

Developing a servitization framework

“helping capital equipment manufacturers develop a sustainable and healthy business through services”

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TU Delft, Management of Technology
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Summary

Since the early 1990's, the machine manufacturing industry has undergone something of a service revolution. Customers in the business to business market have been increasingly demanding for services and more and more traditional manufacturing companies are nowadays extending their business to value-adding services like maintenance, spare parts and trainings. This phenomena is known as "servitization"; "the innovation of an organisation's capabilities and processes to better create mutual value through a shift from selling a product, to selling a product-service system" (Baines et al., 2009). Servitization provides traditional manufacturing companies a concept of significant value. Through services, companies can generate a stable revenue stream with a high profit margin, create a source of knowledge on both products and customers, and create a competitive advantage that is difficult to imitate. In addition, due to the commoditisation of markets, differentiating strategies based on product innovation and cost-leadership are becoming increasingly difficult to maintain (Mathieu, 2001; Gebauer & Fleisch, 2007).

However, although servitization offers traditional product manufacturers a concept of significant value, successfully implementing it as an organizational strategy turns out to be difficult. Gebauer & Fleisch (2007) for example conducted a survey of 200 manufacturing companies and concluded that: "the percentage of manufacturing companies achieving an attractive share of their total revenue through services is still low". Apart from academics, also business consultants recognize the problem. Atos consulting, an international consultancy firm, stated in a whitepaper: "we have experienced in our consulting practice that clients struggle to develop services as a profitable business" (Servitization in product companies, Atos Consulting, Whitepaper, 2011). So despite the proven opportunities of services, the reality is that most companies struggle to capitalize the potential of a servitization strategy.

This research has aimed to make a contribution in helping capital equipment manufacturers successfully expanding their activities with services, by providing them knowledge, information and insight that could lead to adequate decision-making. The transition towards services is a process that has not yet thoroughly been understood and literature on how to approach servitization as an organizational strategy is largely limited to anecdotal evidence from successful cases (Baines, Lightfoot, Benedettini, & Kay, 2009). Since literature does not provide a comprehensive overview on how manufacturing companies can expand their activities with services (Oliva & Kallenberg, 2003), this research has aimed to develop a prescriptive model that provides the tools and techniques needed by practitioners. The main question of this research has therefore been formulated as:

What guidelines, tools and techniques can help capital equipment manufacturers to successfully implement a servitization strategy?

This research question has been answered by conducting two consecutive research stages: (1) a problem diagnosing stage and (2) a design stage. The problem diagnosing stage was conducted to identify why most companies fail to successfully servitize, after which the servitization framework was designed as an intervention plan, pertaining to the causes of the problem. The results of both stages will be discussed next.

During the problem diagnosing stage, the causes to the servitization problem have been determined by conducting a literature review, as well as case study interviews. As stated earlier, literature on the servitization topic is still quite naive. It could therefore provide a theoretical starting point, but did not provide solid evidence on why companies squander the after-market. It is therefore that in addition to the literature reviews, interviews were conducted with business managers that experience the problem in real life. The problem diagnosis has revealed that the difficulty of successfully developing a service business, originates from the challenging characteristics of the service market. The service market is namely characterized by a complex, dynamic and hostile environment and companies that want to compete on it, are confronted with challenges like:

- Service customers heavily differ in their need and willingness to pay, since they operate in separate, possibly unrelated, industries, vary in sizes and are dispersed across geographic regions (Neu, 2005; Cohen et al., 2006);
- Service often has to be provided to multiple product generations and configurations and the service business therefore includes a large variety of parts and suppliers (Cohen et al., 2006);
- Service demands are triggered by machine failures that crop up unexpectedly and sporadically, while most services cannot be stored and carried forward to a future time period. (Cohen et al., 2006; Wolak et al. 2000);
- The service network consists of highly integrated resources that causes managerial actions to have a low temporal order, covariation and continuity in time and space (Neu, 2005);
- Manufacturing companies that move into services can face fierce competition outside their usual domain, since suppliers, distributors and customers might all be able to meet the same service demand (Baines et al. 2009);
- The complexity of the service market leads to higher levels of hostility, since it demands knowledgeable and experienced employees that are difficult to acquire and to attain (Neu, 2005).

Since the characteristics of the service market are significantly different from the goods market, manufacturing companies that move into services have to develop new competences. However, as was concluded from the literature review and verified by the case study interviews, most companies do not seem to be aware of this. Services are often recognized as an enlargement of the product offering, instead of a complete new business and many organizations therefore fail to recognize the distinctive characteristics of this market and the urge of developing new competences. They seem to be misguided by the face similarities of both businesses and apply the methods, tools and techniques from the goods market, to tackle the challenges of the service market. This does not lead to the desired result and services therefore often remain “a necessary evil”, instead of sustainable healthy business. So as a first step towards successfully servitizing, companies need to recognize that they have to go through a significant change process to develop the competences needed to deal with the challenging characteristics of the service market. The servitization framework is therefore designed to fulfil two purposes:

- (1) The servitization framework has to create awareness by indicating why most companies fail to successfully implement a servitization strategy, after which
- (2) The servitization framework can provide a helpful tool for developing the required competences.

As visualised in Figure 1, this way it is opt to come from the current state where services are recognized as a necessary evil, to the desired state in which services provide a healthy sustainable business.

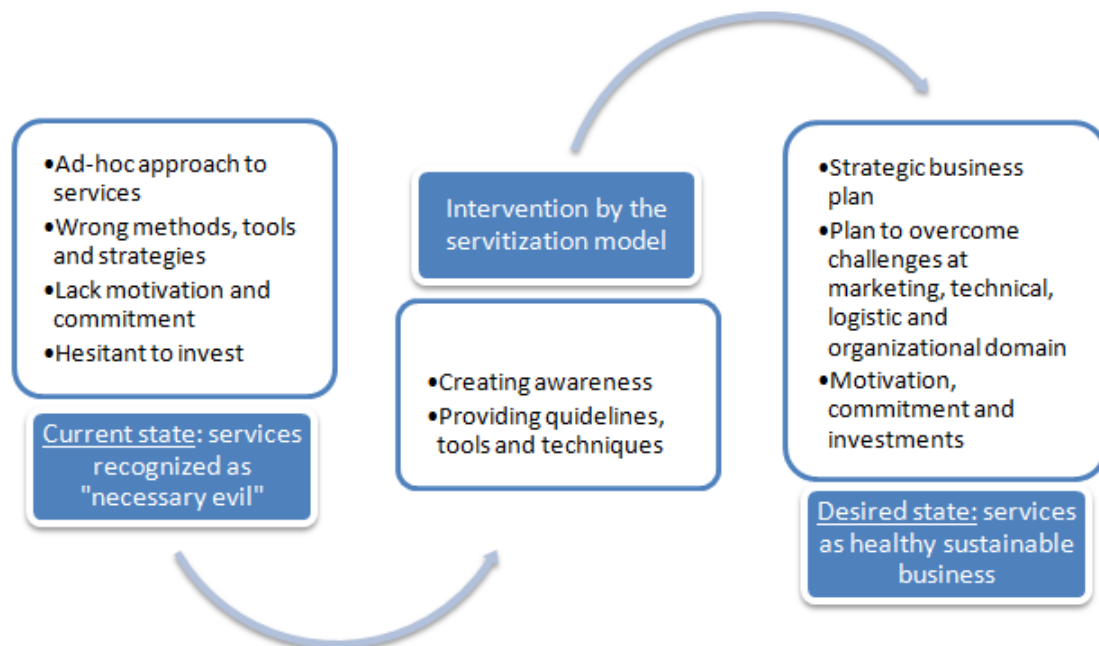


Figure 1: The intervention of the servitization framework visualized

With this perspective, the servitization framework is designed to indicate the servitization challenges at all organizational decision making levels, and the steps that could help to develop the competences needed to overcome these challenges. By talking to business managers, the challenging characteristics of the service market have been translated into managerial problems and traced back to four areas of expertise: the marketing, technical, logistic and organizational domain. It is in these areas where challenges will arise and companies have to develop new competences. The servitization framework is visualized in Figure 2 and the essence of this framework will be briefly discussed next.

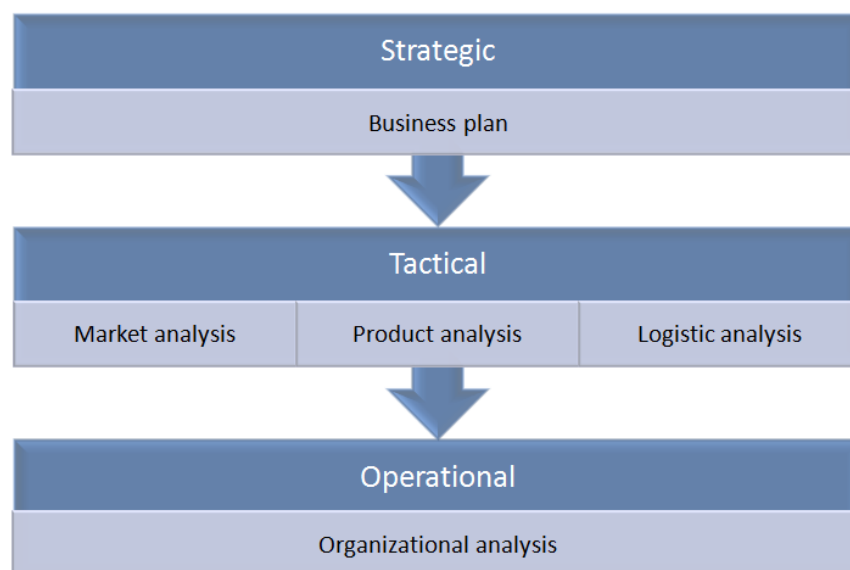


Figure 2: The servitization framework visualized

Business plan

The first step of implementing a servitization strategy is making a strategic business plan. A strategic business plan will indicate what investments are going to allow the organization to achieve its plan and will set out the company course for the next few years. Formulating a strategic business plan is important since:

- “high service revenue will not just happen; it will be the outcome of essential investments in the service business” (Gebauer & Fleisch, 2007), and
- The adoption of a servitization strategy raises significant cultural and corporate challenges” (Baines et al., 2009).

Successfully implementing a servitization strategy thus requires investments, motivation and commitment. Unfortunately, it seems that top management generally lacks the awareness of the required time and resources (Wagner & Lindemann, 2008) and managers cannot be easily motivated to invest resources in extending the service business (Gebauer & Fleisch, 2007). Three critical steps have therefore been identified for formulating a strategic business plan:

1. Focus on product development;
2. Study service potential;
3. Emphasize the service relevance.

These three steps do not cover the complete scope of developing a business plan, but indicate the essence that should be considered when developing a strategic business plan for the service market.

Market analysis

A crucial step of implementing a servitization strategy, is the design of the service product. The service product should fulfil the customer’s need and thereby enhance the product value for the customer. However, customers heavily vary in their need and willingness to pay, since they are located in separate, possibly unrelated industries, vary in sizes and are dispersed across geographic regions (Neu, 2005). Companies therefore have to:

“study the variety of customers and create products and pricing strategies that satisfies different customer segments” (Cohen et al., 2006)

Conducting this step will help to strive towards the goal of generating a maximum amount of profit from the installed base. Four critical steps have been identified for an adequate market analysis:

1. Segment customers;
2. Design service offerings;
3. Design business models;
4. Indicate pricing strategies.

What is important to bear in mind, is that services have an intangible nature that make the value proposition of the service product less clear to the customer. During the complete design process, companies therefore have to focus on communication strategies that clearly describe the value proposition of the service product to the customer (Mathieu, 2001).

Product analysis

The next step of implementing a servitization strategy, is designing the service offerings from a technical point of view. During this step, companies are confronted with the following decision-making issues:

(1) How to pre-plan and pre-schedule maintenance work for sophisticated equipment under a complex operating environment? (2) How to reduce the high inventory cost for spare parts? (3) How to avoid the risk of catastrophic failure and eliminate unplanned forced outage of equipment or systems? (Yam et al., 2001)

To adequately solve these decision-making issues, companies have to conduct a product analysis. They have to study the trade-off between the product's functioning and maintenance costs to strive towards the goal of maximizing the uptime of the product, while minimizing maintenance costs. Three critical steps have been identified for an adequate product analysis:

1. Study the product and determine portfolio;
2. Developing maintenance plans;
3. Identify spare parts assortment.

The product analysis will thus identify: (1) which product to cover, (2) how to cover these products and (3) which spare parts need to be actively managed in order to minimize any potential delays after a machine failure.

Logistic analysis

The fourth step of implementing a servitization strategy, is a logistic analysis. A logistic analysis is important since:

“after-sales services are a commitment companies make to respond within a specific time frame to the customer's need for support” (Cohen et al., 2006)

Companies therefore have to conduct a logistic analysis in which they weigh the levels of response customers need, against the prices they are willing to pay (Cohen et al., 2006). To support a geographically installed base, companies then have to have to set up a distinctive after-sales services supply chain. Setting up a distinctive after-sales service supply chain is important, since:

Effective supply chain strategies for the manufacturing business may not be appropriate in the service sector (Sengupta et al., 2006).

The service network namely has to cope with more stock keeping units, more locations, more uncertainty and often has to be contend with reverse logistics (Cohen et al., 2006). Four critical steps have been identified that can help companies to strive towards the goal of delivering spare parts to the right place within an agreed-upon time, while minimizing costs:

1. Develop a supply chain map;
2. Study spare parts portfolio;
3. Define supply chain strategies;
4. Define inventory policy.

Organizational analysis

To implement a servitization strategy on the operational level, companies have to design a service organization. Managing operational service processes is difficult, since services are characterized by a volatile and unpredictable demand and companies have to manage a large number of integrated resources that causes managerial actions to have a low temporal order, covariation and continuity in time and space (Neu, 2005). It is therefore important that companies design an integrated organization that is capable of diffusing knowledge across the network (Christopher, 2000; Neu, 2005; Oliva & Kallenberg, 2003). These aspects are important since:

- “In service firms, studies show that approximately 98 percent of customer lead time consists of non-value-added activities. Therefore, if such activities were eliminated, customer lead time could be reduced, considerably” (Durmusoglu & Kulak, 2008);
- “Once the service system is in place, it becomes a fixed cost and the main driver of profitability is capacity utilization” (Oliva & Kallenberg, 2003);
- “Effectively addressing the uncertainty of a complex market requires higher levels of information processing” (Neu, 2005).

