

MASTER

The transition of manufacturing firms to servitized business models using a dynamic capabilities approach

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Award date:
2020

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Master Thesis Report

The Transition of Manufacturing Firms to Servitized Business
Models Using a Dynamic Capabilities Approach

In partial fulfillment of the requirements for the degree of
Master of Science in Innovation Management
Faculty of Industrial Engineering & Innovation Sciences

January 2020

Date: 15th January 2020

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Department: Industrial Engineering & Innovation Sciences
Group: Innovation, Technology Entrepreneurship & Marketing (ITEM)
Master track: Business and Product Creation
First assessor: Prof. dr. F. Langerak
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Keywords: Servitization, Product-service systems, Service innovation, Integrated solutions, Dynamic capabilities, Strategic management, Business models, Industrial services.

Acknowledgements

This master thesis marks the end of a period of almost eight-years of studying, which has undoubtedly been one of the most fun and at the same time educational periods of my life. During my pre-university education I always had the ambition to pursue a study at a technical university. My school, however, strongly advised me to pursue a non-technical profile, since mathematics and physics were not the courses at which I excelled. Eventually, by taking a detour via an engineering bachelor at the Rotterdam University of Applied Sciences, I was allowed to do the pre-master program Innovation Management at the Eindhoven University of Technology, quickly followed by the master program. And now, almost three years later, of which a year abroad, I am about to graduate from the Eindhoven University of Technology with an industrial engineering master in Innovation Management, something that makes me feel proud of myself.

This would not have been possible without the support of several people. First of all, I would like to thank Fred Langerak for taking over the supervision of my thesis and for his support and guidance during my master thesis period. At times when I was lost, he was always able to give me a small push in the right direction. His direct feedback always helped me to raise the bar, eventually resulting in the thesis that is in front of you. I would also like to thank Sharon Dolmans for her help and feedback towards the end of my master thesis. Also, I was lucky enough to do my master thesis at Accenture, which gave me the opportunity to gain more professional experience and who provided me with the freedom to research a topic I was interested in. I would like to thank Michiel Does in particular, for his support during my internship and for guiding me through the organizational labyrinth that Accenture sometimes can be.

Finishing any master's degree would not have been possible without the full support of my parents, who have always made me understand the importance of education and have always pushed me to strive for the best possible, whilst still respecting my own interests at all times. Words cannot express how much I owe them for where I am now. Another thank you to my friends, for taking my mind of my thesis at times and for the great student period I have enjoyed.

Finally, I need to thank the case firms for their cooperation and for having me interview them. Without them there would have been no research. I sincerely hope that they are able to learn from my findings.

Floris

Rotterdam, 15-01-2020

Management Summary

Introduction - The emergence of new technologies such as the Internet of Things, part of a transition known as the fourth industrial revolution, enables manufacturing firms to innovate their business models and start selling so-called product-services systems; bundles of products and services. This shift from selling products to selling product-service systems is called servitization. Servitization is not just about the shift from selling products to selling services, but it involves the transformation of organizational capabilities and processes that are required for making this shift. Providing services requires capabilities that are different from the capabilities necessary for producing and selling products (Baines, Lightfoot, Benedittini, & Kay, 2009; Gebauer, Paiola, & Edvardsson, 2012; Kindström, Kowalkowski, & Sandberg, 2013). For a firm to change its operational capabilities and adopt a new business model, it needs to have dynamic capabilities (Helfat & Winter, 2011; Teece, Gary, & Amy, 1997). Research on the dynamic capabilities required for servitization is scarce and many researchers do not distinguish between the dynamic capabilities required for the different stages of servitization. Therefore, this study aims to answer the following main research question: *What dynamic capabilities do manufacturing firms need to move along the product-service continuum and ultimately provide result-oriented services?*

Methodology - The main research question is answered with a combination of research methods. First of all, a systematic literature review was conducted to answer the first sub-question and shed light on what servitization and its different stages look like. Moreover, the aim of the systematic literature was to uncover any research-based dynamic capabilities from existing literature. Secondly, empirical research in the form of case studies at manufacturing firms was conducted to provide this study with practice-based insights. The goal of the case studies was to validate the research-based dynamic capabilities and to uncover new dynamic capabilities from practice. A total of ten manufacturing firms were studied through a combination of interviews and desk research. Part of the interviews was a questionnaire in which the case firms were asked to rate the importance of each research-based dynamic capability and how well developed each dynamic capability is within their organization. The interviews were analyzed using a hybrid coding approach consisting of open coding and the template approach.

Theoretical analysis - The first part of the literature review focused on uncovering the different stages of servitization and their characteristics. The existing servitization typologies of Oliva & Kallenberg (2003) and Tukker (2004) were unable to provide an inclusive framework for answering the research question, thus a more comprehensive servitization framework was developed with four stages along the product-service continuum: basic product-oriented services stage, professional product-oriented services stage, use-oriented services stage, and the result-oriented services stage (see Figure 11). As one moves along the product-service continuum, the nature of the services becomes more process-oriented and the interaction between the customer and the manufacturing firm shifts from transactional to relational. The second part of the literature review derived existing dynamic capabilities required for servitization from literature. These research-based dynamic capabilities were clustered together, eventually resulting in a list of 25 dynamic capabilities, which can be found in Table 1 below.

Table 1: List of dynamic capabilities required for servitization derived from literature.

<i>Dynamic capability</i>	<i>Description</i>
1. Customer need sensing	The ability to understand the customers' business and processes and sense customer needs.
2. Technology exploration	The capability to signal and explore new technological options outside the service system.
3. Service system sensing	Building up an understanding of the entire service system required for delivering the service and creating network skills.
4. Internal service sensing	Having a structured process in place to identify and exploit local/regional initiatives.

5. Reducing dependency	Allowing various service propositions to emerge within the company to increase chances of success.
6. Data interpretation	The ability to process and analyze product usage and process data, to help customers achieve certain outcomes.
7. Service development process	Having a structured and flexible service development process in which customer needs and technologies are applied in a service concept.
8. Service commercialization	The ability to commercialize and scale services in a uniform way.
9. Value understanding	The capability to identify the customer value of the service and communicate this internally.
10. Value communication	The ability of communicating the value of the service to the customer.
11. Hybrid offering deployment	Continuously balancing front-office customization of the service and back-office service design and delivery.
12. (Un)bundling	The ability to bundle or unbundle existing service elements into new services.
13. Managing service delivery	The ability to quickly restructure internal and external resources for the delivery of new and improved services, including having roles dedicated to services on operational and strategic levels.
14. Knowledge sharing	The ability to share information and knowledge inside the organization about services and successful service delivery processes.
15. Adopting new revenue mechanisms	The ability to visualize the value of new services and adopt new revenue mechanisms based on that value.
16. Service interaction	The capability to co-develop and deliver services with customers and partners and manage these partnerships.
17. Sales incentives	Having designed and implemented incentives and measurable goals to sell services.
18. Hybrid offering sales	The capability to continuously adapt to different customer needs, reach key decision makers and sell value based.
19. Management support	Management measures and understand the long-term profitability of the service business.
20. Service-oriented organization	The ability to change culture, structure and processes to fit a service-oriented organization.
21. Service system transformation	The ability to transform the service system and the external actors involved and to extend existing resources.
22. Service-oriented mental model	The capability to learn new routines and unlearn obsolete routines.
23. Deliberate learning	Learning from the way service innovation is managed and subsequently adapt the service innovation process.
24. Balancing product- and service-innovation	Maintaining a balanced relationship between the service organization and the product organization.
25. Defining a service strategy	The capability to define a service strategy and translate this into operational guidelines.

Results of empirical analysis - Case studies were conducted at ten manufacturing firms across the different stages of servitization, as highlighted previously. We found that the case firms pursued servitization for the financial benefits involved, for marketing purposes, or to differentiate themselves on a strategic level. Some of the case firms also mentioned that they become more servitized because their customers want them to, or because they see services as a source for product development. From the interviews we derived two new dynamic capabilities required for servitization: the customer sensing capability and the knowledge capturing capability. During the interviews the case firms filled out a questionnaire, resulting in an overview of which dynamic capabilities are important at what stage of servitization, which was visualized in an overarching servitization framework (Figure 1). Moreover, from the questionnaire we found that the research-based dynamic capabilities are mainly observed within the case firms that are more experienced at servitization, opposed to case firms that only began with servitization recently, which is in line with our expectations.

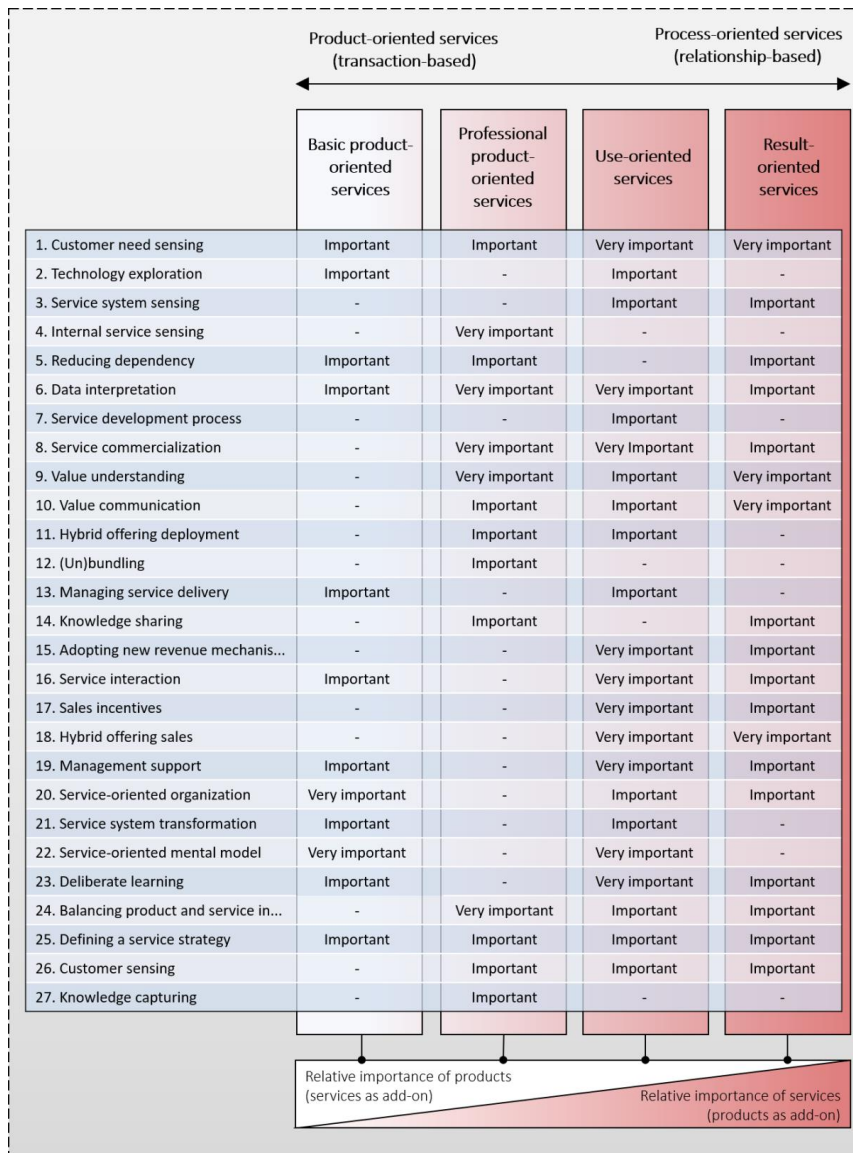


Figure 1: The servitization framework the dynamic capabilities that are important at each servitization stage.

Discussion - This study resulted in an overview of the dynamic capabilities required at each stage of servitization and their importance (Figure 1). Additionally it provides a stepwise overview of the dynamic capabilities that manufacturing firms need to possess to transition through the different stages of the product-service continuum to ultimately provide result-oriented services (Figure 2). Both framework complement each other and provide and answer to the main research question. The results of this study are of high relevance for both scholars and practioners. First, this study contributes to the servitization literature on several aspects. It provides a more inclusive framework for servitization based on the typologies by Oliva & Kallenberg (2003) and Tukker (2004). Secondly, whereas several previous studies on dynamic capabilities for servitization did not include any case firms that had reached the highest level of servitization yet, five out of ten case firms of this study have reached the result-oriented stage, thereby offering new insights on how firms transition to this stage. Thirdly, this study distinguishes between the dynamic capabilities required for the different stages of servitization and thereby offers a comprehensive overview of how manufacturing firms can progress along the product-service continuum, which is unique. In addition to the existing dynamic capabilities research stream within servitization literature, this study introduced two new dynamic capabilities; the ‘customer sensing’ and ‘knowledge capturing’ capabilities.

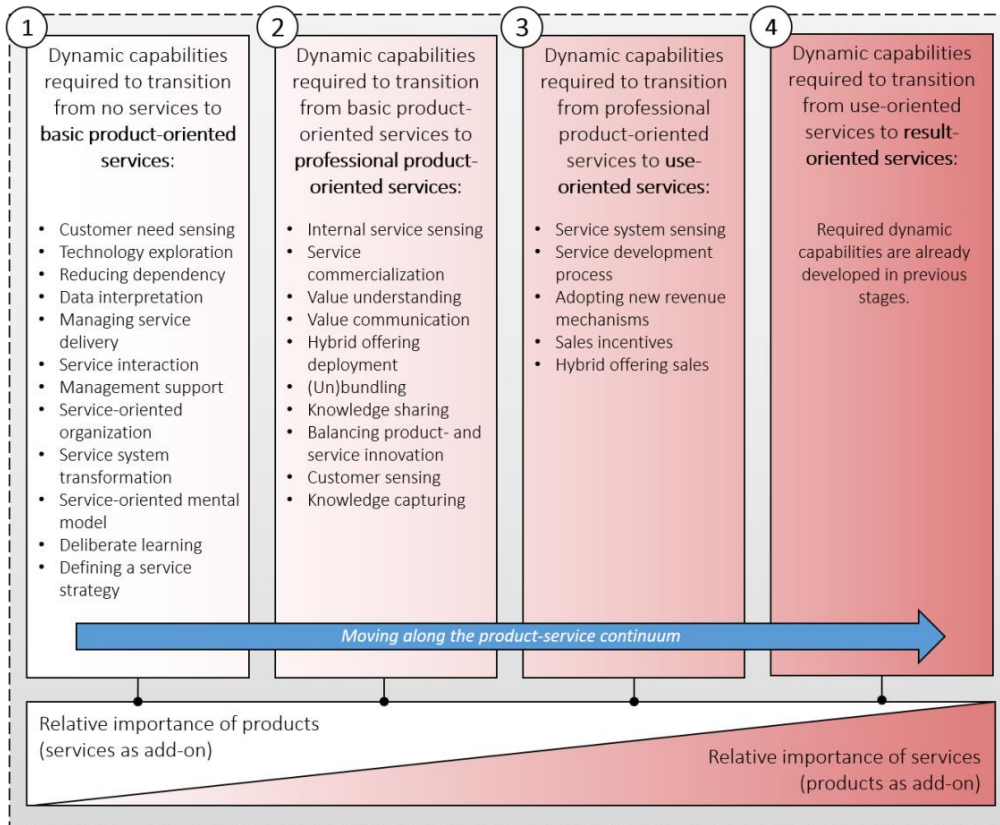


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1 Introduction

1.1 Problem Context

Manufacturing firms are currently undergoing the transition to the ‘fourth industrial revolution’, also known as “Industry 4.0” or “smart manufacturing”, enabled by the emergence of technologies such as the Internet of Things (IoT), artificial intelligence and data analytics. In Industry 4.0, manufacturing systems and physical products are connected via sensors and can exchange information with the digital world. Industry 4.0 also allows for this information to be analyzed and make intelligent decisions based upon it. A large increase in the number of connected products is expected; from 8.4 billion in 2017 to 20.4 billion by 2020 (Gartner, 2017). This development has several implications for manufacturing firms. Not only does it allow manufacturing firms to engage with customers in different, new ways or to improve the efficiency of their business processes. But more importantly, it also enables them to change their value proposition (Deloitte, 2016).

The emergence of IoT allows manufacturers to innovate their business models, therewith often becoming service providers (De Reuver, Bouwman, & Haaker, 2013; Suppatvech, Godsell, & Day, 2019). An example of this is Michelin, a global tire manufacturer. By using IoT technology in their tires, Michelin is able to offer a “tire-as-a-service” model in which truck operators pay for the tires on a kilometer-driven basis, as well the ability to offer advisory services on how to improve fuel efficient driving (Accenture, 2015). Instead of only selling a product-centered offering (e.g. tires), Michelin has switched to selling product-service systems, consisting of a combination of products and services. This phenomenon, selling products as services, is part of an industry trend called “servitization”.

In short, IoT enables firms to transition to service-oriented business models and facilitate the establishment of product-service offerings (Suppatvech et al., 2019). However, for most traditional manufacturing firms the move from a product-oriented business model to a servitized business model is often radical (De Reuver et al., 2013), and many manufacturing firms fail to successfully make this transition (Parida, Sjödin, & Reim, 2019) (Perona, Sacconi, & Bacchetti, 2017). And even though servitization is gaining more attention from practitioners, research on the transition to servitized business models is still lacking behind (Baines et al., 2009; De Reuver et al., 2013; Martín-Peña, Díaz-Garrido, & Sánchez-López, 2018; Suppatvech et al., 2019). How manufacturing firms can successfully make the transition to these servitized business models is yet to be researched.

The research is conducted during an internship at Accenture’s Industry X.0 practice. Accenture is a professional services company and their Industry X.0 practice is focused on supporting industrial clients in their digital transformation journey. Part of this journey is the implementation of technologies such as IoT, which, in turn, facilitate the implementation of servitized business models.

1.2 Research Problem

Declining product margins and greater customization demanded by customers, as well as the rise of technologies such as IoT, encourage manufacturing firms to pursue servitization (Benedittini, Neely, & Swink, 2015; Davies, 2004; Gebauer, Fleisch, & Friedli, 2005). Making this switch is no easy task for firms that have been manufacturing and selling product-based offerings for many years. Evidently, many manufacturing firms fail to successfully make the transition to servitized business models and establish a profitable services business (Parida et al., 2019; Perona et al., 2017). This phenomenon is called the servitization paradox; in theory, servitization clearly offers new opportunities for value creation, yet making the transition to selling product-service systems does not deliver the expected financial returns right away (Benedittini et al., 2015; Gebauer et al., 2005).

One of the reasons why the transition to servitized business models is as challenging as it is for manufacturing firms, is that providing services requires capabilities that are different from the capabilities necessary for producing and selling products (Baines et al., 2009; Gebauer et al., 2012; Kindström et al., 2013). Building and implementing these new capabilities is challenging (Sousa & da Silveira, 2017). This study will focus on uncovering the dynamic capabilities required for transitioning to servitized business models. Dynamic capabilities are required to reconfigure business models and to change a firm's 'regular' capabilities (Helfat & Winter, 2011; Teece, 2007). There are several reasons why taking on a dynamic capabilities approach for studying the transition of manufacturing firms to servitized business models is relevant. First of all, firms need dynamic capabilities to design and adjust business models. Firms that are dynamically capable will be more successful at implementing, testing and refining new or existing business models and will do this more rapidly, opposed to their less dynamically capable counterparts (Teece, 2007, 2018). Servitization involves a large change in a firm's business model. A second reason for using a dynamic capabilities approach is that services are less tangible than products and more embedded in an organization's routines and processes, requiring dynamic capabilities that are completely different from the dynamic capabilities required to be successful with the manufacturing and selling of products (den Hertog, van der Aa, & de Jong, 2010).

Even though the dynamic capabilities required for servitization have been researched before, there are still several areas open for research. For instance, many of the dynamic capabilities identified in previous studies require additional empirical research (Fischer, Gebauer, Gregory, Ren, & Fleisch, 2010). Furthermore, many of the cases studied in previous literature had not reached the highest-level of servitization yet (Coreynen, Matthyssens, & Van Bockhaven, 2017; Kanninen, Penttinen, Tinnilä, & Kaario, 2016; Kindström et al., 2013), making it unclear what the dynamic capabilities for reaching this highest level of servitization are. Moreover, previous studies do not distinguish between the different levels of servitization but look at the capabilities for servitization as a whole, even though it is likely that providing result-based services requires different capabilities than providing, for instance, product-oriented services (Sousa & da Silveira, 2017), see Figure 3.

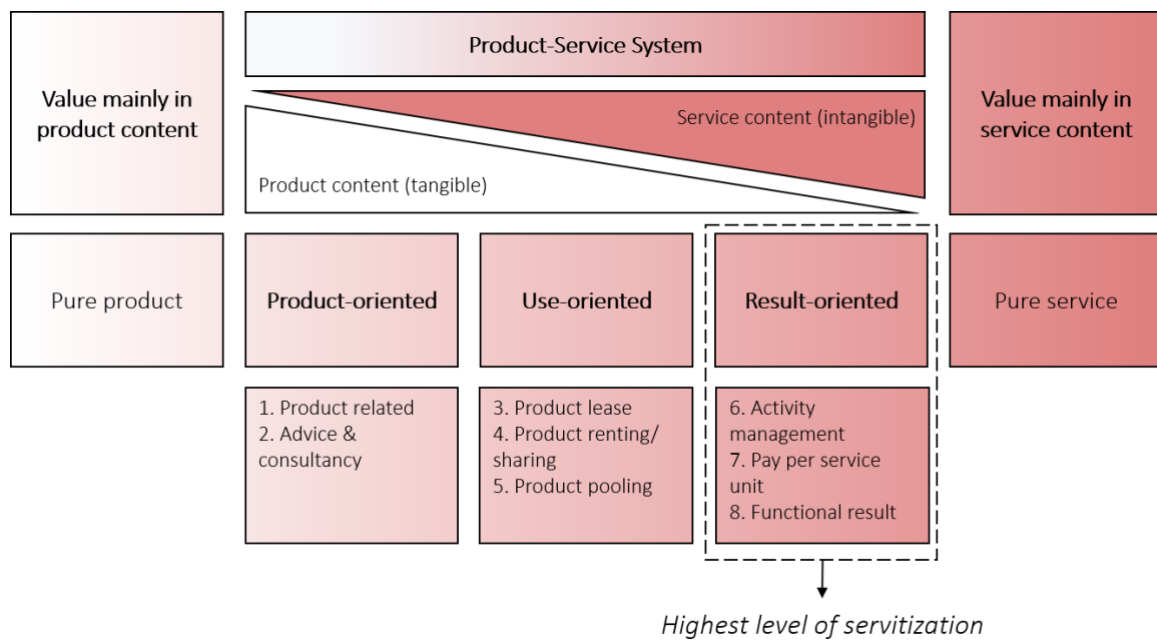


Figure 3: The servitization typology by Tukker (2004).

1.3 Research Questions

This study will specifically focus on the dynamic capabilities required for manufacturing firms in order to transition to providing result-oriented services, the most ‘servitized’ offering (see Figure 3) and the final stage of servitization. With result-oriented services, the manufacturer remains owner of the product and focuses on delivering a certain result or outcome to the customer. The customer pays for the provision of this outcome, for instance through a pay-per-use model (Tukker, 2004). Michelin’s tire-as-a-service offering is an example of a result-oriented service. These more advanced services are often enabled by the use digital technologies for monitoring the service delivery (Coreynen et al., 2017). In order to transition to providing these highly servitized offerings, manufacturing firms need to develop new capabilities (Brax & Jonsson, 2009). Besides focusing on result-oriented services, the scope of this study is further narrowed down to manufacturing firms that provide services in an industrial setting and not to consumers. Services that are provided in an industrial setting are often a critical part of a customer’s business process (Baines & Lightfoot, 2014). In such a setting they can be of great value to the customer, but it also comes with high risk for the service provider. For instance, financial penalties can be the result of failing services. Thus, it becomes even more important for the service provider, in this case the manufacturing firm, to get the servitization process right. Taking this into account, the main research question is as follows:

What dynamic capabilities do manufacturing firms need to move along the product-service continuum and ultimately provide result-oriented services?

In order to answer the main research question, a set of two sub-research questions is defined that need to be answered first. Table 2 shows an overview of the two sub-questions, as well as their relevance and the method used to answer them.

Table 2: The list of sub-questions for this study.

Sub-question	Goal	Method
<i>SQ1: What are the different stages of servitization along the product-service continuum and what are their characteristics?</i>	To understand the servitization process and its characteristics in order to evaluate the position of manufacturing firms on the product-service continuum.	- Literature review
<i>SQ2: What dynamic capabilities do manufacturing firms need at each stage of the product-service continuum?</i>	To identify the dynamic capabilities required for transitioning to the provision of result-oriented services.	- Literature review - Case studies: desk research + interviews

2 Methodology

The following chapter discusses the research methods used for answering the research questions. The first part of the chapter explains how the systematic literature review was set up and conducted as part of the desk research of this study. The second part of this chapter discusses the method for conducting the empirical research in more detail.

2.1 Theoretical Research

2.1.1 Design of the systematic literature review

A systematic literature review is conducted to retrieve research-based insights from literature. The goal of this literature review is twofold. First, it is aimed at gaining a deeper understanding of the servitization process and the different types of services and their characteristics. This information is crucial for understanding the position of the manufacturing firms that are interviewed in the second part of this study. Secondly, the systematic literature review has the goal to uncover the dynamic capabilities required for servitization. There have likely been researchers before that have studied the dynamic capabilities required for servitization and a thorough analysis of existing literature should identify these studies and their findings. The systematic literature review follows a slightly adapted version of the iterative process that is proposed by Wolfswinkel, Furtmueller, & Wilderom (2013) and consists of five stages. An overview of the process can be found in Table 3 below.

Table 3: The five-stage process for reviewing literature adapted from Wolfswinkel et al. (2013)

Stage	Task
1. DEFINE	1.1 Define the criteria for inclusion/exclusion 1.2 Identify fields of research 1.3 Determine the appropriate databases 1.4 Decide on the specific keywords
2. SEARCH	2.1 Search the databases
3. SELECT	3.1 Refine the sample
4. ANALYZE	4.1 Extract relevant content 4.2 Structure the content
5. PRESENT	5.1 Represent and structure the content 5.2 Structure the written article

Three databases are searched for relevant articles: *ABI/Inform*, *Scopus*, and *ScienceDirect*. Due to time constraints no further databases are searched. A list of inclusion and exclusion criteria can be found in Table 4 below. Only English scholarly articles published between from 1988 (introduction of the term “servitization” by Vandermerwe & Rada) and onwards are included in the sample. To further enhance the quality of the sample only articles in peer reviewed journals are considered. To be deemed relevant, the articles should discuss dynamic capabilities and servitization in a non-trivial way.

Table 4: The inclusion and exclusion criteria for the literature review for SQ2.

Databases	Inclusion Criteria	Exclusion Criteria
- ABI/Inform	- Peer-reviewed journal articles	- Literature reviews
- Scopus	- Articles written in English	
- ScienceDirect	- Articles describe dynamic capabilities and servitization in a non-trivial way	

A log is created to document the progress during the search and to keep a record of the search terms used and their results. Table 5 shows the keywords that are used to search the databases listed above. Combinations of these keywords are made by using Boolean operators such as “AND” and “OR” to reduce the amount of hits that the databases return. A log is created to document the progress during the search and to keep a record of the search terms and results.

Table 5: The keywords used in the systematic literature review for SQ1.

Term type I	Term type II	Term type III	Term type IV
“dynamic capabilities”	AND (“servitization” OR “product-service system” OR “product-service continuum” OR “product-service offering” OR “product-service bundle” OR “service innovation” OR “hybrid offering” OR “service transition” OR “service infusion”)	AND (“use-oriented” OR “result-oriented” OR “as-a-service” OR “pay-per-use” OR “advanced service*” OR “integrated solution*”)	AND “business model”

2.1.2 Results of the systematic literature review

The search process followed the steps that were suggested by Wolfswinkel et al. (2013), see Figure 4. The search of the three databases with the keywords resulted in a sample of 531 articles. After filtering out doubles 119 articles remained. These were filtered again, this time based on their title and abstract first, and followed by a filter based on their full text. The eventual result was a total of 9 papers in which dynamic capabilities for servitization were mentioned. Using the backward reference method, 16 new articles were found that were not included in the original sample. Again, these articles were filtered based on their title, abstract and full text, resulting in one extra article in addition to the 9 articles that were already in the sample. No new articles were found by applying the backward referencing method again. This brings the total sample on 10 articles in which dynamic capabilities for servitization are discussed.

