger details can be produced in a single stroke.

Company B supplies tool components from a large number of leading brands as well as from their own production. In Sweden, Company B is the only reseller of Company A components. With regards to the main product range of Company B, tool components and associated products, the customers are either tool manufacturers or OEMs that perform in-house tool production. In addition, they supply spare components to any actor in need. According to company representatives, considering the majority of transactions, the OEMs purchase components mainly for the purpose of repairing or refurbishing tools already in use.

The company is able to supply all components to a stamping tool, of which the components provided by Company A is significant and constitutes about 50-60% of component value, according to company representatives. As described by the sales director, while the company maintains close collaboration with a small number of customers where they form a partnership providing complete sets of components to build a tool, the majority of customers are characterised by ordering smaller amount of components. The managing director describes how the ambition of the company is to maintain the high quality of components they currently offer, as well as their ability to keep delivery times low. Occasionally, according to the representatives, Company B, along with Company A, provides additional services such as training and refurbishment to end customers.

4.3.3 Company C - Stamping tool manufacturer

Company C is a small tool manufacturer located in southwestern Sweden. The company employs 40 people and the yearly revenue is approximately 70 MSEK, making it similar in size to Company B. The company is one of Scandinavia's leading manufacturers of sheet-shaping stamping tools, primarily used in the automotive industry. The stated ambition of the company is to be innovative and in the technological forefront, in order to optimise the production of their customers. Revenue is generated solely from sales of complete tools ready for production, no sales of components or services are currently offered by the company. Currently, the company focuses on increasing the production efficiency by introducing automation to shorten lead times. For financial reasons, customers want to postpone the order point as long as possible, and in combination with the customer wish to being able to make adjustments to the tool design late in the development phase, making short lead times essential in responding to customer demands.

The price of a tool, according to company representatives, varies between approximately 100 000 and 5 000 000 SEK. Out of the total price of a tool, as sold by the manufacturer, approximately 10% of the cost can be derived from components, and 15% from raw materials such as steel. Components used to build a tool are almost exclusively sourced from Company B, the only exception is when a component outside of Company B's assortment is required. The customer base consists of approximately 600 companies globally, comprising both small as well as large enterprises, and the export ratio currently amounts to 40%. Company C operates in an environment with 20 direct competitors performing corresponding business activities. 4-5 of these companies hold the capacity to produce large tools, while the remaining actors on the market mainly produce smaller tools. Company C can produce tools within both segments, and the general rule is that companies which are able to manufacture large tools can also manufacture small tools.

According to company representatives, stamping companies view the quality of the tools and the ability to influence and adapt the design and manufacturing process to their specific needs as critical. In addition, the company emphasises the need for high quality components and manufacturing processes in order to satisfy the performance demands of the customers, ensuring high levels of reliability and durability of the tools. When tools are manufactured, the customer is involved during the entire process, collaborating with the manufacturer during the design process and regularly checking on the process during manufacturing, which can be time-consuming. Company C will also often participate in installation and testing of the tools at the customer facilities.

Due to the level of customisation within the tool design and manufacturing processes, Company C contributes to problem solving within the customer operations, contributing to all phases of the tool acquisition process, participating in design, planning, installation and testing. In its operations, Company C is highly reliant on partnerships with other actors. Within the studied supply chain, this is exemplified best by its partnership with Company B, which is very important. This relation-

ship, by which the company acquires nearly all of its components, is characterised by close communication. The financial situation of Company C is currently stable and the business is not subject to any major financial issues. This is mainly due to the extensive knowledge and competence inherent in the company, as well as their ability to accurately forecast future market states in order to improve their operations, according to company representatives.

4.3.4 Customer X - Stamping company

The first customer company studied, Customer X, is a contract manufacturing company within the sheet metal forming industry. The company offers services within stamping, welding and painting to OEMs and tier 1 suppliers in the automotive industry. One of these customers in particular accounts for a significant portion of its revenue, as a major automotive industry OEM and Customer Y competitor. Customer X is located in relative proximity to Companies B and C in southwestern Sweden, and the yearly revenue is approximately 200 million SEK. The company is more intrinsically connected to the remainder of the supply chain actors studied, in that it sources the majority of its stamping tools from Company C, which in turn utilises A and B components. In cases where the OEM is not the actor performing stamping processes, there are no standards or restrictions on the types of components used, enabling the company to use the vendor which they prefer, for financial or other reasons.

4.3.5 Customer Y - Automotive OEM

The second customer company studied, Customer Y, is a major Swedish automotive manufacturer, located in Gothenburg. In the stamping facility located at their main plant, sheet metal components are manufactured for use in assembly plants all over the world, for their entire product range. In the facility, there is a tool workshop where preventative maintenance as well as urgent repairs are performed on tools and tool components. Refurbishment of tool components is also carried out where possible. The tools used in stamping processes within the Customer Y plant are sourced from various manufacturers, however not from Company C. They are included nonetheless in order to provide the perspective of a major company in the context of stamping tool sourcing and manufacturing. In addition to the externally sourced tools, a number of tools used for smaller details are manufactured by a satellite workshop located in the south-east of Sweden. This workshop additionally provides support in case of major tool breakdowns. In accordance with the terminology introduced above, Customer Y is both a customer and an OEM.

Company A components used in the manufacturing of stamping tools are chosen based on customer specifications. Customer Y has established standards which lay out the component brands that may be used, where the tool manufacturer has the ability to choose between those included on the list. In the case of the component manufactured by Company A, the Customer Y standard includes several brands, which are all manufactured by Company A. On the Swedish market, as a consequence of the A-B partnership, the Company A component included in Customer

Y's specification can solely be sourced from Company B. Tools manufactured outside Sweden for use on the Swedish market, however, may use components sourced from local markets, as long as they are still in compliance with standards requirements. This means that, when intended for use in Customer Y stamping tools, components of the type manufactured by Company A may not originate from any other manufacturer. For further details, refer to figure 4.3.

5

Empirical findings

In this chapter, empirical data collected from interviews will be presented. The data is structured according to which factors act as servitization enablers and opportunities, and which are potential barriers. Additionally, an overview of the findings are presented, as well as perspectives from two customer companies, which together serve as an essential basis for the following discussion.

5.1 Company A - Component manufacturer

5.1.1 Opportunities with servitization

The interview representatives from Company A, presented in table 3.1, coherently express potential benefits servitization could offer to the company, as well as to the supply chain as a whole. The representatives express that while opportunities for Company A itself to act as the provider of the tool as a service is limited, its effects if introduced downstream would propagate up the supply chain. The increased long term stability and profitability of their customers will affect their operations positively as well, as the success of their customers will likely result in increased component sales. Additionally, as stated by the interviewees, the fact that 60-70% of the components are sold to the automotive industry means that the company is subject to significant uncertainty with regards to shifting trends in customer order volumes, and long term stability would reduce this risk as well.

Servitization within the supply chain could lead to a new revenue stream where incomes would become more predictable and revenues secured over time. (Chief Financial Officer, Company A)

5.1.2 Challenges with servitization

The Company A representatives express uncertainty regarding the feasibility of servitization of the entire tool, and specifically with regards to the relations between companies involved at the initial stage. This includes not only the process of determining who provides the actual service in the eyes of the customer, but also whether it is realistic, or even desirable, to include providers further upstream in the supply chain than the tool manufacturers in an initial servitization project. Includ-

ing such complicating factors would require ensuring that a structured system is in place for dividing the profits as well as the costs and responsibilities associated with the provision of the service between the actors involved, a perspective emphasised by all interviewees.

All of the interviewees argue that actors participating in the product service system transition process will also need to consider the risks involved with regards to changes in the market power situations of the individual companies. It is inherently difficult to predict which actors may be positively affected by the PSS transition, and who may be negatively impacted. Regardless of how a service is sold from the perspective of the customer, sub-suppliers such as Company A in this case will still need to serve as innovation partners, playing a highly important role in the supply chain, which is important to consider in any case, according to the representatives.