To design an organization that is capable of managing a large amount of integrated resources in a dynamic environment, companies have to design the whole service process in detail, including micro-processes and individual activities (Edvardsson & Olsson, 1996). This can namely help companies to strive towards the goal of defining an organization that will manage the operational processes in the most effective and efficient manner. Five critical steps have been identified for adequately designing a service organization:

1. Model the service processes;
2. Indicate roles and responsibilities;
3. Design a monitoring system;
4. Formulate targets;
5. Manage information sharing.

A complete overview of all the steps in all three business layers is visualized in Figure 3.

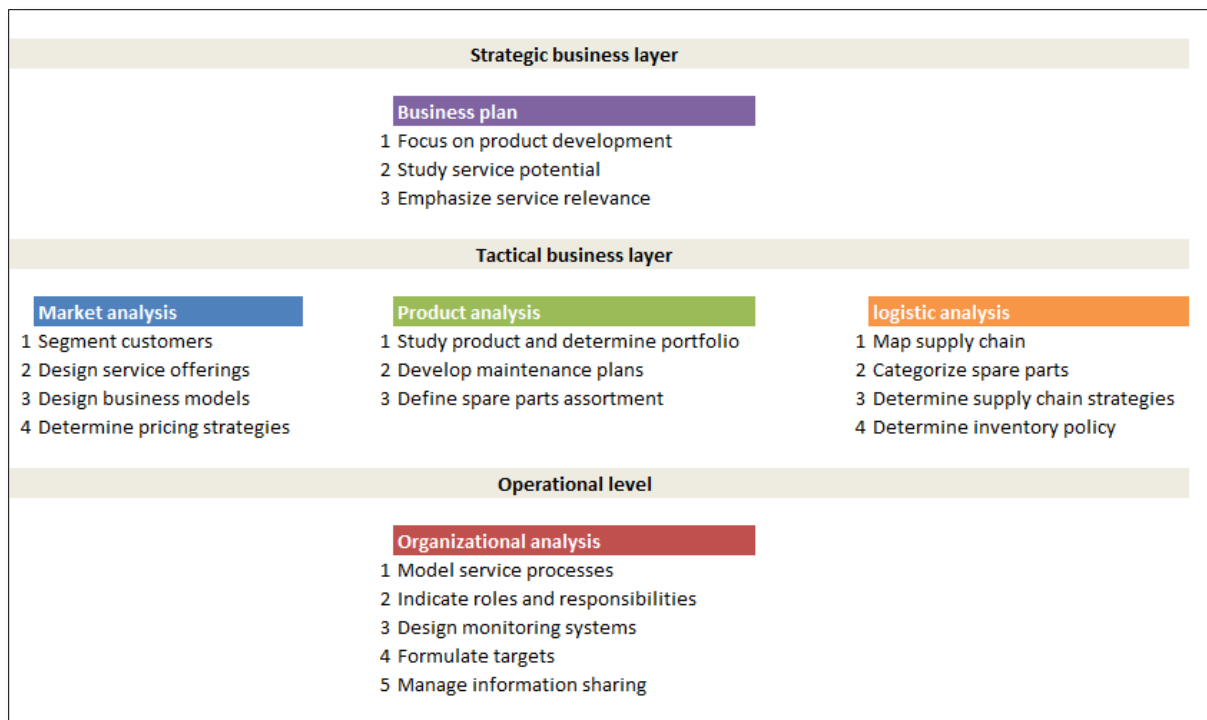


Figure 3: A complete overview of all the steps prescribed by the servitization framework

What should be noted, is that the servitization framework is designed to provide knowledge, information and insight that can lead to adequate decision making. The servitization framework in itself does therefore not yet offer a recipe for success. The success of mechanisms is limited by contextual constraints and developing a plan for intervention therefore requires to design a solution that accurately fits the specific problem, situation and context of a company. However, the servitization framework helps companies to develop such a plan for intervention, since it can (1) help to objectively asses a case company's current abilities (what steps did it take?), after which (2) it can identify important focus areas for enhancing a company's ability in managing services (what steps did it not take?).

The servitization framework has proved its usefulness during a single case study. It has objectively assessed a case company's current abilities and helped to identify a roadmap for development. However, it has also been noted from this case study that the servitization framework as it is now, only has a limited influence in creating awareness, i.e. convincing business managers of the fact that they use the wrong strategies, methods and tools and do not yet posses the required competences. This is because the model is merely founded on logic reasoning and does not incorporate any hard data (e.g. benchmark data) that can support certain claims. Is it therefore believed that, although the servitization framework already turned out to be a valuable tool, improvements are still possible by conducting additional research. Three relevant steps for future research have been identified: (1) conducting a Delphi method to further test the content of the model, (2) collecting and adding empirical data that can support certain claims (e.g. benchmark data) and (3) testing the model's interface with a future user.

Preface

This is the report of my thesis: “Developing a servitization framework” that has been the final step of my Management of Technology MSc program at the TU Delft; a program that learns to explore and understand technology as a corporate research. It is the outcome of almost 1,5 year of research on the topic of servitization in the interest of both academics and practitioners.

The research consisted of a literature study, interviews with business managers and a case study at Stork Food & Dairy Systems B.V., located in Amsterdam. Conducting these steps independently has been a great professional and personal learning experience. Driven by the believe that servitization has introduced a new era for the manufacturing industry, I greatly enjoyed working on this project.

I would like to take this opportunity to thank my interviewees for their cooperation. Getting familiar with their organizations have been a great pleasure and has led to valuable insights for my research. I would furthermore like to thank the employees of Stork Food & Dairy Systems for their cooperation and support, which has allowed me to apply my “thought experiment” on to a real life scenario. I would also like to thank Thijs Westerkamp from Krauthammer International and Jürgen Donders from Gordian Logistics Expert B.V. for revising parts of report that has helped me to critically evaluate my work.

I would in addition like the thank Prof. Dr. Ir. Lorant Tavasszy for chairing my committee and motivating me to take my master thesis as a learning opportunity. Ir. Marcel Ludema for his regular guidance, support and feedback and Dr.ir. Z. Lukszo for her punctuality and great professionalism. Both have helped me to set out the course of my research.

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Bas van Gool

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1. Introduction

This chapter will discuss the background, problem and objectives of this research. At the end of this chapter, an overview of the report structure is given.

1.1 The research background

Since the early 1990's, the machine manufacturing industry has undergone something of a service revolution. Due to a lower demand, an intensified competition and lower profit margins, manufacturing companies slowly changed their strategy from pushing products, to providing solutions (Cohen, Agrawal, & Agrawal, 2006). With the focus on providing solutions, companies started to realize that after-sales services, which include all the activities from product delivery to the end of a product's life cycle, are a lucrative business (Wagner & Lindemann, 2008). Instead of considering it "a necessary evil" that generates high costs, manufacturing companies started to recognize that services actually provided them an opportunity.

Capital goods¹ have associated cost of ownership beyond the purchase price, since they require services as they advance through their life cycle (Oliva & Kallenberg, 2003). By selling spare parts, maintenance, upgrades and other technical support, manufacturers can therefore generate a stable revenue stream with a high profit margin. It in addition provides companies the opportunity to create a source of knowledge on both products and customers and to gain a competitor advantage that is difficult to imitate (Bachetti & Sacanni, 2011). Servitization, the term first coined by Vandermerwe and Rada (1988), is now widely recognised as the process of creating an additional value by adding services to products. "It is the innovation of an organisations capabilities and processes to better create mutual value through a shift from selling a product, to selling a product-service system" (Baines et al., 2009).

More and more manufacturing companies are nowadays offering services in addition to their products (Davies et al., 2006; Neely, 2009). Servitization is happening in almost all manufacturing industries on a global scale (Vandermerwe and Rada, 1988, pp. 315). Customers in the business-to-business and industrial markets have been increasingly demanding for services (Baines et al., 2009) and as estimated by the research firm Aberdeen Group, the sales of spares and after-sales services already account for approximately 8% of the annual gross domestic product of the united states (Cohen et al., 2006). Servitization is a concept of significant value that seems to have introduced a new era for the capital intense manufacturing industry. Especially when considering that due to the commoditisation of markets, differentiating strategies based on product innovation, technological superiority or cost-leadership are becoming increasingly difficult to maintain (Mathieu, 2001; Gebauer and Fleisch, 2007).

Servitization: *"the innovation of an organisations capabilities and processes to better create mutual value through a shift from selling a product, to selling a product-service system"* (Baines et al., 2009).

The next chapter will discuss the research problem that is related to this topic.

¹ "A capital good is a durable good (one that does not quickly wear out) that is used in the production of goods or services." (http://en.wikipedia.org/wiki/Capital_good)

1.2 The research problem

Capital equipment manufacturers that move into services expand their business by entering the service market. The service market has its obvious charms, but also it's challenging characteristics. Service demands are often triggered by machine failures that crop up unexpectedly and sporadically (Cohen et al., 2006), while most services cannot be stored and carried forward to a future time period (Wolak et al. 2000). Customers furthermore heavily differ in their need and willingness to pay, since they operate in separate, possibly unrelated, industries, vary in sizes and are dispersed across geographic regions (W. a. Neu 2005). Service in addition often has to be provided to multiple product generations and configurations and the service network therefore often has to cope with 20 times more stock keeping units (SKU's) than the manufacturing business (M. A. Cohen et al. 2006). These spare parts heavily vary in characteristics like their demand pattern, criticality and availability, which cause service logistics to be a complex matter.

Capital equipment manufacturers thus face significant challenges when entering the service market and as it turns out, most companies are not able to tackle these myriad challenges. According to Cohen et al. (2006), most manufacturing companies are struggling when competing on the service market and therefore squander its potential. Gebauer & Fleisch conducted a survey of 200 manufacturing companies and concluded that, the percentage of manufacturing companies achieving an attractive share of their total revenue through services, is still low. Also Neely, et al. (2011) found examples of companies that were unable to successfully servitize, in terms of both profitability and market valuation.

Apart from academics, also business consultants recognize that most companies are struggling on the service market. Gordian Logistic Expert B.V. is a Dutch consultancy company that is specialised in tackling the logistic challenge that companies face when pursuing a servitization strategy, i.e. service logistics. According to Jürgen Donders, one of Gordian's partners: "Although the concept of service logistics is receiving increasing attention, it remains difficult for companies to recognize and appreciate this form of logistics" (Geld verdienen met service, Logistiek magazine, may 2013). Also Atos consulting, an international consultant, recognizes the problem: "we have experienced in our consulting practice that clients struggle to develop services as a profitable business" (Servitization in product companies, white paper, Feb 2011). The problem that has been the motivation for this research, has therefore been formulated as:

The Research Problem: most manufacturing companies are struggling when making the transition towards services and therefore squander the after-market's potential.

The next chapter will discuss the research objectives, which will indicate how this research has made a contribution to solving the problem under review.

1.3 The research objectives

Since servitization was first coined in 1988, there has been a growing interest in the topic by academia, business and government (Hewitt, 2002; Baines et al., 2009; Neely, 2009; Gebauer & Fleisch, 2007). Especially in the USA and Western Europe, servitization received interest, in the fields of operations, services and business. A literature review from Baines et al. (2009) revealed that there are approximately 60 papers published on the concept of servitization, with an additional 90 or more being closely related. This literature however, is surprisingly sparse in describing how manufacturing companies can servitize, or in detailing the challenges inherent in the transition (Oliva & Kallenberg 2003). As Baines et al. (2009) concluded: “there is a paucity of previous work that provides guidance, tools or techniques, that can be used by companies to servitize”. Also in a more recent article from Evanshitzky et al. (2011) it was concluded that the evolvement of the product offering from “pure goods” to “pure services” has received little attention in literature. Literature is still to a large extent descriptive, giving illustrations of the adoption of servitization by traditional manufacturing companies. While valuable in itself, it does not provide a comprehensive overview on how capital equipment manufacturers can successfully pursue a servitization strategy. Baines et al. (2009) therefore suggest that the research community should engage in more prescriptive research, by engineering the tools and techniques that are needed by practitioners. This research aims to make such contribution and the so called *intervention cycle* provides a helpful instrument for formulating research objectives.

The intervention cycle is a predefined set of steps to reach a solution to operational problems, and distinguishes five stages: problem analysis, problem diagnosis, design, intervention and evaluation (Verschuren & Doorewaard, 2010, 2nd edition, pp 48-49). The first step, is the problem analysis. “In the problem analysis, it should be made clear *what* the exact problem is, *why* it is a problem and *whose* problem it is” (Verschuren & Doorewaard, 2010, pp 48). The problem in this case, is the fact that manufacturing companies are struggling when moving into services and therefore squander the market’s potential. This answers the what, why and whose question. The first step for solving a practical problem can thus be considered complete.

The second step is the problem diagnosis. “After the problem has been identified and acknowledged by all stakeholders, the background and causes can be examined” (Verschuren & Doorewaard, 2010, pp 49). In this case, literature is sparse in describing the challenges that companies face when making the transition towards services (Oliva & Kallenberg 2003). A comprehensive understanding of the problem and its nature is thus lacking. Solving a problem however requires an overview of its causes and their influence, as well as criteria for possible solutions (Wieringa, 2007). Hence, solving the problem under review requires a problem diagnosis. The first research objective has therefore been formulated as:

Research objective 1: to make recommendations for capital equipment manufacturers that want to pursue a servitization strategy, by providing them a comprehensive overview of the challenges inherent to the transition, as well as success criteria for overcoming these challenges.

The third step in the intervention cycle is the design stage. “After the problem analysis and diagnosis have been made, an intervention plan can be developed in order to find a solution for the problem” (Verschuren & Doorewaard, 2010, pp 49). As stated earlier: “there is a paucity of previous work that

provides guidance, tools or techniques, that can be used by companies to servitize” (Baines et al., 2009). Solving the problem under review therefore requires to design an intervention plan, pertaining to the causes of this problem. The second objective of this research has therefore been formulated as:

Research objective 2: to make recommendations for manufacturing companies that want to pursue a servitization strategy, by developing a servitization framework that will provide guidance, tools and techniques on how to successfully servitize.

The last two stages of the intervention cycle are the intervention itself and its evaluation. Although this research will advise how both steps can be taken, executing these stages has not been in the scope of this research. As stated before, this research is meant to provide knowledge, information and insight that can contribute to a successful intervention. It is however not meant to actually solve the problem directly. This will be the task of the problem solver, a business manager or consultant that tries to implement a servitization strategy.