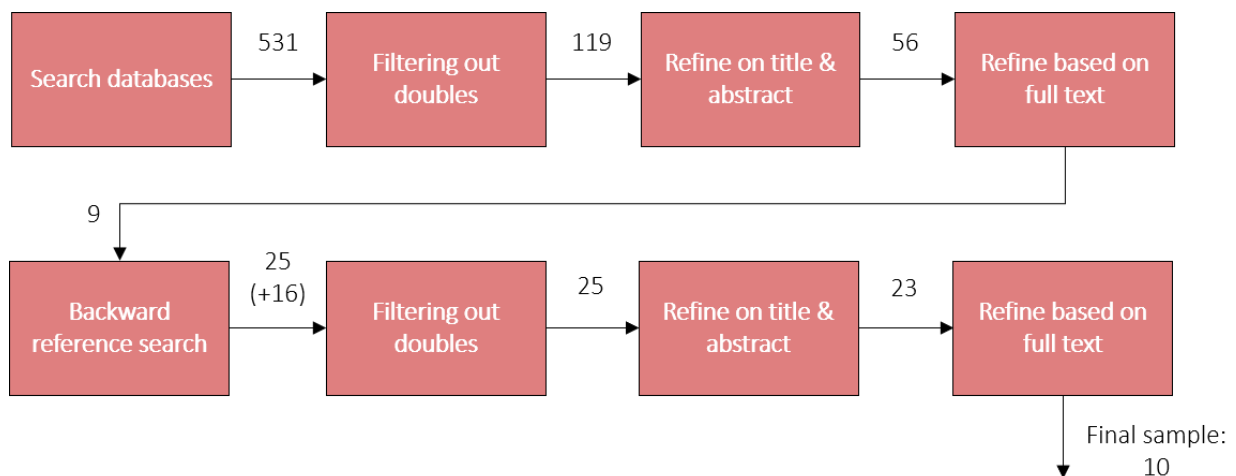


Figure 4: The different steps of the search and selection process of articles.

The systematic literature review resulted in a total of 10 papers. In 7 of those papers, dynamic capabilities for servitization were clearly explained and described (Coreynen et al., 2017; den Hertog et al., 2010; Gebauer, Haldimann, & Saul, 2017; Gebauer et al., 2012; Kanninen et al., 2016; Kindström et al., 2013; Saul & Gebauer, 2018). These papers were analyzed, and relevant dynamic capabilities were selected and put in a table, resulting in a list of 51 dynamic capabilities. Consequently, the dynamic capabilities were clustered based on their similarity and then given an overarching name and definition (see Appendix A for the full list). An overview of the process can be found in Figure 5. Several dynamic capabilities were simplified based on feedback from interviewees during the interviews, as some of the definitions from the literature were difficult to grasp for non-native English speakers. Of course, this is done in such way that the inherent meaning of the dynamic capability is still present in the simplified definition. The result is a final list of 25 research-based dynamic capabilities required for servitization, which can be observed in Table 7.

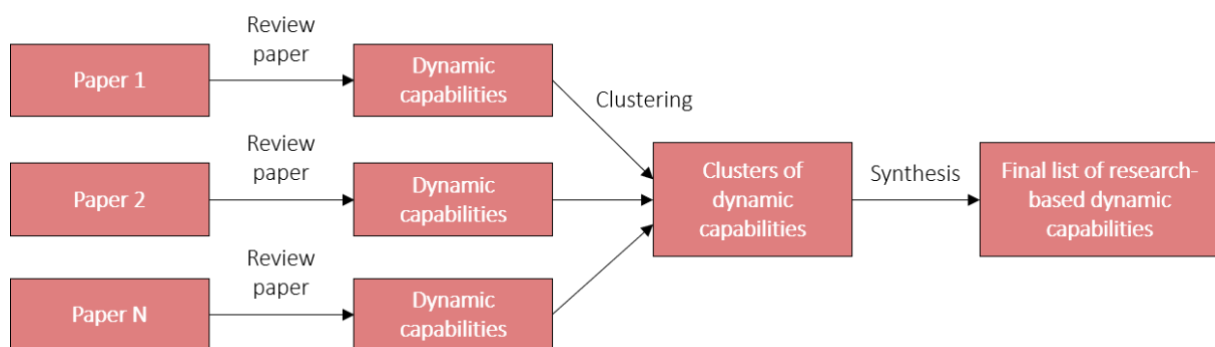


Figure 5: Overview of the process that was used to construct the list of research-based dynamic capabilities.

2.2 Empirical Research: Case studies

2.2.1 Introduction

Only theoretical research, such as the systematic literature review described earlier, is not sufficient for completely answering the second sub-question (SQ2). What is required is input from practice through empirical research. For this study, empirical research is conducted in the form of case studies. The case studies are conducted at manufacturing firms that are currently pursuing some level of servitization, ranging from firms that just started with their servitization ‘journey’, to firms that already employ result-oriented business models. The case studies are researched with a combination of desk research and interviews. The goal of the desk research is to collect valuable information about a case firm’s business model and to derive insights from previously published interviews. The goal of the interviews is twofold:

1. First of all, the interviews provide more insight into how manufacturing firms experience the process of servitization. It enables us to find out what the position of the case firms is on the product- service continuum, the challenges they encounter in the transition to servitization, and how they approach servitization. Moreover, from the interviews new practice-based dynamic capabilities can be derived.
2. The second goal of the interviews is to validate the research-based dynamic capabilities that are the result of the systematic literature review and to see how well these capabilities are developed within each of the case firms. Ideally, we are able to identify what dynamic capabilities are required at each stage of the servitization framework.

2.2.2 Case selection

Interviews are conducted at multiple manufacturing firms (i.e. cases) in order to improve generalizability and validity. In order to be deemed relevant, the case firms are: 1) active in the manufacturing industry, and 2) provide services in an industrial setting (no business to consumer services). Moreover, the final sample of case firms should cover every stage of the servitization framework. This way, conclusions can be drawn on the different capabilities that are needed at different stages of the servitization process. Several manufacturing firms were contacted via Accenture’s client network as well as outside of Accenture’s network. Roughly 25 manufacturing firms were approached, both Accenture and non-Accenture clients, and 10 of them agreed to an interview. Unfortunately, none of the companies approached through the Accenture network were willing to cooperate in the research. All case firms were the result of an online search and were contacted either by phone, e-mail or LinkedIn. The result is a stratified sample of manufacturing firms that covers all four stages of the servitization framework, details of which are listed in Table 6.

Table 6: List of case firms subject to empirical research.

Case	Manufacturing industry	Employees	Role of interviewee(s)	Interview length
Case firm A	Industrial equipment	1500	Manager solution development	60 minutes
Case firm B	Electronics	92.000	Solutions manager Delivery manager	90 minutes
Case firm C	Industrial equipment	35.000	Product manager	57 minutes
Case firm D	Building automation	500	Product manager	52 minutes
Case firm E	Industrial equipment	500	Service manager	50 minutes
Case firm F	Electronics	25.000	Product manager	80 minutes
Case firm G	Material handling	5.400	Service development consultant	52 minutes
Case firm H	Industrial equipment	29.000	Product manager software & services	63 minutes
Case firm I	Poultry equipment	350	Team lead aftersales	77 minutes
Case firm J	Hatchery equipment	150	Service & sales manager	50 minutes

2.2.3 Data collection

As explained earlier, the data will be collected through desk research and interviews. Desk research is required to understand which manufacturing firms fit the profile for this research and to derive additional information. For instance, a number of case firms gave previous interviews on servitization that were published online. Those and several other sources are used to provide additional information. Those sources are not disclosed in this report to guarantee the anonymity of the case firms.

The interviews will be semi-structured and thus (partially) prepared in advance. This method still allows for a certain level of flexibility and discussion during the interviews (Blumberg, Cooper, & Schindler, 2011; Van Aken, Berends, & Van der Bij, 2012). Questions in the interview protocol are mainly open-ended to allow the interviewees to give as much detailed information as they want, as well as to allow for follow-up questions (Turner, 2010). The number of interviews required cannot be predetermined, as it is dependent on the concept of saturation. Theoretical saturation is reached when additional cases do not lead to new insights (Eisenhardt, 1989). In practice, it is impossible to determine how many cases are required to reach saturation. However, Eisenhardt (1989) does state that between 4 and 10 cases is sufficient for most studies. More than 10 increases the complexity and volume of data, making it difficult to cope with. Less than 4 cases and it is difficult to generate theory from it. This implies that for

this particular research, the sample of 10 case firms is sufficient. The interview consists of two parts, see Figure 6:

- **Part 1 – Open-ended questions:** In the first part, the interviewee is first asked several background questions, after which he or she is asked to mark the position of the case within the servitization framework. A selection of open-ended questions will go more in-depth into the services that the case firm offers, as well as how it made the transition to that particular stage in the servitization framework.
- **Part 2 – Questionnaire:** In the second part of the interview the interviewee is asked to fill out a questionnaire. The questionnaire consists of a list of 25 research-based dynamic capabilities. Two questions are answered by the interviewee. First, the interviewee goes through the list of capabilities and marks the importance of each capability in the servitization process of the case firm. The interviewee marks his or hers answer on a Likert scale with five options, which is the preferred number of options for a Likert- type scale (Lietz, 2010). The following options are given: 1 (not important), 2 (slightly important), 3 (moderately important), 4 (important), and 5 (very important). After this, the interviewee is asked to go through to the list of capabilities again, but now the interviewee fills out how well each capability is developed within the case firm. Again, this is done a scale of 1 (not developed) to 5 (very developed). The goal of this questionnaire is to validate the importance of the dynamic capabilities that were identified from literature, as well as to get an understanding of how well developed these capabilities are with the case firms. During the filling out of the questionnaire the respondent is observed by the interviewer, allowing for questions to be asked on why the respondent gives a certain answer to a question.

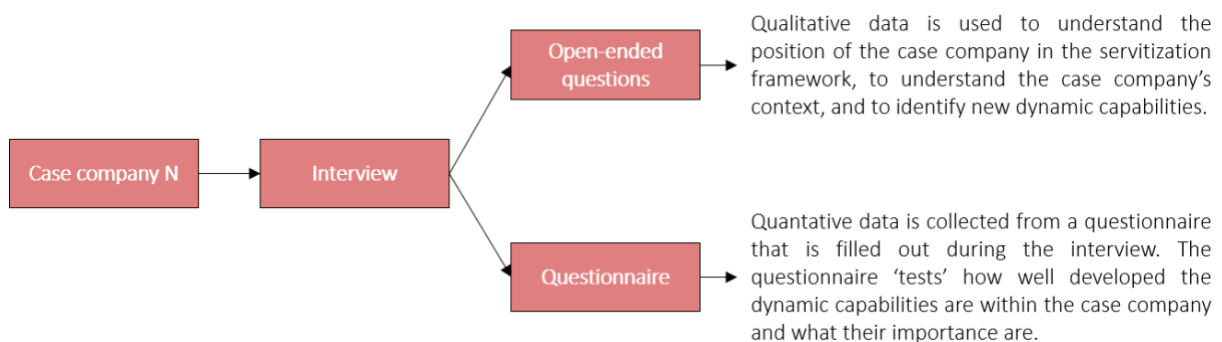


Figure 6: The two research methods used at the case firms.

2.2.4 Interview protocol

In order to make sure that each of the interviews follow a structured approach and cover the research topics, an interview protocol is developed. The interview protocol can be found in Appendix B. The interview protocol refinement framework by Castillo-Montoya (2016) is used as a guide in developing the interview protocol for this study. Following this step-by-step framework increases the reliability of the interview protocol as a research instrument. First, we check if any research questions remain unanswered or if there is even spread of interview questions over the research questions. Secondly, the interview questions are constructed in a way that they feel like everyday questions, not like research questions. To start the conversation, some questions about the interviewee’s background are asked. These are not only crucial to understand the context of the interviewee, but also to start the conversation in a non-threatening way (Castillo-Montoya, 2016). The third step in the process of developing the interview protocol is to have it proof-read by several persons. These persons shared their feedback and the interview protocol was subsequently adjusted and refined where necessary. Lastly, the interview protocol is tested during a pilot interview. A pilot interview gives the interviewer a good impression of the duration of the interview and whether the participants are able to answer all

questions (Castillo-Montoya, 2016; Turner, 2010). Feedback is derived from the pilot interviews and used to adjust the protocol once more. For instance, based on feedback that was given, the questionnaire was translated into Dutch for people who are less proficient in English.

2.2.5 Data analysis

The interviews are recorded and transcribed afterwards. Analyzing the transcribed interviews starts with the process of coding, which is the labelling or categorizing of fragments of text in the transcripts (Miles & Huberman, 1994; Van Aken et al., 2012). It enables the grouping and organizing of pieces of data that have similar characteristics into categories. It is an iterative process, and often several cycles are required to perfect the developed categories and labels (Saldaña, 2013). To support the coding process the software package NVivo 12 is used.

Because the nature of this research is theory-driven, which is expressed in the fact that a theoretical framework is used to guide the interviews and that research-based capabilities are validated in the interviews, solely using the exploratory approach to coding, such as the grounded theory approach, does not fit his study. Instead, the template approach is more appropriate to use in this situation (Van Aken et al., 2012). The template approach builds on existing theories and concepts and codes are constructed a priori (Blair, 2015). However, we will also use an open coding approach to identify new dynamic capabilities in the qualitative data, which is not possible with just the template approach. Overall, we will thus use a hybrid approach to coding, combining the template approach and open coding. The construction of the code book, a template in which all the preconstructed codes are listed, followed the process that is described by Miles & Huberman (1994).

First, codes were created based on the reviewed literature. The codes follow a hierarchical structure, which is created by clustering similar codes together into higher-level themes. This allows for the analysis of text on various levels of specificity (Symon & Cassell, 2012). The preconstructed codes were then aligned with the goals of the interview (see 2.2.1), and aimed at deriving the following information from the interviews:

- The drivers of servitization for the case firms
- The position of the case firms in the servitization framework
- How the case firms experience the transition to the different stages of servitization

The goal of this specific set of codes is to understand the position of the case firms in relation to the concept of servitization. Another set of codes was created that fit the research-based dynamic capabilities. The preconstructed codes were revised multiple times to make sure all relevant aspects of the theory were covered. A subset of the data, in this case 2 interviews, was used to refine the codes. Subsequently, an open coding approach was applied to code any relevant data that did not fit the template with preconstructed codes. New codes were created and added to the coding scheme, for instance when a new dynamic capability was identified in the interviews. This revised coding scheme was then applied again, and several iterations were made until the coding scheme fitted the data sufficiently. According to Brooks, McCluskey, Turley, and King (2015), the coding scheme is sufficient when there are no large sections of data that are relevant to the research question left which cannot be coded. The final coding scheme can be found in Appendix C.

2.2.6 Quality of the research

Several measures have been taken to maximize the quality of this research. First of all, to ensure construct validity, the interview protocol was reviewed by the thesis supervisor and subsequently adapted where necessary. Also, a pilot interview was conducted to test the interview protocol in practice, which resulted in another iteration of the interview protocol. Moreover, a combination of data collection methods was used, namely interviews and a questionnaire. This method, called triangulation,

has a positive effect on this study's construct validity and reliability. The reliability of a study ensures that a different researcher comes to the same conclusions after following the procedures described in this study (Yin, 2009). The reliability of this study is also maximized by having documented all steps that were taken during the research process. Chapter 2.1 of this report describes in detail how the systematic literature review was conducted, whilst Chapter 2.2 describes the steps that were taken during the empirical research for this study. Moreover, the interview protocol with semi-structured questions and the questionnaire was used during the interviews to standardize the collection of data to a certain degree.

3 Theory

This chapter consists of two parts which both explain one of the key concepts used in this study. The first part explains the concept of servitization and concludes with the development of a servitization framework. The second part of this chapter introduces the concept of dynamic capabilities and concludes with a list of research-based dynamic capabilities that is the result of the systematic literature review. The third and final part of this chapter links the identified dynamic capabilities to the servitization framework.

3.1 Servitization

3.1.1 Theoretical background

Defining servitization

The term “servitization” was first introduced by Vandermerwe & Rada in 1988 and it reflects the movement of many corporate firms to add value to their core offering by bundling it with services. One of the more widely adopted definitions of servitization is given by Baines et al. (2009, p. 555), who define servitization as *“the innovation of an organizations capabilities and processes to better create mutual value through a shift from selling product to selling product-service systems”*. This specific definition is one that suits the nature of this research because it emphasizes that servitization is a transformational process. Servitization is not just about the shift from selling products to selling services, but it involves the transformation of organizational capabilities and processes that is required for making this shift. This provides a good link with the dynamic capabilities theory, which is the other key concept in this study. Because in order to transform the required organizational capabilities and processes for servitization, a firm needs to possess certain dynamic capabilities (Teece, 2018). Moreover, the definition states that in the process of servitization, firms move from selling products to selling product-service systems (PSS). A PSS is *“an integrated product and service offering that delivers value in use”* (Baines et al., 2007, p. 3). For a product-oriented firm, selling PSS involves a reconfiguration of the firm’s value proposition, as it moves from selling products to selling service-oriented offerings. The value proposition is an inherent part of a firm’s business model, and dynamic capabilities play a major role in the reconfiguration of a firm’s business model (Teece, 2018). Therefore, the definition by Baines et al. (2009) provides a perfect link between the concept of servitization and the dynamic capabilities theory, since dynamic capabilities are an essential part of the transformational process that is required to move into selling product-service systems.

Different research streams within servitization

Within the articles that were collected through the systematic literature review, several research streams engaged with researching the topic of servitization were identified. First of all, several papers use the term “servitization”, “service infusion” or “service transition” to describe the transformational process that is required to start selling service offerings (Baines, Lightfoot, Smart, & Fletcher, 2013; Baines & Lightfoot, 2014; Brax, 2005; Coreynen et al., 2017; Oliva & Kallenberg, 2003). Others use the term “service innovation” to describe the transition of product-oriented firms to providing services (den Hertog et al., 2010; Kindström et al., 2013). They take a broader view and argue that the concept of service innovation involves changes in many parts of a firm’s service system, such as the way it interacts with customers and how it delivers services to its customers (Kindström et al., 2013). Another stream of researchers focusses more on the service offerings that are the result of manufacturing firms moving towards the provision of services. There is the “solutions” research stream that uses the terms “systems integration” and “integrated solutions” for servitized offerings (Davies, 2004; Windahl, Andersson, Berggren, & Nehler, 2004; Windahl & Lakemond, 2010). Others use terms like “product-service systems” (Baines et al., 2013; Tukker, 2004), or “hybrid offerings” (Ulaga & Reinartz, 2011) to denote bundles of products and services.

Drivers of servitization

Generally speaking, three major drivers for manufacturing firms to pursue servitization are mentioned in literature: financial drivers, strategic drivers and marketing-related drivers (Oliva & Kallenberg, 2003). Based on a more recent paper by Coreynen et al. (2017), we add “digitization” as a fourth driver to that. The following section explains each of the drivers in more detail.

- **Financial drivers:** Financial incentives for manufacturing firms to pursue servitization are increased margins and a more stable income (Davies, 2004; Gebauer et al., 2005). Especially for manufacturers with a large installed base, services offer an attractive and long-term stream of revenue (Davies, 2004; Gebauer et al., 2005; Wise & Baumgartner, 1999). Moreover, the sales of product-service systems seems to be less sensitive to economic cycles that usually affect the sales of physical goods (Wise & Baumgartner, 1999).
- **Strategic drivers:** A strategic driver of servitization is the ability to create a competitive advantage through the sales of services, as they are more difficult to imitate by a competitor due to their intangibility and the human aspect involved (Vandermerwe & Rada, 1988). Also, since differentiation on price and technology is becoming increasingly harder for manufacturing firms, services offer manufacturing firms a way to differentiate themselves from competitors (Baines et al., 2009; Gebauer et al., 2005; Mathieu, 2001a).
- **Marketing drivers:** In terms of marketing drivers, servitization allows manufacturing firms to establish a closer relationship between them and their customers, increasing their customers’ loyalty and their dependency on the manufacturer (Wise & Baumgartner, 1999). A second marketing driver is the fact that increased customer contact allows manufacturing firms to detect new opportunities and provide new services to their customers (Vandermerwe & Rada, 1988).
- **Digitization:** Another driver of servitization, one which is, understandably, rarely mentioned in the older research papers but has become very relevant today, is digitization. The rise of digital technologies such as IoT allow for the creation of new product-service systems (Rymaszewska, Helo, & Gunasekaran, 2017). In the earlier stages of the servitization process, digital technologies support and streamline the back- or front-end operations required to develop and deliver the services. For instance, remote monitoring technologies enable the continuous optimization of customer operations (Windahl et al., 2004). In the later stages of the servitization process, digital technologies and the collection of customer data enable the provision of new hybrid offerings to customers (Coreynen et al., 2017).

The process of servitization

Vandermerwe and Rada (1988) were one of the first to define the process of servitization. According to them, manufacturing firms have to go through three stages in order to become ‘fully’ servitized. In the first stage, manufacturing firms are either in products or in services. The second stage states that manufacturing firms are in both goods and services. And in the third and final stage manufacturing firms combine goods and services into bundles with support, self-services and knowledge (Vandermerwe & Rada, 1988). The process steps defined by Vandermerwe & Rada (1988) still lack some level of detail. Moreover, it is not clear whether a manufacturer has to go through all steps subsequently, or that it is possible to take a leap to a certain stage. The following process, defined by Oliva and Kallenberg (2003), provides more details.

They define a product-service continuum (Figure 7) along which a manufacturer moves when pursuing servitization. Manufacturers that mainly produce and sell goods and deliver services as “add-on” are positioned on the left side of the continuum (Oliva & Kallenberg, 2003). Revenue is mainly generated through the sales of products and the influence of services on the business is low (Gebauer et al., 2005).

On the end of the continuum, at the right side, are the manufacturers located who are a pure service-provider. These are service organizations in which the sales of products only plays a minor role (Oliva & Kallenberg, 2003). In these cases products figure as an add-on to services, and most of the value, more than 30 percent of the total revenue, is created through the provision of services (Gebauer et al., 2005). The transition between the two extremes is a gradual process with incremental steps and can be done by extending the existing service business (Gebauer et al., 2005; Oliva & Kallenberg, 2003). Examples of firms who made this transition are IBM and GE, once mainly hardware manufacturers but now service providers, that rely heavily on services for their profits (Neu & Brown, 2005).

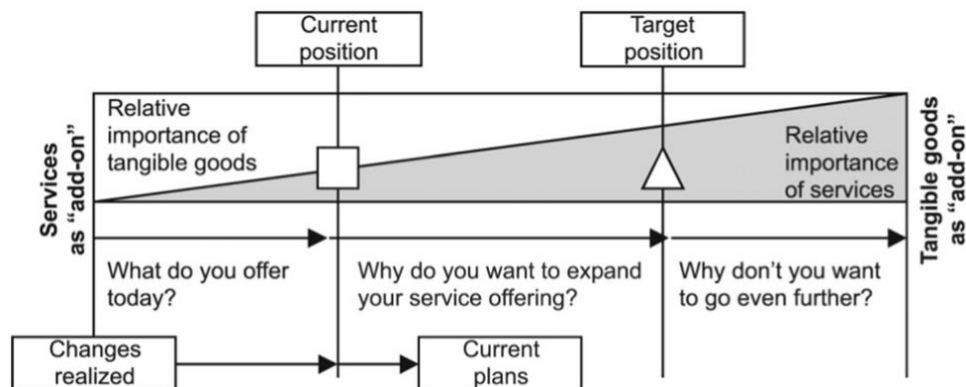


Figure 7: The product-service continuum (Oliva & Kallenberg, 2003, p. 162)

Oliva and Kallenberg (2003) identified a four-phase process through which manufacturing firms move along the product-service continuum (Figure 8). In the first phase firms already offer some services to sell and support their products. These product-related services are often scattered over the organization and are thought of as a loss-making necessity to sell the products. Firms that were successful at developing service offerings consolidated their service offerings into one organizational unit at this stage. The driver for doing this is to improve product sales and service quality. During the second phase firms enter the installed base service market. They identify an opportunity with the installed base market and set up the processes to exploit it. Already in this stage there are changes required in the organization's culture: a switch needs to be made from a product-oriented organization to a service-oriented organization. Manufacturing firms often do not see the value in delivering small services to customers, and the result is that they often give them away for free during the sales negotiations of a new product. Oliva and Kallenberg (2003) also found that it is crucial to build a separate service organization at this stage. Moreover, the infrastructure required to respond to the installed base needs to be built, which requires several new capabilities. The focus of this stage is to build a credible and efficient service organization. The third phase is to expand the existing installed base services. The first step is to move the customer interactions from transaction-based to relationship based. As a result, they also need to change the pricing of the service to a fixed price over a certain period of time. For the manufacturing firm it is key to establish service contracts to reduce variability in demand and allow for a higher utilization of the capacity. The second step involves changing the focus of the value proposition to a process-centered proposition where value in use is created for the customer. The product should not only function properly, but it also needs to work in an effective and efficient way within the customer's process. The product becomes less central in the value proposition. This is where the manufacturing firm is really providing solutions over the lifecycle of a product. The fourth and final phase in the servitization process is to take over parts of the customer's operations and become a pure service organization. However, this step should only be taken when the manufacturing firm has established itself in the previous stages.

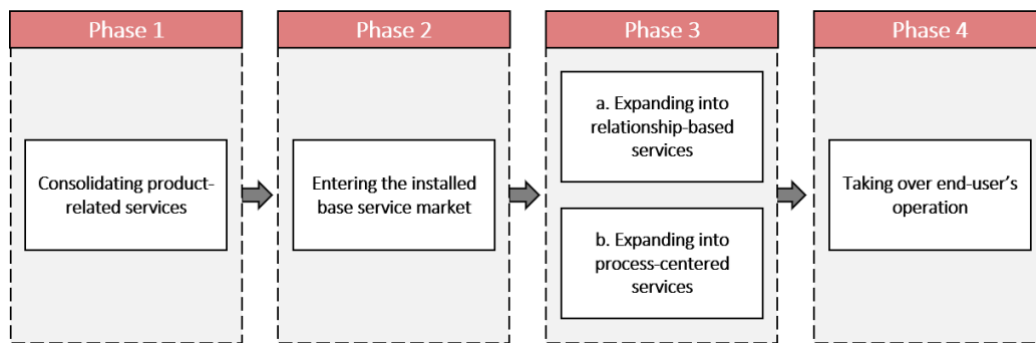


Figure 8: The four-stage servitization process by (Oliva & Kallenberg, 2003)

Types of services along the continuum

Clear is that firms move along a product-service continuum when becoming increasingly more servitized, and that this is accomplished by extending the existing service business through four phases (Oliva & Kallenberg, 2003). However, it is not yet clear what the different types of services are that are offered at the different phases of the servitization journey. In the last 20 years, several authors have each developed a typology for the different services that are offered along the continuum.

Mathieu (2001) divides services into two categories: services supporting the product (SSP) and services supporting the customer (SSC). Although this is an often-used typology within the literature, it is very high level and most manufacturing firms will offer services that fall into both groups of services. In short, it is not a typology suitable for categorizing manufacturing firms along the product-service continuum. Oliva & Kallenberg (2003) propose a typology of their own. They identify four types of services: 1) basic installed base services, 2) maintenance services, 3) professional services, and 4) operational services. Their typology distinguishes the four types of services on two dimensions (Figure 9). Product-oriented services versus process-oriented services, and transaction-based services versus relationship-based services.

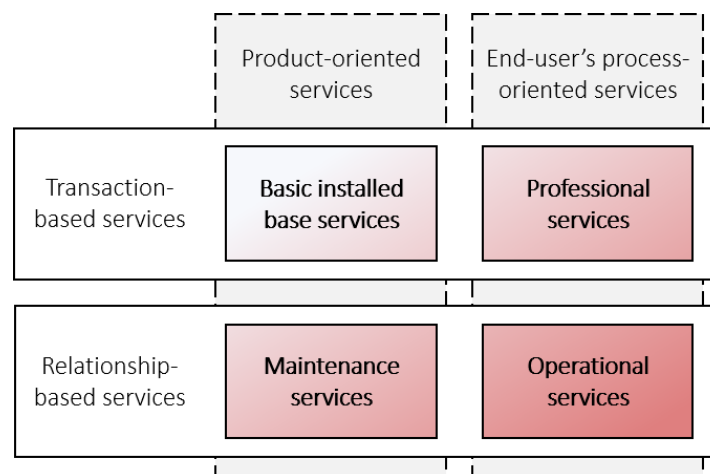


Figure 9: The different types of services by Oliva & Kallenberg (2003).

Although the typology by Oliva & Kallenberg (2003) provides more clarity in the process of categorizing manufacturing firms along the continuum, it is not perfect either. Aside from the two dimensions, there is not much information given about other dimensions such as "ownership of the product/equipment" and the revenue model used. This is where the typology of Tukker (2004), shown in Figure 10, provides more clarity. He groups eight types of services into three overarching groups along the product-service continuum: 1) product-oriented PSS, 2) use-oriented PSS, and 3) result-oriented PSS. A more detailed description of each of the categories is given below.