Another factor discussed was the needs and requirements of the customers, where the Company A representatives express doubts regarding the willingness of customers to transition into purchasing a service instead of a product within the relevant field. How could major companies compare the price of a stamping service with that of a competitor's tool as a product for example? The representatives additionally expressed uncertainty with regards to how a new payment model could be structured.

I don't know, maybe you could charge per tool or per month? Could it be based on the functionality? If we lose the customer focus, this wouldn't be good for us. (Sales Manager Europe, Company A)

The components manufactured by Company A do not constitute a significant share of the final cost of the tools in which they are used, something which affects the role of the company as well, a fact acknowledged by all company representatives. Furthermore, the representatives express uncertainty with regards to what the customers actually demand, as stated in the quote below. All types of services that are priced according to volumes are considered high risk according to the representatives, as this includes the dependence on the order volumes of the end customers. The increased use of the tools must somehow be incentivised.

In their manufacturing process, isn't a complete pressed sheet of metal what the customers actually want? Can this be delivered without selling or otherwise providing a tool as a service at all? (Global Sales Director)

5.2 Company B - Component retailer

5.2.1 Opportunities with servitization

The servitization opportunity initially brought up by the Company B representatives involves the possibility to transfer ownership of the tool and instead sourcing the service tool assembly from a tool manufacturer, such as Company C. Company B would then own the tool, and in an extension provide the production ready tool to the customer instead of Company C. When the representatives were asked the question of how they imagine the implementation of the servitization process in practice, they imagine it as a pilot project, starting with a single tool manufacturer. By introducing such a, currently, industry unique solution, the chief executive officer states that the aspiration is to acquire a 70-80% market share. The risk that tool manufacturers other than Company C would perceive the pilot project as a threat which benefits the specific tool manufacturer participating in the pilot project, and therefore might opt to source components from other companies than Company B is not believed to be major by the company. However, the CEO acknowledges the ability of the tool manufacturers to servitize, which at first sight may seem like a more natural choice, as they are placed downstream and closer to the customer in the supply chain.

Another of the opportunities servitization could offer, according to the company representatives, is to increase revenue, for example by offering the components or the final tool, manufactured by Company C, as part of a new service model or by enabling the company to collect payment for value adding services which were previously offered free of charge to tool manufacturers and end customers. These include performing tasks such as assisting with testing and providing training for customer operators. As margins in the industry become thinner, the company has identified a need to increase revenue in this respect. However, these service offerings currently constitute a very small part of the business activities, restricting the potential impact the initiative could have financially. The interviewees also acknowledge that it may be difficult to convince the customers to pay for services they are used to receiving for free. It was stated by company representatives that it is essential to invest in quality and delivery times because of the market threat where competitors are cutting prices as a strategic move to win customers.

The increased attractiveness of the company value proposition that may result from servitization could, according to the representatives, have a positive impact on the entire supply chain. The representatives believe that the industry wide cash flow issues as well as increased outsourcing to foreign competitors could be alleviated by this as well. When the overall financial situation of the actors that are currently most pressured improves, the representatives believe that this will ensure the stability of their suppliers as well.

The customers are always complaining about OEM payment terms, a new model would be beneficial for the entire industry. (Sales Director, Company B)

The company representatives expect that their own market position could be strengthened by a service transition, despite the fact that they are less pressured financially than their immediate customers (the tool manufacturers) at the moment. The sales director describes that the current situation, where margins are added at every step in the supply chain makes the distribution of risks and responsibilities unequal. As the tool manufacturers benefit from cash flow issue relief, they may be inclined to use the services of Company B rather than their competitors, providing further security and future commitments for company B, according to the belief of the managing director.

One of the company representatives expressed a personal view that a leasing model could be a suitable first step towards servitization. In this case, the responsibility for service and maintenance as well as the provision of the tool function could remain with the tool manufacturer. The increased predictability of cash flows is the main reason used in this determination. With regards to end customer willingness to adopt new service solutions, the company representatives believe that large Swedish OEM companies are approaching a sufficient level of preparedness.

I believe that the big OEMs are approaching enhanced maturity when it comes to servitization and leasing. As concepts such as the sharing economy become increasingly prevalent in society, we believe that the time is right for the introduction of new business models. (Chief Executive Officer, Company B)

According to the representatives, the company sees other opportunities in transferring some control of the tool assembly process to their own company as well. For example, in case the customer purchases the tool function instead of the physical tool consisting of individual components, the company could ensure that only components from their own product offering are used. One of the most significant benefits identified by the company is that the servitization process enables customer relationships to transition from single transactions to long term provider-customer relationships.

5.2.2 Challenges with servitization

The company has identified a number of factors that may prove challenging or difficult in the process of transitioning to a service offering. These include the dynamic market conditions with respect to increased competition and increased innovation, as well as factors such as the risks imposed by currency fluctuations. The representatives note that the company has not identified any major changes recently that increased the urgency of a product service system transition, however there is a general uneasiness within the company with regards to the possibility of competitors introducing new or revolutionary materials or products, something which has been rare historically due to the low levels of innovation within the tool and die industry. Additionally, they have identified the risk of competitors trying to match new offerings and stated during the interviews is the belief that almost 100% of the competitors would follow in their service offering. The representatives also

express self-criticism with regards to efficiency within production and responsiveness to customer demands and requests.

A concern of ours is that competitors will beat us in the introduction of new materials and products. Better efficiency in production, responsiveness to offers and short delivery times is required. We deliver the best quality but sometimes find it challenging to answer to rapid increases in customer demand, which may affect our delivery times negatively. (Chief Executive Officer, Company B)

With regards to risks introduced by servitization initiatives, the representatives mention the risk of supply chain actors failing to adapt to the new business model, bringing down adjacent companies with them, as well as the distribution of responsibilities in case of financial losses. New types of financing will introduce additional costs, and these need to be transferred to the customers, according to the sales director. As risk increases, the representatives express a need to adapt accordingly by adjusting the value proposition. In addition, the complexity of the current flows of communication within the supply chain increases the complexity of developing a new offering. For example, representatives describe how they, in their relationship with customer Y, are required to maintain continuous contact with 70-80 people within the highly fragmented and complex customer organisation, a challenging task.

The economic risk is great. Can the increased costs incurred by servitization be transferred to the customers? The risk has to be covered.
(Quality and Sustainability Manager, Company B)

In assessing market receptivity to new types of value adding services, the representatives judge that the market is a few years away from being ready for a new perspective on the offering, seeing a service that solves a problem instead of a single product transaction. In their opinion, a new financing solution for the current business model could probably be introduced sooner than value added services. The company is unsure how customers would react to having to pay for services such as training sessions and installation that are offered for free along with the product today. With regards to new offerings in general, the representatives believe that few customers have considered their need for new tool and die offerings, but that they could almost certainly benefit from them.

While improving quality and delivery time differentiates Company B from competitors, representatives emphasise the need to find a balance between maintaining price levels high and respond to the lower market prices, as competitors successively are increasing their quality levels. In a pure service offering, where customers pay solely based on their level of usage of the tool, the representatives believe that the risk is considerable, mainly due to significant order level variation in the automotive industry, which accounts for a large portion of revenue. Models such as leasing are considered to be more predictable, and subscription services such as maintenance could be offered in addition to this, according to the managing director.

Leasing would generate a predictable revenue stream. We could charge for services such as assembly, design, testing and training, that are provided for free today. The responsibility for service, maintenance and function would remain with the tool manufacturer. (Chief Executive Officer, Company B)

5.3 Company C - Stamping tool manufacturer

5.3.1 Opportunities with servitization

On the topic of current financial arrangements in the industry, specifically with regards to the automotive industry, the representative expressed that large OEMs are continuously trying to delay payment as much as possible, which is obviously beneficial for their own financial performance. This is in line with statements by the other supply chain actors.