The research thus consisted of two successive stages, a problem diagnosing stage and a design stage. How these stages have been executed, will be described in the Chapter 2: The research method. The next chapter will discuss the report structure.

1.4 The report structure

A complete overview of the report structure is visualized in Figure 1. Chapter 2 will discuss the research method, which will indicate the research framework, questions, strategy and data collection methods. Chapter 3 will discuss the available literature on the servitization topic and Chapter 4 will discuss how business managers perceive the problem under review. Chapter 5,6 and 7 will discuss the design stage of the research. Chapter 5 will discuss the design criteria that have been derived from the problem diagnosis. Chapter 6 will discuss the content of the servitization framework and Chapter 7 will discuss the application of the servitization framework to a real life case. At the end of this report, Chapter 8 will conclude upon the findings of this research.

Developing a servitization model	Research stage	Chapter
	Conceptualization	1. Introduction
		2. The research method
	Problem Diagnosis	3. Theoretical problem diagnosis: studying literature
		4. Empirical problem diagnosis: conducting interviews
	Design stage	5. Design preparation: formulating design criteria
		6. The servitization model designed: the model presented
		7. Design testing: case study at SFDS
	Evaluation	8. Research conclusion and discussion

Figure 1: The report structure visualized

2. The research method

Designing a research involves determining everything the research has to achieve (what, why and how much) as well as determining how to realize all this (how, where and when). This chapter will cover both of these aspects by discussing the research framework, questions, strategy and data collection methods. The first chapter will discuss the research steps that have been taken to achieve the objectives that were formulated in the previous chapter.

2.1 The research framework

The research framework is a schematic representation of the research structure and indicates the internal logic. It shows how the different stages of the research are interconnected and how one step implies the other (Verschuren & Doorewaard, 2010). As stated in the previous chapter, this research consisted of two stages: a problem diagnosing stage and a design stage. This chapter will indicate the steps that have been taken at both of these stages in order to achieve the objectives.

2.1.1 The diagnosing stage

The problem diagnosing stage was concerned with a knowledge problem. In this stage the goal was to find information on why most companies fail to successfully servitize. As a first step of the problem diagnosis, a literature review was conducted. By studying available knowledge and data, information has been gathered on the challenges that companies face during the transition towards services as well as the competences that companies have to possess in order to tackle these challenges. However, as stated earlier, literature is still quite naive in the field of servitization. It could therefore be used as a theoretical starting point, but did not provide sufficient evidence for a comprehensive overview of the problem.

Therefore, as a second step of this stage, case study interviews have been conducted. These interviews have first of all provided the opportunity to inductively verify theory and to identify any potential flaws in literature. In addition, talking to business managers has helped to translate the challenging characteristics of the service market into managerial problems. Finally, analysing the current competences of case companies has helped to identify potential development opportunities, i.e. competences that companies did not yet possess but were considered necessary for tackling the challenges of the service market. Interviewing business managers has thus ensured that the problem was adequately diagnosed at the end of this stage. The framework of the diagnosing stage is visualized in figure 2.

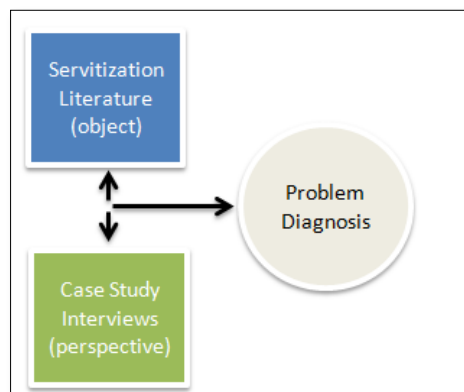


Figure 2: A study of the servitization problem, based on scientific literature has yielded the causes and potential solutions to the servitization problem, which were verified and supplemented by case study interviews to come to the end result of a problem diagnosis (answer to the knowledge problem)

2.1.2 The design stage

After the problem was better understood, a servitization framework has been designed that indicates how companies can change the existing situation into the desired situation, i.e. become successful in implementing a servitization strategy. This stage was concerned with a practical problem and therefore required different steps. As a first step of the design process, design criteria were retrieved from the problem diagnosis. Formulating design criteria is important since, as pointed out by Wieringa (2009): “the answer to a practical problem is not true or false but it is useful or useless (and all shades in between)”. It is therefore that, prior to the actual designing, design criteria have been formulated that have operationalized the process of designing a valuable artefact.

After the design criteria were formulated, all previous results were combined during a creative process; the design process. During this process, the known elements from the empirical- and theoretical analysis were assembled under the criteria previously formulated. The views that underlie the similarities and differences of the gathered information were closely studied and the theoretical premises were translated into managerial practices. The outcome of this stage was a first prototype of the servitization framework.

After the design stage, the content of the model was tested on its validity and applicability during a single case study. The servitization framework was confronted with a case company's current servitization strategy in order to generate a plan for intervention; a roadmap for development. These findings have then been evaluated on its usefulness by the perspective of the client. This confrontation has provided the opportunity to evaluate whether the model indeed provides the knowledge necessary for solving the problem under review (the intended deliverable of this research) and has identified what future steps might improve the usefulness of the servitization framework. The framework of the design stage is visualized in Figure 3.

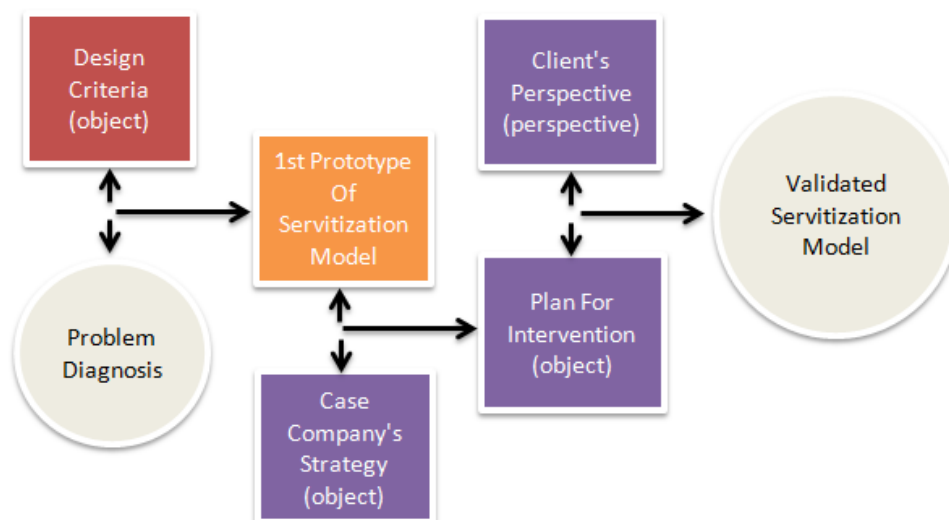


Figure 3: Based on the problem diagnosis, design criteria have been formulated that operationalized the design process of a first prototype, that was then tested by conducting a single case study to come to the end result of a validated servitization framework (answer to the practical problem).

To summarize the above: to achieve both research objectives, five successive research steps have been conducted at two research stages. This is visualised in Figure 4. The interconnection of these five research steps is visualised by the complete research framework in Figure 5.

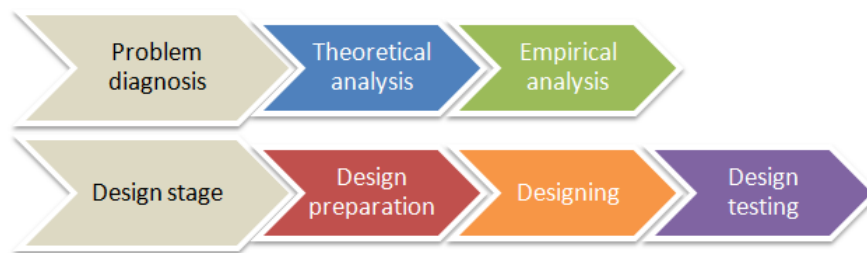


Figure 4: The five research steps

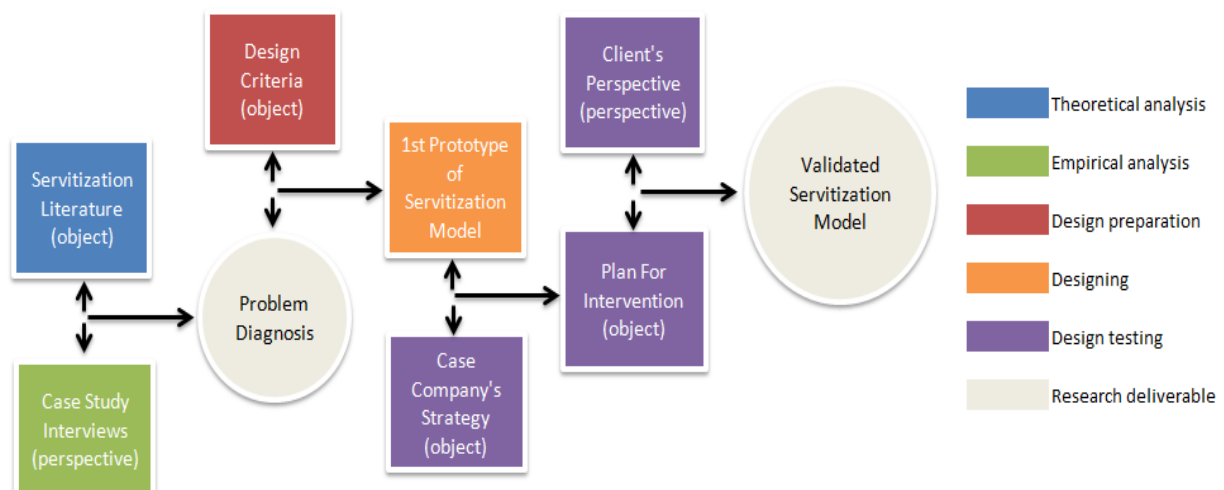


Figure 5: A complete overview of the five research steps and their interconnections

NOTE: For the simplicity, the figures above do not include any feedback loops. However, at least two feedback mechanisms will be used in this research: (1) the case study interviews will be used to evaluate the completeness of the literature study, (2) the feedback from the case study will be used to further improve the servitization framework.

The next chapter will discuss the research questions that have been formulated for each of the five research steps.

2.2 Research questions

The research questions indicate the kind of knowledge that is necessary for achieving the research objectives and therefore have a steering function in deciding which materials to gather (Verschuren & Doorewaard, 2010). As stated in the previous chapter, the end deliverable of this research has been a servitization framework that prescribes how manufacturing companies can successfully implement a servitization strategy. The main research question was therefore formulated as:

Main research question: What guidelines, tools and techniques can help capital equipment manufacturers to successfully implement a servitization strategy?

To answer this question, the five consecutive research steps have been conducted that were visualised in Figure 4: (1) a theoretical analysis, (2) an empirical analysis, (3) design preparation, (4) designing and (5) design testing. This chapter will discuss and motivate the research questions that were formulated for each of these research steps.

2.2.1 The first research step: a theoretical analysis

A literature review has been conducted as a theoretical starting point for this research. The following research questions were formulated for this research step:

- **What are the drivers for servitization according to literature?**
The answer to this question motivates why the problem is worth looking into, i.e. why do companies want to pursue a servitization strategy in the first place. This can be considered an important first question, since the answer indicates the final goal, i.e. what companies wish to achieve by implementing a servitization strategy.
- **What are the characteristics of the service market according to literature?**
The answer to this question provides a better understanding of the characteristics of the service market. This can be considered an important question since the challenges that companies face originate from the fact that they enter this market. It therefore indicates the challenges that companies have to tackle, i.e. what companies have to overcome.
- **What are the service components to be designed when entering the service market?**
The answer to this question will be a conceptual model; a composition of available concepts in literature. The answer to this question will indicate the right prerequisites for successfully servitizing, i.e. the capabilities that companies should possess.
- **What are the requirements for successfully managing the transition towards services according to literature?**
The answer to this question indicates the challenges inherent to the required change process. This can be considered an important question, since it indicates how companies have to servitize, i.e. what criteria have to be met to successfully enhance their abilities over time.

Answering the research questions in this stage mostly required explanatory knowledge, since the answers to the questions have revealed “why things are the way they are” (Verschuren & Doorewaard, 2010).

2.2.2 The second research step: an empirical analysis

Case study interviews have been conducted to verify and supplement the knowledge gathered from the literature survey. The following research questions were formulated for this research step:

- **Do business managers recognize the drivers for servitization?**
The answer to this question reveals whether business managers recognize the drivers for servitization. This can be considered an important question, since it verifies whether business managers are really motivated to successfully implement a servitization strategy.
- **What are the challenges that business managers experience while competing on the service market?**
The answer to this question allows to verify and supplement the knowledge gathered from the literature review. In addition, it helps to translate the challenging characteristics of the service market into managerial problems.
- **What are potential development opportunities for the case companies, based on the required competences indicated by literature?**
The answer to this question identifies development opportunities, i.e. competences that companies do not yet possess but are required for successfully competing on the service market. It therefore allows to evaluate the significance of theoretical premises and will indicate the so-called "quick wins".

Answering the research questions in this stage mostly required descriptive knowledge, since the answers to the questions reveal "how reality is" (Verschuren & Doorewaard, 2010).

2.2.3 The third research step: formulating design criteria

Based on the problem diagnosis, design criteria have been formulated to operationalize the design process. The following research questions were formulated for this research step:

- **What functions should the servitization framework fulfil for solving the problem under review?**
The answer to this question indicates the functional-, contextual- and user requirements for designing the servitization framework.
- **Given the problem diagnosis, what assumptions are required for designing the servitization framework?**
The answer to this question indicates the assumptions on future users, the functionality and contextual aspects for allowing a fruitful use of the servitization framework.
- **What structural and functional characteristics does the servitization framework need to possess for solving the problem under review?**
The answer to this question indicates the structural and functional specifications that the artefact must have to provide a solution to the servitization problem
- **How can the requirements, assumptions and specifications be assembled into a framework for the model?**
The answer to this question will indicate the structural plan for the servitization framework.

The research questions in this stage required predictive knowledge, since based on previous results, it was predicted which criteria have to be met for designing a useful artefact (Verschuren & Doorewaard, 2010).