- **Product-oriented services:** As the name suggests, product-oriented services focus mainly on selling products along with some added services. According to Tukker (2004) the category of product-oriented services consists of two subcategories; *product-related services* and *consultancy and advice*. Ownership of the physical product involved remains with the user and the added services only play a minor role. This type of service is located on the extreme left of the product-service continuum.
- **Use-oriented services:** In contrast, use-oriented services do not aim to sell products, even though the product still plays an important role. Instead, their focus lies on making the product available to its user, often in different forms and sometimes even with sharing between users. In this model the ownership of the product remains with the provider. Both the product and the services are an integral part of the value that is delivered to the user. Within the use-oriented services three sub-categories can be distinguished; *product lease*, *product renting/sharing*, and *product pooling*. With product lease, a subscription fee is paid by the user for using the product. The user has unlimited and individual access to the product. Product renting/sharing differs from product lease in that the product is sequentially used by different users and that the user does not have unlimited access to the product. Product pooling is fairly similar to product renting/sharing, but the difference is that with product pooling the product can be used simultaneously by other users.
- **Result-oriented services:** The most ‘servitized’ category are the result-oriented services, in which the provider and the user agree on the delivery of a result instead of the delivery of a product. The first sub-category of result-oriented services are *activity management/outsourcing*, in which a third-party takes over an activity or business process of the customer. These contracts often include performance indicators to ensure service quality. One of the more ‘classical’ sub-categories of PSS business models is the *pay-per-service unit* business model. Herein the user does not buy the product anymore but buys the output of the product. Payment to the manufacturer is based on the level of use of the product. The final sub-category are the *functional result* models, in which the user pays for a functional result to be delivered by the service provider. In this sub-category, the type of product supplied to the customer is almost irrelevant, as long as the promised result can be delivered.

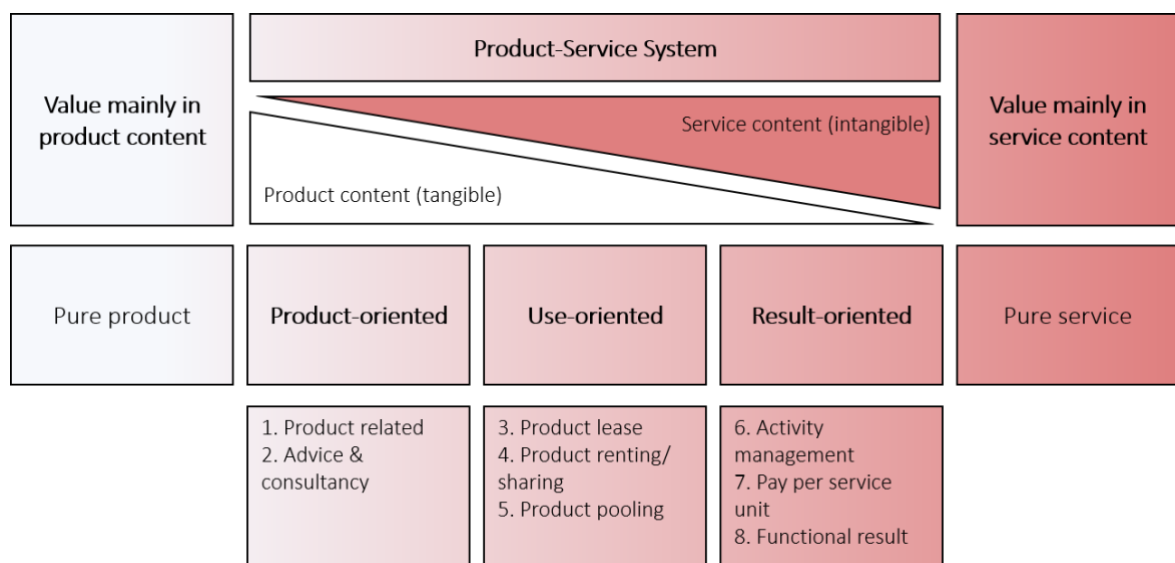


Figure 10: The different categories of services by Tukker (2004).

Concluding remarks on servitization

Both Oliva and Kallenberg (2003) and Tukker (2004) have developed a typology for services along the product-service continuum and both typologies share several similarities. Nevertheless, there are also differences between the two. The typology by Oliva and Kallenberg describes the services on the left side of the continuum with great detail but lacks to provide much information on the services on the extreme right of the continuum, the operational services. On the other hand, Tukker (2004) defines the services at the right side of the continuum with more detail. For each type of service he provides information on the revenue model of the service and the ownership of the products/equipment that are involved in the service, information that is not disclosed by Oliva and Kallenberg (2003). But Tukker's (2004) typology is not perfect either. He groups multiple types of services into the product-oriented services category. For instance, Tukker (2004) groups 'product-related services' and 'advice & consultancy' into the same category, whilst Oliva and Kallenberg (2003) group those into separate categories. Moreover, Oliva and Kallenberg (2003) distinguish between the different types of services on two dimensions: Product-oriented versus process-oriented services, and transaction-based services versus relationship-services. It seems that none of the typologies perfectly fit the nature of this study. Both lack some level of detail in certain areas. But they also complement each other. Both authors use the product-service continuum to map their different categories of services. Where the typology of Tukker (2004) lacks to describe the product-related services at the extreme left of the product-service continuum in more detail, Oliva and Kallenberg (2003) fail to elaborate on the operational services, at the extreme right of the product-service continuum. Both typologies complement each other and should be integrated into one framework.

3.1.2 Servitization framework

Revising the Tukker typology

The typology by Tukker (2004) is relatively simple and easy to explain to non-experts. It clearly distinguishes between the different groups of services. Especially at the right extreme of the product-service continuum it offers more insight into the different types of services than the typologies of Mathieu (2001) and Oliva & Kallenberg (2003). However, where other authors divide the services that are listed in the product-oriented category into multiple categories, Tukker (2004) groups them into one category named product-oriented services. Looking at the typologies of other authors, it is possible to split the services within the product-oriented category into two new categories. Splitting the category into two categories allows the manufacturing firms to be more specifically categorized during the case interviews. Thus, we combine several elements of the typology of Oliva & Kallenberg (2003) with the typology of Tukker (2004) to create a new framework for categorizing services, see Figure 11. Within the revised framework there are four categories of services along the product-service continuum:

- ***Basic product-oriented services*** are positioned at the extreme left of the product-service continuum. In this case, the business model is still very much focused on selling products, along with some extra added services. The services offered are focused on the use of the product, such as maintenance and repair services (Tukker, 2004). Ownership of the product still remains with the customer. Services are aimed at increasing product functionality and durability (Barquet, Oliveira, Amigo, Cunha, & Rozenfeld, 2013; Tukker, 2004), and interaction with the customer is in most cases transactional (Gaiardelli, Resta, Martinez, Pinto, & Albores, 2014). Examples of basic product-oriented services are the provision of spare-parts, installation services, recycling, preventive maintenance, and condition monitoring (Gaiardelli et al., 2014; Tukker, 2004).
- ***Professional product-oriented services*** still have the product as the core element of the value proposition, but services already are a bigger part of the offering. Whereas basic-product oriented services have a product focus, professional product-oriented services can have a product or process focus (Gaiardelli et al., 2014). Services such as training and consultancy are aimed at ensuring efficient use of the product by the customer (Tukker, 2004). Like basic product-oriented services,

ownership of the product remains with the customer (Barquet et al., 2013; Tukker, 2004). The type of relationship between the provider and customer is dependent on the level of training, consultancy, or management that is delivered. In some cases this is transaction-based, while other forms of consultancy or training require a more intense relation between the provider and customer (Gaiardelli et al., 2014).

- **Use-oriented services** are higher positioned on the product-service continuum. In this, products play a smaller role in the overall value of the offering. In fact, the product is owned by the manufacturer and not the customer, and the manufacturer sells the use or availability of the product to the customer (Baines et al., 2007; Barquet et al., 2013; Tukker, 2004). The manufacturer has the incentive to develop durable products and to maintain them correctly, in order to extend their lifecycle and maximize the usage of the products (Barquet et al., 2013; Tukker, 2004). The interaction between the customer and the manufacturer changes from transaction-based to relationship-based. Often, the move to use-oriented services is driven by an urge to increase the utilization of the existing service organization that is already in place (Oliva & Kallenberg, 2003). Examples of use-oriented services are product lease, product sharing and product pooling (Tukker, 2004).
- **Result-oriented services** are at the very end of the of the product-service continuum and can be regarded as the final step in the servitization journey of a manufacturer. Products here are merely an add-on (Oliva & Kallenberg, 2003). With result-oriented services the manufacturer remains owner of the product, but sells the customer a certain outcome or result that is created by the product (Baines et al., 2007; Barquet et al., 2013; Tukker, 2004). In other words, the manufacturer takes over the risk and responsibility of a customer’s process (Oliva & Kallenberg, 2003). Like use-oriented services, the interaction between the customer and manufacturer is relationship-based (Oliva & Kallenberg, 2003). Examples of result-oriented services are outsourcing, pay-per-use schemes and outcome-based agreements (Baines et al., 2013; Gaiardelli et al., 2014).

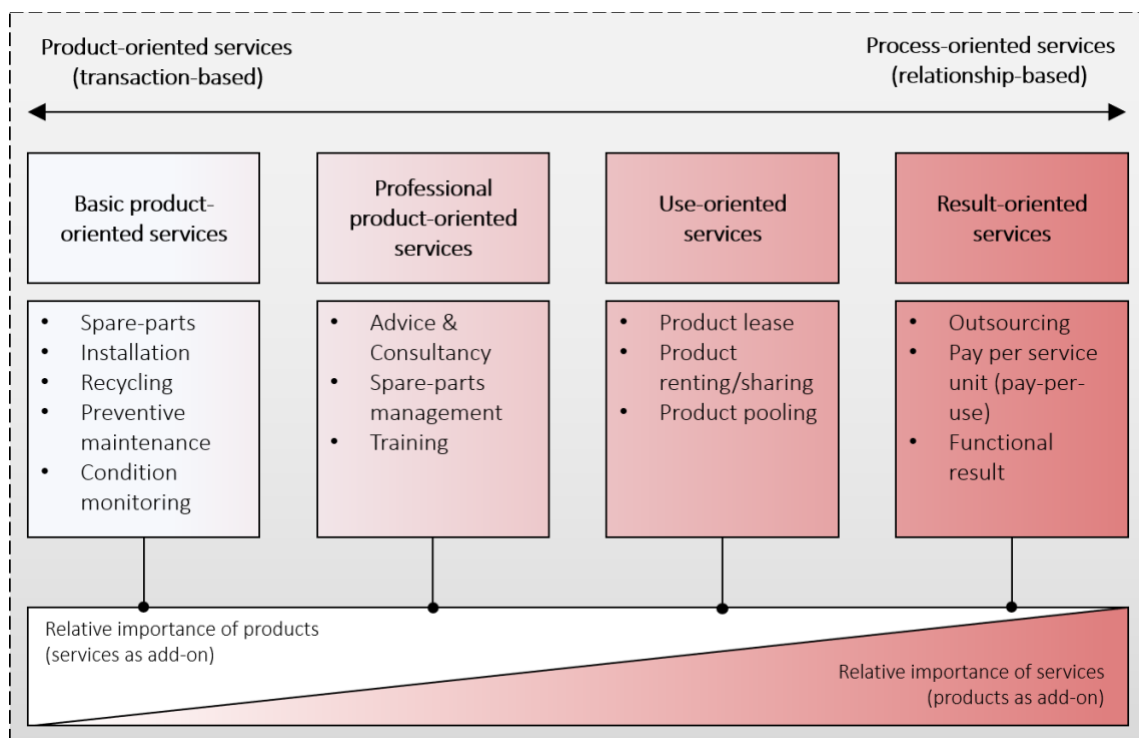


Figure 11: The servitization framework that was developed based on the typologies from Oliva & Kallenberg (2003) and Tukker (2004).

3.2 Dynamic Capabilities

3.2.1 Theoretical background

Origins of the dynamic capabilities theory

The product-based competition in which manufacturing firms usually engage is under pressure as it is becoming increasingly more difficult for firms to differentiate on a product-level. Servitization offers new opportunities for differentiation, as services are more difficult to imitate than products (Vandermerwe & Rada, 1988), allowing manufacturing firms to sustain their competitive advantage (Kindström & Kowalkowski, 2009). One theory that deals with the concept of competitive advantage and how firms can sustain this, is the dynamic capabilities theory, which was first introduced by Teece et al. in 1997. The dynamic capabilities theory builds upon existing strategic management theories such as the resource-based view (RBV). However, the dynamic capabilities theory complements existing strategic management theories on two aspects. First, the term “dynamic” refers to a firm’s ability to renew its competences in order to stay relevant in a fast-changing business environment. The RBV and several other strategic management theories, on the other hand, are static and do not take into account changes in the business environment (Teece et al., 1997). For instance, the RBV does not consider how technological opportunities and engaging in development activities can impact a firm’s fate, and thereby can change competition too (Teece, 2007). The dynamic capabilities theory does account for these changes. And secondly, the “capabilities” part refers to matching the organization’s skills, resources and competences to the fast-changing business environment, which is a key role for strategic management. Even though the RBV argues that control over scarce resources is the source of competitive advantage, it does not provide strategies for developing new capabilities. Combining the dynamic and the capabilities part leads to the following definition by Teece et al. (1997, p. 516), who define dynamic capabilities as *“the firm’s ability to integrate, build, and reconfigure internal and external competences to address rapidly changing environments”*.

Eisenhardt and Martin (2000) conclude that there are two types of markets in which dynamic capabilities have different characteristics. First there are the moderately dynamic markets, where change is frequent and predictable, and where industry structures are relatively stable. In such environments, dynamic capabilities are “complicated, detailed, analytic processes that rely extensively on existing knowledge and linear execution to produce predictable outcomes” (Eisenhardt & Martin, 2000, p. 1106), which is similar to the traditional notion of routines. In highly dynamic markets, on the other hand, dynamic capabilities are “experiential, unstable processes that rely on quickly created new knowledge and iterative execution to produce adaptive, but unpredictable outcomes” (Eisenhardt & Martin, 2000, p. 1106).

Distinguishing between operational and dynamic capabilities

But how exactly do dynamic capabilities differ from ‘ordinary’ capabilities? Wang and Ahmed (2007, p. 35) define capabilities as “a firm’s capacity to deploy resources, usually in combination, and encapsulate both explicit processes and those tacit elements embedded in the processes”. The basis of a firm’s capabilities is formed by its resources, and capabilities demonstrate a firm’s ability to deploy these resources to reach a certain objective (Wang & Ahmed, 2007). Generally speaking, a firm’s ‘ordinary’ capabilities, also known as *operational* capabilities, are required for its day-to-day activities and to keep the business running in the short-term. They are required to keep the status quo (Winter, 2003). However, operational capabilities can become irrelevant in changing market conditions, resulting in a competency trap in which firms become better at a set of processes that are becoming increasingly less relevant (Wang & Ahmed, 2007). Dynamic capabilities, on the other hand, enable a firm to change the way it does business and remain competitive in the long-term. They allow a firm to change its operational capabilities (Helfat & Winter, 2011). However, only when firms apply them earlier and more intelligently than competitors, dynamic capabilities can create a sustainable competitive advantage. A firm’s ability to quickly react to market changes and to transform the organization accordingly, is costly for competitors to imitate and thus creates a competitive advantage (Wang & Ahmed, 2007). In theory,

the difference between operational capabilities and dynamic capabilities seems clear. Nevertheless, Helfat & Winter (2011) rightly point out that the difference between operational and dynamic capabilities is not always as clear-cut as their definitions suggest, simply because (1) some extent of change is always present in a business environment, (2) one cannot distinguish both based on their support for either radical or incremental innovation, and (3) some capabilities can be operational as well as dynamic.

Types of dynamic capabilities

Dynamic capabilities can be divided into two types: *microfoundations* and *higher-order capabilities* (Teece, 2018). One could think of microfoundations, also known as second-order capabilities, as the types of dynamic capabilities required to alter the operational capabilities or to develop new ones. Expansion into new markets or new product development are examples of microfoundations. These microfoundations are guided by higher-order dynamic capabilities and are supported by organizational processes. These higher-order dynamic capabilities allow management to spot future opportunities and to determine the organization’s optimal configuration. Moreover, higher-order dynamic capabilities “are most relevant for the innovation and selection of business models that address the problems and opportunities the company is endeavoring to solve/exploit” (Teece, 2018, p. 40). This statement also explains the relevance of the dynamic capabilities theory in the process of servitization, in which manufacturing firms alter their product-oriented business model to transition to service-oriented business models, which is only possible when possessing the right higher-order dynamic capabilities.

Teece (2007) distinguishes between three types of higher-order dynamic capabilities: *sensing*, *seizing*, and *reconfiguring* (see Figure 12). Sensing capabilities are required to identify and create new and future opportunities. It requires learning and creativity, as well as scanning the internal and external environment for technological developments and (latent) user needs. These activities should be embedded in the enterprise itself, and not just limited to a few persons within the organization. Seizing capabilities are required to capture the opportunities that are ‘sensed’. This involves developmental and commercialization activities. The right technological competences and complementary assets are needed, as well as the development of a business model to capture its commercial value. Organizational innovation, such as the design of a new business model, is as relevant for business success as having the right technology. Sensing and seizing an opportunity successfully can lead to profitable growth. However, to sustain this growth in the long-term, firms need to reconfigure their organization to break free from path dependencies and routines. Assets, routines and the structure and culture of the organization need to be realigned with the new business model, requiring reconfiguring capabilities.

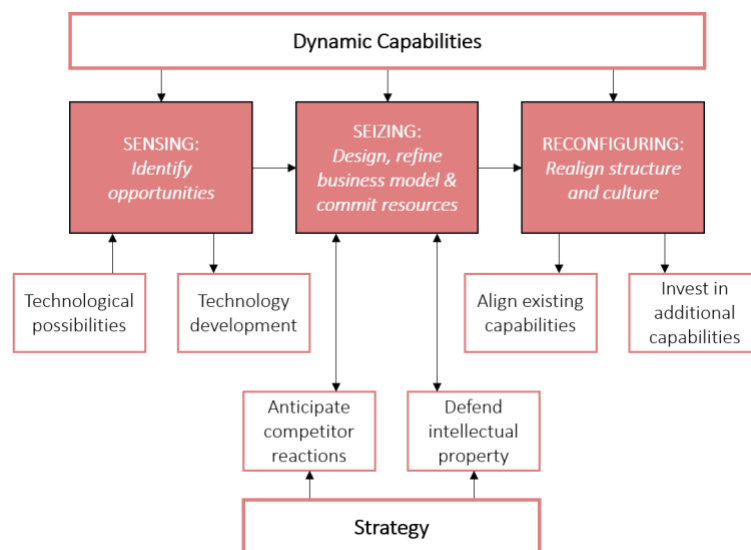


Figure 12: The dynamic capabilities framework adapted from Teece (2018).

Dynamic capabilities and servitization

In the previous section the three types of dynamic capabilities were discussed. In this section they will be put into the context of servitization. As we concluded earlier, how firms can sustain a competitive advantage in fast changing environments is what the dynamic capabilities theory traditionally focusses on (Teece et al., 1997). Manufacturing firms are currently confronted with changing environments, as product margins are declining and digital technologies are rising, pushing manufacturers to go down the path of servitization (Benedittini et al., 2015; Davies, 2004; Gebauer et al., 2005). It is clear that the development and delivery process of services is less tangible than that of products. And because these processes are intertwined with an organization's capabilities, which in turn are rooted in its processes and routines, looking at servitization from a dynamic capabilities perspective is relevant. A manufacturing firm looking to pursue servitization needs dynamic capabilities to create new service offerings, commercialize these successfully, and quickly adapt to changes in its environment (den Hertog et al., 2010). The three types of dynamic capabilities, namely sensing, seizing, and reconfiguring, are all relevant for servitization in different ways.

Sensing capabilities are required to 'sense' new opportunities in the emerging service market (Gebauer et al., 2012), a market that manufacturing firms are often not familiar with. For instance, manufacturing firms pursue servitization to differentiate themselves and create a competitive advantage (Vandermerwe & Rada, 1988), or because of the potential financial benefits that servitization brings (Davies, 2004; Gebauer et al., 2005; Wise & Baumgartner, 1999). However, if you do not possess the right sensing capabilities, it will be very hard to spot these strategic or financial opportunities (Gebauer et al., 2012; Kanninen et al., 2016). Similarly, without the right seizing capabilities manufacturing firms will miss to capture the new opportunities that are presented by servitization. For instance, by having product-oriented decision-making processes in place, firms can easily miss to seize service innovation opportunities. Or when not having a business model in place to successfully exploit them, they will fail to commercialize the service innovation opportunities (Kindström et al., 2013). The development and delivery of services requires different capabilities (den Hertog et al., 2010), thus manufacturing firms need reconfiguring capabilities to modify their existing manufacturing capabilities and create the service-oriented capabilities that are required to successfully develop service innovations (Fischer et al., 2010). Reconfiguring capabilities are also necessary change the organizational culture and structures to fit a service-oriented organization (Gebauer et al., 2012).

Concluding remarks on dynamic capabilities theory

Changing market environments are a reason for manufacturing firms to pursue servitization, as the servitization pathway offers attractive strategic and financial opportunities, amongst others. In order to respond to these changing environments, to spot these opportunities, to turn them into commercially viable offerings, and to change the organization accordingly, firms need to be dynamically capable and have the right capabilities. Based on this, studying how manufacturing firms make the transition to servitization using a dynamic capabilities approach is relevant.

3.2.2 Dynamic capabilities required for servitization

Dynamic capabilities for servitization are still an underresearched topic, as the systematic literature review resulted in only 7 papers in which dynamic capabilities for servitization were at the center of the research. Based on this sample, three types of papers were identified: 1) Papers that focus on the dynamic capabilities required for servitization in general, not distinguishing between the different levels of servitization. 2) Papers that focus on dynamic capabilities for more advanced services (such as result-oriented services) in specific. And 3) papers that do differentiate between the different servitization levels but do not focus on one level in specific. Of the 7 papers in the final sample, there are only three papers who specifically mention the dynamic capabilities required for result-oriented services, advanced services, integrated solutions or similar concepts related to the 'highest' level of servitization.

Coreynen et al. (2017) define three pathways of servitization: industrial servitization, commercial servitization, and value servitization. The latter pathway involves service agreements including monitoring, materials provision, and outsourcing of customer's activities, and shows resemblance with the definition of use-oriented and result-oriented services (Tukker, 2004). Likewise, Gebauer et al. (2012) define three pathways as well; enhancing relational value for the existing-buyer relationships, financial value-seeking behavior in existing and new supplier-buyer relationships, and a radical leap towards a new value constellation downstream in the value chain. Again, the latter one being similar to the definition of result-oriented services. One paper focused on pay-per-use services in specific Gebauer et al. (2017), which are a subcategory of services within the category of result-oriented services (Tukker, 2004). The remaining papers all focused on the dynamic capabilities required for servitization as a whole, not distinguishing between different levels of servitization (Coreynen et al., 2017; den Hertog et al., 2010; Gebauer et al., 2012; Kanninen et al., 2016; Kindström et al., 2013). However, the dynamic capabilities mentioned in these papers are still relevant since manufacturing firms do not start providing result-oriented services overnight. Most firms will incrementally become more service-oriented by adding specific services over time, the so-called exploitation approach (Fischer et al., 2010; Oliva & Kallenberg, 2003). Meaning that dynamic capabilities required for offering basic services are also required in certain phases of the more radical exploration approach (Fischer et al., 2010), when a manufacturing firm moves to providing more advanced services directly.

After a closer inspection, the paper by Saul and Gebauer (2018) was deemed less relevant because the authors specifically focus on the dynamic capabilities for so-called "born solution providers". Born solution providers are firms that provide solutions when markets are still in their market development phase and not yet mature. It is often unclear to them how their product will perform in the market and they often have a small installed base. On the other hand, most incumbent manufacturing firms who are moving to providing solutions already have a good understanding of their products, their clients' needs and have a large installed base of products, since they are experienced at manufacturing and selling their products. In that regard, the position of manufacturing firms that pursue servitization is different from that of born solution providers. Therefore, we do not consider the dynamic capabilities that are specifically focused on born solutions providers.

The next section elaborates on the dynamic capabilities that were retrieved from the final sample of papers. Moreover, it is discussed how each dynamic capability fits in the servitization framework (Figure 11) that was developed earlier in this chapter.

Sensing capabilities

Almost all papers in the final sample highlight the importance of understanding your customers' needs and the way their business works (Coreynen et al., 2017; den Hertog et al., 2010; Gebauer et al., 2012; Kanninen et al., 2016; Kindström et al., 2013). They mention several reasons why this is such an important capability to have. First, the ability to understand your customers' needs enables you to generate ideas for new products and services that fulfil those needs (Coreynen et al., 2017). Where product-based innovations are often the result of research, most service innovations are the result of observed unmet customer needs. Having a function or ability to sense these needs allows you to generate ideas for new services (den Hertog et al., 2010). Moreover, it allows you to identify new strategic opportunities that are located downstream in the value chain (Gebauer et al., 2012), in other words, opportunities that are close to the customers' business. Often, traditional marketing methods that work for product-based offerings are less sufficient. What is required for sensing the needs for service-based offerings is a more collaborative way (Kindström et al., 2013). For instance, sensing customer needs can be done by interacting closely with your customer (den Hertog et al., 2010), and by having dedicated organizational roles, systems and processes in place that capture and communicate customer needs on a continuous basis. However, in order to do so, front-line staff should have the competences to build new relationships and interact with customers (Kindström et al., 2013).

Developing new services is useless when it is not done in close collaboration with customers, or when there is not a high understanding of the needs they have (Kanninen et al., 2016). Having the ability to understand your customer’s business and needs is important in every stage of the servitization process. However, extra care should be given to this capability if firms want to be successful in the development and delivery of services that have an increased process focus instead of a product focus (Coreynen et al., 2017), which are use-oriented and result-oriented services, as well as some professional product-oriented services. Synthesizing these findings leads to the first dynamic capability:

1. CUSTOMER NEED SENSING

<i>Description:</i>	The ability to understand the customers' business and processes and sense customer needs.
<i>Important for:</i>	Professional product-oriented services + Use-oriented services + Result-oriented services
<i>Authors:</i>	Coreynen et al. (2017); Den Hertog et al. (2010); Gebauer et al. (2012); Kanninen et al. (2017); Kindström et al. (2013)

The customer need sensing capability indicates that service innovation often the result is of unmet customer needs. However, unmet customer needs are not the sole initiator of new service offerings. Service innovation is also driven by new technological opportunities, and therefore a firm should have the ability to detect new technological options (den Hertog et al., 2010; Kindström et al., 2013). Firms can cover this by having people dedicated to scanning new technologies for promising opportunities. For example, this could be part of the responsibilities of an IT or business development function within the organization (den Hertog et al., 2010). Possessing the capability to explore new technological opportunities is crucial to be successful at any of the four stages in the servitization framework. For instance, digital technologies enable manufacturers to turn maintenance services into predictive maintenance services. On the professional product-oriented level, innovative remote monitoring technologies allow manufacturers to track the use of their products and provide consultancy services based on that data. An example of this is Michelin, who analyzes the data coming from their customer’s tires to provide training on how truck drivers can drive more fuel efficiently. Manufacturers use technology to predict failures and reduce downtime, which is especially useful when assuring the availability of a product to a customer in a use-oriented service offering. And for result-oriented services, in which the customer pays for the use of the product, it is absolutely crucial that manufacturing firms can track the use and output of their product. Taking all the above in mind, we come to the second dynamic capability:

2. TECHNOLOGY EXPLORATION

<i>Description:</i>	The capability to signal and explore new technological options outside the service system.
<i>Important for:</i>	Basic product-oriented services + Professional product-oriented services + Use-oriented services + Result-oriented services
<i>Authors:</i>	Den Hertog et al. (2010); Kindström et al. (2013)

Besides understanding your customers’ business and sensing new technological options, firms should also understand the service system and the different actors involved in order to sense new opportunities for service innovations. Co-suppliers and other partners in the service system can be sources for service innovations (Kindström et al., 2013). Gebauer et al. (2012) also conclude that firms should have the ability to vision and understand their service system and the key partners involved. Manufacturing firms should be able to anticipate how new service offerings will affect the service system and the roles of the actors involved. This is especially the case for the transition to use-oriented and result-oriented services (Gebauer et al., 2012), as the provision of these types of services often require several changes in a firm’s business model. Kindström et al., (2013) views the ability to understand the services system

as a “sensing” capability, but Gebauer et al. (2012) classify it as a “seizing capability”. Having two similarly defined capabilities in different categories creates confusion. Therefore, they were grouped together into the following capability belonging to the “sensing” category, which suits the nature of this capability better:

3. SERVICE SYSTEM SENSING

<i>Description:</i>	Building up an understanding of the entire service system required for delivering the service, including links to partners and suppliers, and creating network skills.
<i>Important for:</i>	Use-oriented services + Result-oriented services
<i>Authors:</i>	Gebauer et al. (2012); Kindström et al. (2013)

The fourth way of sensing opportunities for new service offerings is to get an understanding of the services that are already offered by the firm. Not all services are visible internally, for instance when they are not listed in the financial statements. It could be that there are local service initiatives in subsidiaries that are unknown to the rest of the firm. Being able to identify these local service innovations and subsequently exploit them could be another source of service innovation and allows for the integration of existing products and services (Kindström et al., 2013), making *internal service sensing* an important capability for the transition to use-oriented and result-oriented services in which product and services are combined to create complex bundles of products and services.