They won't pay before someone's driving the car. (Chief Executive Officer, Company C)

These trends will, as previously discussed, propagate through the supply chain. For example, suppliers who provide stamping services are required to invest in expensive tools significantly earlier than when details are actually delivered to the OEM, which is the point where the payment "timeline" starts from the perspective of the OEM, and the supplier will consequently be paid several months later. The consequence of this is that the supplier is unable to pay for the tool until long after the tool is delivered. Similarly, this process applies for the next step in the chain, causing the cash flow issues of the tool manufacturer. The CEO expressed the opinion that a solution to this problem is what the customers mainly are looking for. Elaborating on this, the belief that stamping companies, in general, are willing to innovate and transition to new business models in order to achieve financial relief was also expressed.

It's all about the financing. I think that's what the customers want. (Chief Executive Officer, Company C)

In the case of automotive supply chains, the CEO expressed the opinion that customers and OEMs in turn would be willing to accept the added cost of new financing solutions in exchange for the cash flow benefits that such solutions would provide. In fact, OEMs today are spending large amounts of money on solutions which enable them to pay their suppliers as late as possible, even intentionally delaying payment as they view the costs associated to be acceptable, according to the CEO.

According to the CEO, negotiations between OEMs and their suppliers with regards to payment terms are constantly ongoing, and are often challenging. This is an indication of the need for new business models and cost structures, which could be delivered in the form of servitization. Solutions such as this can also assist in reducing risks within the supply chain. In the industry, servitization concepts are

becoming more popular, with small scale pilots being conducted by a number of actors. For the manufacturer, this provides an opportunity for increased revenue in case customer order volumes are higher than expected, but the opposite is also true. The CEO expressed that, when pay-per-use service models are employed, there is a need for accurate prognoses in order to ensure success for both the supplier and the customer.

Customer X is also conducting pilots where they want the tool for free, paying instead per stamping operation. In that case, it's all about the prognoses. (Chief Executive Officer, Company C)

With regards to solutions other than those involving the servitization of the entire tool, the CEO expressed that a model where a tool is leased over a fixed time period, such as three years, after which the ownership of the tool would be transferred to the customer, could be suitable. In addition, maintenance services could be offered for a fixed price. Of course, there are many possible variations as well. Among others, the CEO listed types of subscription and pay-per-use service models.

I'm convinced it would be a great sales argument. It would stir things up in the market and add value for the customers. It would also allow them to improve business with their customers in turn. (Chief Executive Officer, Company C)

5.3.2 Challenges with servitization

A number of possible servitization configurations can be imagined by the Company C representative. However, when asked the question if a possible alternative would be for Company B to source the service of tool assembly by Company C and take over ownership of the final tool, the representative express scepticism. It is not believed to be a suitable supply chain configuration for Company B to manage, in terms of communication abilities and relationship towards other customers. In addition to the already existing business of Company B, they would have to extend their communication network to also include all of Company C's current customers, which the CEO believes to be infeasible. In addition, the Company C representative express that there is a risk in such a set up that Company B will be perceived as biased towards Company C by establishing such a relationship. By extension, the representative believes that it can result in Company B losing potential tool manufacturing customers as they would opt to source components from a retailer neutral from collaboration with one of their direct competitors. Rather, it is believed by the Company C representative that Company B could provide more value as a financing partner for tool builders, in exchange for customers using their components when building tools.

No, I don't think that would be a good alternative. For us it wouldn't be a problem, but I don't think that Company B would be able to manage all communication needed. Moreover, I believe that they face the risk of negatively affecting their relationship with other customers by appearing biased towards us. (Chief Executive Officer, Company C)

While the representative believes that the introduction of a financing solution, such as leasing, is needed in order to answer to customer demand and alleviate their cash flow issues, there are also some factors that needs to be acknowledged in order to make it a viable option for all customers. According to the representative, the deadlines for when customers receive payment from their customers varies between six months and two years. Consequently, the contract period must be adjusted accordingly, no one payment solution will fit all customer needs, but an option to tailor the payment terms must be in place.

Another possible service model option, according to the representative, could for example be to offer stamping as a service where a pay-per-use payment model is employed. The Company C representative express significant doubt towards such a solution, because of the fact that it is based on uncertain customer forecasts. Unless Company C can control the operations of their customers, rapid changes in production volumes would immediately affect the Company C revenue stream and pricing becomes a very complicated issue. Further emphasised by the interviewee is that there is no way for Company C to know in advance if the customer product is going to turn out as a success or only sell in small quantities, therefore he does not consider a pay-per-use model to be a viable option given the volatile market characteristics.

Imagine the case where a car manufacturer produces a car model that turns out to be unsuccessful, then they have transferred the risk to their suppliers instead. Smart, but they must take that risk themselves. (Chief Executive Officer, Company C)

In the customer portfolio of Company C, there are customers outside of the automotive industry. According to the interviewee, some of these have a considerably more even and reliable sales pattern, which would make it possible to establish a more reliable pricing mechanism. However, the interviewee states that these customers generally constitute only a small portion of Company C's yearly turnover and do not contribute to the technical development of their operations or innovation in general. Accordingly, this customer segment is not considered to be suitable for servitization by the Company C representative.

Regarding the alternative of a service model, where the customer would pay a fixed or variable fee in exchange for renting the tool for production, the Company C representative sees at least one immediate issue. As the tool is customised and built to customer order, meaning that there is no resale value of the tool, there is no other customer on the market for which the tool could generate value, as it is product-specific. An additional factor behind Company C not wanting to provide a service

model is the very limited possibility to disassemble a tool and reuse the components in a new tool. Consequently, it would generate no value for Company C to offer a take-back service of the tool.

We don't want to take the tool back, it is customer specific and built for a specific customer and sheet metal detail. There is no resale value and only a fraction of all components can be recycled or reused in another tool. (Chief Executive Officer, Company C)

5.4 Overview of identified factors

In this section, the findings as laid out above will be briefly summarised and structured, in order to provide a foundation for the analysis to come. The opportunities and barriers to servitization as discussed by the companies will be displayed in tables, showing only those aspects identified by the companies, and does not represent a complete picture of all applicable factors affecting the viability of servitization. During the interviews, the initial business models as imagined by Company B were used as a basis for discussion, but other solutions not involving the servitization of the tool itself were covered as well. The data from the customer interviews will not be presented separately in the tables, but will instead support the following analysis.

In tables 5.1 and 5.2 below, opportunities and barriers of servitization that have been identified by each company are presented. The table contents are based on collected interview data, and the columns marked with an "x" symbolise issues where the companies agree on a specific viewpoint.

Table 5.1: Servitization opportunities identified by companies

Companies	A	B	C
Market and relationships			
Industry is ready for change	x	x	x
Strengthen customer relationships	x	x	
Strengthen own market position		x	
Allows for use only of own assortment products		x	
Supply chain risk reduction			x
Financial aspects			
Increased predictability of own cash flow and incomes	x	x	x
Cash flow relief in entire supply chain		x	x
Reduce customer need for significant investments	x	x	x
Diversification leads to increased company revenue	x		
Increase company revenues by charging for currently performed services		x	
Enables companies to provide performance based services	x		x

As can be seen from table 5.1 above, the companies share many perspectives about what opportunities servitization could provide to their businesses. Within the market oriented factors, the coherency is especially clear regarding the industry attitude, where all of the companies have identified an increased readiness and need for change. With regards to the financial factors, emphasis is placed on the potential cash flow relief and reduced requirement of heavy investments. As such, the common denominators are primarily identified at an aggregated level, whereas the factors separating the businesses are of company-specific characteristics, such as *strengthen own market position*.