2.2.4 The fourth research step: designing the servitization framework

The views that underlie the similarities and differences of the gathered information have been closely studied and the theoretical premises were translated into managerial practices. The following research questions were formulated for this research step:

- **Through what steps can companies enhance their capabilities required for successfully competing on the service market?**
The answer to this question indicates what companies have to do to enhance their capabilities. It therefore helps a problem solver to “set the agenda”.
- **What are the tools and techniques that can be used by practitioners to enhance a company’s capabilities required for successfully competing on the service market?**
The answer to this question indicates how companies have to conduct the steps prescribed by the model.

Answering these questions required prescriptive knowledge, since the servitization framework provides instructions on how to successfully implement a servitization strategy.

2.2.5 The fifth research step: testing the servitization framework

To test the content of the servitization framework, a single-case study has been conducted. The following research questions were formulated for this research step:

- **What potential development opportunities have yet been captured by the case company?**
The answer to this question indicates the case company’s current maturity, i.e. the steps prescribed by the model that has yet been taken.
- **What are the case company’s potential development opportunities, based on the servitization framework ?**
The answer to this question reveals the steps that have not yet been taken by the company and therefore indicates important target areas for enhancing the capabilities of the companies, i.e. a roadmap for development.
- **How does the client evaluate the recommendations generated by the servitization framework?**
The answer to this question helps to conclude upon the applicability and validity of the model.
- **What adjustments can further improve the content of the model?**
This question indicates what further research can contribute to improving the content of the model

Answering these questions required descriptive knowledge for describing the case company’s current servitization capabilities, prescriptive knowledge for defining a roadmap for development and evaluative knowledge to conclude upon the applicability and validity of the model.

To summarize the above: sub-questions have been formulated for each of the five research steps. After all the sub-questions have been answered, the tested servitization framework has provided the answer to the main research question. A complete overview of the research steps and their sub-question is visualized in Figure 6.

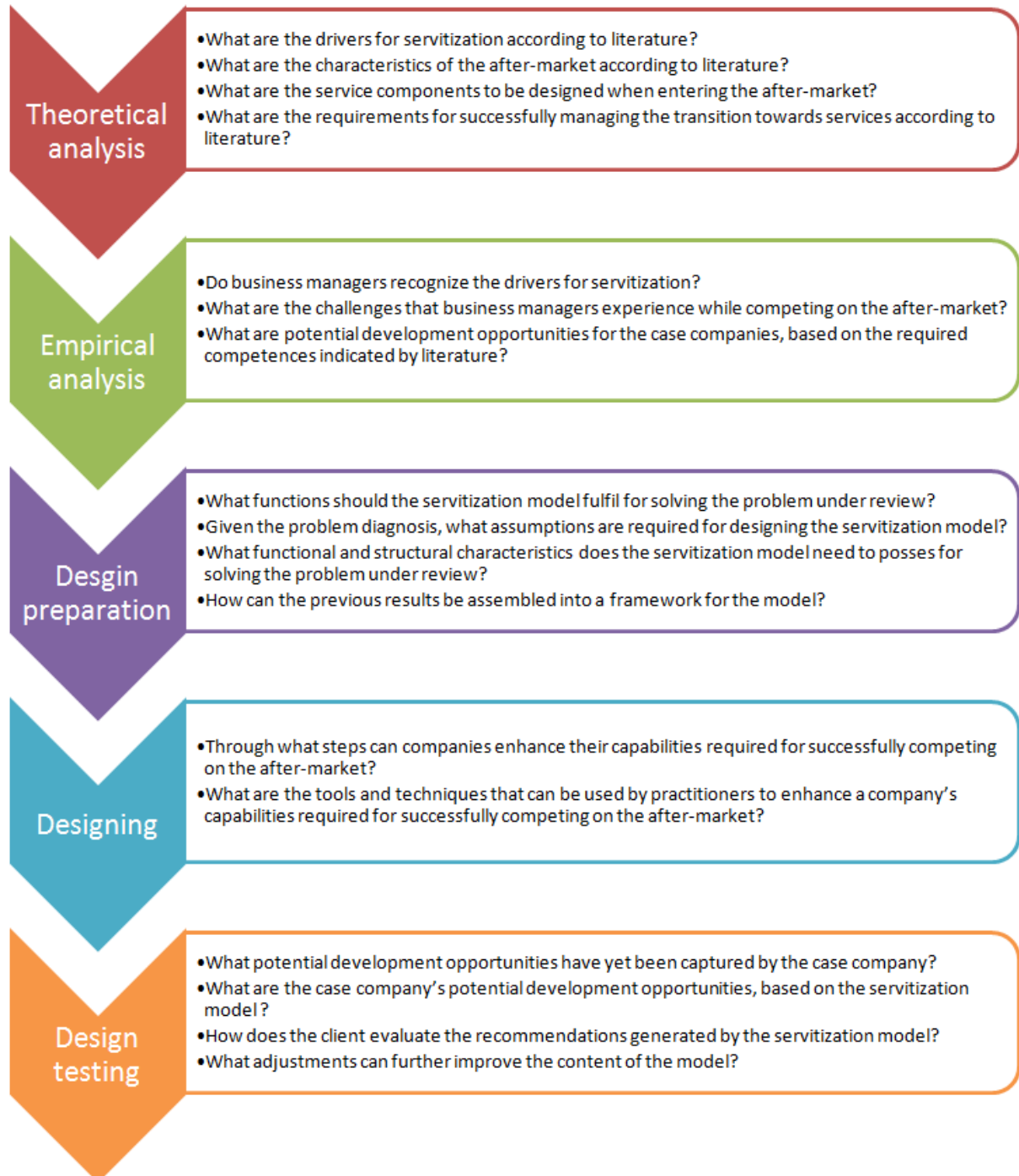


Figure 6: A complete overview of the research stages and their sub-questions

The next chapter will indicate how the knowledge required for answering the questions has been gathered and processed into valid answers.

2.3 Research strategy & data collection methods

The previous chapter indicated the sub-questions that need to be answered in order to answer the main research question. How the knowledge required for answering these questions has been gathered and processes into valid answers, will be discussed for each research step below.

2.3.1 Theoretical analysis

The problem diagnosis started with a literature review that was conducted during a desk research. Reflecting upon the knowledge compiled by others in all the relevant areas of servitization, has provided a holistic view of the causes and the criteria for potential solutions to the problem under review. In this step, the problem was studied in breadth by collecting as much relevant information as possible. The main source of information has been scientific literature that was collected from electronic databases like Scopus, Science-Direct and for example Google Scholar. Other electronic sources that have been used are business forums, like for example the management team forum (www.mt.nl) and the logistic forum (www.logistiek.nl). Although these forums were not really of any academic value, they did provide more direct and up-to-date information about our object of study; capital equipment manufacturers. They for example provided valuable information on market trends, business cases, key players, research communities and so on. A third source of information that has been studied was printed literature, like books, folders, magazines etc. They were however not the primary source of information, since electronic sources, due to its convenience, provided a far more efficient tool when searching for valuable information. With the gathered information, the research questions of this step have been answered with deductive reasoning.

2.3.2 Empirical analysis

After the literature survey, several case study interviews have been conducted. Analyzing a small number of real life cases has provided the opportunity to verify, supplement and evaluate the knowledge gathered from the literature review. In this step, the problem was studied in more depth, which together with the literature survey has provided a profound and full insight into the problem, i.e. an adequate problem diagnosis. Information during this step was gathered by face-to-face interviews with business managers. Face-to-face interviews were preferred, since it provided the researcher the change of observing the expression and body language of the interviewee, which may be of particular interest for a correct interpretation of the answer (Verschuren & Doorewaard, 2010). These signals namely help to conclude whether the interviewee understands the questions and is motivated to answer correctly. This is of importance when the interviewee considers the subject difficult, and given the problem statement, this seemed quite likely. During this step, conclusions have been drawn based on inductive reasoning, since the empirical data from these few companies, have been used to conclude upon the complete object of study; capital equipment manufacturers. An overview of the research materials for the problem diagnosis is given in Table 1.

Table 1: The research materials for the problem diagnosing stage

	Sources	Accessing
Literature	Papers	Content analysis
	Books	Content analysis
The media	Forums	Content analysis
Documents	Reports	Content analysis
People	Business managers (respondents)	Face-to-face interviews
	Business consultant (expert)	Face-to-face interviews

2.3.3 The design preparation

After the problem diagnosis, design criteria have been formulated. This step was accomplished by conducting a **grounded theory approach**. The conclusions that were drawn in the problem diagnosis have been analyzed in depth to see what they imply for designing a valuable plan for intervention. The research questions of this step have been answered with deductive reasoning. The design preparation did not require collecting additional data.

2.3.4 The designing

After the design criteria were formulated, the actual designing took place. The servitization framework has been designed by following a **grounded theory approach**. The views that underlie the similarities and differences of previous results, were closely studied by following a purely qualitative approach. By constantly comparing theoretical premises with the various items observed in reality and by evaluating each part of information on its worth, a valid approach for successfully implementing a servitization strategy has been designed. Conclusions have been drawn based on deductive reasoning, but also on abductive reasoning. Although a significant amount of the claims could be thoroughly motivated by theories, others were based on “thought experiments”.

2.3.5 Design testing

After the servitization framework was designed, the content of the model has been tested during a single case study. A **single case study** provided the opportunity to implement the model to and to test and evaluate its content. Testing the model by applying it to a real-life case has therefore generated a first insight into the applicability and validity of the model. During this step, several research materials have been collected. First of all, the background information of the case company was studied. Any company data that seemed relevant has been studied in order to make a company profile. After that, the case company’s current capabilities were analyzed, by evaluating which potential development opportunities of the servitization framework had yet, and had not yet, been captured. Concluding upon this aspect was done by studying company data and by conducting face-to-face interviews. Company data was used to collect the “hard data”, while the face-to-face interviews were used to collect more detailed information, like motivations and opinions. The case company’s evaluation and its implications generated by the servitization framework were then presented to the management board of the company. Feedback from this meeting was gathered to conclude upon the overall usefulness of the model and to indicate relevant steps for improving the content of the model. This feedback was again gathered by face-to-face interviews, since also here the expressions and body language were considered of particular interest for a correct interpretation and evaluation of the answer. The overall conclusion of this step has mainly been drawn with inductive reasoning, since the findings from this single case study were used to conclude upon the overall applicability and validity of the model. An overview of all the information sources during this last step of the design stage is given in Table 2.

Table 2: The research materials for the design testing

	Sources	Accessing
Documents	Company data	Content analysis
People	Business managers (respondents / informants)	Face-to-face interviews

3. Theoretical problem diagnosis: studying literature

A literature review is conducted as a first step of this research. Although literature is still quite naive in the field of servitization, it did provide a good theoretical starting point for the development of the servitization framework. By conducting a literature survey, the following research questions have been answered:

- **What are the drivers for servitization according to literature?**
- **What are the characteristics of the service market according to literature?**
- **What are the service components to be designed when entering the service market?**
- **What are the requirements for successfully managing the transition towards services according to literature?**



Figure 7: The literature survey is the first research step

This chapter provides an overview and evaluation of the literature that is related to this research. Chapter 2.1 will first discuss and motivate how the literature survey has been conducted. Before analysing the problem in more detail, Chapter 2.2 will discuss the drivers for servitization, which will motivate why the problem is worth looking into. The problem analysis will start with discussing the distinctive characteristics of the service market in Chapter 2.3, as this is where the challenges originate from. Chapter 2.4 will discuss the service components that capital equipment manufacturers have to design for successfully entering the service market, i.e. the goals of servitization. Chapter 2.5 will then indicate the success criteria for achieving these goals, i.e. the requirement for successfully managing the transition towards services. The findings of the literature review will be summarized in the Chapter 2.6: Conclusion, which will answer the research questions formulated above.

3.1 Introduction

As was stated earlier, literature on the servitization topic is surprisingly sparse in describing how manufacturing companies can servitize, or in detailing the challenges inherent in the transition (Oliva & Kallenberg, 2003). As Baines et al. (2009) concluded: “there is a paucity of previous work that provides guidance, tools or techniques, that can be used by companies to servitize”. It can therefore be stated that there exists a gap between research and practice. Hence, literature has failed to provide the required knowledge and insight that manufacturing companies need to successfully servitize. However, what is quite revealing, is that the researchers mentioned above did not cover the logistical domain of servitization, better known as spare parts management. Providing service is largely concerned with logistics, since the availability of parts influences maintenance delay either directly, in the case of corrective maintenance, or indirectly, in the case of preventive maintenance (Driessen et al., 2012). However also in this area, literature is sparse in describing how manufacturing companies should tackle the challenges. As Bacchetti & Sacconi (2012) concluded: “a major problem stands in the paucity of research with an integrated perspective on spare parts management”. Also Wagner & Lindemann (2008) recognizes this problem and adds that the problem originates from the fact that spare parts management literature has primarily focused on the planning and operational aspects (e.g. the determination of optimum spare parts inventory levels), but has neglected the strategic and organisational problems manufacturing companies have to solve in order to manage their spare parts business effectively.

What can be concluded from the above, is that two literature areas have coexisted but have not yet supplemented each other. In the servitization literature it is concluded that there is paucity of previous works that provide guidelines, tools or techniques for servitization, but for the logistic domain of servitization, there are several frameworks available that provide this information. In the spare parts management literature it is concluded that the strategic and organizational problems of servitization has been ignored, while these, at least to some degree, have been covered in the servitization literature. The literature survey was therefore conducted by taking a holistic approach in which both areas were combined.

Literature reviews in both area's provided a starting point for the literature review. Baines et al (2009) conducted a literature review in the servitization literature and three literature reviews were available at the spare parts management literature ([1] Bacchetti & Sacconi, 2012 [2] Kampen & Donk, 2012 [3] Kennedy et al., 2002). These literature reviews were of great importance. First of all, since they provided a clear overview of available papers and leading researchers, which saved a lot time for collecting data. In addition, it provided a key insight into the relevant topics and how they could be organized, which was of great use for integrating both areas. Valuable papers were then selected based on criteria like authority, accuracy, coverage and currency. Judging the validity was considered of vital importance, since a qualitative approach implies that the knowledge that will be used is often created with a different purpose. Elaborating on the literature reviews was continued until a point of data saturation was reached. The information that was found was screened and an evaluation of the gathered information indicated several plot holes, i.e. area's that were barely covered. The aspect of how to develop maintenance plans was for example an area that was considered relevant, but was not covered in any of the servitization or spare parts management literature. A second search round was therefore conducted that went beyond the two literature areas. This search process was conducted by using several search queries via multiple databases, like Scopus, Science-Direct and Google. The search engine Google was used to search for additional data

sources, like books, business forums and for example articles. Again, the search process was continued until a point of saturation was reached. In total, 74 papers and thesis reports, 4 books and several articles were identified that were relevant for the research. Research strategies included case studies, literature reviews, grounded theory research, benchmarks and so on.