4. INTERNAL SERVICE SENSING

<i>Description:</i>	Having a structured process in place to identify and exploit local/regional initiatives
<i>Important for:</i>	Use-oriented services + Result-oriented services
<i>Authors:</i>	Kindström et al. (2013)

A final sensing capability that was identified is the ability of a firm to invest in multiple service propositions at the same time. The possibility that a service innovation does not make it to the market is evident (Gebauer et al., 2012), especially in the case of more advanced service offerings such as use-oriented and result-oriented services, in which significant parts of the firm’s business model change. For instance, these advanced service offerings often include revenue models that are new to the firm. Allowing various service propositions to emerge will increase the chances of ending up with a successful offering at the end of the innovation process. The risk of failure is lower for basic- and professional product-oriented services, as they often target existing customers and do not require the business model to change as much.

5. REDUCING DEPENDENCY

<i>Description:</i>	Allowing various service propositions to emerge to increase chances of success.
<i>Important for:</i>	Use-oriented services + Result-oriented services
<i>Authors:</i>	Gebauer et al. (2012)

Seizing capabilities

The more advanced services such as result-oriented services often guarantee a certain outcome or performance delivered to the customer. Remotely monitoring the products or equipment that are part of the service offering allows firms to better estimate how usage will affect the costs and help to mitigate risks (Gebauer et al., 2017). Moreover, the ability to track product usage allows them to implement pay-per-use models. In order to process the data that is collected through remote monitoring technologies such as IoT, firms need to have a data processing and interpretation capability, allowing them to analyze product usage and process data to further improve the performance of the solution and to deliver the guaranteed results (Coreynen et al., 2017).

6. DATA INTERPRETATION

<i>Description:</i>	The ability to process and interpret data, analyzing product usage and process data to help customers achieve certain outcomes.
<i>Important for:</i>	Use-oriented services + Result-oriented services
<i>Authors:</i>	Coreynen et al. (2017); Gebauer et al. (2017)

In order to fully seize new opportunities for service innovations, firms should have a structured service development process in place (den Hertog et al., 2010; Kanninen et al., 2016; Kindström et al., 2013). Services are often developed on an ad-hoc or project basis. They are tailored to specific customer needs and the process is difficult to replicate (Kanninen et al., 2016; Kindström et al., 2013). Moreover, firms often apply a product development approach to service development, therewith overlooking challenges that are specific to services (Kindström et al., 2013). A more structured development process dedicated to services is required to fully exploit service innovation opportunities on a continuous basis (den Hertog et al., 2010; Kanninen et al., 2016; Kindström et al., 2013).

7. SERVICE DEVELOPMENT PROCESS

<i>Description:</i>	Having a structured and flexible service development process in which customer needs and technologies are applied in a service concept.
<i>Important for:</i>	Basic product-oriented services + Professional product-oriented services + Use-oriented services + Result-oriented services
<i>Authors:</i>	Den Hertog et al. (2010); Kanninen et al. (2017); Kindström et al. (2013)

Due to their intangible nature and the human component involved, standardizing all types of services is hard, making it very challenging to commercialize and scale services in a uniform way. Customers still expect services to be similar in terms of process, quality and price when they are associated with a certain brand name. Therefore, manufacturing firms should have a structured commercialization process in place, which enables them commercialize and scale services in a uniform way (den Hertog et al., 2010; Kanninen et al., 2016).

8. SERVICE COMMERCIALIZATION

<i>Description:</i>	The ability to commercialize and scale services in a uniform way
<i>Important for:</i>	Basic product-oriented services + Professional product-oriented services + Use-oriented services + Result-oriented services
<i>Authors:</i>	Den Hertog et al. (2010); Kanninen et al. (2017)

Bringing new service innovations to the market is one thing, but successfully selling them to customers is another. In order to successfully commercialize new service innovations, firms themselves should understand the potential of moving towards a service-oriented business model. Part of this is the ability to see the new solution not just as a composition of products and services, but as a utility that delivers value to its customers (Gebauer et al., 2012). For basic- and professional product-oriented services this is less of an issue, as the physical product remains at the core of the value proposition and the service aspect is merely an add-on. For use- and result-oriented services, on the other hand, it is key to have your organization understand why this change of business model is taking place. Building this credibility and trust within the firm can be done by sharing showcases and success stories internally. In the end, it is crucial for a firm to have the ability to communicate the value of the new service value throughout the organization (Kanninen et al., 2016), which is expressed in the following dynamic capability:

9. VALUE UNDERSTANDING

<i>Description:</i>	The capability to identify and understand the value of the service to the customer and communicate this internally.
<i>Important for:</i>	Use-oriented services + Result-oriented services
<i>Authors:</i>	Gebauer et al. (2012); Kanninen et al. (2017)

Besides creating internal understanding, the firm should also be able to communicate the value of the new service offering to the customers. Customers are often hesitant to work with new offerings, and firm should convince them that the new service-based offering offers more potential than the traditional product-based offerings (Coreynen et al., 2017; Kanninen et al., 2016). Similarly, Coreynen et al. (2017) conclude that firms need a value visualization capability that allows them to communicate the value of the new solution to the customer in various ways. Essentially, regardless of the type of service, firms should be able to clearly communicate the value of the service to its customer.

10. VALUE COMMUNICATION

<i>Description:</i>	The ability of communicating the value of the service to the customer.
<i>Important for:</i>	Basic product-oriented services + Professional product-oriented services + Use-oriented services + Result-oriented services
<i>Authors:</i>	Coreynen et al. (2017); Kanninen et al. (2017)

Services, and especially the more advanced offerings, are often highly customized and intangible, leading to conflicts between front-offices and back-offices. However, front-office employees are often engaged with the customer and therefore also understand what the client demands. This should be communicated clearly to the back-offices, to ensure that the service is designed and delivered in a way that meets the customer demands (Kanninen et al., 2016). Firms should constantly balance the relationship between the front-offices, where customization is demanded by the customer, and back-offices, where the service is designed and delivered to the customer and where standardization is preferred (Coreynen et al., 2017). Having a balanced relationship between the front-office and back-office, the so-called *hybrid offering deployment* capability, is important in the development and delivery of all types of services.

11. HYBRID OFFERING DEPLOYMENT

<i>Description:</i>	Continuously balancing front-office customization and back-office service design and delivery.
<i>Important for:</i>	Basic product-oriented services + Professional product-oriented services + Use-oriented services + Result-oriented services
<i>Authors:</i>	Coreynen et al. (2017); Kanninen et al. (2017)

Service innovations are often no more than a new combination of existing service elements applied in a new environment. These existing service elements, which are often stripped down to essential service components, allow for two things. First, they allow the customer to have all its needs fulfilled by one service provider. An example of this are manufacturers that offer basic product-oriented services that cover the entire lifecycle of the product, ranging from installation services all the way to recycling services. Secondly, since these service elements are stripped down to the bare essential, they are also highly specialized and thus allow for a certain level of standardization from the perspective of the service provider. In order to do so, firms must first possess the capacity to bundle or unbundle existing service components into new services (den Hertog et al., 2010), which we call the *(un)bundling* capability. This is a key capability in all of the stages in the servitization framework. For product-oriented services it is important because different customers have different needs. Being able to strip down services or to combine service elements allows manufacturers to target these different needs whilst still remaining a certain level of standardization. This capability is also necessary to combine existing service elements

and products in order to create the complex PSS that are characteristic of the use- and result-oriented services.

12. (UN)BUNDLING

<i>Description:</i>	The ability to bundle or unbundle existing service elements into new services.
<i>Important for:</i>	Basic product-oriented services + Professional product-oriented services + Use-oriented services + Result-oriented services
<i>Authors:</i>	Den Hertog et al. (2010)

As was stated earlier, services are often intangible of nature and involve a human aspect, making it hard to deliver them in a uniform way. Having a well-managed service delivery process is a way to reduce variability of the service delivery, which is relevant for all types of services. An example of this is to introduce service scripts for basic product-oriented services, in which the method for delivering the service is outlined. A well-managed process also figures as the foundation for more efficient sensing and seizing of new opportunities. For instance, within the service delivery scripts, service technicians could be encouraged to interact with customers more actively, allowing them to spot new opportunities (Kindström et al., 2013). Moreover, a well-managed process allows firms to find a good balance between service quality and service costs. For instance, by continuously assessing the strengths of your own service organization with those of external organizations, you may find out that outsourcing some of your services to partners could be more beneficial. This is especially relevant for more advanced service offerings such as use- and result-oriented services, where the manufacturer often takes over customer activities that are distant from its core capabilities. In such situations it is good to assess whether it is more beneficial to outsource certain service components. Again, this is only possible if you have good management over your own service-delivery process (Kindström et al., 2013), which is reflected in the *managing service delivery* capability.

13. MANAGING SERVICE DELIVERY

<i>Description:</i>	The ability to quickly restructure internal and external resources for the delivery of new and improved services, including having roles dedicated to services on operational and strategic levels.
<i>Important for:</i>	Basic product-oriented services + Professional product-oriented services + Use-oriented services + Result-oriented services
<i>Authors:</i>	Kindström et al. (2013)

In order to have full commitment for expanding the service business from inside the organization, it is important to share knowledge on successful projects with the rest of the organization. This creates trust and internal commitment (Kanninen et al., 2016). Creating this trust and commitment is especially important to get everyone on board for services that radically change the firm's business model, which is the case with use- and result-oriented services. For the delivery of those services it is essential that both the product- and service organization support the development of PSS, and exploiting the *knowledge sharing* capability is an important factor in this.

14. KNOWLEDGE SHARING

<i>Description:</i>	The ability to share information and knowledge inside the organization about services and successful service delivery processes.
<i>Important for:</i>	Use-oriented services + Result-oriented services
<i>Authors:</i>	Kanninen et al. (2017)

Value-creation is at the center of more servitized offerings such as the use- and result-oriented services. And in order to completely seize an opportunity, firms need to turn the value that is delivered to the customer into a stream of revenue (Kindström et al., 2013). However, firms often struggle to monetize

this value and to define the right pricing logic for different services. Also, customer segmentation remains challenging (Kanninen et al., 2016). Firms often invent new mechanisms to monetize on the value, such as profit sharing, dynamic pricing, and performance-based contracts. These mechanisms focus on the “value-in-use” that is created during the lifecycle of a product, unlike product-based offerings where the focus is on the transfer of ownership (Kindström et al., 2013). Thus, in order to monetize the value that is created from result-oriented services, firms should have the ability to adopt new revenue mechanisms based on the value they identify (Kanninen et al., 2016; Kindström et al., 2013).

15. ADOPTING NEW REVENUE MECHANISMS

<i>description:</i>	The ability to visualize the value of new services and adopt new revenue mechanisms based on that value.
<i>important for:</i>	Result-oriented services
<i>authors:</i>	Kanninen et al. (2017); Kindström et al. (2013)

The transition to more servitized offerings requires firms to have a higher degree of interaction with their customers and service network partners (Davies, 2004; Oliva & Kallenberg, 2003; Visnjic, Neely, & Jovanovic, 2018; Windahl et al., 2004). Interaction between firm and customer is needed regardless of whether the type of innovation is product- or service-based. However, what makes service interactions different is that they can lead to the seizure of new service innovation opportunities, as a result of the repeated co-creation with customers (Kindström et al., 2013). Co-creation with customers and partners is essential as service offerings are often combinations of different service elements and products and require different service partners in order to be delivered to the customer. Not only should firms be able to co-develop with their customers and partners, but they should also be able to manage these processes and partnerships (den Hertog et al., 2010). Part of this is the ability to mobilize these partners and convince them to join the value-creating process. Cooperating with partners in this process is key in developing advanced service offerings that question the firm’s existing business model (Gebauer et al., 2012). Concluding, we can say that firms should possess the ability to co-create with customers and partners in the development and delivery of services and that they should also be able to manage these partnerships, which we call the *service interaction* capability.

16. SERVICE INTERACTION

<i>Description:</i>	The capability to co-develop and deliver services with customers and partners and manage these partnerships.
<i>Important for:</i>	Use-oriented + Result-oriented services
<i>Authors:</i>	Den Hertog et al. (2010); Gebauer et al. (2012); Kindström et al. (2013)

Kanninen et al. (2016) found that most firms do not price their services separately but combine them with products, resulting in sales-related goals and incentives that are still focused on the sales of products. For instance, basic product-oriented services are often given away for free to close the sale of a product. Without the right incentives sales is often not motivated to sell use- or result-oriented services either. They often prefer to sell product-based offerings that generate immediate cash flow and help them reach their financial target, instead of selling use- or result-oriented offerings that generate smaller, reoccurring streams of revenue. Manufacturing firms can maximize their service revenue by taking on a more innovative approach when it comes to defining sales incentives, which is known as the “sales incentives” capability. Measures such as customer retention and the amount of sold service units are more suitable for incentivizing salespeople to sell services.

17. SALES INCENTIVES

<i>Description:</i>	Having designed and implemented incentives and measurable goals to sell services.
<i>Important for:</i>	Basic product-oriented services + Professional product-oriented services + Use-oriented services + Result-oriented services
<i>Authors:</i>	Kanninen et al. (2017)

Just having the right sales incentives in place will not turn your service offering into a sales success. Selling services, especially the more advanced ones, requires a different kind of sales approach. The sales process of services extends over a longer period of time, is more complex and requires a strong understanding and empathy of the customer. The seller should have the ability to constantly adapt to different customer needs that come with different customer segments, hence this is a 'dynamic' capability. The right decision-maker should be targeted and the salesperson should focus on selling the value of the solution to the customer, not so much its features (Coreynen et al., 2017).

18. HYBRID OFFERING SALES

<i>Description:</i>	The capability to continuously adapt to different customer needs, reach key decision-makers and sell value-based.
<i>Important for:</i>	Basic product-oriented services + Professional product-oriented services + Use-oriented services + Result-oriented services
<i>Authors:</i>	Corynen et al. (2017)

Many firms struggle to initiate the sales of service offerings within their organization. Internal commitment is often lacking, as well as a lack of investment in service development. Having a management in place that understands how a service business can positively impact the firm's profitability in the long-term will not only lead to the initiation of a service business, but also to the allocation of the right resources to manage it. Having this support is especially important in the development and delivery of use- and result-oriented services in which parts of the existing business model change. It is common for companies to set up a separate unit or even a subsidiary firm that solely focuses on services. However, key is that management understands the profitability of service offerings in the long-term (Kanninen et al., 2016).

19. MANAGEMENT SUPPORT

<i>Description:</i>	Management measures and understands the long-term profitability of the service business.
<i>Important for:</i>	Use-oriented services + Result-oriented services
<i>Authors:</i>	Kanninen et al. (2017)

Reconfiguring capabilities

In order for a business to adopt a more service-oriented strategy, changes in the business, organization and service system are required. Reconfiguring capabilities allow a firm to change its operational capabilities and to transition to such a service-oriented strategy (Gebauer et al., 2012). One of the changes that is required for this transition is the creation of a service-oriented culture and mindset throughout the organization (Kanninen et al., 2016). Successfully moving into the provision of any service requires major changes in an organization's culture, processes, and organizational structure (Gebauer et al., 2012; Kanninen et al., 2016). The corporate culture should be more service-oriented, which can be done by reconfiguring values and roles (Gebauer et al., 2012). Another way of establishing a service-oriented culture is to separate the service business from the traditional, more product-oriented business, therewith reducing the chance of clashes between the product-oriented culture and the service-oriented culture.

20. SERVICE-ORIENTED ORGANIZATION

<i>Description:</i>	Changing the culture, structure, and processes to fit a service-oriented organization.
<i>Important for:</i>	Basic product-oriented services + Professional product-oriented services + Use-oriented services + Result-oriented services
<i>Authors:</i>	Gebauer et al. (2012); Kanninen et al. (2017)

The development of new service offerings often involves the inclusion of external actors into the service system of a firm, which is especially the case with the more advanced service offerings at the end of the product-service continuum, i.e. the use- and result-oriented services. These external actors often consist of external service providers and tier-two suppliers, and need to be managed effectively to ensure that the final service delivers the right value (Gebauer et al., 2012; Kindström et al., 2013). In order to manage the extended service system effectively, there needs to be a broader emphasis on value creation for the whole service system. For instance, firms that rely heavily on dealers to sell their integrated solutions need to create benefits for dealers to incentivize them to sell the solutions (Kindström et al., 2013). Manufacturing firms initiating this transition should also support the reconfiguring activities of other network actors, ensuring that there is a service system built that is not only able to develop a new service offering, but is also able to commercialize it (Gebauer et al., 2012).

21. SERVICE SYSTEM TRANSFORMATION

<i>Description:</i>	The ability to manage and transform roles, resources, locus of control, and power in the service system and of the external actors involved.
<i>Important for:</i>	Use-oriented services + Result-oriented services
<i>Authors:</i>	Gebauer et al. (2012); Gebauer et al. (2017); Kindström et al. (2013)

One of the hardest parts of the reconfiguration of your business to a service-oriented business is creating a service-oriented mental model (Kindström et al., 2013). According to Gary and Wood (2011, p. 569), “mental models are simplified knowledge structures or cognitive representations about how the business environment works”. Having a service-oriented mental model that frames the way you do business, is essential to the long-term success and innovation capability of all service businesses. Besides learning, part of creating such a mental model is the ability to also unlearn routines that have become obsolete in the new business. However, firms should be aware that the process of reconfiguring the business logic requires constant effort over a long period of time, before success is achieved (Kindström et al., 2013).

22. SERVICE-ORIENTED MENTAL MODEL

<i>Description:</i>	The capability to learn new routines and unlearn obsolete routines
<i>Important for:</i>	Basic product-oriented services + Professional product-oriented services + Use-oriented services + Result-oriented services
<i>Authors:</i>	Kindström et al. (2013)

Once service innovations are commercialized and provided to customers, it is key to learn from the way the current process is managed. Firms should constantly question the way they develop and deliver their service offerings, and where necessary the service innovation process should be adapted (den Hertog et al., 2010). To do so, they should adopt a trial-and-error approach to define their service portfolio (Gebauer et al., 2017). Part of this is to keep track of which service innovation failed and which service innovation was successful (den Hertog et al., 2010). This is expressed in the *deliberate learning* capability.

23. DELIBERATE LEARNING

<i>Description:</i>	Learning from the way service innovation is managed and subsequently adapt the service innovation process.
<i>Important for:</i>	Use-oriented services + Result-oriented services
<i>Authors:</i>	Den Hertog et al. (2010); Gebauer et al. (2017)

Within manufacturing firms that have their roots in a product-oriented business model and for which product development is a core activity, service innovation often is a subordinate. Especially when firms start developing more advanced services, in which products and services are combined into integrated solutions, tensions between the interests of the service business and the product business can arise due to integration issues. Therefore, firms need to be able to balance the interests and assets of the service-oriented business and the product-oriented business. The creation of service development roles within the strategic and operational departments of a firm could be a way of managing the interests of the service business (Kindström et al., 2013).

24. BALANCING PRODUCT- AND SERVICE INNOVATION

<i>Description:</i>	Maintaining a balanced relationship between the service and the product organization.
<i>Important for:</i>	Use-oriented services + Result-oriented services
<i>Authors:</i>	Den Hertog et al. (2010); Gebauer et al. (2017)

The final capability that was mentioned in the literature is the ability to define a service strategy and subsequently translate this strategy into operational guidelines. A coherent service strategy should be developed by manufacturing firms and they should adhere to it even at times that markets change for a moment. It allows them to know what their possibilities are, even if they continue to have a product orientation (Kanninen et al., 2016).

25. DEFINING A SERVICE STRATEGY

<i>Description:</i>	The capability to define a service strategy and design operational guidelines.
<i>Important for:</i>	Basic product-oriented services + Professional product-oriented services + Use-oriented services + Result-oriented services
<i>Authors:</i>	Kanninen et al. (2017)

3.2.3 Overview of the research-based dynamic capabilities

The literature review resulted in a final list of 25 capabilities that were derived from 6 scientific papers. An overview of all capabilities and the respective authors can be found in Table 7 below.

Table 7: The final list of dynamic capabilities required for servitization derived from literature.

<i>Type</i>	<i>Dynamic capability</i>	<i>Description</i>
Sensing	1. Customer need sensing	The ability to understand the customers' business and processes and sense customer needs.
	2. Technology exploration	The capability to signal and explore new technological options outside the service system.
	3. Service system sensing	Building up an understanding of the entire service system required for delivering the service and creating network skills.
	4. Internal service sensing	Having a structured process in place to identify and exploit local/regional initiatives.
	5. Reducing dependency	Allowing various service propositions to emerge within the company to increase chances of success.
Seizing	6. Data interpretation	The ability to process and analyze product usage and process data, to help customers achieve certain outcomes.
	7. Service development process	Having a structured and flexible service development process in which customer needs and technologies are applied in a service concept.
	8. Service commercialization	The ability to commercialize and scale services in a uniform way.
	9. Value understanding	The capability to identify the customer value of the service and communicate this internally.
	10. Value communication	The ability of communicating the value of the service to the customer.
	11. Hybrid offering deployment	Continuously balancing front-office customization of the service and back-office service design and delivery.
	12. (Un)bundling	The ability to bundle or unbundle existing service elements into new services.
	13. Managing service delivery	The ability to quickly restructure internal and external resources for the delivery of new and improved services, including having roles dedicated to services on operational and strategic levels.
	14. Knowledge sharing	The ability to share information and knowledge inside the organization about services and successful service delivery processes.
	15. Adopting new revenue mechanisms	The ability to visualize the value of new services and adopt new revenue mechanisms based on that value.
	16. Service interaction	The capability to co-develop and deliver services with customers and partners and manage these partnerships.
	17. Sales incentives	Having designed and implemented incentives and measurable goals to sell services.
	18. Hybrid offering sales	The capability to continuously adapt to different customer needs, reach key decision makers and sell value-based.

	19. Management support	Management measures and understand the long-term profitability of the service business.
Reconfiguring	20. Service-oriented organization	The ability to change culture, structure and processes to fit a service-oriented organization.
	21. Service system transformation	The ability to transform the service system and the external actors involved and to extend existing resources.
	22. Service-oriented mental model	The capability to learn new routines and unlearn obsolete routines.
	23. Deliberate learning	Learning from the way service innovation is managed and subsequently adapt the service innovation process.
	24. Balancing product- and service-innovation	Maintaining a balanced relationship between the service organization and the product organization.
	25. Defining a service strategy	The capability to define a service strategy and translate this into operational guidelines.

3.3 Creating an overarching framework

In the first part of this chapter we explored the concept of servitization and developed a servitization framework based on the insights that were derived from literature (see Figure 11). In the second part of this chapter the dynamic capabilities theory was discussed, and as a result of the systematic literature review, a list of 25 research-based dynamic capabilities required for servitization was constructed (see Table 7). Based on the dynamic capabilities that were found, a second iteration of the servitization framework was made, resulting in an overarching servitization framework, which can be seen in Figure 13.

This overarching servitization framework links the servitization framework with the dynamic capabilities that were derived from literature and are described in the previous section of this chapter. The vertical pillars show the different types of services that are offered along the product-service continuum, and thus represent different positions in the servitization process. On the very left the product-oriented services are located, in which the relationship between the manufacturing firm and its customers is often transactional and where services are mostly just an add-on. Move to the right and you will find the more process-oriented services such as use- and result-oriented offerings. Here, the interaction between manufacturer and customer is relationship-based, and products are merely an add-on to the services. The horizontal, blue colored pillars contain the dynamic capabilities that are relevant for the servitization stages that the pillars overlap with. For example, as we established in the previous chapter, technology exploration (2) is deemed to be a key capability to be successful at any stage of the servitization framework. On the other hand, service system sensing (3) is only considered to be a key capability for use-oriented and result-oriented services (Gebauer et al., 2012), and the blue pillar therefore only overlaps with the vertical use-oriented and result-oriented pillars. The number behind each dynamic capability corresponds with the numbering of the dynamic capabilities in Table 7.

The revised servitization framework thus shows the research-based dynamic capabilities that are relevant to be successful at each stage of the transition to servitization, and to ultimately transition to offering result-oriented services.

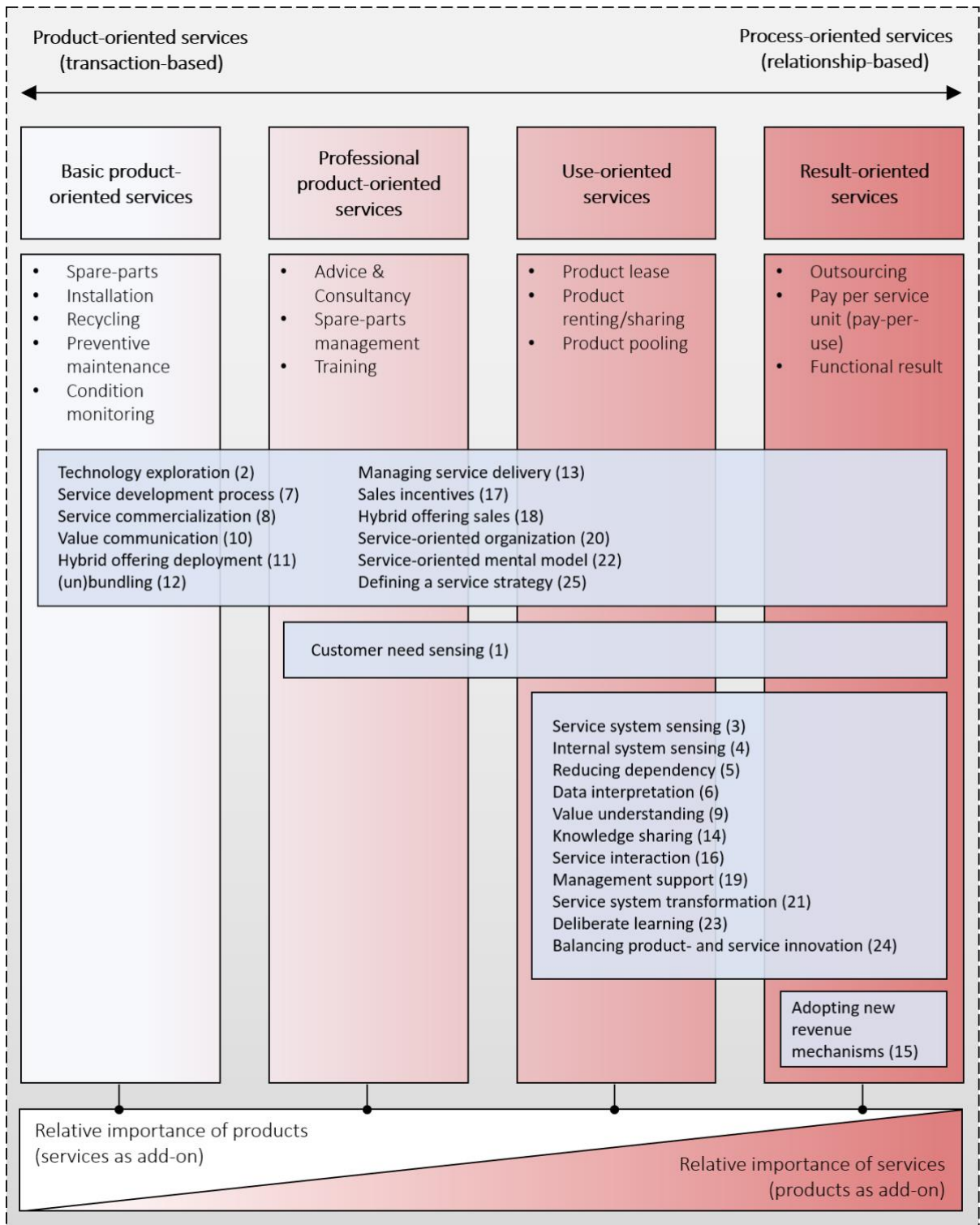


Figure 13: The servitization framework with the dynamic capabilities required for the different stages of servitization.

4 Empirical Analysis

This chapter discusses the results of the interviews that were conducted at a total of 10 case firms. First, the case firms are briefly described. After that, the second part goes in-depth on how the case firms experience the transition to servitization. Part of this is their position in the theoretical framework, their motivation for pursuing servitization, and the challenges they encounter in that journey. The third part will discuss the dynamic capabilities for servitization that are identified from the case interviews.

4.1 Case firms

A total of 10 manufacturing companies are interviewed in the course of this research. These case firms are active in a range of different manufacturing industries, such as industrial equipment (A, C, E & H), electronics (B & F), building automation (D), material handling (G), hatchery equipment (I), and poultry equipment (J). Moreover, the final sample is also diverse in terms of headcount, as it includes several companies that have 500 or less employees, as well as large, multinational companies up to 90.000 employees. An overview of the final sample of case firms can be found in Table 8 below.

Table 8: An overview of the case firms that were interviewed.

Case organization	Manufacturing industry	Employees	Current servitization level	Role of interviewee(s)	Drivers of servitization
1. Firm A	Industrial equipment	1500	Result-oriented services	Manager solution development	Marketing, financial, strategic & market pull
2. Firm B	Electronics	92.000	Result-oriented services	Solutions manager Delivery manager	Strategic & Market pull
3. Firm C	Industrial equipment	35.000	Result-oriented services	Product manager	Marketing, Financial & Market pull
4. Firm D	Building automation	500	Use-oriented services	Product manager	Strategic
5. Firm E	Industrial equipment	500	Professional product-oriented services	Service manager	Marketing & Strategic
6. Firm F	Electronics	25.000	Result-oriented services	Product manager	Financial & Market pull
7. Firm G	Material handling	5.400	Result-oriented services	Service development consultant	Marketing, Financial, Market pull & Development
8. Firm H	Industrial equipment	29.000	Use-oriented services	Product manager software & services	Marketing & Strategic
9. Firm I	Poultry equipment	350	Basic product-oriented services	Team lead aftersales	Marketing & Strategic
10. Firm J	Hatchery equipment	150	Professional product-oriented services	Service & sales manager	Marketing, Financial & Development

In the next part of this chapter the case firms are discussed in more detail, as well as their position in the servitization framework and their experience with servitization.