Table 5.2: Servitization barriers identified by companies

Companies	A	B	C
Market and relationships			
Uncertain customer demands and industry maturity	x	x	
Unequal market power distribution	x		
Risk of increased demand variations		x	
Risk of actors not adapting to new BM	x		x
Risk of competitors adapting and capturing market share		x	
Unjustified complexity of new business models			x
Inexperience of other actors with regards to tool sales			x
Risk of losing customers due to perceived bias			x
Financial aspects			
Uncertainty with regards to risk and profit distribution	x	x	x
Difficulties with regards to pricing and prognoses	x		
Challenges with regards to finding financing partners			x
Uncertainty with regards to the effects of OEM payment terms	x		
Absence of tool resale value			x
High financial risk in case of tool ownership			x

As in the case of identified opportunities, a number of factors are shared by the companies regarding identified risks their businesses could be exposed to by transitioning into a service supply chain, according to table 5.2. The most prominent challenge emphasised by all companies is the difficulty to find an equitable way to share risks and profits within the supply chain. Also concerns relating to the service configuration, meaning the role distribution between the actors and the perceived ability to transition into a new business model are considerable. However, while many of the factors are closely related, the challenges are more company-specific than the opportunities outlined in figure 5.1.

5.5 Customer perspectives

To support the analysis of the data presented in the sections above, interviews have been conducted with two end customers (complete tool users) from different industries. The resulting data is presented below.

5.5.1 Customer X - Stamping company

An interview was conducted with the Chief Executive Officer of Customer X, a contract stamping company supplying sheet metal components to the automotive industry. Initially, the representative described the current state of the industry and the market conditions that prevail, and overall the general market trends are considered to be relatively constant. Within the Swedish contract stamping market, there are approximately 100 actors, where Customer X is a medium sized company. Most of these companies compete in the same markets and for the same contracts.

Currently, the company produces approximately 300 details for their combined customer base, where in addition to stamping, the details are subject to processes such as welding, painting and/or packing according to the specifications of the customers. The customer base consists of a handful of companies, varying in size. Each of the 300 details requires its own tool, which is stored at the Customer Y facility when not in use. The CEO, in contrast to the representatives of other companies, describes their current operations as offering a service.

We're providing a service today, essentially we sell operating hours in our machinery. The automotive OEMs place their tools in our machines.
(Chief Executive Officer)

With regards to the financial situation of the company, the CEO describes that the company has been doing relatively well in the last few years, but that cash flow is always an issue. This issue was described in a similar way as with Companies B and C, where OEM pressure propagates up through the supply chain. This situation is, according to the representative, likely to affect all of their competitors in a similar way, where the size of the cash reserve, or access to credit lines, is what determines the long term viability of the operations if the trend of strict OEM payment conditions continues.

On the topic of relationships within the supply chain, the CEO explained that their main upstream contact is with Company C, which manufactures a majority of the tools that they use. Tool manufacturers each specialise in certain types of tools, consequently some are sourced from elsewhere, even though C is the preferred supplier internally. The company is allowed relative freedom by their customers to source the tools from wherever they deem suitable, as long as the quality of the final detail is acceptable. In addition, the company also has the capability to produce tools in-house, something that they do occasionally, when it is deemed a valuable use of resources and time.

The CEO is only vaguely familiar with Companies A and B, and does not maintain contact with them in the daily operations. With regards to customer relationships, the representative echoes comments by other supply chain actor about the characteristics that define those with major OEMs, in that they are very important for their survival, being close and collaborative, but that there are also challenges with regards to the power dynamics at play.

Sometimes it's love, sometimes it's like war. (Chief Executive Officer)

The overall process of tool acquisition and entry into operations of a new stamping tool was described in detail by the CEO. Initially, the OEM publishes a Request for Quotation (RfQ) to a number of competing pre-approved suppliers, specifying the detail that is to be produced, as well as prognoses with regards to expected order volumes and other related data. Contract stamping companies can thereafter in turn request quotations from tool manufacturers, who in turn presumably research the cost of any required components. These are all taken into account by the tool manufacturer, and in turn the contract stamper in providing the quotation for the OEM or tier 1 supplier that is its customer. The tool will be purchased by the stamping company, and thereafter sold on to the customer once the first detail has been produced. The tool however remains physically in the possession of the stamping company. This stage of the process may take as long six to nine months to reach, after the initial contract was signed.

A solution where the tool ownership is arranged in this fashion provides benefits for both parties, in that the stamping company is relieved of the risks involved with regards to varying order volumes affecting their ability to pay for the tool, and that the OEM can retain the tool in case of financial difficulties or bankruptcy of the supplier, allowing them to transfer it to another company for continued stamping. From the viewpoint of the stamping company however, they would prefer not to own the tool even temporarily, as this is the cause of their cash flow difficulties. The CEO exemplified by recounting a case where a major automotive manufacturer delayed payment in every possible way for more than a year, requiring the company to cover the several million SEK cost of the tool in the interim. This would be avoided if the OEM would purchase the tool directly from the tool manufacturer. The trend at the moment, according to the CEO, is moving in the opposite direction, where OEMs move from paying a share of the tool cost in advance, to nothing at all before full production is achieved.

In addition the CEO discussed the possibility of purchasing value added services not related to the servitization of the tool as a product itself. The stamping tools require regular maintenance, and this is handled internally within the company. In cases where spare parts are required, they may be purchased from Company C. Generally, the contracts with the OEM customers require the stamping company to keep the tool in storage for at least 15 years after the conclusion of series production. However, in practice, the tools often end up remaining in their possession even longer, as OEMs are reluctant to order their destruction.

In the opinion of the CEO, what would be beneficial for a company in their situation is the ability to fund the tools for the period of time before the OEM payment is received. Naturally, any such financing solution could be acquired cheaper and more efficiently directly from a bank or financial institution, and would only be required for a short period of time. The belief of the representative is that the OEM leadership is fully aware of the financial stress that their requirements places on suppliers, but that this is not understood at lower operative levels of the OEM companies.

I can't see why anyone would want to do this in the automotive industry, the current solution is the best for both parties, under the circumstances. We can't sell a tool that we do not own. Everyone between B and the final OEM is completely uninterested in owning the tool. (Chief Executive Officer)

When presented with descriptions of servitization solutions as imagined by Company B, the CEO expressed significant scepticism regarding their viability in the market. For the reasons described above, there is little incentive for any of the intermediate parties to actually own a stamping tool.

5.5.2 Customer Y - Automotive OEM

In order to provide an understanding of customer perspectives on tools and related services as well as their opinions on the concept of servitization, an interview was conducted with a manager from the Customer Y stamping facility workshop.

Our production line runs 24/7, and things go wrong all the time. We send components back and forth in a panic. You need to perform continuous maintenance, achieving the right quality is an involved process. Sometimes, even a strand of hair in the tool can make the vehicle details unusable. (Stamping Tool Workshop Manager)

Traditionally, preventative maintenance is performed at fixed intervals, usually based on the number of operations in which the tool or its constituent components have been used. In the tool workshop, the company has the ability to perform almost all required maintenance. The exceptions are if there are large scale structural failures of the tools, in which case the manufacturer may need to be involved. The representative emphasises the focus on quality in the stamping operations.

We can handle almost anything here, 95%. I want to know that maintenance is performed correctly, or production will be jeopardised. Internally, this is easier to manage. (Stamping Tool Workshop Manager)

The components used in the initial manufacturing of tools are usually sourced by the tool manufacturer, based on specifications of the end customer. For example, internal requirements in this case stipulate that tool components from certain manufacturers, among which company A is one, are to be used. Spare components however, are bought directly from a reseller such as Company B, which is the supplier

mainly used by Customer Y. The representative describes the relationship between companies Y and B as good, involving large volumes of orders as well as additional services within areas such as employee training.

Regarding possibilities of providing the tools as a service and/or possibilities for the provision of other related services, the company representatives expressed a degree of scepticism. The interviewee brought up the facts that tools are very expensive, as well as stamping being an important process, as reasons behind OEMs opting to own the tool themselves. This includes concerns with regards to the maintenance of tools not in the ownership of the company, and the representative expressed doubts with regard to the ability of outside actors to manage these processes adequately.

How would that work, do you lease a few maintenance people then too?
(Stamping Tool Workshop Manager)

Regarding the possibility of not performing the stamping process in-house at all, the representative assessed that the cost would be prohibitively high. While they have sourced finished details externally a few times, the representative believes that it would not be economically sustainable in the long term. Additionally, they can manage quality more effectively in their own facilities, according to the representative. To summarise, in the specific context of large automotive manufacturers, the representative expressed the view that there are significant challenges and uncertainties associated with servitization.