The next chapter will start discussing the gathered information. It will discuss the drivers for servitization, which will motivate why the problem is worth looking into.

3.2 Drivers for servitization

More and more manufacturing companies are nowadays offering services in addition to their products (Neely, 2009). Servitization is happening in almost all manufacturing industries on a global scale (Vandermerwe and Rada, 1988, pp. 315). According to Baines et al. (2009), this urge for servitization is driven by three factors: financial-, marketing- and strategic drivers. These three drivers will be described in more detail below.

3.2.1 Financial drivers

Probably the most often mentioned financial driver in literature is the service product's high profit margin in comparison to the sales of the physical product. Services in general provide higher levels of profitability, since they tend to be less sensitive to price-based competition and require fewer assets (Frambach et al., 1997). According to a survey of the Association of German Equipment Manufacturer (VDMA, 1998), the profit margin of equipment sales averages at 1%, while services such as maintenance, installation and support, provides an average profit margin of more than 10% (Gao et al, 2009). Also Cohen et al. (2006) found evidence for this claim and stated that: "according to a 1999 AMR Research report, businesses earn 45% of gross profits from the aftermarket, although it accounts for only 24% of revenues". It is due to these profit margins, that in many manufacturing sectors, where the number of units in the installed base is an order of magnitude greater than the annual sales, the after-sales revenues are 10-30 % higher than the product sales (Auramo & Ala-risku 2005). It is therefore that Wise and Baumgartner (1999) argue that in mature industries, companies should be looking for service opportunities to achieve new growth and profitability. According to them: "providing services to customers, is where the real money is". The attractiveness of service is likely to increase even further in the future, since the increased life-cycle of many modern products pushes the most significant revenues even further towards services (Ward and Graves, 2005).

The other often mentioned financial driver for services is the fact that it can generate a stable income (Wise and Baumgartner, 1999; Gebauer and Friedli, 2005). Service customers strive to minimize the downtime of their machines by regularly conducting preventive maintenance. Services can therefore generate a stable source of income with a relative low risk (Bacchetti & Sacconi 2012). Service sales furthermore tends to be counter-cyclical and more resistant to the economic cycles that affect investment and goods purchase (Oliva and Kallenberg, 2003; Gebauer and Fleisch, 2007). It can therefore help to secure a regular income and stabilise the effects of mature markets and unfavourable economic cycles (Brax, 2005). Sawhney et al. (2004) proved this point by identifying several companies (e.g. GE, IBM and Siemens and Hewlett Packard) that achieved a stable income from services, despite significant drops in sales.

3.2.2 Marketing

The most important marketing driver for manufacturing companies to servitize, is that it can enhance the product sales (Gebauer et al., 2006; Gebauer and Fleisch, 2007). Customers attach a great value to customer care and services are therefore an important evaluation criteria for their initial purchasing decision (Mathieu, 2001b; Gebauer and Fleisch, 2007). Especially in capital intensive markets, customers are increasingly demanding for services (Baines et al., 2009). Companies in these markets are forced to become more flexible and have to focus on their core competences. This, in addition with the fact that they are confronted with an increasing technological complexity, pressures them to outsource services (Slack, 2005). Due to these developments, providing services is becoming increasingly important for selling products.

Apart from the influence of services on the initial purchasing decision, services can create customer loyalty and dependency that can both induce repeated sales (Vandermerwe and Rada, 1988). It in addition intensifies the contact opportunities with the customer and companies can therefore create a source of knowledge on both products and customers, which can contribute to developing more tailored offerings (Bachetti & Sacanni, 2011).

3.2.3. Strategic drivers

The strategic driver for manufacturing companies to servitize is the fact that they can differentiate themselves from others and thereby create a competitive advantage (Frambach et al., 1997; Mathieu, 2001b; Gebauer and Fleisch, 2007; Bachetti & Sacanni, 2011). This strategy is often more sustainable than other differentiation strategies, since services are less visible and more labour dependent, making them difficult to imitate (Oliva and Kallenberg, 2003; Gebauer and Friedli, 2005; Gebauer et al., 2006). The transition from selling a homogeneous product towards selling a product service system can even enhance the customer value to the point where products are perceived as customised (Frambach et al., 1997). It can therefore significantly increase market barriers to (potential) competitors (Mathieu, 2001). Servitization as a differentiation strategy is even becoming more attractive, since due to the commoditisation of markets, differentiating strategies based on product innovation, technological superiority or cost-leadership are becoming incredibly difficult to maintain (Mathieu, 2001b; Gebauer and Fleisch, 2007).

Literature is thus almost unanimous in suggesting that product manufacturers should move towards services (Oliva & Kallenberg, 2003). However, as pointed out by Cohen et al. (2006): “despite the service market obvious charm, most organizations squander its potential”. The next chapter will discuss the distinctive characteristics of the service market, which will be a first identification of why most companies are struggling when moving into services.

3.3 Characteristics of the service market

Manufacturing companies that move into services expand their business by entering the so called service market. The service market has its distinctive characteristics and providing service is therefore completely different from manufacturing products (Cohen et al., 2006). To indicate these differences, this chapter will characterize the service market by referring to the three dimensions of a business environment formulated by Dess and Beard (1984): (1) simple-complex, (2) stable-dynamic, and (3) tame-hostile (Neu, 2005).

3.3.1 Simple-complex

The simple-complex dimension refers to the range of factors that affect an organization's activities, as well as the heterogeneity of the environment (W. a. Neu 2005). Given this definition, it can be concluded that the service market is characterized by a complex environment. The service business namely requires a network of parts and people that have to be deployed at multiple locations. Managing this network is complex, since resource deployment decisions are interrelated (Cohen et al., 2006). There are therefore a large number of factors that affect an organization's activities, which causes managerial actions to have a low temporal order, covariation and continuity in time and space (Neu, 2005). Stocking decisions, repair decisions, replacement decisions all influence the functioning of the complete network. Stocking a critical item at a customer location for example will decrease the emergency demand for parts at the central location(s). Supplying a customer that might decide to increase its safety stock can cause the unavailability of that same part for another customer that experiences a breakdown. The network structure and integrated resources, are the first aspects that cause the business environment to be a complex environment.

The second aspect is the large variety in customers and products. Customers are located in separate, possibly unrelated, industries, vary in sizes and are dispersed across geographic regions (Neu, 2005). As a result, they heavily differ in their product use, need and willingness to pay (Cohen et al., 2006), which raises both marketing and technical related challenges. Services in addition also include a large variety of products and parts. Service namely often has to be provided to multiple product generations and configurations. It therefore involves a lot of stock keeping units (SKU's) that heavily differ in characteristics like price, lead time and demand pattern, making spare parts management a complex matter (Cohen et al., 2006). The heterogeneity of both customers and products is another reason why the service market's business environment, can be considered a complex environment.

3.3.2 Stable-dynamic

The stable-dynamic dimension refers to the degree and nature of change in factors that are relevant to an organization's activities (Neu, 2005). In the case of the service market, the environment is dynamic. First of all, due to its technological nature. Customers needs are triggered by machine failures, which crop up unexpectedly and sporadically (Cohen et al., 2006), while in general services cannot be stored and carried forward to a future time period (Wolak et al., 2000). Manufacturing companies therefore have to be able to respond to an unpredictable and dynamic environment.

The other aspect that causes the service market to be dynamic, is the constantly evolving customer base. Customers and their need evolve over time, since they adopt new technologies and deploy new technologies (Neu, 2005). Activities previously performed by customers can therefore present new challenges (Slack, 2005). Customers respond differently to change and this further increases the diversity among customers over time. The evolving customer base is therefore another reason why the service market's environment, can be considered a dynamic market.

3.3.3 Tame-hostile

The tame-hostile dimension pertains to the availability of resources that allow an organization to survive and grow (Neu, 2005). In the case of the service market, the environment can be considered hostile. First of all, since the market complexity leads to higher levels of hostility (Neu, 2005). Complex businesses demand experienced and knowledgeable employees which are, due to their scarcity, hard to acquire and retain.

Another aspect that causes the service market to be a hostile environment is the fact that, when moving into services, manufacturing companies can face fierce competition outside their usual domain (Mathieu, 2001; Oliva and Kallenberg, 2003). Service suppliers are namely not restricted to product manufacturers. Suppliers, distributors, components manufacturers, or other third parties can all be potential competitors in the service market. They can provide the same parts and services and might even own the presence of economies of scale and scope (Cohen et al., 1997). The competition of the service market is another reason why the service market's environment, can be considered a hostile environment.

Given these challenging characteristics of the service market, the next chapter will discuss the competences required for successfully competing in this environment.

3.4 Developing services

Manufacturing companies are enthusiastically embracing the idea of servitization, but do often not consider the required competences for successfully competing on the service market (Evanschitzky et al. 2011). Since providing service significantly differs from providing goods, a move towards services requires organizational principles, structures and processes new to a product manufacturer (Oliva & Kallenberg, 2003; Gebauer & Fleisch, 2007). According to Cohen et al. (2006), it is due to the fact that companies fail to recognize the required competences, that they fail to capitalize the service market:

"They blindly apply enterprise-resource-planning thinking, processes, and software solutions to tackle the complexity of support networks. In our experience, that doesn't deliver results; the processes and tools that companies use to manufacture goods in a cost-effective manner don't work well in the support business" (Cohen et al., 2006) .

Since this indicates an important explanation of why companies fail to successfully servitize, this chapter will design a conceptual model that indicates the goals of servitization, i.e. the components to be designed for successfully competing on the service market. It will do so by using the organization of Edvardsson's model, which assumes that three distinct service components have to be developed for a new service: (1) the service concept (product), (2) the service system (resources) and (3) the service process (Edvardsson, 1996). Each of these components is visualized in Figure 8 and will be discussed on more detail next.

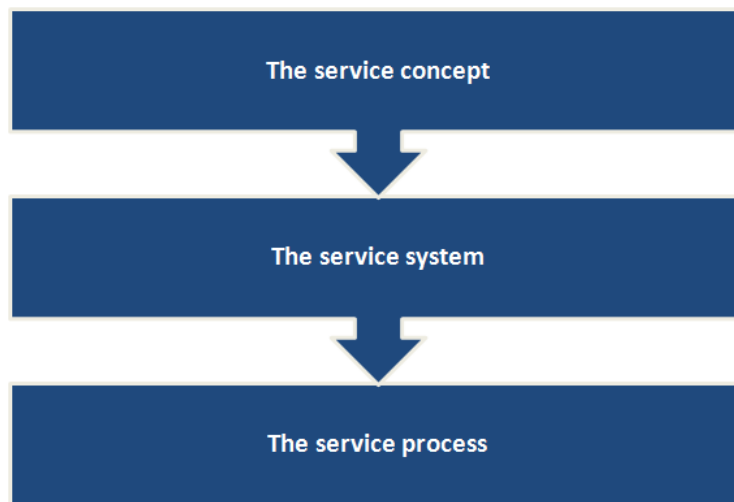


Figure 8: The three service components as defined by Edvardsson (1996)

3.4.1 The service concept

The first component that has to be developed is the service concept. The service concept reflects how the customer needs are satisfied in the form of the content of the service offering. However, where goods are visible and tangible products, service offerings are not. When providing service, manufacturing companies basically offer a desired functionality. Services are therefore fuzzy and difficult to define (Slack, 2005) and there is little previous work offering guidelines, tools or techniques for designing the service concept. However, with the work of Baines et al. (2009), Cohen et al. (2006) and Mathieu (2001), there are, in respective order, at least three aspects covered that relate to designing a service concept: (1) the service offering, (2) the business model and (3) communication strategies. Each of these aspects will be discussed in more detail below.

Service offering

The first aspect that is covered in literature, is the service offering. Obtaining a desired functionality encompasses all services required by the end-user (Oliva & Kallenberg, 2003). This means that service offerings can include the availability of spares, preventive and/or corrective maintenance, trainings, machine up-grades, retro-fits, (de-) commissioning and so on. However, as pointed out by Cohen et al. (2006), service often has to be provided to a large variety of customers, that heavily differ in their need and willingness to pay. Some might want to outsource the complete maintenance of their equipment, while others have their own technical staff and are only interested in the availability of spare parts. Manufacturing companies therefore have to design several customized service offerings, which, according to Baines et al. (2009), can be achieved by (1) either combining a base package of standard services with particular service options or by (2) designing modular units that can be “mixed and matched” in different combinations. Hence, the first goal of servitization:

Servitization goal #1: *Manufacturing companies have to design a customized service offering by combining a base package of standard services with particular service options or by designing modular units that can be “mixed and matched” in different combinations (Baines et al., 2009).*

Business model

The second aspect that is covered in literature, is the design of a business model. According to Cohen et al. (2006), it is due to the fact that customers differ in their need and willingness to pay, that manufacturing companies should use several type of business models. Some customers demand a low level of service and do not want to be attached to any type of contract. For these group, manufacturing companies can use an ad-hoc business model, which allows customers to pay for use. When the product functionality is critical, customers might want to pay for services according to the way products perform. These type of customers are best served with a performance-based contract. As pointed out by Cohen et al. (2006), different business models are important to consider since they drive the incentives and will eliminate a (potential) conflict of interest between the customer and the product manufacturer. Manufacturing companies will for example not try to sell more parts and services to customers that use an ad-hoc business model and want to minimize costs. On the other hand, customers that want to maximize their product functionality with a lease- or performance based contract will not pay for unneeded services, since the manufacturer is the product owner and bears the costs of services. Cohen et al. (2006) therefore emphasizes that companies should choose their business models, based on the customer's need. Hence, the second goal of servitization:

Servitization goal #2: *Manufacturing companies have to design business models that meet the need of customers to eliminate a conflict of interest (Cohen et al., 2006).*

Communication strategies

The two aspects above indicated that manufacturing companies have to design a customized service product, in terms of service offerings and business models. However, due to the intangible nature of services, the value proposition of the service product is less clear to the customer than that of goods. This is due to the fact that the costs of downtime are difficult to quantify. It may include production loss, but could also reduce the quality of the product or increase the risk to personal (Kennedy, Patterson, & Fredendall, 2001). According to Mathieu (2006), companies therefore have to design communication strategies that clearly describe the value proposition of the service product to the customer. Hence, the third goal of servitization:

Servitization goal #3: *Manufacturing companies have to formulate communication strategies that clearly describe the value proposition of the service product to the customer (Mathieu, 2001).*

To summarize the above: Figure 9 visualizes the three known elements from literature for designing the service concept. For each element, a goal has been formulated that indicates the right prerequisites for successfully servitizing.