4.2 The position of the case firms in the servitization framework

A total of ten manufacturing firms were interviewed to provide practice-based input to the research questions. At the beginning of the interview the servitization framework (Figure 11) was explained to the interviewees, and subsequently, they were asked where in the framework they would position their firms. Their input and the data gathered during the interview were used to place each of the case firms along the product-service continuum. The result of this is presented in Figure 14 below. The green bar shows the servitization path that the case firms have followed. For instance, case firm A is positioned in the result-oriented stage, but does also still offer the other, less advanced services. We will label the case firms based on the most advanced services they offer, meaning that case firm A is labeled as “result-oriented”. Each of the case firms and their position on the framework are elaborated in more detail in the next section.

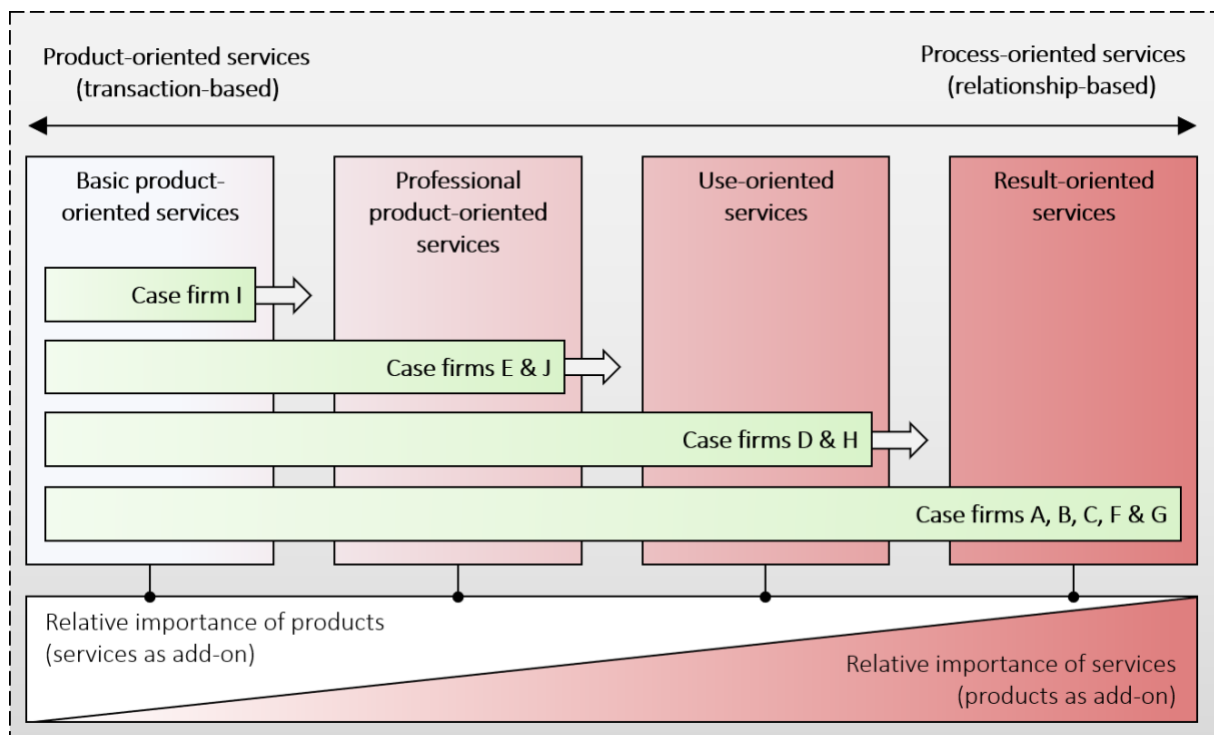


Figure 14: The position of each of the case firms on the product-service continuum. The green bar shows the path that the case firms have followed.

Case firm A

Case firm A is a manufacturer of industrial equipment and is part of a larger, internationally operating parent organization. The Dutch organization clearly expressed its ambition to become a fully servitized manufacturer a few years ago, and now offers services in all stages of the servitization framework. For a large part their service business still relies on maintenance contracts, but they do offer training and consultancy services to their customers, as well as the possibility for their customers to lease their equipment. They also have several customers who completely outsource the use of the machinery to case firm A. We can consider case firm A as a fully servitized manufacturer, active in all phases along the product-service continuum.

Case firm B

Case firm B is a multinational manufacturer of electronic and imaging products. Case firm B notices that its customers want to focus more on their core business processes, and they are responding to this by offering end-to-end services and solutions to their customers. It also offers its customers to pay for these services and its hardware through a pay-per-use model, something that they have been doing for

a long time now. Case firm B suggest they are experienced in the delivery of result-oriented services, and that their focus is now on extending their portfolio by offering more end-to-end solutions and taking over larger parts of their customers' business processes.

Case firm C

As a large multinational manufacturer of industrial equipment, case firm C covers the full range of services along the product-service continuum and can be regarded as a fully servitized manufacturer. Currently they are rolling out a new service model in which the customer pays for the solution per running hour and case firm C is responsible for all maintenance.

Case firm D

Case firm D is a firm from the Netherlands that develops and sells hardware and software related to building automation and climate control. They offer a variety of basic- and professional product-oriented services along with their hard- and software. Recently, they decided to become more servitized and, in order to pursue servitization, a new start-up was founded within the existing organization. This team specifically focuses on the development and sales of a new use-oriented offering. Case firm D also stated that this offering differs significantly from their traditional business model and that a different sales approach was required, resulting in the need to create a separate organization within the parent organization in order to develop this solution successfully.

Case firm E

Case firm E is a Dutch firm that is active in the development and manufacturing of industrial equipment and tools. They work with a network of dealers around the world to sell their equipment, and they are persuading these dealers to start providing more services to their customers. They are currently in the transition to professional product-oriented services. These services, such as training and advice, are focused on sharing knowledge with customers on how to work with their equipment more safely. Asked why they are not experimenting with more servitized offerings yet, they replied that their traditional way of selling products and services is sufficient and that they do not feel the necessity to move into use-oriented or result-oriented services yet. Moreover, their market share on the products that they deem suitable for servitization is not high enough.

Case firm F

Case firm F is a manufacturer of electronics and imaging products. They offer the full range of services along the product-service continuum and can be regarded as a fully servitized manufacturer. Within the result-oriented category, they offer a wide range of services, often consisting of a combination of hardware, software, and service. Their intention is to focus less on the manufacturing part of their business and become more of a service- and platform provider.

Case firm G

Active in the development and manufacturing of material handling solutions and logistics automation, case firm G already offers both basic- and professional product-oriented services. However, they are currently making the transition to offering result-oriented services too. In order to do so, they created a separate organization within their firm tasked with developing and operating this new business model. This end-to-end solution consists of hardware, software, and services, such as installation and maintenance. The customer either pays a yearly fee for the solution or pays for the capacity used. Currently, this solution is being trialed at a selection of customers and the first few solutions are sold as well. Taking in mind the product-service continuum, we can place case firm G within the result-oriented stage. However, we have to note that their maturity with employing result-oriented services is still relatively low, which was confirmed by the interviewee.

Case firm H

Case firm H is a multinational firm that is active in the development and manufacturing of a range of industrial products and tools for the construction industry. They offer a variety of services, ranging from basic product-oriented services such as maintenance to professional product-oriented services, such as advice and training. They also offer a solution that can be classified as a use-oriented service. This use-oriented service that they offer is a fleet management solution for their customer's equipment. Case firm H has been offering this fleet management solution for over ten years now, and we can, therefore, argue that case firm H has a high maturity in the use-oriented phase of the product-service continuum. When asked why they do not yet provide result-oriented services to their customers, they replied that there is still enough growth potential in their current range of services and that they do not see a need to move into result-oriented services soon. They want to focus on improving the efficiency of their current services and on creating a more uniform portfolio of services first.

Case firm I

A firm that is still at the very beginning of the servitization journey is case firm I, a Dutch manufacturer of poultry equipment and solutions. At the moment, case firm I is exploring how servitization can be of value to them. Instead of waiting for the customer to report a problem, they aim to start providing support in a more proactive way. Additionally, they are contemplating the transition to professional product-oriented services, and on the longer-term use-oriented services such as leases. At the moment of the interview though, they only offered basic product-oriented services that are delivered globally through a network of dealers.

Case firm J

Case firm J is a Dutch firm that is active in the development and manufacturing of hatchery equipment. Similar to case firm I, the support they initially offered to their customers was mainly on a reactive basis, but since a few years they have made the switch to a more proactive approach. At the moment, their service portfolio consists of basic product-oriented services such as maintenance and spare-parts, as well as professional product-oriented services in the form of spare-parts management, training, audits, and consultancy. According to case firm J's services & sales manager, the transition to these professional product-oriented services is an ongoing process and not yet completed. We therefore position case firm J at the early end of the product-service continuum, with the basic- and professional product-oriented services.

4.2.1 Drivers of servitization

To better understand the context of the case firms, during the interviews each of the case firms was asked what their main motives were for pursuing servitization. Every case firm mentioned multiple drivers of servitization within their firm. These drivers are elaborated in more detail in the following section.

Marketing-related drivers

Several case firms (A, C, E, G, H, I & J) mentioned that servitization leads to a longer-term relationship with the customer, and that this is a key motive for pursuing servitization. Case firm E states that this longer-term relationship leads to customers coming back to them, and that such a relationship can be built with services and the people that provide the services:

"We really want to focus on long-term relationships. It's not like we say, "we'll sell you the product and good luck with it". We just really want to build a long-term relationship . . . And you build that relationship with services" – Case firm E

Moreover, a longer-term relationship with your customers, for instance because of service contracts, keeps the firm afloat during periods of economic downturn, according to case firm G. Lastly, companies

H & J see servitization as a way to lock-in their customers and make them dependent on them. This is consistent with the views of Wise & Baumgartner (1999), who state that servitization leads to increased customer loyalty and their dependence on the manufacturer. Case firm J mentions that such a closer and longer-term relationship can lead to a better understanding of the problems customers are facing, and that it can even lead to input for development and improvements in the way that service is delivered.

Financial drivers

Several case firms mentioned financial drivers. Case firms A, C & F view servitization as a way of expanding their current revenue stream. Case firm A is market leader in a mature market, and servitization allows them to increase revenue in a market where product sales are saturated:

“We only have replacement of existing machines. You don't grow with that . . . So we can simply increase the turnover on a machine much more through more and more services” – Case firm A

Similarly, case firm F is active in a market where product sales are stagnating, and servitization generates new streams of revenue. Case firms G and J praise the higher margins that services bring over products. All these results are consistent with findings in the literature (Davies, 2004; Gebauer et al., 2005), but none of the case firms mentioned the reoccurring streams of revenue that are characteristic of use- and result-oriented services as a driver for pursuing servitization.

Strategic drivers

Similar to findings in the literature (Baines et al., 2009; Gebauer et al., 2005; Mathieu, 2001b), many of the case firms (A, B, D, E, H & I) named differentiation as a major motive for servitization. For instance, asked why they were pursuing servitization, case firm I answered the following:

“It is a way to differentiate yourself . . . You have to keep your distinctiveness in something. If the copies become the same as your system, then you have to be able to distinguish yourself. We have never been the cheapest and we are not going to be the cheapest.” – Case firm I

Like case firm I, the other case firms manufacture premium products and do not want to engage in price-based competition as it is not a sustainable business model for them. Servitization is a way for them to differentiate themselves from, often cheaper, competitors without having to engage in price-based competition.

Market-pull as a driver

Several case firms stated that servitization is partially driven by market pull, i.e. customers that have expressed their needs for more servitized offerings. For instance, case firms A, B, & F found that there is the general trend within their industry that customers want to focus more on their core business processes. In those cases, result-oriented services were a way for them to take over business processes from their customers. Case firm C observed that their customers focus less on ownership and more on the use of their equipment:

“On the other hand, all those new business models, such as pay-per-use, are in nowadays. You have Netflix, car sharing, etc. There is a bit of a change in mentality, people don't necessarily want to buy something anymore but just want to use it instead. So in order to respond to that trend, we're trying to work this out now.” – Case firm C

They responded to this need with a result-oriented model in which they remain owner of their customer's equipment. Case firm G stated that their customers are expecting a higher flexibility and quality from their systems. Result-oriented services allow them to offer needed flexibility and quality to their customers, and this was a major motivation for them to develop these types of servitized offerings.

Development-related drivers

Case firm G & J mentioned that the more intimate and longer-term relationship that is the result of servitization allows them to better understand their customers and how their products are used. In turn, this increased understanding leads to new ideas for development (J) or allows them to improve their products (G):

*“So the moment you are much more involved with customers in the long term and are very close to his operation and you understand it, then you would also be able to better develop your own systems” –
Case firm G*

4.3 Dynamic capabilities within the case firms

In the following sections the results of the questionnaire that was filled out by the case firms during the interviews are discussed. In the first part of the questionnaire the case firms answered the following question: *“How important are the following capabilities for your company in your current stage/position in the servitization framework?”*

With “current stage/position” we refer to the servitization stage the case firms transitioned to most recently, i.e. the servitization stage furthest on the product-service continuum. To illustrate, case firm C offers services across all stages of the servitization framework, but the focus of the questionnaire was on the importance of the dynamic capabilities for result-oriented services, the most advanced services they offer and the stage they transitioned to most recently. For each research-based dynamic capability they indicated its importance on a 5-point Likert-type scale with the following options: 1 (not important), 2 (slightly important), 3 (moderately important), 4 (important), and 5 (very important). Subsequently they indicated how well developed these dynamic capabilities are within their organizations on a similar 5-point Likert-type scale. The results per case firm are in Appendix D. The case firms were clustered based on their current position in the servitization framework and the mean scores per servitization stage were calculated. Because we have ordinal data it would be more suited to use the mode or median instead of the mean (Sullivan & Artino, 2013). However, we argue that using the mean is suitable in this situation since the mode cannot be calculated for all servitization stages because of the small sample size. The median does not give us a good indication of the importance of the dynamic capabilities because it only reflects the middle value in a range of values. Therefore, we choose to use the mean to determine the importance of the dynamic capabilities. Dynamic capabilities with a mean score between 3,5 and 4,5 are considered “important” capabilities for that stage. Dynamic capabilities with a mean score that is equal to or greater than 4,5 are considered “very important” capabilities for that stage.

In order for product manufacturers with no services to become fully servitized manufacturers and offer result-oriented services, they need to transition through the four servitization stages. In the next section we will discuss the dynamic capabilities that manufacturing firms need to transition along the product-service continuum. We will start with the first transition, i.e. the dynamic capabilities that manufacturing firms need to transition from no services to basic product-oriented services. Subsequently we will analyze the dynamic capabilities required for the transition from basic product-oriented services to professional product-oriented services. We do this by comparing the important dynamic capabilities for basic product-oriented services with the dynamic capabilities required for professional product-oriented services and see what dynamic capabilities have not been developed in the previous stage. We will do the same for the transition to the other stages in the servitization framework.

4.3.1 Dynamic capabilities required for the transition to basic product-oriented services

In Table 9, the results of the questionnaire for the case firms in the basic product-oriented stage are presented. Only case firm I was still at this stage of servitization, all other case firms already progressed to more mature stages of servitization. This limited sample size drastically reduces the reliability of the results, and we will, therefore, complement the quantitative results with the qualitative insights from the interviews.

The yellow highlighted dynamic capabilities in Table 9 are the dynamic capabilities that are deemed “important” or “very important” by the basic product-oriented case firms to transition from offering no services to offering basic product-oriented services. We will highlight some of the important dynamic capabilities with insights from the interviews in the next section.

Table 9: The dynamic capabilities required for the transition from no services to basic product-oriented services.

<i>Dynamic capabilities</i>	<i>Basic product-oriented (n=1)</i>	
1. Customer need sensing	4,0	Important
2. Technology exploration	4,0	Important
3. Service system sensing	3,0	-
4. Internal service sensing	3,0	-
5. Reducing dependency	4,0	Important
6. Data interpretation	4,0	Important
7. Service development process	3,0	-
8. Service commercialization	3,0	-
9. Value understanding	2,0	-
10. Value communication	2,0	-
11. Hybrid offering deployment	3,0	-
12. (Un)bundling	2,0	-
13. Managing service delivery	4,0	Important
14. Knowledge sharing	3,0	-
15. Adopting new revenue mechanisms	3,0	-
16. Service interaction	4,0	Important
17. Sales incentives	3,0	-
18. Hybrid offering sales	3,0	-
19. Management support	4,0	Important
20. Service-oriented organization	5,0	Very important
21. Service system transformation	4,0	Important
22. Service-oriented mental model	5,0	Very important
23. Deliberate learning	4,0	Important
24. Balancing product- and service innovation	3,0	-
25. Defining a service strategy	4,0	Important

The first important dynamic capability for basic product-oriented services is *customer need sensing (1)*, and during the interview it became clear that case firm I is struggling to operationalize this capability. They work with a network of dealers to sell their products and services, allowing them to target international customers despite their relatively small size. The downside is that they are not in direct contact with most of their customers because all contact is done through dealers. Case firm I recognizes this as a challenge:

“Yes, that is the challenge, because we work with a dealer network. So in the end, on the one hand, you want to be as close to the customer as possible in order to get as much information as possible. On the other hand, you just want to have dealers in between, because you can't supply the whole world from here.” – Case firm I

Case firm I also states in the interview that they should intensify the relationship with their dealers, and ask their dealers more often what their challenges are and where they see opportunities. They also acknowledged that they need to improve on this capability before they can think of moving into use-oriented services in the near future. What we can take from this finding is that sensing customer needs is more difficult when working with a dealer network, and that close collaboration between the dealers and the manufacturing firms is required to understand where opportunities for new services are. Their sales approach also hinders the case firm in the **managing service delivery (13)** capability. Because they are dependent on their dealers for providing their services to customers, they cannot quickly restructure their service portfolio. Dealers need to be trained and need to invest in personnel before they can start with a new service proposition. Not all dealers are open to new service propositions or are capable of delivering all types of services. During the interview, the **data interpretation (6)** capability was extensively discussed. This dynamic capability is focused on processing and analyzing product usage and process data to help customers achieve certain outcomes. From the interview it became clear that this capability can help manufacturing firms to deliver basic services such as maintenance in a more effective way. For instance, insights from usage data could be used to predict when maintenance is required or allows them to see remotely what is wrong with one of their machines. And manufacturing firms should not just be able to collect data; they should also be able to process and analyze this data:

“Yes, first data. Because you can collect all kinds of data, but if you don't get it analyzed, if you can't convert that data into knowledge, then it's of no use to you. So that is certainly important.” – Case firm I

Some of case firm I's machines are able to collect usage data from their customers, but they do not know what to do with the data and what information to present to their service engineers. Currently, they are in the process of setting up an internal team that is concerned with collecting and analyzing the data. **Management support (19)** is considered important by case firm I. That is reflected by the management's drive to increasingly focus on servitization:

“The management here, the executive board, are on the same page. Together, we set that goal and told ourselves that we must move in that direction, which is something they all agree on.” – Case firm I

This management support is required to allocate budget to new service initiatives. In their case, this relates to the founding of a new internal team that is concerned with data collection and analysis. Moreover, this management support is related to another important dynamic capability, namely **defining a service strategy (25)**. Case firm I's management has put servitization in its five-year strategy plan as one of the five main pillars. However, case firm I also recognizes that there is still much improvement to be made. The main challenge that the case firms I comes across in their transition to servitization is their limited ability to create a more **service-oriented organization (20)**. They recognize this dynamic capability as “very important” for developing and providing basic product-oriented services, but still have a long way to go themselves:

“The biggest challenge is to change the way of thinking within the organization. It's a bit like you're still limping on two legs as an organization. On the conservative, what we have been doing for so many years, and also the great desire to take that step, but how?” – Case firm I

This change in thinking and in culture is also what they foresee as the biggest challenge when transitioning to more servitized offerings such as lease. Part of this change is the capability to learn new

routines and unlearn obsolete routines, the so-called *service-oriented mental model (22)* capability. It is considered to be “very important”, but case firm I does also recognize that this capability is barely developed within their own organization.

4.3.2 Dynamic capabilities required for the transition to professional product-oriented services

Case firms E and J have recently transitioned to the professional product-oriented services stage in the servitization framework. Table 10 shows the dynamic capabilities they consider to be important in the transition to professional product-oriented services. The “*Important/very important in previous stages*” column shows which of the dynamic capabilities were important in previous servitization stages. The yellow highlighted dynamic capabilities are the dynamic capabilities that were not considered to be important in the previous servitization stages yet and need to be developed in this stage. In the next section we will go more in-depth on some of the important dynamic capabilities.

Table 10: The dynamic capabilities required for the transition from basic product-oriented services to professional product-oriented services.

<i>Dynamic capabilities</i>	<i>Important/very important in previous stages</i>	<i>Professional product-oriented (n=2)</i>		<i>SD</i>
1. Customer need sensing	X	4,0	Important	1,41
2. Technology exploration	X	3,0	-	1,41
3. Service system sensing		3,0	-	1,41
4. Internal service sensing		4,5	Very important	0,71
5. Reducing dependency	X	4,0	Important	1,41
6. Data interpretation	X	4,5	Very important	0,71
7. Service development process		3,0	-	0,00
8. Service commercialization		4,5	Very important	0,71
9. Value understanding		4,5	Very important	0,71
10. Value communication		4,0	Important	0,00
11. Hybrid offering deployment		4,0	Important	0,00
12. (Un)bundling		3,5	Important	0,71
13. Managing service delivery	X	2,5	-	0,71
14. Knowledge sharing		4,0	Important	0,00
15. Adopting new revenue mechanisms		2,5	-	0,71
16. Service interaction	X	2,0	-	0,00
17. Sales incentives		2,5	-	0,71
18. Hybrid offering sales		2,5	-	0,71
19. Management support	X	3,0	-	0,00
20. Service-oriented organization	X	3,0	-	1,41
21. Service system transformation	X	2,5	-	0,71
22. Service-oriented mental model	X	2,5	-	2,12
23. Deliberate learning	X	2,5	-	0,71
24. Balancing product- and service innovation		4,5	Very important	0,71
25. Defining a service strategy	X	3,5	Important	0,71

The *customer need sensing (1)* capability seems to be important for every servitization stage, and therefore also for professional product-oriented services. Case firm J sits down with customers on a more structural basis, for instance by having regular Skype calls with them. They see that this approach

encourages customers to share their concerns more quickly and eventually also leads to opportunities for new or improved services:

“What you see is that because you talk to customers in a much more structured way, and talk about other things as well, you also notice that they are more likely to share the things that they run into or have in mind. New ideas, eventually leading to new developments.” – Case firm J

This approach helps them better understand the problems their customers are facing, which in turn helps them to offer a suitable solution more quickly. Next to that, these observed customer needs are also a way to improve existing services. Both case firm E and J need to further develop on this dynamic capability. Another dynamic capability they need to improve significantly on is the **data interpretation (6)** capability. Case firm E does not collect any data from its customers yet but sees potential in IoT-related solutions to track product usage. Case firm J already collects data from its machines at customers, and they are currently figuring out how to create a service around the information they retrieve from that data. They want to use these insights for predictive maintenance, but also to benchmark customers and find out what the success factors are and to help customers improve their business. However, they come across several challenges, such as having a flow of data on a continuous basis and the quality of the data. Both case firm E and J acknowledge that such a *data interpretation* capability is important for professional product-oriented services, but they also see that it is essential for moving into more advanced services such as lease and pay-per-use. Case firm J developed this capability by starting with several customers on a small scale. Their observation is that many companies want to start with something big, but in their experience, it is better to develop this capability on a small scale and work together with customers.

The case firms do understand what the value of services is for their customers and also try to communicate this internally, i.e. the **value understanding (9)** capability. Within case firm E, as result of the growing service business, it now accounts for 25 percent of its revenue, the organization starts to understand the value of services. Case firm J labels the *value understanding* capability “essential”:

“Communication is essential. That we continuously say what we are doing, where we want to go, that you take everyone with you and that through this way you try to change the mindset.” – Case firm J

Case firm J’s service manager actively shares his mindset and direction internally with the rest of the organization. They do this with a presentation every one or two months. Case firm J also recognizes that the value should not just be communicated internally, but also to their customers. This ability to communicate the value of services to the customer is reflected in the **value communication (10)** capability. The case firms have realized that most customers do not understand why they have to pay for services, something that they used to get for free. Case firm J emphasizes that it is important to communicate the value of the service to the customer. In this example, they convince the customer to see the service as an investment with a short payback period:

“In Africa, that’s a good example. The first time I spoke to our salesman there he said that it was really not possible there. Customers won’t pay for a visit because we always did it for free. And then you notice that when you explain the added value to a customer, he will do it. For example, one visit for free in the beginning, you can do that commercially. But if they start to see the added value of it, they also start paying for it. And of course, you have to explain that to the customer. If we can now improve the outcome by half a percent, they will easily get a return on investment” – Case firm J

Several more dynamic capabilities were labeled as “important” or “very important” in the questionnaire but were not discussed extensively during the interviews.

4.3.3 Dynamic capabilities required for the transition to use-oriented services

For case firms D & H, use-oriented services are the most advanced service offerings they currently offer to their customers. They were asked to rate the importance of each dynamic capability in relation to the use-oriented services they offer, the results of which are shown in Table 11. Manufacturing firms should develop the yellow highlighted dynamic capabilities when they transition from professional product-oriented services to use-oriented services.

Table 11: The dynamic capabilities required for the transition from professional product-oriented services to use-oriented services.

<i>Dynamic capabilities</i>	<i>Important/very important in previous stages</i>	<i>Use-oriented (n=2)</i>		<i>SD</i>
1. Customer need sensing	X	5,0	Very important	0,00
2. Technology exploration	X	4,0	Important	0,00
3. Service system sensing		4,0	Important	0,00
4. Internal service sensing	X	3,0	-	1,41
5. Reducing dependency	X	3,0	-	0,00
6. Data interpretation	X	4,5	Very important	0,71
7. Service development process		3,5	Important	0,71
8. Service commercialization	X	4,5	Very important	0,71
9. Value understanding	X	4,0	Important	1,41
10. Value communication	X	3,5	Important	2,12
11. Hybrid offering deployment	X	4,0	Important	1,41
12. (Un)bundling	X	3,0	-	0,00
13. Managing service delivery	X	3,5	Important	0,71
14. Knowledge sharing	X	3,0	-	1,41
15. Adopting new revenue mechanisms		4,5	Very important	0,71
16. Service interaction	X	4,5	Very important	0,71
17. Sales incentives		4,5	Very important	0,71
18. Hybrid offering sales		4,5	Very important	0,71
19. Management support	X	4,5	Very important	0,71
20. Service-oriented organization	X	4,0	Important	0,00
21. Service system transformation	X	4,0	Important	0,00
22. Service-oriented mental model	X	4,5	Very important	0,71
23. Deliberate learning	X	4,5	Very important	0,71
24. Balancing product- and service innovation	X	4,0	Important	0,00
25. Defining a service strategy	X	4,0	Important	1,41

The *customer need sensing (1)* capability seems to be a very important capability, again. However, within the use-oriented case firms this dynamic capability is significantly better developed than within the case firms in the previous two stages. Unlike the basic product-oriented case firms, both companies D & H use a direct sales model and thus are in direct contact with their customers. Next to that, case firm H has its own unique approach:

“The intention is that an account manager should have at least four fixed appointments a day in order for us to remain in dialogue with the customer. So that he knows what is going on, what developments there are, and what complaints they have. Not only the account manager, but also our shop, customer service, it’s a kind of network in which everyone sends out signals to each other about what’s going on with the customer.” – Case firm H

They stress that this interaction with the customer is essential to get a good understanding of what the customer wants and the problems he is facing. This is important when developing new service propositions, as these should perfectly meet the needs of their customers. For case firm D, not only customer needs are an important source for new service innovations, but new technologies are too. They recognized the importance of technology and built their use-oriented service proposition around new technologies such as artificial intelligence, digital twins and data analytics. In order to 'sense' what technologies could be useful, they actively go out and explore new technologies, i.e. the **technology exploration (2)** capability. They also mention that it is important to know what is going on outside of their firm and that you should have to be open to new things:

"So, technology is extremely important to us. So, we follow that very closely. A data science convention is currently in progress in Utrecht. Yesterday one of our two data scientists went there and today the other one went there. You have to keep track of that, what is going on and in what way can we apply that on the things we do. Can we perhaps change the whole product? We don't know. If there are new things coming up, we're always open to them." – Case firm D

The **value communication (10)** capability has a high standard deviation (2,12) and when looking at the individual scores we see that case firm D considers this dynamic capability to be "very important", whereas case firm H regards it as "slightly important". During the interview it became clear why company D considers this to be such an important capability:

"What we have is a communication problem. How do you explain, both to the person for whom the value is, in this case the facility manager or a building owner, and how do you explain to a sales channel what the value is for their customer, i.e. the customer of your customer." – Case firm D

Case firm D finds it challenging to explain what the value of their use-oriented service proposition is to their customers. Case firm H did not express any concerns that are related to this. During the interview case firm H did stress the importance of being able to find a balance between customization and standardization. This so-called **hybrid offering deployment (11)** capability is necessary to prevent manufacturing firms from developing service propositions that are irrelevant for a large part of their customer base:

"That's really incredibly important to us. Otherwise, we are going to develop something that is irrelevant to a very large proportion of our customers." – Case firm H

For the case firms this often creates a dilemma. On the one hand they want to have a 'one size fits all' solution, but on the other hand they want a solution that is specific to their customers' needs. Going with the latter option also makes it complex to find the right partners and to sell them. Both companies use a direct sales approach to sell their services. Earlier, we established that such an approach allows companies D & H to better 'sense' customer needs. Part of such a sales approach is that manufacturing firms should set **sales incentives (17)** to persuade their salespeople to sell services. Case firm D has salespeople that are dedicated to selling their use-oriented service offering, but case firm H does not have this focus within sales. They argue that the right incentives are necessary to give their salespeople a push in the right direction and to have to sell more advanced services. Moreover, the case firms agree from their own experience that **management support (19)** is required for the long-term success of the service business. For instance, case firm D meets with its management on a regular basis to evaluate the position of the use-oriented business. They do not know yet of this business model will be profitable in the long-term, but they do understand the strategic importance of a use-oriented offering with, in their case, subscription model. Even though it is still relatively small in turnover, management understands that they need to make a change strategically and thus support this transition towards servitization. Similarly, case firm H also views **management support** as crucial to the survival of their service business in the long-term.