6

Discussion

In this chapter, the information gathered during the empirical data collection phase of the project will be related to the theoretical framework laid out, using the methodology as previously determined. Initially, issues relating to the servitization of multi-actor supply chains will be discussed, and the prerequisites for servitization in terms of customer needs and requirements will be summarised and analysed. Finally, the various types of service concepts that could be the result of a servitization process will be introduced, and the reasons why they may or may not be suitable for use in the specific context of the tool and die industry will be investigated.

6.1 Service supply chains

A number of supply chain and service structures were proposed by the company representatives during the interviews, some of which were relatively simple and some which would completely transform the supply chain structure. Considering real life examples of servitization, both within the tool and die industry and in general, it is highly unusual, or perhaps even unheard of, for a supply chain actor other than that producing the product that is to be servitized to act as the service provider (Schuh et al., 2016). The possibility of providing services that independently support the tool as a product, however, is much less dependant on the relationships between the actors (Coreynen et al., 2017). Based on the context of the specific supply chain, factors that affect the distribution of roles and responsibilities within the value chain will be investigated in this section.

6.1.1 Roles and responsibilities

In the case of the focal supply chain of this study, it is difficult to imagine how the component manufacturer, Company A, in an initial phase could be a part of the process as an actor providing the tool itself as a service. Initiating the servitization process already at the component manufacturer level in the supply chain would entail that their service offering is incorporated into the subsequent service offering by Company B or C. To equitably divide risks, profits and losses becomes a very complex issue as the interdependence of the actors increases, and their respective contributions to the final tool, both in terms of cost and value, is difficult to calculate. The complexity would then additionally increase exponentially for each additional

component which is to be servitized. Another factor affecting the servitization viability is the fact that a stamping tool consists of a wide variety of components, which are usually sourced from a large number of manufacturers. In the initial stages of servitization, it would therefore complicate the process immensely to opt for a model where the services themselves are composed of other services, as it is, naturally, difficult for companies to sell what they do not own.

As the intended use of the components manufactured by Company A and those retailed by Company B is to be built into a stamping tool, they do not serve any purpose as stand-alone components for the customers of the tool manufacturers, the stamping companies. The feasibility to servitize components separately is therefore regarded to be very limited. Furthermore, the relatively low cost of the components considerably affects the potential benefits the customers could enjoy from sourcing components as a service instead of as a product, as the expense to purchase the component should not imply any major impact on their financial situation. Moreover, no immediate benefits have been identified that a solution based on service provision of single components would contribute to the supply chain as a whole, in terms of cash flow relief or increased revenues.

During the interviews, the proposals by Company B were the most notable and included examples where they would assume control of supply chain roles previously under the control of other actors, such as retaining tool ownership while employing the tool manufacturer as a subcontractor. It can be assumed that, in the initial stages of servitization, significant challenges and issues will arise, when the concept has not previously been introduced on the market in question. For that reason, opting for a less complex model may be a reasonable choice. These structures have been found to lack support among the other participating actors. Rather, in line with the opinion of Benedettini et al. (2015), when the actor closest to the point of consumption servitizes, they will be first to benefit from the reduced pressure from customers to offer lower prices and more customer friendly offerings. Consequently, it could be argued that the tool manufacturer, Company C, is the actor most naturally placed in the supply chain to servitize, when considering the entire tool as a service. As stated by Ayala et al. (2017), the utilisation of actor knowledge and experience (i.e. their core competencies) is a key factor in constructing services that are attractive to customers and successful in the market. Services are not offered to any considerable extent in any of the actors' current business models, meaning that their inexperience in service provision itself is a barrier. In addition, when companies aim to move away from the fields in which they are experienced, this adds to the challenge.

The question of whether the service provider has enough capacity to provide all the services required to ensure the functionality of all tools they have distributed additionally becomes essential. This question is brought up by the customer companies during interviews, and supported by Coreynen et al. (2017), arguing that as a first step when servitizing, one must ensure that the service provider has the ability to extend their involvement beyond the point of sale. As each tool is unique and built to order, in the event of a tool breaking down, the service provider can not hold

stock of tools to re-distribute, but is restricted to repairing the already existing tool. The stamping customers unanimously stated that the risk of tools breaking down is considerable and that continuous maintenance is required. If the service provider's capacity is insufficient, a solution where the maintenance responsibility is transferred to the customer would have to be constructed, which contradicts Rapaccini (2015), stating that the relief of risk and responsibility is one of the biggest reasons why customers would want to engage in a service contract. As none of the actors in the studied supply chain individually have the capacity to provide maintenance services to all of their customers, servitization solutions addressing the needs and requirements of customers would need to involve the combined services of several providers, further increasing their complexity.

However, regardless of whether the respective company engages in servitization of their business activities or not, they constitute an essential role enabling the supply chain as a whole to transfer into service provision. As the relationships between the actors are close, where the Company A tool component is exclusively distributed by Company B, and where Company C source the vast majority of their components from Company B, well-functioning relationships between the actors are crucial. As unanimously described by representatives from all companies, the relationships are well-managed today and the parties are happy with the collaboration. In addition, all actors see several potential benefits from servitizing the supply chain, as such having a positive mindset towards the transition. Together, these characteristics are argued to be facilitating factors in the servitization process, in accordance with the conclusions of Ellram et al. (2004).

6.1.2 Relationship management

One of the major issues in establishing functioning servitization supply chain relationships is the process of clearly defining the roles and responsibilities of each actor. It is apparent from interview data that the supply chain actors' views on the distribution of roles and responsibilities when the value chain is servitized differ significantly. The service supply chain structures proposed by Company B involve taking control of activities previously performed by Company C. Company A, simultaneously, do not consider their role to be suitable for servitization in an initial stage. Conflicting visions and ongoing projects at different stages of the supply chain, aiming to gain control of the same market in different fashions each act as complicating factors. A unified vision and strong relationships, as well as internal (within the company) and external (within the supply chain) alignment, all support servitization (Benedettini et al., 2015). In a case such as this, where there are a large number of possible servitization configurations, it is essential that each actor can consider the possible consequences of implementing each option before committing, a process which has not been performed in this case. Rather, it appears that the complex visions proposed by Company B assume the collaboration of the remaining actors, without them having actually been consulted.

In order for a service model to seem attractive to each actor, reasonably, the model must provide potential benefits for every company involved, and this in turn means

that each actor must be willing to act equitably in distributing the risks and responsibilities that the provision of the service requires. The alignment of the supply chain actors, or the *ecosystem* surrounding the service provider is a key prerequisite in enabling transformation of the tool offering, and this fact was brought up by representatives from all companies during the interviews. In accordance with the ecosystem theories laid out by Adner (2016), the relationships between the actors and their positions in relation to each other is what enables activities to link their operations. In supporting the changing value propositions of the actors, the companies brought up the issue of how the actors which are not the direct providers of a service still can support its provision. For example, when services involving maintenance and spare part distribution supporting stamping operations are offered by the tool manufacturer, the knowledge and resources from all levels of the supply chain may need to be utilised (Adner, 2016).

A tool manufacturer, who has developed a significant network of business relationships and regular customers since they initially started operations may be hesitant to transfer ownership of the tool to another supply chain actor, the motivations and actions of which they can not easily ascertain. In addition, it was identified that a radically different business model may alter market dynamics, affecting the service provider negatively, and in turn therefore also the adjacent actors in the supply chain. In the current state of the market, the potential implications of these actions could include that the competitors of Company C refrain from using the services of Company B, if they feel that Company C may be receiving beneficial treatment such as lower prices and better payment terms. This risk was identified by Company C, but was immediately dismissed by Company B, the actor which would be affected negatively. Inconsistencies in the reasons for, and misunderstandings regarding the reasons behind, servitization among the collaborating parties may cause conflicts, disagreements and dysfunctional relationships (Ellram et al., 2004), a risk that seems to be present in this case. In addition, Eggert et al. (2014) reaffirms the importance of customer base loyalty in achieving sustained success, something which is obviously complicated by projects such as these.