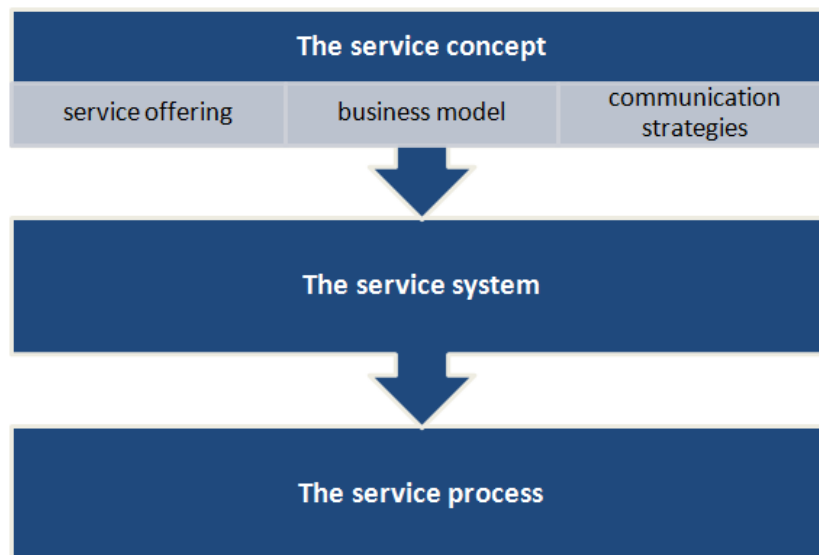


Figure 9: The three servitization goals visualized in the framework of Edvardsson (1996)

3.4.2 The service system

The second component of service, is the service system. The service system includes the resources available for realizing the service concept (Edvardsson & Olsson, 1996). As pointed out by Cohen et al. (2006), manufacturing companies have to deliver service products through a network of people, materials and infrastructure. How each of these aspects should be managed, is fairly well covered in literature and will be discussed in more detail below.

Human resources

One of the resources in the service system is human resources. As pointed out earlier, the complex businesses environment of the service market demands experienced and knowledgeable employees (Neu, 2005). According to Neu & Brown (2008), manufacturing companies therefore have to formulate programs that can develop the knowledge and behavioural competences needed from service personnel. In line with reasoning, they advocate that companies have to support intra-organizational cooperation and teamwork, by developing a reward system consistent with other organization design decisions. Also Olivia & Kallenberg (2003) advocate that companies have to develop the capability to diffuse knowledge. They however emphasize that knowledge should be shared across the complete service network, and thus also requires inter-company collaboration. Edvardsson and Olsson (1996) recognize the need for knowledgeable and experienced employees, but in addition point out that knowledge and experience alone have proved to be insufficient for high performances in service companies. The customer's perception of the quality of a service namely largely depends on how he perceives the staff and it is therefore important that employees are motivated and committed. According to Edvardsson and Olsen (1996), designing attractive jobs and a stimulating work environment will therefore probably be the most important quality-creating factor in service development. The fourth goal of servitization is formulated as:

Servitization goal #4: *Manufacturing companies have to design attractive jobs and a stimulating work environment for service personnel (Edvardsson and Olsen, 1996) and have to support intra- and inter-organizational cooperation and teamwork to develop the knowledge and behavioural competences needed from service personnel (Neu & Brown, 2008; Olivia & Kallenberg, 2003)*

Spare parts

The other resource that manufacturing companies have to manage are spare parts. Spare parts are an important resource, since when unavailable, it will either directly (in the case of corrective maintenance) or indirectly (in the case of preventive maintenance) influence the downtime of the equipment (Driesen et al., 2012). However, due to the high number of parts, the presence of intermittent and lumpy demand patterns, the high responsiveness required due to downtime cost and the risk of stock obsolescence, managing spare parts is a complex matter (Bacchetti & Saccani, 2012). As pointed out by Kennedy et al. (2002): “spare parts inventories are not intermediate or final products to be sold to a customer, and the policies that govern spare parts inventories are different from those which govern WIP and other inventories”. This is also noted by Huiskonen (2001): “the impact of a shortage of a critical part may be a multiple of its commercial value, which makes e.g. an ordinary ABC-analysis an insufficient control tool”. Managing spare parts thus requires a different approach, an advanced inventory management approach (Cohen et al., 1997). Several researchers prescribe how such advanced management system should be developed (Bacchetti & Saccani, 2012; Cavalieri et al., 2008; Driessen et al., 2012) and although these methodologies slightly differ from each other (on completeness and purpose for which they were developed), they at least include the following same steps: categorization, demand forecasting and stocking policies. Although these steps might not differ from any other traditional inventory management of finished goods, the approach, tools and techniques should be adapted to the special characteristics of spare parts (Kennedy et al., 2002). Researchers all agree on this point, but many debate has been going on in the academic world about which techniques, tools and approaches are most successful. However, according to Bachetti and Sacanni (2012), the adoption of an integrated view on these steps is one of the main aspects affecting the overall effectiveness of spare parts management, leaving aside the complexity of the specific techniques used. The fifth goal of servitization is therefore formulated as:

Servitization goal #5: *Manufacturing companies have to design an integrated and advanced inventory management system to efficiently handle a large amount of spare parts that heavily vary in their characteristics.* (Bacchetti & Saccani, 2012; Cavalieri et al., 2008; Driessen et al., 2012)

Distribution network

The third aspect of the service system is the infrastructure that will be used to match the demand and supply of services. The service infrastructure has to deploy parts and people at more locations than the manufacturing infrastructure, but also has to be contend with reverse logistics of failed parts (Cohen et al., 2006). Effective supply chain strategies for the manufacturing business may therefore not be appropriate in the service sector (Sengupta et al., 2006). To support a geographically distributed in installed base, manufacturing companies therefore have to set up a distinctive after-sales services supply chain, consisting of suppliers, repair centres, warehouses and service centres (Cohen et al., 2006). To set up such distribution network, a company can choose between a direct market entry and an indirect market entry (Grönroos, 1999). An indirect entry means that the service providing organization is only partly owned by the manufacturing company. A direct entry means that the manufacturing company establishes its own organizational infrastructure. Either way, the goal for a manufacturing company is to deliver the parts and people to the right place within an agreed-upon time, while minimizing costs. They therefore have to weigh the levels of response customers need against the prices they are willing to pay (Cohen et al., 2006). Unlike products, services cannot be produced in advance. Companies therefore have to make

investments to “purchase” options to deliver services to customers. The faster the response that manufacturers promise, the greater their costs will be. The sixth goal of servitization is formulated as:

Servitization goal #6: *Manufacturing companies have to design a distinctive after-sales service supply chain to support a geographically distributed installed base, by weighing the levels of response customers need, against the prices they are willing to pay* (Cohen et al., 2006; Sengupta et al., 2006)

To summarize the above: Figure 10 visualizes the six known elements from literature for designing services. For each element, a goal has been formulated that indicates the right prerequisites for successfully servitizing.

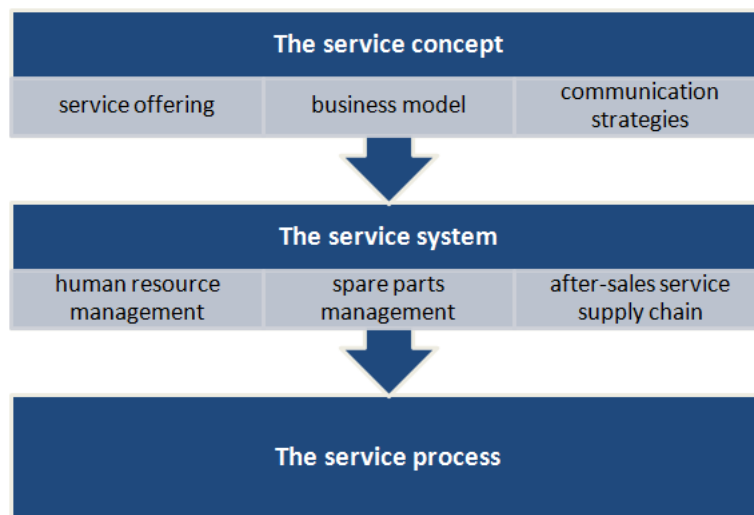


Figure 10: the six servitization goals visualized in the framework of Edvardsson (1996)

3.4.3 The service process

The third component that has to be managed is the service process. The service process reflects how a service concept is developed and offered to the customer, by means of the service system. According to the PBOI model developed by Berenschot Group B.V. (Meerman et al., 2011), there are three aspects to cover when designing processes: (1) the organization, (2) information and (3) control. How each of these aspects apply to the service market is fairly well covered in literature and will be discussed in more detail below.

Organization

Designing an organization is concerned with defining roles, tasks and responsibilities (Meerman et al., 2011). For defining a service organization, it is important to bear in mind that the service process mainly consists of non-value added activities, since the customer lead time is for a large part determined by the relocation of spare parts and administrative delay (Durmusoglu and Kulak, 2008). Also, once the service organization is in place, it becomes a fixed cost and the main driver of profitability is therefore capacity utilization (Oliva & Kallenberg, 2003). Integrating both the inter- and intra-company processes can therefore enhance the operational performance in terms of speed and quality (Sengupta et al., 2006), but also in terms of profitability. Companies therefore have to design the whole service process in detail, including micro-processes and individual activities (Edvardsson & Olsson, 1996) and integrate these processes (Christopher, 2000; Neu, 2005). This does

not only relate to the internal processes, but also to the external processes. Network competition is becoming increasingly important and requires companies to better structure, coordinate and manage the relationships with their partners (Christopher, 2000; Huiskonen, 2001). Hence, the seventh goal of servitization:

Servitization goal #7: *Manufacturing companies have to integrate both intra- and inter-company service processes, by aligning roles, tasks and responsibilities* (Christopher, 2000; Neu, 2005).

Control

Managing service processes is difficult, since due to the highly integrated resources, there are myriad factors that affect the organization's activities. Managerial actions therefore have a low temporal order, covariation and continuity in time and space (Neu, 2005). Nevertheless, companies have to meet service level agreements. Hence, an organization that wants to change its orientation from products to services needs to adapt its performance measures to anchor the transition successfully" (Servitization in product companies, Atos Consulting, White paper, 2011). A good example of how such control mechanism can be developed, is given by Donders on the logistic forum www.logistiek.nl. Donders advocates that a so called KPI tree needs to be developed, which links key performance indicators to underlying performance indicators and identifies who is responsible for which performances. Such KPI-tree enhances the transparency of the service process and provides the opportunity to adequately pursue targets (either based on the past or the desired future). Also Cohen et al. (1997) stresses the importance of properly defined service metrics and adds that end-user customer satisfaction should be used to obtain direct feedback on the service performance. Hence, the eight goal of servitization:

Servitization goal #8: *Manufacturing companies have to develop control mechanism to efficiently and effectively manage a large number of highly integrated resources that causes managerial actions to have a low temporal order, covariation and continuity in time and space* (Cohen et al., 1997; Atos Consulting, White paper, 2011; Neu, 2005).

Information

In the service market, companies have to operate in an unpredictable and inconsistent market place because demands for repairs crop up unexpectedly and sporadically (Cohen et al., 2006). Effectively addressing such uncertainty requires higher levels of information processing (Neu, 2005). Neu (2005) therefore advocates that four interrelated information processes have to be managed: (1) acquiring external and internal information, (2) inter- and intra company information sharing, (3) conceptual utilization of information, and (4) instrumental utilization of information. These last two information processes have been covered under the "control" of service processes, i.e. formulating KPI's and targets. To cover the first two processes, manufacturing companies have to design a so called "virtual" supply chain. A virtual supply chain indicates how actors in the service process are expected to collaborate and disseminate value-generating information (Christopher, 2000). Knowledge sharing and collaboration can be considered critical success factors for a number of aspects (as also pointed out earlier), but what should probably be emphasized the most, is that companies have to become market sensitive to efficiently respond to customers (Christopher, 2000). As was stated earlier, customer needs evolve over time and customers demand are often triggered by machine failures (Neu, 2005; Cohen et al., 2006).

Therefore, the more value generating information a company can gather about its customers and their product use, the more likely it is that companies can effectively and efficiently manage its processes. Hence, the ninth goal of servitization is formulated as:

Servitization goal #9: *Manufacturing industries have to design a virtual supply chain that indicates how actors in the network have to generate and disseminate value-generating in order to successfully address the uncertainty of the service market and to effectively respond to customers* (Neu, 2005; Christopher, 2000).

To summarize the above: Figure 11 visualizes the nine known elements from literature for designing services. For each element, a goal has been formulated that indicates the right prerequisites for successfully servitizing.