Both case firms commented during the interview that a service-minded culture is important for the success of the service business. Especially case firm D finds it challenging to change their product-oriented culture to a more **service-oriented organization (20)**, which is also reflected in the results of the questionnaire:

“That change is incredibly difficult. I just hear that when I talk to colleagues. They are still so in love with their hardware and software. So I think that it's an incredibly difficult process. Although the management may have the will to do it, I'm talking about our ability, that's the question you're asking, and I think we just cannot do it at the moment.” – Case firm D (use-oriented)

Not only are employees still attached to their products, they are also used to selling their products using a different approach. They are used to selling one-off deals to their customers. After the deal is done, they lose contact with the customer. Use-oriented services require a **hybrid offering sales (18)** approach, in which the focus is on establishing a long-term relationship with the customer and to sell value-based. Moreover, their direct sales approach causes irritations with their other sales colleagues, who believe sales should be done through partners. Speaking about partners, manufacturing firms should also be able to control their partners and have a certain amount of influence on them, which is the **service system transformation (21)** capability. Because the case firms use a direct sales model, they are both not reliant on many partners. This allows them to have more control over their service delivery too.

4.3.4 Important dynamic capabilities for the transition to result-oriented services

Case firms A, B, C, F & G are positioned at the very end of the product-service continuum, at the result-oriented services stage. The dynamic capabilities they consider to be important in the transition from use-oriented services to result-oriented services are listed in Table 12. None of them are highlighted yellow, meaning that all of them were already considered important by the case firms in earlier stages on the product-services continuum, and thus manufacturing firms that gradually move along the product-services continuum should, in theory, already possess these dynamic capabilities. Nevertheless, we will highlight some of the more important dynamic capabilities using the insights from the interviews.

Table 12: The dynamic capabilities required for the transition from use-oriented services to result-oriented services.

<i>Dynamic capabilities</i>	<i>Important/very important in previous stages</i>	<i>Result-oriented (n=5)</i>	<i>SD</i>	
1. Customer need sensing	X	4,8	Very important	0,50
2. Technology exploration	X	3,4	-	0,50
3. Service system sensing	X	3,8	Important	0,58
4. Internal service sensing	X	3,4	-	1,29
5. Reducing dependency	X	4,2	Important	0,50
6. Data interpretation	X	4,4	Important	0,50
7. Service development process	X	3,4	-	0,96
8. Service commercialization	X	4,2	Important	2,00
9. Value understanding	X	4,6	Very important	0,58
10. Value communication	X	4,8	Very important	0,00
11. Hybrid offering deployment	X	3,0	-	1,26
12. (Un)bundling	X	3,2	-	1,41
13. Managing service delivery	X	2,8	-	0,96
14. Knowledge sharing	X	3,6	Important	0,58
15. Adopting new revenue mechanisms	X	4,2	Important	0,82
16. Service interaction	X	3,6	Important	1,71
17. Sales incentives	X	4,0	Important	0,82
18. Hybrid offering sales	X	4,8	Very important	0,50
19. Management support	X	4,4	Important	0,96
20. Service-oriented organization	X	4,4	Important	0,50
21. Service system transformation	X	3,4	-	1,41
22. Service-oriented mental model	X	3,4	-	0,96
23. Deliberate learning	X	3,6	Important	0,96
24. Balancing product- and service innovation	X	3,8	Important	1,29
25. Defining a service strategy	X	4,2	Important	0,82

It is no surprise that the *customer need sensing (1)* capability is considered to be “very important” by the result-oriented case firms, as it is important for the other servitization stages too. Just like the use-oriented case firms, this dynamic capability is well represented within the result-oriented case firms. They also understand the relevance of this dynamic capability. For instance, when asked what skills are important in delivering result-oriented services, case firm A answered that more in-depth knowledge is required in order to better understand customer processes:

“And you need much more substantive knowledge. So you need to understand much more about that particular customer process. And not only in problems and opportunities, but also just knowing how the process works.” – Case firm A (result-oriented stage)

In the interview, case firm A highlights that in order to deliver a functional result or a performance to their customers, they first need to know how their customer operates and what kind of performance they want to have. They also use the data collected from their software products used by customers to better understand the differences between customers and see where improvements can be made. This can also be a source for new services. They also argue that direct contact with the customer is a prerequisite for being able to fully understand their customers' problems. If there is a dealer in between, the dealer has insight into what the customer wants. Moreover, the dealer is not necessarily exclusive with a manufacturing firm and could also get services from other partners. Case firm B also stated during the interview that a proactive approach is required. Customers will not necessarily express their needs and manufacturing firms should be proactive in discovering those needs. **Service system sensing (3)** is the ability to understand the service system that is required for delivering the services. Part of this capability is the ability to understand what service system is required, how the role of actors in the system will change with new services, and to use partners as a source of innovation. The case firms marked this dynamic capability "important". An example of the *service system sensing* capability is given by case firm B, who extensively works together with partners to provide a large part of their services. When they see the possibility for a new service proposition in the market, they scout for partners who can support them in the development and delivery of this service:

"So, when we see an application in the market and we want to do something with it, so we have to look for a partner who delivers something." – Case firm B

Partners can also figure as a source of new service innovations, which is illustrated by case firm A. They are currently piloting a service based on a technology that was provided to them by a partner. Others, like companies F, G & I, do not rely on partners and do much of the service development and delivery themselves. The **data interpretation (6)** capability, the ability to process and analyze customer data, is several times mentioned "important" in the interviews and the questionnaire. Case firm A even stated that having a well-developed *data interpretation* capability is critical for servitization:

"That is critical, for servitization it is critical." – Case firm A

The case firms mentioned several reasons why this capability is such an important capability. First of all, for product-service systems with a pay-per-use revenue model it is essential that the manufacturer is able to collect data on the use of the product by the customer. Collecting this data can be done with IoT solutions that monitor the status of the products, collect data, and send this data to the manufacturer. Secondly, by having insight into the use of their products, manufacturers can optimize their service operations. For instance, it allows them to proactively send a service engineer when they see from the data that a machine is about to break down:

"Proactively, that we know exactly what the machine says, where the alert comes from and we know in advance that if he gives that alert three times, we have to do something about it so that we prevent it from standing still. We send toner to customers because we know when the yellow toner on the seventh floor is almost gone." – Case firm F

Such preventive maintenance is especially relevant for use-oriented and result-oriented services, in which the manufacturer is responsible for maintenance and in which often a certain amount of uptime is guaranteed to the customer. Thirdly, by collecting data from customers it is possible to compare customers and see where differences in terms of use of the product and performance of the product arise. In turn, this information can be used by the manufacturers to advise the poorer performing customers on how they could improve performance and efficiency:

"But if you have data from many different customers, you can see where the differences lie and where the possibilities for improvement are." – Case firm A

The **service commercialization (8)** capability entails the ability to commercialize and scale services in a uniform way. Because of their intangible character, services can be challenging to scale while delivering the same service and quality across each customer. During the interviews it became clear that several of the case firms are working on improving this capability by standardizing their service portfolio. Both case firm A and case firm F use the concept of a 'menu' to communicate the services they offer to their customers and to maintain a certain level of standardization throughout their service portfolio:

"So, we literally have what we call a menu. As long as you stick to the price and delivery time stated on the menu, you can just sell it without a hitch, if you deviate from it, you have to ask it." – Case firm A

"What we are doing more now, instead of innovation, is more standardization. That people buy something that is on the menu." – Case firm F

With standardization, these case firms aim to reduce the amount of custom-made services that are sold by their sales departments, with as goal to improve the scaling of these services and to ensure that the right margins are retained. Case firm G considers this standardization to be important because they promise a certain output commitment to their customers and do not want to manage tens of different contracts. The case firms consider the **value understanding (9)** and **value communication (10)** capabilities to be very important for result-oriented services. Both dynamic capabilities are on average decently present within the case firms. First of all, manufacturing firms should understand the potential value of services for their customers and communicate this value internally. Companies A & B both agree that communicating this value is important, but that it is not necessary that the whole organization should be involved in this. Their view is that only the people that are directly involved with the development and delivery of services should be made aware of the value. All case firms do agree on the fact that it is very important to be able to communicate the value to the customer. Based on this value, companies active in the result-oriented stage should **adopt new revenue mechanisms (15)**. Basic product-oriented services are often sold as an add-on to a product and do therefore not require a different revenue mechanism. Result-oriented services on the other hand, offer by nature more possibilities for new revenue mechanisms, such as pay-per-use. During the interview, case firm B and F gave several examples in which the capability to **adopt new revenue mechanisms** was reflected. For instance, case firm B uses this capability to proactively change their revenue mechanisms and adopt new pricing models to differentiate themselves from their competitors. The **hybrid offering sales (18)** capability is the capability to continuously adapt to different customer needs, reach key decision makers and sell value based. Several case firms stated that this is a very important capability to have, which is illustrated by the answer that case firm A give to the question of how important the **hybrid offering sales** capability is:

"Yes, I should say almost critically, because it seems as if you've been listening to our sales training lately. All our salespeople from all countries receive a training in value-based selling. That's a bit like in the beginning, when you also talked about customer questions. It's important, you can't live without it." – Case firm A

Several case firms (A, B & F) highlighted that the sales approach changes to a more value-based approach when selling result-oriented services, and that a consultative mindset is required:

"In any case, we have a sales method that is truly consultative selling driven. And very focused on you say that you want this but what do you want with it, what is the question behind the question, and what are your pain points, and do you indeed want to have them solved and what is it worth to you to solve them. So, it's very much on value and then you'll find out very quickly." – Case firm F

The case firms argue that manufacturers should focus less on an offering based on its specifications, but that they should emphasize the value that this offering delivers to the customer. Also, they should have knowledge about what the customer wants to accomplish with the offering, i.e. the focus should be on the output or the results that the customer wants to see delivered from the offering. This change in sales approach is part of a larger transition to a more **service-oriented organization (20)**. Several case firms from the result-oriented group stated that the cultural change that is required to pursue servitization is the biggest challenge they face. In order to change the culture, process, and structures of the organization, the *service-oriented organization* capability is required. According to case firm A this is a critical capability to have, and the following quote illustrates how they tackled the cultural change:

“Critical, because if you don't do something about it, you're not going to do it. Because if you keep doing everything the old way... The organization has been adapted here, people have been given different functions, and we have created different functions. You try to take people with you as much as you can with a servitization training course: what is the philosophy, what does it mean, how are we going to work? We have defined five customer segments. So, from the cheapest machine to complete outsourcing. You have explained to the employees what servitization is, what kind of phases there are.”
– Case firm A

From the quote of case firm A we can deduct that it is important to communicate within the organization what servitization is and to adapt the organization where necessary. According to case firm F, a culture in which experimentation is allowed and where trying new things are rewarded is needed. This cultural change should be supported by management. Most of the case firms acknowledge that **management support (19)** is an important capability in order to be successful with services in general. During the interviews several case firms emphasized the importance of management support as an enabler for the transition to result-oriented services. For instance, at case firm C it was the management that pushed the organization to pursue a pay-per-use business model:

“It was pushed top down. Top management, so the business president here, has said “I want that.” –
Case firm C (result-oriented)

Case firm C also highlights the importance of management support in the organizational transformation that is required to deliver such services. For instance, their management decided to split the service division into a new organizational unit, in order to get better insight into the profitability of the service business. Management should also **define a service strategy (25)**, which guides the manufacturing firms through their servitization journey:

“The strategic translation is a very important one. That everyone understands where we ultimately have to go to. And it doesn't matter how we get there, but it does matter that we all end up in the same ‘city’.” – Case firm B (result-oriented)

However, even though the case firms acknowledge the importance of having a service strategy, several of them did not have a clear servitization strategy when starting with servitization. For instance, case firm A describes their servitization journey as an incremental process in which they just started experimenting with developing new types of services. There was no clear strategy defined upfront. And today there is still room for improvement, which is also reflected in the development score for this capability. Likewise, case firm B does not have a fully defined strategy for the development of services either. Their head office defines a very general vision that they have to follow, and they have translated this vision into a strategy themselves. Despite that it is important to have a well-defined service strategy, some of the case firms still lack a clearly defined strategy.

4.3.5 Development of dynamic capabilities within the case firms

In the questionnaire the case firms were also asked to answer the following question related to the list of 25 research-based dynamic capabilities: “How well developed are the following capabilities within your case firm?”

They answered this question for each dynamic capability on a 5-point Likert-type scale with the following options: 1 (not developed), 2 (slightly developed), 3 (moderately developed), 4 (developed), and 5 (very developed). The individual answers of the case firms can be found in Appendix D. The case firms were clustered based on their position in the servitization framework and the mean scores per group were calculated, the results of which are in Table 13. Dynamic capabilities with a mean score between 3,5 and 4,5 are considered “developed” capabilities within the case firms. Dynamic capabilities with a mean score that is equal to or greater than 4,5 are considered “very developed” capabilities within the case firms. For more details see Appendix E.

Table 13: The mean questionnaire results per servitization stage when asked how well developed each dynamic capability was within the case firms.

Dynamic capabilities	Basic product-oriented (n=1)	Professional product-oriented (n=2)	Use-oriented (n=2)	Result-oriented (n=5)
1. Customer need sensing	2	2,5	4	3,8
2. Technology exploration	4	2	3,5	3
3. Service system sensing	3	2,5	4	3,6
4. Internal service sensing	3	2,5	3,5	2,8
5. Reducing dependency	4	4	2	4,6
6. Data interpretation	2	1,5	3,5	3
7. Service development process	1	1,5	3	3,2
8. Service commercialization	1	4	4	3,4
9. Value understanding	2	3	3,5	3,2
10. Value communication	2	3	4	3,8
11. Hybrid offering deployment	4	2,5	3,5	2,8
12. (Un)bundling	2	2,5	2	4,4
13. Managing service delivery	3	2,5	3	2
14. Knowledge sharing	2	3	3,5	3,4
15. Adopting new revenue mechanisms	1	2,5	2,5	3
16. Service interaction	1	3	2,5	3,2
17. Sales incentives	2	2	3,5	3,8
18. Hybrid offering sales	2	2,5	3,5	3,6
19. Management support	3	2,5	3,5	3,4
20. Service-oriented organization	2	2	2	3,4
21. Service system transformation	2	2	3,5	3
22. Service-oriented mental model	2	3	3,5	2,6
23. Deliberate learning	3	2,5	3	2,8
24. Balancing product- and service innovation	3	2,5	2,5	3,4
25. Defining a service strategy	2	3,5	3,5	3,2
Mean	2,32	2,6	3,22	3,30
SD	0,90	0,97	0,84	1,02

First of all, we see a clear distinction between the case firms positioned at the left side of the servitization framework and the companies on the right side of the servitization framework. Moreover, this is also reflected in the mean scores per servitization stage. Unsurprisingly, the case firms in the use-oriented and result-oriented stages are more experienced at servitization and have had more time to develop these dynamic capabilities. Secondly, the overall difference between the use-oriented case firms and the result-oriented case firms is small. The standard deviations for each group of case firms are not too far apart from each other, indicating that the majority of the answers fall within a range of 0,84 to 1,02 of the mean. The standard deviations do indicate that there is some level of polarization among the answers.

As to be expected, the basic product-oriented case firms have on average the least developed set of dynamic capabilities. Four dynamic capabilities are not at all present within case firm A, the only case firm in the basic product-oriented sample: *service development process (7)*, *service commercialization (8)*, *adopting new revenue mechanisms (15)*, and *service interaction (16)*. Of those four, the first three were regarded as “not important” for providing basic product-oriented service by case firm A during the first part of the questionnaire. A question that arises is whether they were marked as “not important” because they are not present within case firm A, or are they not present within case firm A because they are regarded by A as not important and therefore they did not invest in these three dynamic capabilities. The fact that case firm A scores high on *technology exploration (4)* could be the result of the product leadership strategy that case firm A follows. They are used to exploring and developing new technologies for their machinery.

The professional product-oriented case firms score have on average slightly better developed dynamic capabilities. Most of the dynamic capabilities are “moderately developed”. Interesting is that the case firms have a low developed *data interpretation (6)* capability, despite the fact that it was labeled as “very important” by them. The dynamic capabilities that are “developed” within the professional product-oriented case firms (*reducing dependency*, *service commercialization*, *defining a service strategy*) are not necessarily unique to this servitization stage.

Most of the dynamic capabilities are “developed” within the use-oriented case firms. On average they are closely matched with the result-oriented case firms. A surprising result is that in comparison to the case firms in the other servitization stages, the use-oriented case firms score badly on the *reducing dependency (5)* capability. There was no reason found for this deviation in the qualitative data. The *service-oriented organization (2)* capability is poorly developed within the use-oriented case firms too. However, this is more or less in line with what both case firms said in the interviews, namely that the cultural change that is required to be successful with servitization is the biggest challenge they are facing.

Not surprisingly is that the dynamic capabilities are best represented within the result-oriented case firms, the companies that are most experienced at servitization. Even though the *(un)bundling (12)* was not considered “important” for result-oriented services, this dynamic capability is significantly well represented within the result-oriented case firms. This could suggest that this dynamic capability was already developed at an earlier servitization stage and, therefore, not considered important for the result-oriented stage. The result-oriented companies score lowest on the *managing service delivery (13)* capability, but this dynamic capability was not considered important by them either.

4.4 New dynamic capabilities

Based on the findings from the interviews that were held with the case firms, we would like to propose two new dynamic capabilities that are required to move along the product-service continuum. Each proposed dynamic capability is discussed in more detail below.

4.4.1 Dynamic capability 26: Customer sensing

Several case firms (D, E, F, G & J) from the professional product-oriented, use-oriented, and result-oriented stage all mentioned the importance of being able to identify and target the right customer when starting with a new service proposition. Asked whether they target specific customers to sell their services to, case firm E answered the following:

“We make a conscious choice, yes. We do have customers where we say it is just not useful. Because that doesn't make the customer happy and it doesn't make us happy.”

Many customers expect proven solutions or are very price-sensitive, and their willingness to innovate is low. Such customers are most likely not the customers who will adopt a new service innovation right away. For manufacturing firms, it is therefore key to identify customers that are open to new services and are open to innovate with the manufacturing firm:

“I think that we are now slowly finding our way, that we are very conscious of the fact that we are simply choosing certain customers. Not so much from a business case perspective, but simply from a willingness to innovate at all.” – Case firm G (result-oriented)

Moreover, case firm E concludes that their professional product-oriented services often involve a certain level change management in their customers' organizations. For them, it does not make sense to target customers of which they know are not open to such change. Targeting the right customers right away allows a manufacturing firm to quickly build references, making it easier to sell the new service proposition. Identifying the target customer can be done by, for instance, assigning maturity levels and labels to the existing customer base. To conclude, based on the insights from the interviews the following new dynamic capability is proposed:

26. CUSTOMER SENSING

<i>Description:</i>	The ability to identify and target customers that have a high willingness to innovate and are open to new service propositions.
<i>Category:</i>	Sensing capabilities
<i>Important for:</i>	Professional product-oriented services + Use-oriented services + Result-oriented services

4.4.2 Dynamic capability 27: Knowledge capturing

During the interview case firm E stressed multiple times the importance of being able to capture knowledge and share this internally and with partners. Case firm E is currently making the transition to more professional product-oriented services, and one of the challenges they encounter is capturing the tacit and explicit knowledge that is existent within their organization:

“We have of course grown very fast in recent years and people have long contracts here, there are people here who have been working here for 30 or 40 years. There is a lot of knowledge in people's minds and we try to get that knowledge out of it and record it as much as possible. Because that's where our value to our customers lies, that we have that knowledge and training and that we can continue to do so.” – Case firm E (professional product-oriented services)

The current list of research-based dynamic capabilities does hold a *knowledge sharing* capability: “The ability to share information and knowledge inside the organization about services and successful service delivery processes”. Yet, this capability does not cover the capturing of tacit knowledge that is rooted in the employees’ minds and the explicit knowledge that has been build up within an organization over the years. Asked what capabilities are important in the development and delivery of professional product-oriented services, case firm E replied:

“That we are able to record the knowledge and experience we have within the organization in a good way and make it understandable and available to the outside world.” – Case firm E (professional product-oriented services)

The tacit and explicit knowledge is the basis for providing professional product-oriented services such as consultancy and training. If firms do not have the capability to capture that knowledge, it will be hard to transfer that knowledge to the customer through such services. This knowledge, once captured, should be shared internally and with partners that are part of the service delivery process. Therefore, we propose to add the following dynamic capability, which we will name the “knowledge capturing” capability:

27. KNOWLEDGE CAPTURING

<i>Description:</i>	The ability to capture explicit and tacit knowledge and share this knowledge internally and with partners.
<i>category</i>	Seizing capabilities
<i>Important for:</i>	Professional product-oriented services

4.5 Revising the servitization framework

The results from the interviews were compared to the servitization framework (Figure 13) that was developed with the findings from literature. We found that the interviews provided us with new information on several dynamic capabilities, and it was decided to revise the servitization framework and create a new iteration. The final servitization framework can be seen in Figure 15.

First of all, the two new dynamic capabilities that were proposed in chapter 4.4 were added to the list of dynamic capabilities in the framework. Secondly, we checked each dynamic capability again on its relevance for each servitization stage, this time with the results from the questionnaire and the interviews. Subsequently, the framework was adapted where necessary. Dynamic capabilities with a mean score between 3,5 and 4,5 were considered “important” capabilities for that stage. Dynamic capabilities with a mean score that is equal to or greater than 4,5 are considered “very important” capabilities for that stage. The final framework consists of four vertical pillars, each representing a stage in the servitization process and therewith also a level of servitization maturity. When going from the left of the framework to the right side of the framework, the nature of the services offered change from product-oriented to process-oriented. The relative importance of products/hardware in the value proposition degrades, and the interaction between the manufacturing firm and its customer changes from transaction-based to relationship-based. Mapped onto the four servitization stages are the dynamic capabilities that were identified from the literature and interviews. For each of the servitization stages, the framework indicates which dynamic capabilities are “important” or “very important” for that particular stage in the servitization process.

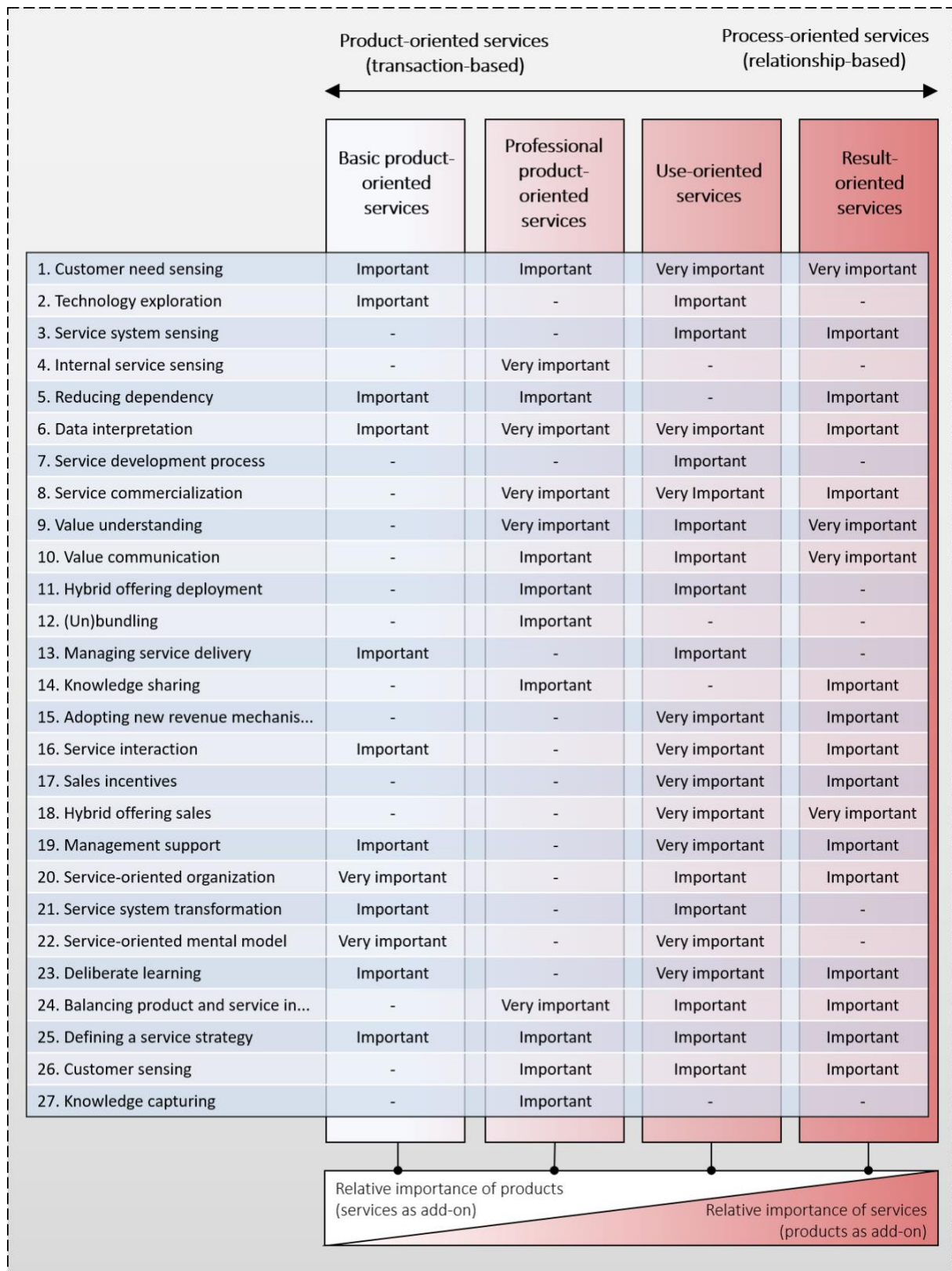


Figure 15: The revised servitization framework with the relevant dynamic capabilities per stage.

4.5.1 Differences and similarities between the servitization stages in terms of dynamic capabilities

The servitization framework in Figure 15 shows which dynamic capabilities are important at each stage of the servitization process. It visualizes the results of the questionnaire comprehensively and distinguishes between the “important” and “very important” dynamic capabilities. When observing the results, we first notice that more dynamic capabilities become important when progressing along the product-service continuum. On the left side of the framework, at the basic product-oriented services, only a small part of the dynamic capabilities is considered to be important at this stage. Only two dynamic capabilities are very important. However, on the right side, with the use-oriented services and result-oriented services, more dynamic capabilities are important or very important for success at that stage. From the framework we can tell that there is relatively little overlap between the dynamic capabilities required for basic product-oriented services and for professional product-oriented services. Once the transition from basic product-oriented to professional product-oriented services is made, a large part of the dynamic capabilities required for use-oriented and result-oriented services should already exist within the firm. In theory, firms progressing from professional product-oriented services to use-oriented or result-oriented services do not need to develop as many new dynamic capabilities as for the transition to professional product-oriented services.