6.1.3 Risk factors

The complexity of the issues laid out above relating to distribution of roles and responsibilities, naturally, depends on the complexity of the supply chain itself. Uncertainty with regards to this process was expressed by most of the supply chain actors (see table 4.4), specifically considering the potentially conflicting interests that may affect how each company is willing to accept risk and divide increased profits, and how the current financial situation of each company affects their willingness to change their current business model. For example, since the intermediate supply chain actors, those other than the component manufacturer and the OEM, tend to be relatively small companies, the strict payment terms that OEMs require will probably affect them the most. As they are then more inclined to transition into a new model, they may underestimate the risks and challenges involved, or absorb too much of them (Coreynen et al., 2017).

It should be noted that very few companies considering servitization actually proceed to the stage of implementation (Benedettini et al., 2015), indicating that the challenges noted above are difficult to overcome, and these trends are representative of the European market on a larger scale, as concluded by Schuh et al. (2016). Furthermore, when a company relies on business models which are easy to imitate, they expose themselves to significant risk. It can be assumed an actor which is not the manufacturer of the tool would absorb significant levels of risk in a situation where they supply the tool as a service (Teece, 1986). The structures initially proposed by Company B are in line with this, moving the operations of the company away from their core competencies, performing instead services that could easily be imitated not only by competitors, but in some cases probably more efficiently and successfully by other actors. This, obviously, places the company in a disadvantageous market position. This is a concern brought up by the Company B CEO during interviews, where the belief that almost all of the competitors would copy their service offering, in a case where it turns out successful, was expressed. In a situation where the tool is offered as a service by the tool manufacturer, the situation is slightly less complex as the upstream actors are not required to adapt their business models.

The process of transitioning into a new business model, regardless of the circumstances, will in most cases entail a temporary increase in the costs involved in service provision, as well as an increased risk of reduced revenue as the company and its customers get acquainted with the new model (Schuh et al., 2019). This initial impact may become significant, and may not resolve in cases where the business model is not well suited to the operating environment (Eggert et al., 2014). It is likely that, even in the case a profitable PSS is achieved, the costs of business model development and implementation will exceed the increased revenue in the short term. This means that a company will need to be prepared, and have the financial capacity to absorb losses at least for an initial period of time (Schuh et al., 2019). When an opportunity to introduce services into the business model is identified, there are no guarantees that the heavy investments and enhanced service offerings will generate the anticipated higher returns, which corresponds to the "service paradox" (Gebauer et al., 2005). Interestingly, it has been noted as well that business model innovation projects in manufacturing companies tend to be more successful when the company focuses on either product or service innovation, that is, not on a combination (Gebauer et al., 2011).

Currently, in accordance with the research by Schuh et al. (2016) and Neely (2009), servitization concepts are considered by an increasing number of tool manufacturers on the European market, however the number of actual implementations and the degrees of servitization within them vary significantly. This may indicate that other manufacturers have judged the risks and/or challenges involved in a service transformation to be unacceptably high, a fact that should at least make the actors in this case cautious. On the other hand, if the external risks were less prevalent, the positive aspects of the studied supply chain, such as the strong and collaborative relationships developed between the actors, could be a strength in the process of servitization.

6.2 Customer perspectives

In a situation where a tool manufacturer, or even one of the upstream actors, decides to transition into providing the tool as a service, a key prerequisite is the existence of customer interest in actually procuring the resulting service. In assuming that this exists, without even investigating the ways in which tool ownership are handled today within the industry, the servitizing project actor is being exposed to significant risk (Coreynen et al., 2017), which may not only affect the future success of their operations, but also that of the remaining actors. This would then provide opportunities for their competitors to capture market shares.

According to Baines et al. (2009), the challenge of increasing the willingness of customers to actually procure a service is separate from that of just meeting their needs and requirements. Based on the empirical data collected during the interviews, it is possible to easily identify some trends and patterns in the requirements and wishes of the customers and those who are affected by OEM payment terms. The design of the service is therefore crucial, and must take these into account (Baines et al., 2009). With regards to servitization, there seems to be no general consensus considering its viability. Rather, the customers actually express a number of reasons why its applicability in these specific circumstances could be questioned.

These factors affect how stamping companies view ownership of the stamping tools as well. For subcontractors such as Customer X, there are definite advantages to not owning the tool, mainly financial (Schuh et al., 2016). Whether the tools are owned by the OEM or by some other actor however, does not change their situation substantially. The reasons listed by OEMs that support their ownership, such as the increased flexibility with regards to supplier selection, provide additional support to the arguments challenging the idea of retaining tool ownership in the manufacturing supply chain as proposed by Company B.

On the topic of servitization that does not concern the tool itself, customers specifically note the ability to maintain control of maintenance processes as a reason why they perceive that utilising external providers could increase the risk of reduced product quality and damage to equipment. As equipment and processes differ between stamping companies, utilising internal experienced workers provides assurance that maintenance is performed appropriately, including that which is preventative. This applies both when stamping is performed at subcontractor companies and by OEMs. This is in line with Coreynen et al. (2017) arguing that in order to provide services such as preventative maintenance, problems related to customers being used to receive ownership of the product and perform the service themselves must be overcome.

Interestingly, the belief of certain actors that customers are not aware of the possible opportunities that servitization could bring is in contrast to the active statements of the customers. As an example, Customer Y stated that the services proposed in fact could be counterproductive to their operations, such as the maintenance services discussed above, and therefore are not desired. What actually affects the

tool manufacturers as well as their subcontractor customers most negatively is the lack of liquidity during the payment progress (Schuh et al., 2011), originating from the power imbalance in which the OEMs market power enables them to maintain full control of payment conditions.

6.3 Factors affecting servitization viability

In this section, various types of servitization as introduced in the theoretical framework will be considered with respect to the specific circumstances of the studied industry and supply chain. In the initial phases of the research project, the actors involved wished to investigate the suitability of different service models, in their aspiration to servitize stamping tools. As outlined by Rapaccini (2015), services can be divided into the service model categories pay-per-outcome, pay-per-use and subscription, as described in section 2.2, and the viability of these service models will be investigated in this section, both with regards to servitizing the tool itself and to services supporting stamping operations. In addition, other possible servitization options can be imagined, why a discussion on the potential effects leasing procedures and service offerings omitting servitization of the entire tool can have on the issues faced by the tool and die industry will be provided.

A service model where the pricing is dependant on tool use heavily increases the risk for the service supplier given the inherent uncertainty in demand. Even if the customer can be assumed to maximise the use of the tool, there are no guarantees of how many pieces of sheet metal that are going to be produced in total, as emphasised by the stamping customer and the tool manufacturing company. To equitably calculate a price that ensure coverage of providing the services without being over-priced is considered to be very difficult by the companies involved, and adds uncertainty into the system. An additional dimension of risk is added as the service provider's incomes would be lost if demand drops and the customer stops its production, an issue which is difficult to safeguard against. Also the size of most tool manufacturing and retail companies in relation to the cost of the tools they manufacture poses some difficulties as well. Since each company may be working on relatively few projects at one time, the financial impact of only a few issues could become significant. This in itself serves as a servitization barrier, as the financial risk would be increased dramatically when incomes are not guaranteed.

In addition to the market characteristics where the demand can be very volatile, tools used in stamping processes possess a number of specific characteristics that further complicate a service model development process. First, each tool is manufactured to order, specifically adapted to the customer needs and requirements for the detail that is to be manufactured. This makes it difficult, if not impossible, to resell an already existing tool to customers other than that for which it was originally intended, as the company representatives point out. Consequently, the service provider can not offer take back services and reduce production volumes by re-distributing it to a new customer, but is required to manufacture a new tool. Additionally, components cannot be reused or raw materials recycled to any consid-

erable extent by disassembling the tool.