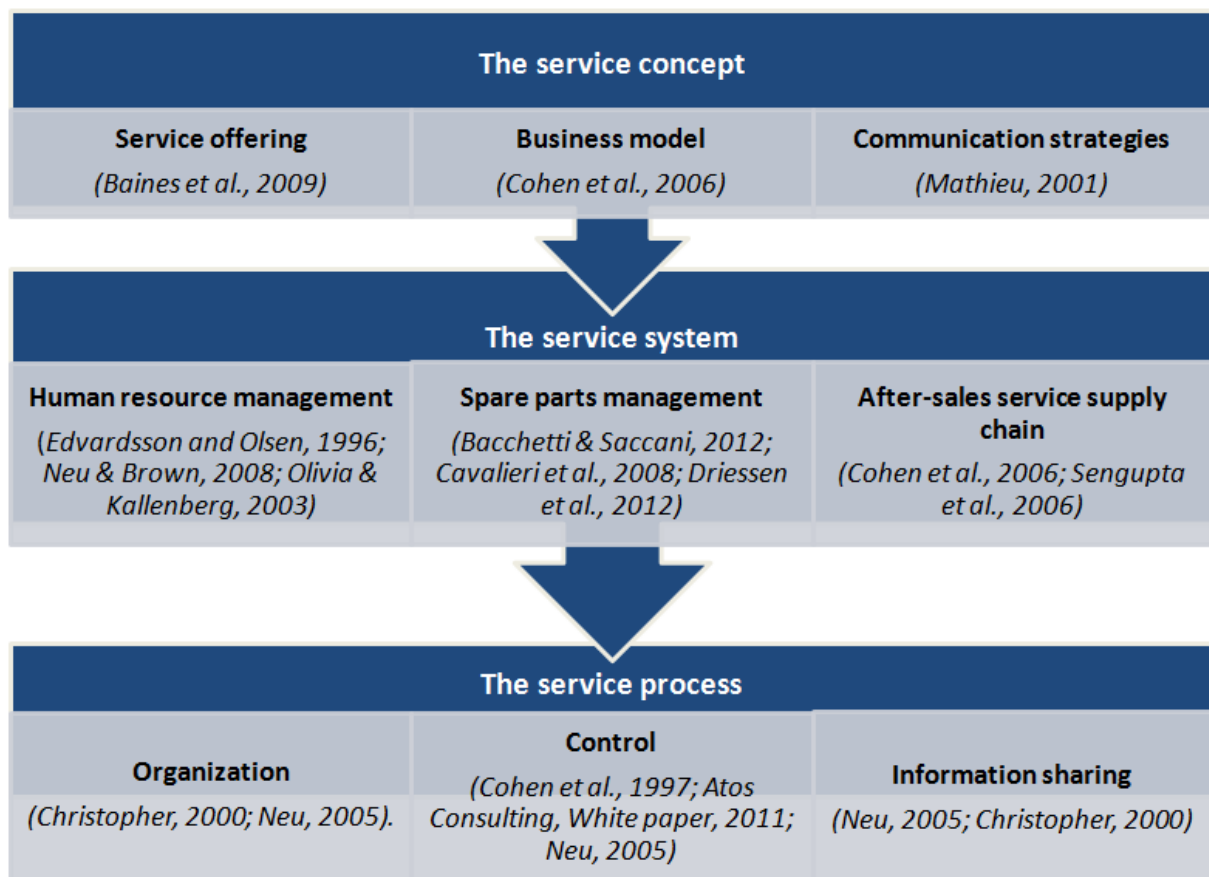


Figure 11: The nine servitization goals visualized in the framework of Edvardsson (1996)

The next chapter will indicate how companies can develop these competences by discussing how companies should manage the transition towards services.

3.5 Managing the transition towards services

As pointed out by Baines et al. (2009), guidance in literature on how to approach servitization as an organisational strategy is largely limited to anecdotal evidence from studying companies that have been successful in making the transition. Oliva & Kallenberg (2003) for example studied 11 capital equipment manufacturers and recognized that the implementation of a servitization strategy, is one of incremental changes along a continuum from pure product provider to pure service provider. This continuum is visualised in Figure 12 and implies that “there is a particular order in which firms need to tackle challenges and develop capabilities” and “by identifying the required skill set for the next stage, the framework allows management to concentrate on a plan to develop or acquire it” (Oliva & Kallenberg, 2003).

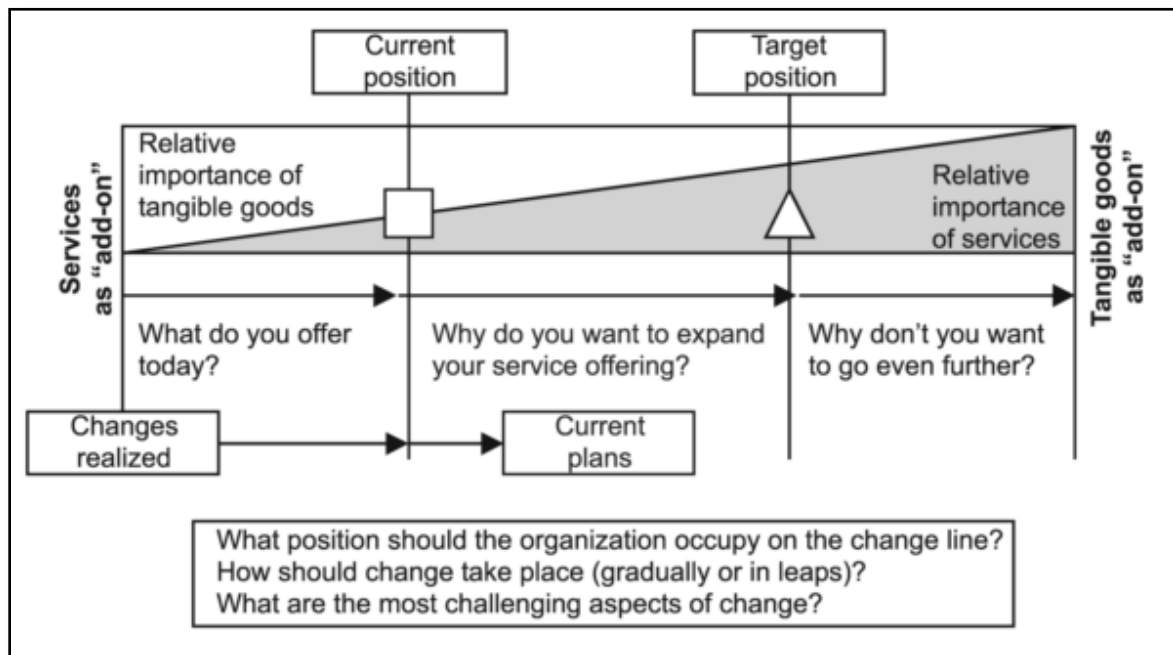


Figure 12: The product service continuum (Oliva & Kallenberg, 2003)

Like Oliva & Kallenberg (2003), many existing maturity models on servitization assume such similar phased introduction of services and are aiming to provide a transformational path by indicating the competences of several maturity stages (Burger et al., 2011; Atos Consulting, 2011; Van Meijl, 2012; Neff et al., n.d.; Steunebrink, 2012). However, Brax (2005) points out that “the common implicit view, that manufacturers can shift to service provision steadily, by adding service offerings to their total offering one by one, may actually be hazardous”. Brax argues that “services cannot be merely added on top of the original goods-dominated total offering”, since this “might nourishes the attitude that services are not real business, and this is the source of the problems”. Services are real business, but significantly different from the goods market and successfully capturing the service market therefore requires a more radical approach in which the whole company re-focuses its attention (Brax, 2005).

Frankly enough, also Oliva & Kallenberg (2003) have pointed out that a move towards services is not just a matter of the offering, but requires manufacturing companies to adapt their organizational principles, structures and processes. Companies namely have to “(1) change their culture from a product-centered organization to a service-centered organization”, (2) “their focus of customer interactions from transaction- to relationship-based” and (3) “the value proposition to the end-user from product efficacy - whether the products work - to the products efficiency and effectiveness within the end-user’s process” (Oliva & Kallenberg, 2003).

A move towards services therefore requires a significant change process and also according to Gebauer & Fleisch (2007), achieving an attractive revenue share with services therefore requires a radical approach. They conclude that “high service revenue will not just happen; it will be the outcome of essential investments in the service business”. Unfortunately, it seems that top management generally lacks the awareness of the required time and resources (Wagner & Lindemann, 2008) and managers cannot be easily motivated to invest resources in extending the service business (Gebauer & Fleisch, 2007). They are often highly averse to the risks associated with service and often fail to recognize its profit potential, since service have a low cost transparency (cost are more variable than fixed and more indirect than direct) (Gebauer & Fleisch, 2007; Mathieu, 2001; Oliva & Kallenberg, 2003).

Another problem in managing the required change process, is the fact that service management principles are often at odds with traditional manufacturing practices. Companies therefore face the risk of internal resistance from areas within the organization where the service strategy is not understood or because of a fear of infra-structural change (Mathieu, 2001; Gebauer & Fleisch, 2007). This can be quite problematic, since overcoming the structural problems requires employees to be enthusiastic and committed (Gebauer & Friedli, 2005). Gebauer & Fleisch (2007) therefore advocate to “focus on acceptance of the service strategy in all the relevant business units or departments by ensuring their strong involvement in strategy formulation”.

Given the fact that a move towards servitization requires a significant change process, both Oliva & Kallenberg (2003) and Gebauer & Fleisch (2007) plea for entering the service market by using a separate service organization, i.e. an organization with its own profit and loss responsibility. They namely recognize that this might be a good way to provide managerial focus and to effectively protect the emerging service culture. As pointed out by Oliva & Kallenberg (2003): “given the significant challenges that a simultaneous entry into both fields represents, it may be advisable to tackle them sequentially”. In other words, using a separate service organization might be a good way to manage a move towards services. It namely emphasizes that service is a different business, which provides managerial focus and eliminates/reduces the (potential) clash between both businesses.

3.6 Conclusion

A literature review is conducted as a first step of this research. Although literature is still quite naive in the field of servitization, it did provide a good theoretical starting point for the development of the servitization framework. The following research questions have been answered during this stage:

What are the drivers for servitization according to literature?

Literature has indicated that there are three drivers for servitization: financial, marketing and strategic related drivers.

(see Chapter 3.2: Drivers for servitization)

What are the characteristics of the service market according to literature?

Literature has indicated that the service market is characterized by a complex, dynamic and hostile environment, due to its following characteristics:

- The service business requires a network structure to deploy people and parts at a geographically dispersed installed base (Cohen et al., 2006);
- The integrated resources causes managerial actions to have a low temporal order, covariation and continuity in time and space (Neu, 2005);
- Customers differ in their need and willingness to pay since they are located in separate, possibly unrelated, industries, vary in sizes and are dispersed across geographic regions (Neu, 2005; Cohen et al., 2006);
- Service often has to be provided to multiple product generations and companies therefore have to manage a lot of stock keeping units that heavily vary in characteristics like price, lead time and demand pattern (Cohen et al., 2006);
- Demands for repairs crop up unexpectedly and sporadically (Cohen et al., 2006) and in general, services cannot be stored and carried forward to a future time period (Wolak et al., 2000);
- Customers and their need evolve over time, since they adopt new technologies and deploy new technologies (Neu, 2005). Activities previously performed by customers can therefore present new challenges (Slack, 2005);
- In the service market, companies can face fierce competition outside their usual domain (Vandermerwe and Rada, 1988; Mathieu, 2001; Oliva and Kallenberg, 2003).
- The shortage of the qualified employees leads to a higher level of hostility (Neu, 2005);

(see Chapter 3.3: Characteristics of the service market)

What are the service components to be designed when entering the service market?

Literature has indicated that a successful service business should at least consists of the following service components: (1) customized service offerings, (2) customized business models, (3) communication strategies, (4) attractive jobs and a stimulating work environment and intra- and inter-organizational cooperation and teamwork (5) an advanced inventory management, (6) an after-sales service supply chain, (7) integrated service process, (8) control mechanisms, (9) a virtual supply chain (see Figure 11). These goals do not yet provide us with a comprehensive overview on how to servitize, but do provide a better insight on how companies can successfully compete on the service market.

(see Chapter 3.4: Developing services)

What are the requirements for successfully managing the transition towards services according to literature?

Apart from the challenge of competing on the challenging service market, companies also face a significant challenge in managing the required change process. Companies namely have to adapt their organizational principles, structures and processes and a move towards services therefore requires a company to completely re-focus its attention (Oliva & Kallenberg, 2003; Brax, 2005). Literature again does not provide a comprehensive overview on how to manage this challenge, but does emphasize that a successful transition requires investments, motivation and commitment (Gebauer & Friedli, 2005; Gebauer & Fleisch, 2007). It in addition indicates that using a separate organization might be a good way to manage the transition, although it has not been recognized as a critical success factor.

(see Chapter 3.5: Managing the transition towards services)

The next chapter will discuss the findings from the case study interviews that were conducted to evaluate and supplement the knowledge gained from literature.

4. Empirical problem diagnosis: talking to business managers

Since literature is still quite naïve in the field of servitization, a literature survey alone did not provide sufficient evidence for the development of servitization framework. Therefore, as a second step of this research, case study interviews have been conducted to adequately diagnose the problem under review. The interviews provided experimental evidence for the development of the servitization framework and helped to answer the following research questions:

- **Do business managers recognize the drivers for servitization?**
- **What are the challenges that business managers experience while competing on the service market?**
- **What are potential development opportunities for the case companies, based on the required competences indicated by literature?**



Figure 13: The empirical analysis is the second research step

This chapter provides an overview of the findings from the empirical analysis. Chapter 4.1 will first discuss and motivate how the case study interviews were prepared and conducted. Chapter 4.2 will discuss whether the business managers recognize the drivers for servitization, which will indicate whether business managers are really motivated to successfully deploy services. Chapter 4.3 will discuss the challenges that business managers experience, which will verify the challenges indicated by literature and translate them into managerial challenges. Chapter 4.4 will discuss the case companies current competences, which, given the required competences for successfully competing on the service market, will identify important focus areas for the development of the servitization framework. The chapter will end with a conclusion in Chapter 4.5, which will answer the research questions formulated above.

4.1 Introduction

The empirical analysis consisted of face-to-face interviews. Face-to-face interviews were preferred, since it provided the change of observing the expression and body language of the interviewee, which may be of particular interest for a correct interpretation of the answer (Verschuren & Doorewaard, 2010). This information also indicated whether the interviewee understood the questions and was motivated to answer correctly. This is of importance when the interviewee considers the subject difficult, and given the problem statement, this seemed quite likely. The interviews were semi-structured to provide a framework of themes to be explored without constraining the interview to a particular format. This left the possibility to tailor the exact questions to the situation in order to create a thorough understanding of the company specific context. Based on the literature review, seven relevant themes were indicated. Relevant questions and possible answers were formulated in advance and a time slot was assigned to each theme. The interview format can be found in Appendix A: the case study interview format.

The sample was strategically chosen, since the triangulation of sources will maximize the outcome in qualitative research (Verschuren & Doorewaard, 2010). Conclusions in this stage were namely drawn by inductive reasoning and it is therefore important to assure that most or all of the perceptions that might be important, are uncovered. A first assessment revealed approximately 70 companies that seemed relevant to approach. These were then analyzed and evaluated to create a strategic sample of approximately 20-30 companies. The following criteria were used for the selection:

- **Business scope:** engineering, manufacturing, service;
- **Geographical scope:** national, international, world-wide;
- **Market:** auto, airplane, marine, food, etc;
- **Product life cycle:** shorter, average, longer;
- **Number of employees:** smaller, average, larger;
- **Average company turnover:** smaller, average, larger

The interviews were conducted by following the concept of saturation (Glaser & Strauss, 1967). After the data started to become repetitive, and therefore did not lead to more information, the interview round was terminated. Due to the diminishing returns, analyzing a larger sample was considered too much time consuming and therefore impractical. In total, twelve capital equipment manufacturers participated, but only ten interviews were considered valuable. An overview of the test sample is provided in Table 3.