We also observe that three dynamic capabilities are important at every servitization stage, namely the *customer need sensing (1)* capability, *data interpretation (6)*, and *defining a service strategy (25)*. The *customer need sensing* capability is important to understand the customer’s business and to identify customer’s needs, which is relevant for all types of services. The *data interpretation* capability is required for basic product-oriented services such as predictive maintenance and to optimize service delivery. Insights from usage data can be used to provide consultancy services to customers. And data is important for use-oriented and result-oriented services to understand the operational costs of taking over a customer’s product and to employ a pay-per-use revenue model. The ability to *define a service strategy* and translate this strategy into operational guidelines is necessary to ensure that everyone in the case firm follows the same direction and understands why servitization is relevant. From the interviews we got the impression that the case firms with a high level of *management support (19)* for servitization, also had a well-defined servitization strategy. Some of the case firms lacked a defined servitization strategy before they pursued servitization. Most of them do not set out the pursue result-oriented services right away. The case firms first started with transitioning from basic product-oriented services to professional product-oriented services. This transition is part of a natural progression, not so much a clear servitization strategy. From there, they naturally made the progression to more advanced services. Because it is a gradual process and not part of a clear strategy, the case firms often do not realize what capabilities they should develop upfront, as this is something they only find out when they naturally make the transition and start experimenting with new types of services.

Several dynamic capabilities are unique to a servitization stage. The professional product-oriented case firms find the *internal service sensing (4)* capability very important for the stage they are in, while the other case firms do not regard this as an important dynamic capability. The *service development process (7)* capability is important for use-oriented services. Most of the basic- and professional product-oriented case firms do not have a structured service development process, and they do not see this as an important dynamic capability either. The result-oriented case firms find this dynamic capability on average only marginally less important, but not important enough to make it onto the framework. This is contrary to what we found in the literature, which implied that this dynamic capability was relevant for all servitization stages. Another surprising finding is that the *(un)bundling (12)* capability is deemed to be important for only professional product-oriented services. Based on the literature review we expected this dynamic capability to be relevant for all servitization stages, and especially for use-oriented and result-oriented services as they often consist of existing products and services bundled together in a PSS. This dynamic capability is well developed within the result-oriented case firms, but

this has not translated into a high importance. Another dynamic capability unique to professional product-oriented services is the *knowledge capturing* (27) capability, one of the two dynamic capabilities were derived from the interviews. Professional product-oriented services, such as training and consultancy, are often knowledge driven and they are about transferring knowledge from the manufacturer to the customer.

We also observed some unexpected findings that were not entirely in line with what we found in the literature review. For instance, we expected the *service system transformation* (21) and *service-oriented mental model* (22) to be very important for the result-oriented case firms, as these types of services require the largest changes in the business model. Moreover, most of the case firms thought the cultural transition to a more service-oriented organization was the biggest challenge they faced. Instead, the result-oriented case firms did not consider this to be an important dynamic capability for result-oriented services. One of the reasons could be that they already have developed this capability in an earlier servitization stage and therefore take this capability for granted in the result-oriented stage.

4.5.2 Additional findings

From the interviews we derived several other interesting findings. First of all, several of the case firms in the basic product-oriented and the professional product-oriented stages sell their products and services through a network of dealers. The more servitized case firms in the use-oriented and result-oriented stages all use a direct sales approach. A direct sales model allows them to be in close contact with their customers, making it easier to understand their customer's business, his needs, and the challenges he is facing. The companies that use a dealer network to sell and provide their services experience more difficulties in sensing customer needs. This could explain why the basic product-oriented and the professional product-oriented services have a less developed *customer need sensing* capability.

Moreover, we found that making use of a dealer network hinders the manufacturing firms in their service delivery. For instance, when launching a new service proposition, dealers need to be incentivized to sell the new proposition and to invest in the training of support personnel. Not all dealers will have the resources or knowledge to provide all types of services right away. These manufacturing firms can only be successful with servitization if their dealer network follows them in this transition. Furthermore, selling and providing services through dealers reduces the flexibility and agility of the manufacturing firms in quickly developing new or improved service propositions.

And lastly, most of the case firms expressed that the cultural change involved with servitization is the biggest challenge they are or were facing in their transition to servitization, even for most of the result-oriented case firms who are relatively experienced with servitization.

5 Discussion

In this chapter, we will discuss the meaning of the results of our research concerning the literature first, followed by a discussion on the managerial implications of this study. We end the chapter by discussing the limitations of our research and by suggesting directions for future research.

5.1 Evaluating the results

The goal of this thesis was to understand the dynamic capabilities that manufacturing firms need in order to transition from product-oriented services to offering the highest level of servitization, result-oriented services. This was initiated by the fact that offering services requires different dynamic capabilities than selling products and many manufacturing firms struggle to make this transition (Parida et al., 2019; Perona et al., 2017). Therefore, the following main research question was set at the beginning of the research process:

“What dynamic capabilities do manufacturing firms need to move along the product-service continuum and ultimately provide result-oriented services?”

The main research question is answered by reflecting on the sub-questions and by evaluating the results from the empirical research.

Answering SQ.1: What are the different stages of servitization along the product-service continuum and what are their characteristics?

In order to answer the main research question, it was important to understand what the different stages of servitization and their characteristics are. The systematic literature review resulted in an overview of the servitization process and several typologies to categorize services along the product-service continuum. Based on the outcome of the literature review, the servitization framework in Figure 16 was constructed.

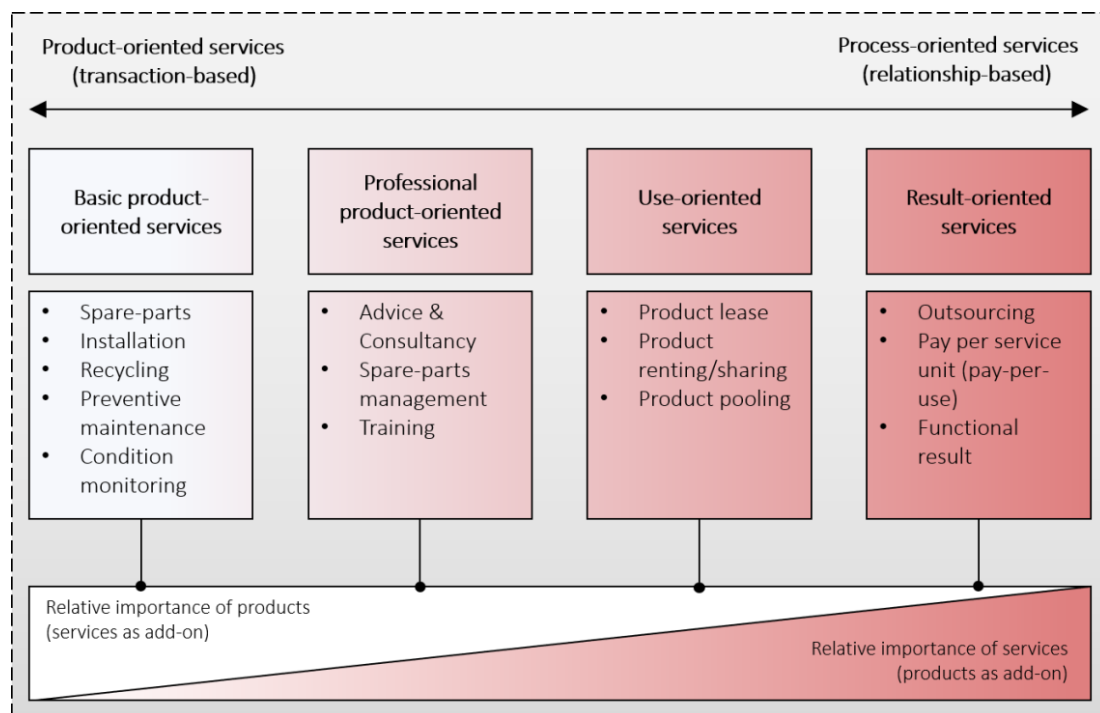


Figure 16: The servitization framework that provides the answer to the first research question.

This framework, visualized in Figure 16, combines the typologies of Oliva & Kallenberg (2003) and Tukker (2004) into one cohesive framework depicting the four different stages of servitization and their characteristics. The first stage that manufacturing firms enter when pursuing servitization is the basic product-oriented stage, at the very left of the product-service continuum. These services are very much product-oriented and the relationship between the manufacturing firm and its customer is transactional. From here firms can move into professional product-oriented service, in which the focus is on providing advice and training to the customer on a product- or process-level. The relationship becomes slightly less transactional. Use-oriented services are more process focused and manufacturing firms herein focus less on the sales of a product, but more on the delivery of a solution that creates value for the customer. The relationship between customer and manufacturer becomes more intense, and it is important for the manufacturer to fully understand its customer's business. This becomes even more crucial when firms start providing result-oriented services, the most servitized offerings and located on the right side of the product-service continuum. Interaction is relationship-based, and the focus of the manufacturing firm is very much on delivering a certain outcome or result to the customer. The role of the product in the value proposition is relatively small in result-oriented offerings.

Answering SQ.2: What dynamic capabilities do manufacturing firms need at each stage of the product-service continuum?

The second sub-question (SQ.2) was answered with a systematic literature review and empirical research in the form of case studies consisting of interviews and a questionnaire. From the interviews it was evident that manufacturing firms pursue servitization for a number of reasons, but most notably because of the potential financial rewards involved, the prospect of a longer-term relationship with customers, and the differentiative power that services offer. This is all consistent with findings from previous studies (Baines et al., 2009; Gebauer et al., 2005; Wise & Baumgartner, 1999). Nevertheless, we found that several case firms also pursue servitization because their customers expect them to. For some case firms this customer need, i.e. pull from the market, played a role in their decision to pursue servitization. Other case firms moved into servitization because service offerings are a new source for product improvement and innovation. These drivers have not been mentioned by servitization literature before. The results of this study show that servitization is an incremental process and that manufacturing firms gradually move along the product-service continuum to ultimately offer result-oriented services. All case firms started out with the provision of basic product-oriented services, and over time they moved stepwise along the product-service continuum to ultimately provide result-oriented services. Viewing servitization as an incremental process is in line with existing servitization literature (Gebauer et al., 2005; Oliva & Kallenberg, 2003). In line with servitization literature (Oliva & Kallenberg, 2003), we also observed that services become more process-oriented towards the right side of the product-service continuum and that the interaction with the customer changes to a longer-term relationship.

The results suggest that more service-related dynamic capabilities are required as one moves along the product-service continuum. On the right side of the product-service continuum the service offerings become more advanced and account for a larger part of the manufacturing firm's value proposition (Tukker, 2004). Therefore, it is logical that service-related dynamic capabilities start playing a more fundamental role when moving along the product-service continuum. Furthermore, we see a difference in the dynamic capabilities required for professional product-oriented services and basic product-oriented services, whilst the dynamic capabilities for professional product-oriented services have a large overlap with the dynamic capabilities required for use-oriented services. This suggests that manufacturing firms need to develop many new dynamic capabilities to make the transition to professional product-oriented services. Basically, once manufacturing firms possess the dynamic capabilities for basic product-oriented services and professional product-oriented services, they for a large part also possess the dynamic capabilities for use-oriented services and result-oriented services. In theory, this makes the transition to these more advanced services less challenging than establishing

a services business in the first place. That is, when firms are moving stepwise along the product-service continuum like the case firms. Once a manufacturing firm has established itself in the use-oriented stage, it seems to be relatively easy to make the step to result-oriented services as most of the dynamic capabilities are already there. However, more research is needed to support this. We also observe that three dynamic capabilities are important at every servitization stage, namely the *customer need sensing* capability, *data interpretation* capability, and *defining a service strategy* capability. The literature considers the *customer need sensing* capability and equivalent capabilities to be relevant for every form of service innovation (Gebauer et al., 2012; Kanninen et al., 2016; Kindström et al., 2013), which was confirmed by the case firms in our research. Most of the case firms use a direct sales approach to sell their products and service offerings to their customers. This allows them to be in direct customer contact and better 'sense' customer needs. Case firms using an indirect sales model, e.g. using a network of dealers, found it more challenging to understand their customers' problems and opportunities. Moreover, we found that making use of a dealer network hinders the manufacturing firms in their service delivery. For instance, when launching a new service proposition, dealers need to be incentivized to sell the new proposition and to invest in the training of support personnel. Not all dealers will have the resources or knowledge to provide all types of services right away. Jovanovic, Engwall, and Jerbrant (2016) found that an indirect sales model slows down the servitization process, but mostly because of the complexity involved. Surprisingly, they argue that an indirect sales model with local dealers has a positive impact on the customer relationship, as local dealers are often part of the community and are able to connect more with customers. This seems to be contradictive with what the case firms in our research mentioned. Existing researchers concluded that the *data interpretation* capability is mainly important for their equivalent of result-oriented services (Coreynen et al., 2017; Gebauer et al., 2017). However, from our research, we conclude that the data interpretation capability is an important dynamic capability along the whole product-service continuum, from basic product-oriented service to result-oriented services. We also found that that the capability to *define a service strategy* is an essential capability during the whole servitization process, which is in line with what Kanninen et al., (2016) conclude in their research. Surprisingly, most of the case firms had not defined a service strategy beforehand, and naturally progressed towards the provision of more advanced services. Some case firms argued in hindsight that a servitization strategy helps to create commitment within the organization and provides clarity and guidance on what direction to take. The case firms with a high level of *management support* for servitization often also stated that they had a well-defined servitization strategy. This relation would be an interesting topic for future research. According to literature, having a clearly defined servitization strategy also helps in the transition to becoming a more service-oriented organization (Homburg, Fassnacht, & Guenther, 2003). During our empirical research we did not find any support for this. The case firms do consider the transition to a more service-oriented organization as the most challenging task in the servitization process, which is in line with what previous research concluded (Kanninen et al., 2016).

None of the case firms have a perfectly developed set of dynamic capabilities within their firm, suggesting that there is still much room for improvement for manufacturing firms. We see a clear pattern in terms of how well developed the dynamic capabilities are within the case firms. The more servitized a manufacturer is, the better developed its dynamic capabilities are. This is in line with our expectations, as the case firms on the right side of the servitization framework are more experienced at servitization.

Moreover, during the empirical research we identified two dynamic capabilities that are an addition to the existing servitization literature. First of all, firms that are in the basic product-oriented stage of servitization and are looking to progress along the product-service continuum, should develop a *customer sensing* capability to identify and target customers that have a high willingness to innovate and are open to new service propositions. The customer sensing capability is important for all servitization stages from the professional product-oriented services onwards. Secondly, firms that want to be successful with professional product-oriented services should develop a *knowledge capturing*

capability to capture explicit and tacit knowledge and share this knowledge internally and with partners. Both dynamic capabilities have not been mentioned before by the existing servitization literature on dynamic capabilities. Finally, we combined the results of the empirical research with the servitization framework in Figure 13 that was constructed based on the literature view. This led to the development of the revised framework in Figure 15. This framework shows which dynamic capabilities are important or very important at each stage of servitization and thereby provides an answer to the second sub-question.

Answering the main research question: “What dynamic capabilities do manufacturing firms need to move along the product-service continuum and ultimately provide result-oriented services?”

The goal of this research was to provide manufacturing firms with the dynamic capabilities they need to move along the product-service continuum to transition to result-oriented services and become a fully servitized manufacturer. Reflecting on the results of this study we can conclude that we have fulfilled this goal. The servitization framework in Figure 15 depicts the dynamic capabilities required for each stage of servitization and distinguishes between important and very important dynamic capabilities. This is ideal for those manufacturing firms that are already in the process of servitization and want to benchmark themselves against these capabilities. To make it even more comprehensive, we visualized the steps that non-servitized manufacturing firms can take to develop the dynamic capabilities to gradually move along the product-service continuum, see Figure 17. Both frameworks complement each other. In short, non-servitized manufacturing firms that ultimately want to offer result-oriented services should follow the steps that are listed in Figure 17 below. Firms that are already in the process of servitization or want to should use the framework in Figure 15 to benchmark their dynamic capabilities and prepare themselves for the next stage of servitization.

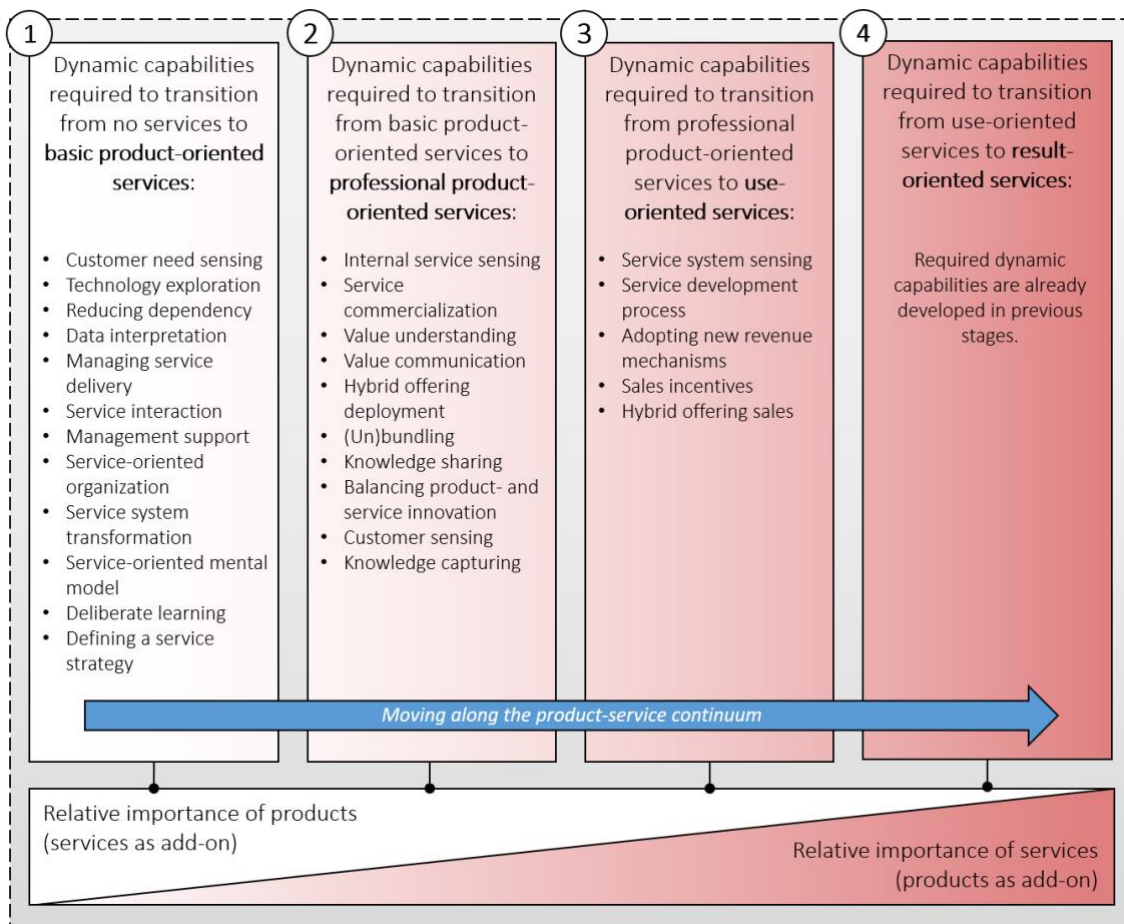


Figure 17: The steps that manufacturing firms should take to transition from no services to offering result-oriented services.

5.2 Theoretical implications

First of all, this study contributes to the existing servitization literature by providing a new framework for servitization based on the widely-used typologies by Oliva & Kallenberg (2003) and Tukker (2004). It integrates both typologies into a more comprehensive framework consisting of four stages of servitization. Two of the four stages were newly developed: the basic product-oriented services and the professional product-oriented services. The framework provides a greater level of detail which allows for a more accurate categorization of services and firms. We suggest that researchers use this framework in their future research on servitization. Furthermore, this study also provides valuable contributions to the dynamic capabilities research stream within the servitization literature on several levels. First, some of the previous studies on the dynamic capabilities required for servitization do not include case firms that have actually reached the highest level of servitization yet (Coreynen et al., 2017; Kanninen et al., 2016; Kindström et al., 2013). This study tackles this flaw by having included five case firms that offer result-oriented services, the highest level of servitization. Hence, this study offers new insights on manufacturing firms employing result-oriented services compared to the above-mentioned studies. Secondly, many of the previous studies focus on the dynamic capabilities required for servitization in general, but do not distinguish between the dynamic capabilities required at different stages of the servitization process (den Hertog et al., 2010; Kanninen et al., 2016; Kindström et al., 2013). This study combines all the research-based dynamic capabilities that were found during the literature review and places them in a comprehensive overview showing the different dynamic capabilities required to transition along the product-service continuum and become a fully servitized manufacturer. Furthermore, it gives a distinction whether a dynamic capability is “important” or “very important” for success at that stage of servitization. Such a comprehensive framework is to our knowledge unique and therefore a valuable addition to the servitization literature. And last but not least, this study proposes two new dynamic capabilities required for servitization in addition to the existing research-based dynamic capabilities: the *customer sensing* capability belonging to the sensing category and the *knowledge capturing capability* belonging to the seizing category of dynamic capabilities. These dynamic capabilities are a new addition to the dynamic capabilities research stream within the servitization literature and offer possibilities for future research.

5.3 Managerial implications

The framework in Figure 15 and the steps in Figure 17 offer guidance to manufacturing firms in the transition along the product-service continuum to ultimately offer result-oriented services. It supports managers in understanding the position of their firm in relation to the servitization process, and it highlights which dynamic capabilities are necessary at what stage of this transition. Firms can benchmark themselves against the proposed dynamic capabilities and understand where they might need to improve, ultimately preparing them better for the challenges they might encounter during their servitization journey. Likewise, this study provides the case firms that were the subject of the empirical research insight into where they can improve their dynamic capabilities. In general, as a result of the interviews among ten manufacturing firms at different stages of the servitization framework, this research offers best practices for manufacturing firms looking to become more servitized. Aside from the proposed dynamic capabilities, there are several more recommendations we would like to give to manufacturing firms.

Based on the experiences from the case firms, we advise manufacturing firms to pursue servitization in an incremental and stepwise approach. Firms should first establish themselves in one stage before moving to the next stage of servitization. This allows them to timely develop the right dynamic capabilities. The largest challenge that manufacturing firms encounter during the servitization process is the cultural change towards becoming a more service-oriented organization. Firms should prepare themselves better for this change, for instance by defining a clear servitization strategy beforehand (Homburg et al., 2003). A direct sales model is the preferred sales approach for services, as it allows firms to be in direct contact with their customers, helping them to better understand their customers’

business. Sales through a network of dealers not only hinders this *customer need sensing* capability, it also makes the manufacturing firm more dependent on the dealers for the sales and provision of services and therewith less flexible to introduce new or improved services. Firms that do not have a direct sales model or expect major challenges in changing their organizations culture could create a new organization within their firm dedicated to the development and provision of services. Case firms D and G both created an internal 'start-up' within their organization responsible for the development and exploitation of a more servitized business model. This allowed them to create a service-oriented culture more easily and they were able make the transition towards a direct sales model more effectively. Firms contemplating servitization could follow a similar approach if they expect these challenges along their way too.

5.4 Limitations and future research

5.4.1 Limitations

This study also has its limitations, which are discussed in this section. First of all, even though a total of ten case firms were interviewed, only one employee per case firm was interviewed, with the exception of case firm B. This results in a single perspective of the case firm which might be biased towards servitization because in all cases a service-related manager was interviewed. For a more balanced view, multiple employees should have been interviewed at the case firms. This did not happen for several reasons. Many case firms first wanted to schedule one interview and see what it was like, instead of already scheduling multiple interviews upfront. Due to time constraints, it was often not possible to schedule more interviews after the first one was conducted. Other case firms simply believed a second interview was not necessary as the first interview captured the information they considered to be relevant.

A second limitation is the limited sample size of the questionnaire (n=10). Moreover, three of the four servitization stages only contained one or two case firms, except for the result-oriented stage. The initial method for data collection was interviews, and after some time we decided to 'test' the list of research-based dynamic capabilities with the case firms during the interviews. The questionnaire was filled out during the interviews with the researcher present, which gave us more insight into their reasoning behind certain answers they gave and allowed us to understand the context better. The downside is the low sample size, which reduces the statistical power of the questionnaire and the reliability of this study.

Thirdly, the goal of this research was to research the dynamic capabilities required to successfully make the transition to servitization and result-oriented services in particular. Some of the case firms that were interviewed had only transitioned to result-oriented services recently, and it is not yet clear if they will be successful with it if the long-term.

Lastly, some of the dynamic capabilities were not deemed important for the use-oriented and result-oriented stages despite that literature hinted otherwise. It could be that some of the more servitized case firms considered a dynamic capability not important at that particular stage because they had already developed those dynamic capabilities in an earlier stage. Thus, it could be that a certain dynamic capability is important for success in a certain stage, but that it is not recognized as important because the case firm had already developed it in an earlier stage and takes it for granted. This is not a problem if companies go stepwise through all servitization stages before arriving at the result-oriented stage, like all result-oriented case firms in this study have done. However, it does become a problem when companies decide to take a leap and skip a certain stage, e.g. when they decide to move from basic product-oriented services directly into result-oriented services. In such cases, it could be that if the manufacturing firm follows the in this study proposed frameworks, will be missing out on some important dynamic capabilities that were supposed to be developed in earlier stages.

5.4.2 Suggestions for future research

First of all, to future researchers, we propose to replicate this study by or instance, a questionnaire with a larger sample size would yield more statistical power and provide more reliable results, hopefully leading to more detailed insights into the exact differences between servitization stages in terms of dynamic capabilities. Another suggestion is to analyze this study's data using the Qualitative Comparative Analysis (QCA) method. QCA is a case-study research method that allows for cross-case comparison of data sets with a low sample size (Legewie, 2013). Using this approach could be more effective in uncovering the relationship between the identified dynamic capabilities and the different servitization stages.

Secondly, scholars could research the servitization stages individually and in more detail. This study covered the whole product-service continuum and, due to time constraints, was not able to go more in depth on each servitization stage. Future research could, for instance, uncover other factors besides dynamic capabilities that are required to be successful at each servitization stage.

Thirdly, due to time constraints, this study was unable to provide recommendations on how to operationalize and implement the proposed dynamic capabilities required for servitization. Future studies could investigate how to develop and operationalize these dynamic capabilities, for instance by conducting interviews among manufacturing firms on how manufacturing firms develop new capabilities. Such research could lead to more practical implications and could further support manufacturing firms in the transition to result-oriented services.

Fourthly, we propose to study servitization among manufacturing firms over longer periods of time. The reason for this is twofold. First of all, it would allow us to see whether manufacturing firms are actually successful with servitization, what the success factors are within such a transition, and the role that dynamic capabilities play in this success. Secondly, and this is related to the future research direction we discussed above, a study over a longer period of time would give us insight into how manufacturing firms develop new dynamic capabilities. Such insights would be useful for other manufacturing firms that are looking to move into servitization.

And lastly, it would also be interesting to go more in-depth on some of the suspected relations that we found. For instance, from the interviews we derived that a direct sales approach is the preferred strategy by the case firms, and that selling and providing services through a network of dealers hinders *customer need sensing* and *managing service delivery*. Future research could for instance research the effect of sales approach on servitization success. Another relation that should be a topic for future research is the relation between *management support* and *defining a service strategy*. From the interviews we got the impression that manufacturing firms where servitization was well supported by management, also a clearly defined servitization strategy was in place.