In line with the argumentation by Coreynen et al. (2017), a common mistake by servitizing companies is to absorb too many risks that previously belonged to the customer. Moreover, the authors argue that servitization processes commonly encounter problems related to customers being used to ownership of the end product. This argumentation is applicable in the studied supply chain, as the tool has no resale value for the service provider, which should be an incentive for not wanting to remain the owner of the tool after finished assembly. In addition, several of the interviewees at the OEMs emphasised that they prefer to own the tool themselves, consequently creating a significant servitization barrier, from both a customer and service provider perspective. Similarly, stamping suppliers prefer solutions where the tool is owned by the OEM. As such, it is difficult to imagine how the needs of all parties could be met when transferring ownership to the service supplier.

The effects of servitization are highly dependent on the context in which it is implemented, and the suitability of a service model is affected by the expectations of each actor, the supplier and the customer. According to Benedettini et al. (2015), difficulties in servitization processes can be caused by factors that are either internal or external to the service provider and/or its supply chain. In this case, the majority of the issues identified would be classed as external, including the specific properties of the tools themselves such as the complexity, level of customisation and lack of resale value, while internal factors relate mainly to the lack of capacity within the downstream supply chain actors.

6.3.1 Stamping as a service

Services providing customers with a promised result, in this case the ability to use the tool in their stamping operations, constitute servitization of the entire tool, corresponding to the top level of the servitization pyramid 2.2. In such a solution, the service provider would remain the owner of the tool. Consequently, the following discussion aims to investigate the viability of a service offering incorporating the stamping tool itself as a service, including pay-per-outcome, pay-per-use and subscription service models.

In a pay-per-outcome service model, the customer pays for an agreed result, in this case the production of sheet metal pieces, which is performed by the service provider. This solution eliminates the requirement of heavy investments as there is no shift in ownership and the customer does not purchase the tool. However, a pay-per-outcome service model is in this supply chain considered to be infeasible, as it implies that the service provider is responsible for functionality, meaning both production as well as continuous maintenance. None of the project participating companies currently hold the capacity or aspiration to provide such a service offering.

A pay-per-use service model may initially seem appropriate for a product such as stamping tools, which are used in discrete manufacturing. However, considering the characteristics of the tool and die industry, as outlined in section 6.3 above, imple-

mentation of a pay-per-use service model is regarded to be limited as it introduces increased risk for both the service provider as well as the customer. The uncertainty of demand makes it very difficult to calculate the cost per use, where one of the actors will profit from the offering while the other actor's situation will be considerably more disadvantageous. The marginal cost of each additional operation in a case where a pay-per-use service model is used will be significant to the customer, likely causing them to doubt whether it would be financially advantageous in case of an increased order volume. On the other hand, it may result in significant savings in situations where order volumes drop.

The customisation of the tool, the lack of resale value and recycling opportunities cause the tool to not generate any value for anyone except for the originally intended customer. Thus, the tool characteristics restricts the willingness of the service provider to offer take-back services of the tool, why a subscription model is not considered to be feasible. As in the above described cases of pay-per-outcome and pay-per-use service models, a subscription service model would incorporate a shift of ownership from the stamping customer to the service provider. This in itself is a major factor restricting the viability of all result-based services, as it was stated by both customer companies as well as tool manufacturers that they do not wish to remain the owner of the final tool.

It could be imagined that in a setting where the demand is more reliable and products more standardised, that the stamping customer would be willing to remain the owner of the stamping tool and provide end-customers with the service to stamp sheet metal pieces. However, the characteristics outlined and discussed above are general for the tool and die industry, where the automotive industry is the single most important customer, therefore it should be hard to find profitable and viable servitization alternatives of complete tools in the tool and die industry.

6.3.2 Services supporting tool operations

Having determined that challenges with regards to servitization of the stamping tools are difficult to overcome, services placed in the top level of the servitization pyramid, displayed in figure 2.1, are not considered to be applicable in the focal supply chain. However, Baines et al. (2009) and Oliva and Kallenberg (2003) argue that the addition of services can differentiate the business offering of a company from that of its competitors, which according to Teece (1986) is an efficient safeguard preventing competitors from imitating the service offering. Therefore, it is still considered relevant for the supply chain to investigate whether alternative service offerings from the remaining pyramid-levels, performance and input-based value propositions, could possibly alleviate some of the problems experienced by the supply chain actors and/or their customers.

Schuh et al. (2016) argue that there is a need for differentiator development within the Western European tool and die industry, with maintenance services, testing and component development serving as examples. Furthermore, a study by Schuh et al. (2011) shows that customers value production up-time, followed by real-time

monitoring and optimisation of the production processes the most. The customer companies studied in this thesis brought up the difficulties of maintaining high levels of reliability within their production lines as one of the main issues, considering that downtime can be very expensive, impacting the supply of details to their customers and other production lines in turn. Additionally, the companies expressed that the process of maintaining the tools and components requires significant resources, both in terms of equipment and employees. Taking these needs and wishes into consideration, the potential benefits of expanding the service offering of the supply chain actors beyond what they traditionally provide become apparent.

A way to maximise the tool availability (up-time) could be to monitor the tool condition in real-time to evaluate its performance (Schuh et al., 2016), thereby detecting quality deviations in time. All project actors are already today emphasising the importance of high quality products, which could be further improved by allowing the customer to engage in preventative maintenance, providing systems that monitor tools and components to avoid breakdowns, something which could be offered as a service. If the offering is tailored and targeted towards enhanced product performance and maximising production up-time, it could be argued that there could additionally be a sustainability value proposition to be acquired from servitization by increasing resource efficiency while simultaneously improving the efficiency of the customers' operations. The monitoring system could either be aimed at monitoring specific and essential components, such as those manufactured by Company A, or the entire tool. Given the business model and knowledge of respective company, most naturally a monitoring service would be developed by either Company A or Company C, in accordance with the views expressed by company representatives. As Company B focus on resale of tool components, and do not assemble the tool or manufacture any components which are critical to monitor, they are likely the least suitable actor in the supply chain to develop a monitoring service at present, contrary to their own statements.

Additionally, services could be offered where an external service provider is responsible for regular maintenance of the tool and its components. According to interview data, customers however are reluctant to give up control of maintenance processes. Both customer companies included in this study stated that they prefer to retain the ability to repair their own tools and perform their own maintenance, as they possess the knowledge and capacity, and can schedule maintenance when it fits into their production schedule in a flexible way. In this case, in accordance with the logic introduced above, it is likely that only Company C has the competence required to provide such services, and capacity limitations are likely to limit its viability.

While Company B is not considered to be the most natural provider of monitoring or maintenance services, there are service offerings which can be imagined. The company already today provides services to a certain extent, in terms of packaging according to customer specifications and aim to supply customers with complete sets of tool components, an area which is easier to visualise as suitable for further servitization. The Company B representatives stated that short delivery times is a key factor in meeting customer requests. To shorten delivery times, as well as to

increase availability of components and spare parts at both tool manufacturers and OEM sites, a solution where Company B is responsible for the customers' inventory levels, in the form of vendor managed inventory, could be relevant to evaluate. As such, the conditions for Company B to launch a pilot project, aimed at investigating the viability of VMI, with a number of selected customers are considered to be favourable.

During the interviews, all company representatives interviewed stated with that the communication and cooperation within the supply chain is very satisfactory. These are emphasised by Ziaee Bigdeli et al. (2018) as facilitating factors when engaging in extended service provision, and lower the risks associated with implementation of new technologies and organisational structure. Regardless of the type of supporting services that are offered, Sharma and Singh (2017) argue that servitization incorporating a shift of responsibility for certain supporting activities can incentivise increased sustainability, both economically and environmentally, by extending the service providers' responsibility of the product beyond the point of sale, as well as by maximising the intended use of the service through closer collaboration with end-customers. According to the interviewees, there seems to be very little external stakeholder pressure for the supply chain to become more sustainable. In accordance with the studies by Pigosso and McAloone (2016), the addition of services does not inherently contribute to increased sustainability, however, supporting services addressing the main concerns of the customers could contribute to increased sustainability even where this is not their primary purpose. The service offering, in any case, must provide increased value for the customer to be profitable or even desired.

6.3.3 Leasing

The most critical issue emphasised by all supply chain actor is the cash flow problems. Despite the servitization limitations discussed above, as the financial demands placed on the entire supply chain affect all the actors involved to some degree, arrangements liberating actors from cash flow issues propagating up the supply chain are still necessary, in order to secure the long term survival of the industry. The concept of leasing foremost implies a change of payment terms and will not generate new revenue streams for the companies involved, therefore, leasing can not be considered as a form of servitization. The solutions that are still possible, even though servitization of the tool itself has been deemed infeasible, differ depending on whether the specific supply chain includes an OEM performing stamping processes themselves or whether this is done by a supplier.

In the situation which is probably most common, where the stamping processes are performed by a supplier external to the OEM, as displayed in figure 4.4, the financing issues originate where the supplier has to purchase a tool several months before the start of production, at which point the OEM will purchase it, and payment is not being effected until several additional months after that. A solution where, as suggested by Customer X, the supplier could lend money using the contract with the OEM as collateral, only for the period before OEM payment is received,

could be assumed to be relatively simple to implement. This issue thus affects both the supplier and the tool manufacturer equally, and a solution such as this would solve the problems of all actors, as the supplier would then be able to pay the tool manufacturer within a reasonable period of time as well. Furthermore, the risk assumed by the bank would be very low, as OEMs tend to be the strongest party financially in the chain.

Situations where the tool manufacturer sells stamping tools directly to the OEM, as displayed in figure 4.5, are interesting, as the financial issues affect only one of the parties to the transaction of the tool. This market power imbalance is difficult to resolve, and the OEM has no interest in trying to resolve the issues their suppliers. The arrangement proposed above, however, can be used similarly in this case, where the tool manufacturer is the borrower in place of the supplier, as they are the party with the direct financial relationship to the OEM. Either way, the risk involved for the party providing financing services is very low, as there are contracts in place, suitable for use as collateral.

Any solution involving changes in the payment model, reasonably, will entail a cost increase of some type purely originating from the implementation and use of required financing solutions, which may involve a bank for example. This fact was identified by the tool manufacturer, but dismissed as a relatively minor issue due to the relief from cash flow issues that these solutions may offer. One fact which may be overlooked here, however, is the willingness of financial partners such as banks to participate in these solutions at all (Schuh, Klotzbach, & Gaus, 2007). Banks tend to be risk averse in times of economic uncertainty, and in the case of models which exhibit a significant degree of uncertainty to begin with, it can be assumed that finding a financing partner could be challenging, unless there are assurances in place that ensure that the financing company will be able to recoup the money at stake. As described in section 6.3, owning a tool which can not be resold or remanufactured entails significant risk unless an agreement is in place which guarantees a certain level of income, and this applies also to financial actors such as banks.

The risk that the financing party is exposed to in solutions such as these varies depending on the size and characteristics of the customer company. In cases where a supplier to an OEM purchases the tool, their contract with the OEM serving as collateral effectively ensures that the risk to the financing company will be acceptable, regardless of the size and/or financial situation of the subcontractor. On the other hand, when a small OEM is the tool customer, since their revenue is dependant on final product sales, it is more difficult to predict whether they will be able to repay the tool cost. With major OEM companies, this risk is negligible as well.

7

Conclusion

In this final chapter, the purpose of the thesis will be revisited and reflected upon, after which the key information collected during the study will be presented. Based on the discussion, a number of implications and consequences of our conclusions will be developed.

Stamping tool manufacturing companies as well as their customers within the Swedish automotive industry are increasingly being pressured by foreign competition and strict OEM payment terms. This report aims to consider whether the concept of servitization could alleviate these issues, investigating how the structure of the supply chain, the actors involved, their relationships and the needs and requirements of their customers affects its viability. The conclusions of this study are meant to support business model development processes at various levels of stamping tool supply chains in the Swedish market.

Taking into consideration the data collected during the interviews, it was determined that the specific characteristics of stamping tools pose a number of significant challenges to servitization of the complete tool itself. First, with regards to stamping tool components such as those manufactured by Company A, the fact that stamping tools are composed of a large number of components from a large number of manufacturer means that servitization can not reasonably be performed at the component manufacturer level of the supply chain, as this would mean that hundreds of services would need to themselves be combined into services that can thereafter be sold to the end customer. This is referred to as the tool *complexity*.

Second, the fact that the tools are *uniquely customised* for each specific customer and application means that the tools have next to no resale value, rendering the risks involved in any service where the ownership of the tool is not at the stamping company or OEM level unjustifiably high. Third, the *cost* of the tools themselves are extremely high in relation to the annual revenues of average tool manufacturers and stamping companies, this means that changes to each specific transaction affects their risk levels significantly. The customers of the tool manufacturers express significant doubts with regards to the servitization of complete tools, which is in line with the barriers as described here.

In general, research shows that business models tend to be more successful when they rely on companies performing services incorporating activities in which they are sufficiently skilled and experienced in order to perform them well. This indicates that all actors within the studied supply chain are not equally suited to provide stamping as a service, but rather that the actor furthest downstream in the supply chain, in this case the tool manufacturer, is the best equipped to servitize considering their core competencies. Structuring service offerings in accordance with these findings will improve risk management performance within the supply chain as well. The division of roles and responsibilities as well as profit and risk distribution within supply chains where companies collaborate in service provision should be carefully considered before new business models are introduced.

The answer to the question whether the tool and die industry is suitable for servitization is considered to be *partly*. While the addition of services could have a positive effect on the cash flow issues experienced today, the always present industry and product specific characteristics outlined above considerably restrict the viability of servitization relating to stamping-as-a-service. These factors pose significant barriers that makes it difficult to reach a unified vision of how the service offering should be constructed to be beneficial for both the customer and service provider. Consequently, the hindering factors behind servitization are related to product and market specific issues rather than an industry reluctance of change.

Tool manufacturers and customers report a strong need for financial solutions that would improve liquidity, and given above outlined problems, service offerings decoupled from the physical product are easier imagined to implement. Solutions that have been identified to be viable include short term loans supporting liquidity until payment has been made from the OEM. In addition, the actors studied in this thesis have expressed openness to the development of new supporting services within the areas of maintenance, repair, spare part provision and condition monitoring. Therefore, the potential for new business model development within the field of supporting services in tool and die supply chains appears to be significant. On the other hand, the barriers present demonstrate that there is a need to proceed with caution.

Research output within the field of servitization in manufacturing has over the last decades been high (e.g. Baines et al., 2009). However, research relating specifically to the tool and die industry has, during literature studies of this project, proved to be relatively scarce. Consequently, this thesis contributes to theory by investigating the applicability of servitization in the Swedish tool and die industry. Whether the constraining conditions are general and apply to other markets as well is a question for further research. Moreover, the thesis contributes to the research of Schuh et al. (2011) and Schuh et al. (2016) by adding a customer perspective of servitization, extending the findings beyond market factors and supplier capacity to provide services.

The findings of this case study are considered to be partially generalisable. While the theoretical framework aims at describing industry general characteristics, the data collection was performed in a predetermined supply chain, consisting of a number of actors. The companies studied constitute a single supply chain on the Swedish market, and their understandings and opinions about market conditions in general may not be representative of their competitors. While studying predetermined actors could affect the generalisability negatively, the actors included in this thesis are assessed to operate in a way representative of the industry as a whole, which is why the findings are still considered to be relevant and applicable for other actors on the Swedish market.

Despite other actors on the market potentially having diverging attitudes towards servitization, it is likely that a significant share of tool and die industry actors encounter the same types of issues and questions and thereby could enjoy the proposed recommendations. Therefore, the external validity is considered to be high in similar industry settings consisting of a supply chain manufacturing stamping tools used in the automotive industry. However, if the scope is extended to cover different settings that do not share the same market or product characteristics, the degree of external validity is considerably more limited.

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