6 References

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7 Appendices

7.1 Appendix A: Full list of dynamic capabilities

Type	Dynamic capability	Description in literature	Authors
Sensing	<p>1. Customer need sensing: Ability to understand the customers' business and processes and sense customer needs.</p> <p>2. Technology exploration: The capability to signal and explore new technological options outside the service system.</p> <p>3. Service system sensing: Building up an understanding of the entire service system and creating network skills</p> <p>4. Internal service sensing: Having a structured process in place to identify and exploit local/regional initiatives</p> <p>5. Reducing dependency: Allowing various service propositions to emerge to increase chances of success.</p>	Opening up sensing activities toward strategic opportunities downstream in the value chain, the customer's total costs consideration, new value constellations beyond industry and existing value network borders	Gebauer et al. (2012)
		Ability in the customer interface to understand the customers' business and processes	Kanninen et al. (2016)
		Capturing customer needs to create new ideas for products (customer needing interpretation capability)	Coreynen et al. (2017)
		Ability to emphatically understand users and sense their needs in advance by interacting with clients	Den Hertog et al. (2010)
		Customer-linked service sensing: Building up deep customer knowledge, including institutionalizing feedback loops and creating organizational roles, systems, and processes that continuously capture and relay customer demands.	Kindström et al. (2013)
		The capability to signal new technological options	Den Hertog et al. (2010)
		Scanning and exploring sources outside the service system, primarily related to more radical technological changes.	Kindström et al. (2013)
		Building up an understanding of the entire service system required for delivering the service, including links to partners and suppliers, and creating network skills	Kindström et al. (2013)
		Visioning a value network, which is most suitable to form a new value constellation	Gebauer et al. (2012)
		Anticipating how each scenario affects value creation logics and influences the roles of actors and their value-creating processes	Gebauer et al. (2012)
Seizing	<p>6. Data interpretation: The ability to process and analyze product usage and process data, to help customers achieve certain outcomes.</p>	The ability to process and interpret data, analyzing product usage and process data help customers achieve certain outcomes	Coreynen et al. (2017)

	Investing in enabling technologies (e.g. remote monitoring systems, self-service technologies, data processing, and analytics)	Gebauer et al. (2017)
7. Service development process: Having a structured and flexible service development process in which customer needs and technologies are applied in a service concept	The creative process of applying customer needs and technology options in a service concept.	Den Hertog et al. (2010)
	Processes and structures for service design, development, packaging, and delivery	Kanninen et al. (2016)
	Structuring a service development process and being flexible as the process develops.	Kindström et al. (2013)
8. Service commercialization: The ability to commercialize and scale services in a uniform way	A process for commercialization and productization of services	Kanninen et al. (2016)
	The ability to introduce and scale services in a uniform way	Den Hertog et al. (2010)
9. Value understanding: The capability to identify and understand the value of the service to the customer and communicate this internally	Considering value propositions not as a decomposition into a product or service attributes but as utility or what a product and service does for the customers	Gebauer et al. (2012)
	Capability to understand and define value drivers other than monetary ones	Kanninen et al. (2016)
	Ability to identify how value is created for different customer groups/segments and communicating that further in the organization	Kanninen et al. (2016)
10. Value communication: The ability of communicating the value of the service to the customer	Ability to communicate how the service brings value to the customer	Kanninen et al. (2016)
	The ability to choose from various methods to convince customers of the new value provided (value visualization capability)	Coreynen et al. (2017)
11. Hybrid offering deployment: Continuously balancing front-office customization and back-office service design and delivery.	Integrated front office and back office in service design, development, and delivery	Kanninen et al. (2016)
	The ability to continuously balance both front-office customization and back-office production and delivery processes (hybrid offering deployment capability)	Coreynen et al. (2017)
12. (un)bundling: The ability to bundle or unbundle existing service elements into new services	The ability to bundle or unbundle existing service elements into new services	Den Hertog et al. (2010)
13. Managing service delivery: Having the ability to restructure internal and external resources swiftly, for the delivery of new or improved services, including roles dedicated to services at both operational and strategic levels.	The ability to quickly restructure internal and external resources for the delivery of new or improved services.	Kindström et al. (2013)
14. Knowledge sharing: The ability to share information and knowledge inside the organization about services and successful service delivery processes	Ability to share information and knowledge inside the organization about services and successful service delivery processes	Kanninen et al. (2016)
15. Adopting new revenue mechanisms: The ability to visualize the value of new services and adopt	Different pricing logics for services, clear value capturing logics for services	Kanninen et al. (2016)

new revenue mechanism based on that value	Rolling out new revenue mechanisms based on service value, such as availability and customer productivity. The ability to visualize the value of new, often intangible services and solutions for a wide array of actors in the service-delivery system.	Kindström et al. (2013)
16. Service interaction: The capability to co-develop and deliver services with customers and partners and manage these partnerships	Interacting and co-developing with customers and partners to understand, visualize, and deliver value propositions. Involves processes, roles, and skills to interact and change together with customers.	Kindström et al. (2013)
	The capability to co-produce and co-design with clients and partners and orchestrate these partnerships or alliances.	Den Hertog et al. (2010)
	Mobilizing other network players to participate in seizing scenarios, value propositions, role of actors, and the value-creating process.	Gebauer et al. (2012)
17. Sales incentives: Having designed and implemented incentives and measurable goals to sell services	Designed and implemented incentives and measurable goals to sell services	Kanninen et al. (2016)
18. Hybrid offering sales: The capability to continuously adapt to different customer needs, reach key decision makers and sell value-based	A hybrid offering sales capability to continuously adapt to different customer needs, reach key decision makers and sell value-based	Coreynen et al. (2017)
19. Management support: Management measures and understand the long-term profitability of the service business	The management measures and understands the long-term profitability of the service business	Kanninen et al. (2016)
Reconfiguring		
20. Service-oriented organization: Changing the culture, structure and processes to fit a service-oriented organization	Service-oriented organizational culture and mindset throughout the organization	Kanninen et al. (2016)
	Initiating reconfigurations in corporate culture, human resources, organizational structures, and innovation process inside the single supplier	Gebauer et al. (2012)
	Substituting the embedded theory-in-use for service markets	Gebauer et al. (2012)
21. Service system transformation: The ability to manage and transform roles, resources, locus of control and power in the service system and of the external actors involved.	Managing and transforming the service system, especially managing external actors central to performance of the service. An ability to extend the resource base into new markets and services, and to incorporate complementary resources and co-specialization. Reconfiguring roles, resources, locus of control, and power in the service system.	Kindström et al. (2013)
	Orchestrating reconfiguration activities of other network actors	Gebauer et al. (2012)
	Modifying partnerships with existing suppliers and collaborating with new supplementary firms	Gebauer et al. (2017)
22. Service-oriented mental model: The capability to learn new routines and unlearn obsolete routines	Creating service oriented mental-model: the ability to learn but also to unlearn and reject obsolete routines	Kindström et al. (2013)
23. Deliberate learning: Learning from the way service innovation is managed and subsequently adapt the service innovation process.	The capability to deliberately learn from the way service innovation is managed currently and subsequently adapt the overall service innovation process	Den Hertog et al. (2010)
	Defining the service portfolio through trial-and-error processes	Gebauer et al. (2017)

<p>24. Balancing product- and service innovation: Maintaining a balanced relationship between the service and the product organization.</p>	<p>Maintaining a balanced relationship between the service organization and the product organization, necessitating the creation of roles designed for service on all levels of the organizational structure.</p>	<p>Kindström et al. (2013)</p>
<p>25. Defining a service strategy: The capability to define a service strategy and design operational guidelines.</p>	<p>Balancing profits made by PPU services and other business lines</p>	<p>Gebauer et al. (2017)</p>
<p>25. Defining a service strategy: The capability to define a service strategy and design operational guidelines.</p>	<p>The capability to define a service strategy and translate this into operational guidelines.</p>	<p>Kanninen et al. (2016)</p>

7.2 Appendix B: Interview Protocol

7.2.1 English

Interview Protocol – Case Study Interviews

The goal of this document is to improve the reproducibility of the interviews, as well as to improve the controllability of the results. It is written before the interviews are conducted. The interviews will be semi-structured and most of the questions are open-ended, allowing for some level of flexibility and discussion. During the interview, the interviewee is asked to fill out a questionnaire. The questionnaire contains a list of 25 dynamic capabilities and the respondent is asked to mark the importance of each capability in the process of providing services, as well as how the company scores on each of the capabilities.

- *Explain that the anonymity of the interviewee is guaranteed*
- *Ask the interviewee if he/she agrees with the recording of the interview*
- *Explain the objectives of this study:*
 - This research aims to study the transition of product-oriented manufacturing firms to result-oriented business models. More specifically, its objective is to uncover the (dynamic) capabilities required to make this transition.
- *Explain the goal of this interview:*
 - The goal of this interview is twofold. First, it is aimed at understanding the manufacturing firm's position in the servitization process. In other words, to find out how servitized the case firm is.
 - Secondly, the goal of the interview is to understand how the manufacturing firm transitioned to a servitized business model and the dynamic capabilities that are important in the process.
- *Explain the setup of the interview:*
 - The first part of the interview consists of several open ended questions about your background, your company and the position of your company within the servitization framework.
 - In the second part of the interview you will be asked to fill out a questionnaire in two parts. Afterwards we will discuss the results of the questionnaire.
- *Explain the next steps after the interview:*
 - The transcription of the interview will be shared with you for verification purposes.
 - The final report of this research will be shared with you afterwards.
- *Explain that you will now start with the questions*

Part 1 - Background questions

1. For how many years have you been with the company?
2. What is your role in the company and what are your responsibilities?

Part 2 - Servitization within the case firm

3. Can you point out where in the servitization framework your company is positioned? (*show theoretical framework in appendix A*)
4. Why do you position your company in this particular stage of the servitization framework?
5. How does the position of your company compare to the position of your direct competitors? Why is this?
6. How important are services for your company?
7. How do you develop new services?
8. Do you involve customers in the development process of new services? If so, how do you engage with them?

Please continue with the questions that fit the case firm's service offering

Part 3.1 – Result-oriented services (*only for case firms that are at the result-oriented services stage within the framework*)

9. What services did your company already offer before result-oriented services?

10. Why did your company introduce result-oriented services?
11. What barriers did your company experience in the transition to result-oriented services?
12. What are important enablers for your company in developing and delivering result-oriented services?
13. What capabilities are important in the development and delivery of result-oriented services?

Part 3.2 – Use-oriented services (only for case firms that are at the use-oriented services stage within the framework)

14. What services did your company already offer before use-oriented services?
15. Why did your company introduce use-oriented services?
16. What barriers did your company experience in the transition to use-oriented services?
17. What are important enablers for your company in developing and delivering use-oriented services?
18. What capabilities are important in the development and delivery of use-oriented services?
19. Why does your company not offer result-oriented services yet?
20. Is your company planning on moving into result-oriented services in the near future?
21. What capabilities do you think are important to make that transition happen?

Part 3.3 – Professional product-oriented services (only for case firms that are at the professional product-oriented services stage within the framework)

22. What services did your company already offer before professional product-oriented services?
23. Why did your company introduce professional product-oriented services?
24. What barriers did your company experience in the transition to professional product-oriented services?
25. What are important enablers for your company in developing and delivering professional product-oriented services?
26. What capabilities are important in the development and delivery of professional product-oriented services?
27. Why does your company not offer use-oriented or result-oriented services yet?
28. Is your company planning on moving into use-oriented or result-oriented services in the near future?
29. What capabilities do you think are important to make that transition happen?

Part 3.4 – Basic product-oriented services (only for case firms that are at the basic product-oriented services stage within the framework)

30. Why did your company introduce basic product-oriented services?
31. What barriers did your company experience in the transition to basic product-oriented services?
32. What are important enablers for your company in developing and delivering basic product-oriented services?
33. What capabilities are important in the development and delivery of basic product-oriented services?
34. Why does your company not offer services that are higher up in the servitization framework yet?
35. Is your company planning on moving up in the servitization framework in the near future? If so, how?
36. What capabilities do you think are important to make that transition happen?

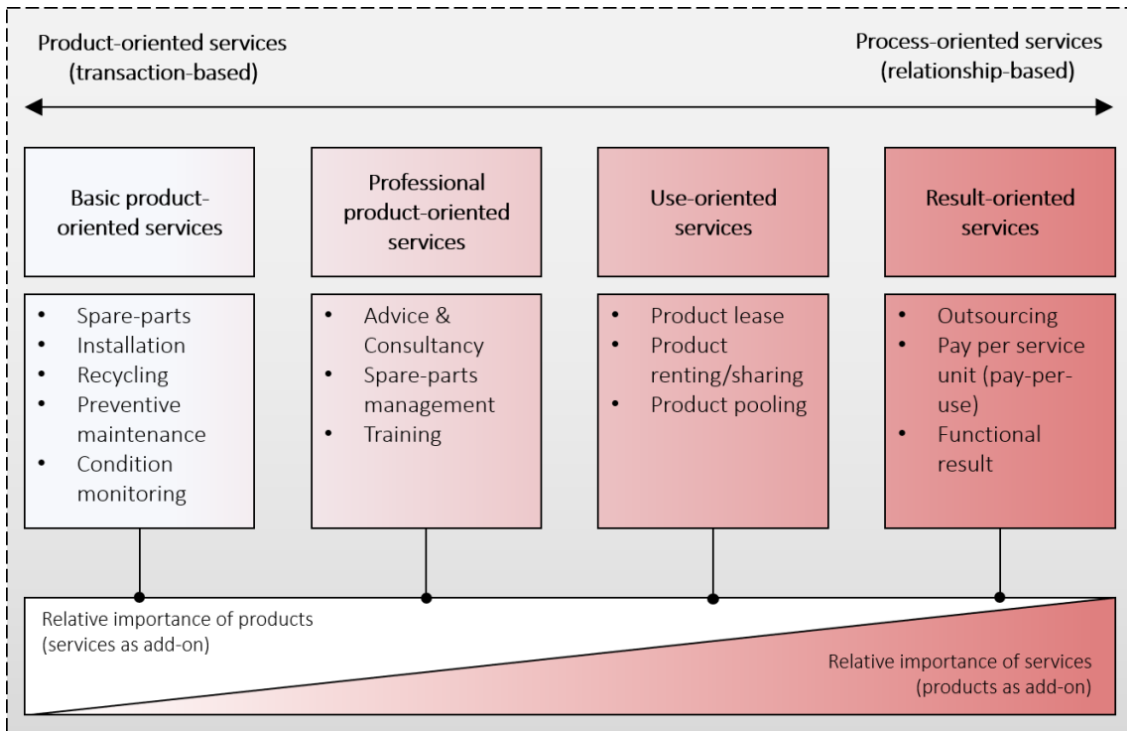
Part 4 – Questionnaire

Introduce the questionnaire to the interviewee and let the interviewee fill it out (Appendix B & Appendix C). Discuss the outcome of the questionnaire with the interviewee. After discussing the questionnaire, continue with the remaining questions.

37. Are there any other factors (besides capabilities) important in the transition to result-oriented services?
38. What do you think of this interview? Do you have any points of improvement?

End the interview and thank the interviewee for his cooperation

Appendix: Servitization Framework



Appendix: Questionnaire Part 1

From literature I have identified a list of capabilities that manufacturing firms need in order to move into the provision of result-oriented services, the highest level of servitization. Could you please answer the following question for each of the capabilities:

How important are the following capabilities for your company in your current stage/position in the servitization framework?

Please mark the answer that is most applicable to your company on a scale of 1 (not at all important) to 5 (extremely important) below.

	Not important	Slightly important	Moderately important	Important	Very important
1. <i>The ability to understand the customers' business and processes and sense customer needs</i>	1	2	3	4	5
2. <i>The capability to signal and explore new technological options outside the service system (service system = organizational and technological network required to deliver services).</i>	1	2	3	4	5
3. <i>Building up an understanding of the entire service system required for delivering the service and creating network skills.</i>	1	2	3	4	5
4. <i>Having a structured process to identify and exploit local/regional service initiatives.</i>	1	2	3	4	5
5. <i>Allowing various service propositions to emerge within the company to increase chances of success.</i>	1	2	3	4	5
6. <i>The ability to process and analyze product usage and process data, to help customers achieve certain outcomes.</i>	1	2	3	4	5
7. <i>Having a structured and flexible service development process in which customer needs and technologies are applied in a service concept.</i>	1	2	3	4	5
8. <i>The ability to commercialize and scale services in a uniform way.</i>	1	2	3	4	5
9. <i>The capability to identify and understand the customer value of the service and communicate this within the rest of your company.</i>	1	2	3	4	5

10. <i>The ability of communicating the value of the service to the customer.</i>	1	2	3	4	5
11. <i>Continuously balancing front-office customization of the service and back-office service design and delivery.</i>	1	2	3	4	5
12. <i>The ability to bundle or unbundle existing service elements into new services.</i>	1	2	3	4	5
13. <i>The ability to quickly restructure internal and external resources for the delivery of new or improved services (e.g. knowing when to outsource vs. when not to).</i>	1	2	3	4	5
14. <i>The ability to share information and knowledge inside the organization about services and successful service delivery processes.</i>	1	2	3	4	5
15. <i>The ability to visualize the value of new services and adopt new revenue mechanisms based on that value.</i>	1	2	3	4	5
16. <i>The capability to co-develop and deliver services with customers and partners and manage these partnerships.</i>	1	2	3	4	5
17. <i>Having designed and implemented incentives and measurable goals to sell services.</i>	1	2	3	4	5
18. <i>The capability to continuously adapt to different customer needs, reach key decision makers and sell value-based.</i>	1	2	3	4	5
19. <i>Management measures and understand the long-term profitability of the service business.</i>	1	2	3	4	5
20. <i>The ability to change culture, structure and processes to fit a service-oriented organization.</i>	1	2	3	4	5
21. <i>The ability to manage and transform the service system and the external actors involved and to extend existing resources.</i>	1	2	3	4	5
22. <i>The capability to learn new routines and unlearn obsolete routines.</i>	1	2	3	4	5

23. <i>Learning from the way service innovation is managed and subsequently adapt the service innovation process.</i>	1	2	3	4	5
24. <i>Maintaining a balanced relationship between the service organization and the product organization within your company.</i>	1	2	3	4	5
25. <i>The capability to define a service strategy and translate this into operational guidelines.</i>	1	2	3	4	5

Appendix: Questionnaire Part 2

From literature I have identified a list of capabilities that manufacturing firms need in order to move into the provision of result-oriented services, the highest level of servitization. Could you please answer the following question for each of the capabilities:

How well developed are the following capabilities within your company?

Please mark the answer that is most applicable to your company on a scale of 1 (not at all developed) to 5 (extremely well developed) below.

	Not developed	Slightly developed	Moderately developed	Developed	Very developed
1. <i>The ability to understand the customers' business and processes and sense customer needs</i>	1	2	3	4	5
2. <i>The capability to signal and explore new technological options outside the service system (service system = organizational and technological network required to deliver services).</i>	1	2	3	4	5
3. <i>Building up an understanding of the entire service system required for delivering the service, including links to partners and suppliers, and creating network skills.</i>	1	2	3	4	5
4. <i>Having a structured process to identify and exploit local/regional service initiatives.</i>	1	2	3	4	5
5. <i>Allowing various service propositions to emerge within the company to increase chances of success.</i>	1	2	3	4	5

6. <i>The ability to process and interpret data, analyzing product usage and process data to help customers achieve certain outcomes.</i>	1	2	3	4	5
7. <i>Having a structured and flexible service development process in which customer needs and technologies are applied in a service concept.</i>	1	2	3	4	5
8. <i>The ability to commercialize and scale services in a uniform way.</i>	1	2	3	4	5
9. <i>The capability to identify and understand the customer value of the service and communicate this within the rest of your company.</i>	1	2	3	4	5
10. <i>The ability of communicating the value of the service to the customer.</i>	1	2	3	4	5
11. <i>Continuously balancing front-office customization of the service and back-office service design and delivery.</i>	1	2	3	4	5
12. <i>The ability to bundle or unbundle existing service elements into new services.</i>	1	2	3	4	5
13. <i>The ability to quickly restructure internal and external resources for the delivery of new or improved services, including having roles dedicated to services on operational and strategic levels.</i>	1	2	3	4	5
14. <i>The ability to share information and knowledge inside the organization about services and successful service delivery processes.</i>	1	2	3	4	5
15. <i>The ability to visualize the value of new services and adopt new revenue mechanisms based on that value.</i>	1	2	3	4	5
16. <i>The capability to co-develop and deliver services with customers and partners and manage these partnerships.</i>	1	2	3	4	5
17. <i>Having designed and implemented incentives and measurable goals to sell services.</i>	1	2	3	4	5
18. <i>The capability to continuously adapt to different customer</i>	1	2	3	4	5

<i>needs, reach key decision makers and sell value-based.</i>					
<i>19. Management measures and understand the long-term profitability of the service business.</i>	1	2	3	4	5
<i>20. The ability to change culture, structure and processes to fit a service-oriented organization.</i>	1	2	3	4	5
<i>21. The ability to manage and transform the service system and the external actors involved and to extend existing resources.</i>	1	2	3	4	5
<i>22. The capability to learn new routines and unlearn obsolete routines.</i>	1	2	3	4	5
<i>23. Learning from the way service innovation is managed and subsequently adapt the service innovation process.</i>	1	2	3	4	5
<i>24. Maintaining a balanced relationship between the service organization and the product organization within your company.</i>	1	2	3	4	5
<i>25. The capability to define a service strategy and translate this into operational guidelines.</i>	1	2	3	4	5

7.4 Appendix C: Coding scheme

Concept	Category	Code	Sub code
Dynamic capabilities	1. Sensing capabilities	1.1. Technology exploration	
		1.2. Customer need sensing	
		1.3. Service system sensing	
		1.4. Internal service sensing	
		1.5. Reducing dependency	
	2. Seizing capabilities	2.1. Service interaction	
		2.2. Data interpretation	
		2.3. Hybrid offering sales	
		2.4. Service development process	
		2.5. Service commercialization	
		2.6. Value communication	
		2.7. Value understanding	
		2.8. Hybrid offering deployment	
		2.9. Knowledge sharing	
		2.10. Managing service delivery	
		2.11. Sales incentives	
		2.12. Management support	
		2.13. (Un)bundling	
		2.14. Adopting new revenue mechanisms	
	3. Reconfiguring capabilities	3.1. Service-oriented organization	
3.2. Service-oriented mental model			
3.3. Deliberate learning			
3.4. Balancing product- and service innovation			
3.5. Service strategy			
3.6. Service system transformation			
4. New dynamic capabilities	4.1. Knowledge capturing		
	4.2. Customer sensing		
Servitization process	5. Drivers of servitization	5.1. Financial	5.1.1. Revenue expansion
			5.1.2. Higher margins
		5.2. Marketing	5.2.1. Customer intimacy
			5.2.2. Lock-in customers
		5.3. Market pull	
		5.4. Strategic	5.4.1. Differentiation
	5.4.2. Price-based competition		
	5.5. Product design		
	6. Challenges of servitization	6.1. Cultural change required	6.1.1. Different sales approach
			6.1.2. Reactive to proactive
		6.2. Dependence on parent organization	
		6.3. Internal cooperation	
		6.4. Cannibalization of product sales	
		6.5. No references	
6.6. Working with dealers			
6.7. Traditional market			
6.8. Technological challenges			

7.5 Appendix D: Questionnaire answers

Measuring importance of dynamic capabilities

In the table below, the answers of the case firms to the following question are listed: “How important are the following capabilities for your company in your current stage/position in the servitization framework?”

Questions	A	B	C	D	E	F	G	H	I	J	Mean
1. <i>The ability to understand the customers' business and processes and sense customer needs</i>	5	5	4	5	5	5	5	5	4	3	4,6
2. <i>The capability to signal and explore new technological options outside the service system (service system = organizational and technological network required to deliver services).</i>	4	3	3	4	4	3	4	4	4	2	3,5
3. <i>Building up an understanding of the entire service system required for delivering the service and creating network skills.</i>	4	4	3	4	4	3	5	4	3	2	3,6
4. <i>Having a structured process to identify and exploit local/regional service initiatives.</i>	3	2	5	2	4	4	3	4	3	5	3,5
5. <i>Allowing various service propositions to emerge within the company to increase chances of success.</i>	4	4	5	3	5	4	4	3	4	3	3,9
6. <i>The ability to process and analyze product usage and process data, to help customers achieve certain outcomes.</i>	4	4	5	5	5	4	5	4	4	4	4,4
7. <i>Having a structured and flexible service development process in which customer needs and technologies are applied in a service concept.</i>	4	3	2	3	3	4	4	4	3	3	3,3
8. <i>The ability to commercialize and scale services in a uniform way.</i>	5	1	5	5	4	5	5	4	3	5	4,2
9. <i>The capability to identify and understand the customer value of the service and communicate this within the rest of your company.</i>	5	4	4	3	4	5	5	5	2	5	4,2
10. <i>The ability of communicating the value of the service to the customer.</i>	5	5	5	5	4	5	4	2	2	4	4,1
11. <i>Continuously balancing front-office customization of the service and back-office service design and delivery.</i>	3	4	1	3	4	3	4	5	3	4	3,4
12. <i>The ability to bundle or unbundle existing service elements into new services.</i>	4	4	1	3	3	3	4	3	2	4	3,1

13. <i>The ability to quickly restructure internal and external resources for the delivery of new or improved services (e.g. knowing when to outsource vs. when not to).</i>	2	4	2	3	2	3	3	4	4	3	3,0
14. <i>The ability to share information and knowledge inside the organization about services and successful service delivery processes.</i>	3	4	3	2	4	4	4	4	3	4	3,5
15. <i>The ability to visualize the value of new services and adopt new revenue mechanisms based on that value.</i>	3	4	5	5	2	4	5	4	3	3	3,8
16. <i>The capability to co-develop and deliver services with customers and partners and manage these partnerships.</i>	3	5	1	4	2	4	5	5	4	2	3,5
17. <i>Having designed and implemented incentives and measurable goals to sell services.</i>	4	3	4	5	3	5	4	4	3	2	3,7
18. <i>The capability to continuously adapt to different customer needs, reach key decision makers and sell value-based.</i>	4	5	5	4	3	5	5	5	3	2	4,1
19. <i>Management measures and understand the long-term profitability of the service business.</i>	5	3	5	4	3	4	5	5	4	3	4,1
20. <i>The ability to change culture, structure and processes to fit a service-oriented organization.</i>	4	5	4	4	2	4	5	4	5	4	4,1
21. <i>The ability to manage and transform the service system and the external actors involved and to extend existing resources.</i>	3	4	1	4	2	4	5	4	4	3	3,4
22. <i>The capability to learn new routines and unlearn obsolete routines.</i>	4	2	3	5	4	4	4	4	5	1	3,6
23. <i>Learning from the way service innovation is managed and subsequently adapt the service innovation process.</i>	3	2	4	5	3	4	5	4	4	2	3,6
24. <i>Maintaining a balanced relationship between the service organization and the product organization within your company.</i>	3	2	5	4	5	4	5	4	3	4	3,9
25. <i>The capability to define a service strategy and translate this into operational guidelines.</i>	3	4	5	3	3	4	5	5	4	4	4,0

Development of dynamic capabilities within case firms

In the table below, the answers of the case firms to the following question are listed: “How well developed are the following capabilities within your company?”

Questions	A	B	C	D	E	F	G	H	I	J	Mean
1. The ability to understand the customers' business and processes and sense customer needs.	4	3	3	4	2	5	4	4	2	3	3,4
2. The capability to signal and explore new technological options outside the service system (service system = organizational and technological network required to deliver services).	2	2	5	4	2	3	3	3	4	2	3,0
3. Building up an understanding of the entire service system required for delivering the service and creating network skills.	3	3	4	4	2	4	4	4	3	3	3,4
4. Having a structured process to identify and exploit local/regional service initiatives.	3	1	3	3	3	5	2	4	3	2	2,9
5. Allowing various service propositions to emerge within the company to increase chances of success.	4	4	5	2	4	5	5	2	4	4	3,9
6. The ability to process and analyze product usage and process data, to help customers achieve certain outcomes.	2	2	3	4	1	5	3	3	2	2	2,7
7. Having a structured and flexible service development process in which customer needs and technologies are applied in a service concept.	3	3	2	2	2	4	4	4	1	1	2,6
8. The ability to commercialize and scale services in a uniform way.	3	3	5	4	3	3	3	4	1	5	3,4
9. The capability to identify and understand the customer value of the service and communicate this within the rest of your company.	3	4	3	4	2	3	3	3	2	4	3,1
10. The ability of communicating the value of the service to the customer.	4	2	5	4	3	4	4	4	2	3	3,5
11. Continuously balancing front-office customization of the service and back-office service design and delivery.	3	3	1	3	3	3	4	4	4	2	3,0
12. The ability to bundle or unbundle existing service elements into new services.	4	5	3	2	2	5	5	2	2	3	3,3
13. The ability to quickly restructure internal and external resources for the delivery of new or improved services (e.g. knowing when to outsource vs. when not to).	2	2	1	2	1	3	2	4	3	4	2,4
14. The ability to share information and knowledge inside the organization about services and successful service delivery processes.	3	4	4	4	4	3	3	3	2	2	3,2
15. The ability to visualize the value of new services and adopt new revenue mechanisms based on that value.	3	2	2	3	3	4	4	2	1	2	2,6

16. <i>The capability to co-develop and deliver services with customers and partners and manage these partnerships.</i>	4	4	2	3	2	3	3	2	1	4	2,8
17. <i>Having designed and implemented incentives and measurable goals to sell services.</i>	3	4	4	4	2	5	3	3	2	2	3,2
18. <i>The capability to continuously adapt to different customer needs, reach key decision makers and sell value-based.</i>	4	2	4	4	2	4	4	3	2	3	3,2
19. <i>Management measures and understand the long-term profitability of the service business.</i>	4	4	1	3	3	5	3	4	3	2	3,2
20. <i>The ability to change culture, structure and processes to fit a service-oriented organization.</i>	2	3	4	1	2	4	4	3	2	2	2,7
21. <i>The ability to manage and transform the service system and the external actors involved and to extend existing resources.</i>	2	3	3	3	2	4	3	4	2	2	2,8
22. <i>The capability to learn new routines and unlearn obsolete routines.</i>	2	4	2	4	3	2	3	3	2	3	2,8
23. <i>Learning from the way service innovation is managed and subsequently adapt the service innovation process.</i>	3	2	3	4	4	2	4	2	3	1	2,8
24. <i>Maintaining a balanced relationship between the service organization and the product organization within your company.</i>	2	5	4	2	4	2	4	3	3	1	3,0
25. <i>The capability to define a service strategy and translate this into operational guidelines.</i>	3	2	4	3	4	3	4	4	2	3	3,2

7.6 Appendix E: Questionnaire scales

Scale	Category
Not important	$1,0 \leq \text{mean score} < 1,5$
Slightly important	$1,5 \leq \text{mean score} < 2,5$
Moderately important	$2,5 \leq \text{mean score} < 3,5$
Important	$3,5 \leq \text{mean score} < 4,5$
Very important	$4,5 \leq \text{mean score} \leq 5$

Scale	Category
Not developed	$1,0 \leq \text{mean score} < 1,5$
Slightly developed	$1,5 \leq \text{mean score} < 2,5$
Moderately developed	$2,5 \leq \text{mean score} < 3,5$
Developed	$3,5 \leq \text{mean score} < 4,5$
Very developed	$4,5 \leq \text{mean score} \leq 5$