The interviewees mainly consisted of service managers that were in the end responsible of service. These people have a complete overview of the service process and were therefore considered primary targets for the interviews. However, interviews were also conducted with a maintenance engineer, a logistic manager and a purchasing manager, to attain additional in depth-knowledge on relevant sub-areas of servitization. Important information was sent in advance, to make sure that the interviewee was well prepared. The background of the interviewees were studied with the use of LinkedIn², to get more information about his career and previous job experience.

The next chapter will discuss the findings of the interview round, namely why business managers believe that servitization can create an additional value for their company.

² LinkedIn is a online, work related, social network (www.linkedin.com)

Table 3: The test sample of the interview round

Company	Industrial Market	Number of employees	Average company turnover (million euro's)	Product Groups	Product price (euro's)	Product life cycle (years)	Product criticality ³
A	Food	200	10	Packaging automation systems	250000 -	15-20	medium-high
B	Animal Feed, Chemical, Recycling	1000	40	Industrial machinery	40.000 - 200.000	50	high
C	Food, Pharmacy, Farming	150	35	Counting & packaging machinery	8500 - 1.000.000	20	high
D	Aero-space	6000	600	Aircraft technology	100.000 -	30	medium-high
E	Automotive (wheel), Aero-space, petroleum	175	50	Production machinery	10.000.000	50	high / medium
F	Off-shore	2000	600	Heavy construction equipment	10.000.000 -	20 -25	high / medium
G	On- and off-shore	120	-	Cranes	1.000.000 -	20 -25	high / medium
H	Food (chicken)	1000	200	Food processing equipment	20.000.000 -	10	high
I	Food (bakery)	500	65	Food processing equipment	100.000 -	25	high
J	Dairy, Juice, Food, Pharmacy	200	70	Dairy, Juice, Food processing	100.000- 3.000.000	40	high / medium

³ All products were critical for the production process, but a slight distinction was made, based on the product's operating hours.

4.2 Company drivers for servitization

Literature quite extensively describes all the drivers for servitization and in the academic world, there is a general consensus that servitization can create an additional value for product manufacturers. However, this is not a common believe that is shared among the manufacturing industry. Four out of ten case company namely stated that their company was purely sales driven and that services were considered necessary to keep customers satisfied. The second group that could be distinguished were the companies where the service manager recognized the potential of services, but the rest of the company did not. As visualized in Table 4, only three case companies shared a company-wide believe that an additional value can be generated by combining products with services.

It is quite trivial that believing in success is crucial for achieving success. Companies have to invest time, effort and resources in order to tackle the challenges of the service market. The case companies that did not share a common believe on the potential of services, where all hesitating in making these efforts and investments. They often gave priority to production and were averse to risks of the service business. They in addition often ran into organizational problems, as will be discussed later on in this chapter. A company-wide believe on the potential of services therefore seems a critical success factor and two factors were recognized that separated the “best in class” cases from the others: (1) knowledge about the service adoption rate and (2) top management commitment. Both aspects will be discussed in more detail below.

Table 4: Case companies and their believe in servitization

	Considered service as a necessary evil	Opportunity at least recognized by service manager	Service potential was recognized company-wide
Company A		X (only recently)	
Company B	X		
Company C	X		
Company D			X (offers customized solutions)
Company E		X	
Company F		X	
Company G	X		
Company H			X
Company I		X	
Company J			X

4.1 Knowledge about service adoption rate

What separated the “best in class” from the others, is that they all knew the adoption rate of their service product. Almost each company knew the size of their installed base, but only companies H and J, knew the adoption rate of their service products among their installed base. Due to this kind of knowledge, these companies recognized the often most important driver for servitization; financial revenues. The other companies knew the size of their installed base, but had no idea about the overall adoption rate of their service product. These companies were sales driven and used an ad-hoc approach to service. They never analyzed the market penetration of their service product and therefore failed to recognize that services can create an additional value for their company. Knowing the adoption rate of the service product among the installed base therefore seems an important qualifier for success.

This is also in line with Gebauer & Fleish (2007), who recognized that before managers are willing to invest the required resources in the service business, they have to recognize its financial potential. They therefore advocate that: “managers should start learning the service management approach by understanding the financial opportunities of services”.

4.2 Top management commitment

Another aspect that separated the best in class cases from the others, was the commitment that went along with the believe in services. Several companies advertised on their website that the company was committed to offer the best product performance and services to their customers, but in several cases, these statements seemed to be formulated by a marketing department instead of top management. Service managers were sometimes not even aware of such statement and if they were, they could not indicate how the company tried to achieve such goal. What separated the best in class companies, was that they each committed themselves to attaining such goal. Their top management formulated a mission, goal and/or targets that guided further implementation and caused employees to be enthusiastic and committed to work towards a success. Gebauer & Friedli (2005) have noted that a successful transition towards services requires enthusiastic and ongoing commitment of service employees, and that this can further enhance the believe in services through a positive feedback loop. This was also noted during the interview rounds. Managers that worked towards improvement by striving to meet goals and targets recognized opportunities that others did not. In one of the best in class companies for example, one manager recognized that the potential of services had only increased over the years. Customers had become more focused on their core business and their product knowledge had therefore decreased over the years, making them more dependent on outsourcing services. Another manager recognized that the new ISO norm concerned with asset management (ISO 55000) offered their company the opportunity to further expand their service product. It was due to the fact that these managers were pro-actively seeking a servitization success, that they recognized such opportunities. Top management commitment and the formulation of clear strategies, goals and targets therefore seem important qualifiers for successfully managing the transition towards services, since it causes employees to be motivated and committed. This commitment and motivation even further enhances itself and the believe in services, due to the positive feedback loop that is created once successes have been achieved.

What can be concluded from the above, is that there are at least two important qualifiers for successfully making the transition towards services: (1) knowledge about the size of the installed base and the adoption rate of the service product and, (2) top management commitment. Both aspect are considered important success criteria, since implementing a servitization strategy requires investments, motivation and commitment (Gebauer & Friedli, 2005; Gebauer & Fleisch, 2007).

4.3 Challenges of the service market

The literature survey indicated that the service market is characterized by a complex, dynamic and hostile environment. To better understand how these challenging characteristics raises difficulties for manufacturing companies, service managers were asked about the difficulties they faced when deploying services. The answers provided an overview of the decision making issues of servitization and provided a better insight into the kind of knowledge and information that can help capital equipment manufacturers to successfully compete on the service market. The decision making issues which with service managers were confronted, can be grouped into four categories: (1) technical, (2) marketing, (3) logistic and (4) organizational related. Each of these categories will be discussed in more detail below.

4.3.1 Challenge #1: Technical challenges

A problem that was frequently mentioned during the interview round, was related to the technical complexity of maintaining an asset. Service is provided to achieve a certain uptime for the customer, but achieving a certain product performance is difficult, since there are a myriad factors that influence the product performance. Products are often (at least to a certain degree) customized to the special operating conditions of each customer. The parts and their performance therefore heavily vary among customers. The product performance in addition also depends on the customers actions. While some conduct regular inspections and small maintenance themselves, others might not take any actions. As one manager explained: “due to the myriad factors that influence the product’s performance, a maintenance job is more like a single operation than a routine job”. Managers therefore find it difficult to formulate effective and efficient maintenance policies and are hesitating in making any service level agreements. As a result, most companies merely focused on selling spare parts with some intentional maintenance jobs, which hampered the development of their service business.

Another manager in addition pointed out that valuable information on the product use, can be difficult to attain. In markets where competition is fierce, customers are often unwilling or hesitating in sharing valuable information on the production process. It is therefore difficult to gain a better understanding upon how certain factors affect the product performance, which make it even more difficult to adequately make maintenance decisions. Some companies eliminated this problem to a certain degree, by the use of condition based maintenance. They for example equipped their product with sensors that indicated when certain parts of the machine required maintenance (for example for lubrication). Although this option worked for a few, others pointed out that such option was not a solution for all. Condition based maintenance is expensive and in most industries, customers are not willing to pay for such service.

The myriad factors that make the product’s performance in-transparent and the fact that reliable information on the product use can be difficult to obtain, raises significant technical related challenges for manufacturing companies that want to expand their service business.

4.3.2 Challenge#2: Marketing challenges

Another problem that was frequently mentioned during the interviews, was related to a marketing challenge. Customers operate in different markets and are located among a geographically dispersed installed base. They therefore differ in characteristics like technical knowledge, labour costs, culture and for example production process. As a result, customers heavily vary in their need and willingness

to pay. While some customers might want to minimize its operating costs, others might consider the uptime the most critical value driver and therefore want to outsource the complete maintenance process. Most manufacturing companies therefore find it difficult to design a service product that can satisfy different customer segments, given the fact that it requires significant investments and raises risks. They do often not know how to further expand their service product and are therefore not able to further develop their service business.

What further complicates the design of a service product, is the fact that customers are heavily biased when asked about their need and willingness to pay. As one managers stated, customers want their service as soon as possible and for the lowest price. Designing a service product in collaboration with the customers, as some researchers have suggested, is therefore difficult. Another manager also pointed out that interpreting the information from customers can be difficult. He for example explained that urgency has a relative meaning and that it takes experienced employees to interpret such information accurately.

The variety in customer's need and willingness to pay, combined with the difficulty of obtaining reliable information on both, raises significant marketing related challenges for companies that want to expand their service business.

4.3.3 Challenge #3: Logistic challenges

The third frequently mentioned challenges were related to the logistical aspect of deploying services. Customers are located among a geographically dispersed installed base and managers therefore find it difficult to efficiently and effectively deploy services. Quickly responding to breakdowns requires to stock spare parts, but companies find it difficult to decide upon where to stock which parts. Products are often customized or renewed and spare parts therefore heavily vary in characteristics like price, availability and demand pattern. Most manufacturing companies therefore hesitate to invest in spare parts inventory, since stocking parts is expensive and companies face the risk of parts becoming obsolete. They often provide the customers with a recommended spare parts list and are reserved in offering any type of guarantees about the availability or lead times of spares, which hampers the further development of their service business.

The other logistic challenge that companies experience, relates to the allocation of human resources. Some customers demand that when a breakdown occurs, a service engineer is available right away. However, as several managers pointed out, offering such service is difficult. Service includes a sporadic demand and it is therefore difficult to allocate human resources among a geographically dispersed installed base. This is another reason why manufacturing companies find it difficult to make service level agreements. Some companies used foreign service offices to tackle this challenge, but this was not an option for all companies. Some companies stated that their installed base was either too small or too dispersed for such investment to be profitable. Other companies offered remote support. They used a programmable logic controller (PLC) to be able to analyze the fault cause from distance. This eliminated a major uncertainty for the planning, since corrective maintenance could often be conducted by the customer itself. However also this option is not a solution to all. The equipment is expensive, complex and not suitable to every product.

The geographically dispersed installed base combined with an unknown future demand, raises significant logistic challenges for companies that want to expand their service business.

4.4.4 Challenge #4: Organizational challenges

The fourth type of challenge that was often mentioned, was related to the organizational aspect of managing and developing a business. Managers namely often stated that their service organization was not really capable of tackling the myriad challenges of the service market, since it was limited in its capacity. Both managers and employees were often busy with their day-to-day job, which often consisted of operational tasks that lead to direct results. As a result, they had not been able to perform tasks on the tactical level that might help to expand their business and tackle the service related challenges. The capacity problems were often the result of two aspects, that will be discussed in more detail below.

Most organizations had entered the service market by integrating the organization of the service business with the manufacturing business, instead of designing a distinctive service organization. This often leads to internal conflicts, since the manufacturing of products was recognized as core business and therefore sales has priority over service. Whenever a conflicts of interest arose at for example the purchasement, logistic or engineering department, service often had to take a back seat. As one manager explained: “whether I like it or not, the reality is that as a service managers, I am also involved in politics. I constantly have to convince others of the necessity and urgency of day-to-day tasks. This costs me a significant part of my time and limits my ability”. The internal conflicts thus limits both the effectiveness and the efficiency of service managers. They often lose a significant part of their time to political games, but in addition also posses limited human and financial resources. It therefore provides additional evidence that stresses the importance of a company width believe in services and top management commitment.

A second, more fundamental organizational challenge that causes capacity problems, is concerned with the recruitment of qualified employees. Each manager recognized the importance of qualified personnel, but in addition acknowledged that they are difficult to acquire and to retain. Solving the internal conflicts will therefore not directly eliminate the capacity problems. The scarcity of qualified employees often leads to under capacity, causing managers to be involved in operational tasks that lead to direct results. It therefore limits them to plan more strategically and tactically. At the same time, a shortage of qualified employees can be a limiting factor for further up-scaling the service business. Employees need to posses both technical skills and people skills and such competences are difficult to acquire. Developing such skills requires significant time and investments and expanding the service business might therefore require patience.

The difficulty of recruiting qualified employees causes the development of the service business to be slow and cautious, since it raises a significant organizational challenge for manufacturing companies. In addition, it can be concluded that top management commitment and a company width believe in the potential of services is crucial to eliminate internal conflicts that might limit the organization's capability in managing and expanding the service business.

The next chapter will discuss the overall impression of the case company's current competences, which will to identify important focus areas for the development of the servitization framework.

4.4 Development opportunities

The literature review indicated what competences manufacturing companies should possess in order to successfully compete on the service market. This chapter will reflect upon these goals, by discussing the competences that the case companies possessed. It will compare the overall impression with that of the best in class cases to identify potential development opportunities. The first goal that was formulated, was:

Servitization goal #1: *Manufacturing companies have to design a customized service offering by combining a base package of standard services with particular service options or by designing modular units that can be “mixed and matched” in different combinations (Baines et al., 2009).*

The majority of the case companies never reached this goal and merely focused on selling spare parts with some intentional maintenance. These companies were often averse to the risk of pro-actively offering any additional services or were simply not able to overcome the challenging characteristics of the service market. These companies therefore often only serviced 10-40 percent of their installed base, while the best in class cases achieved a service adoption rate of 60 percent and higher. The best in class case companies however, were able to meet a lot more variety of needs, since they offered a far more extensive service product. They offered maintenance service, standardized maintenance kits, standardized retro-fits and so on. One company even offered a mobile workplace for conducting the maintenance, so that the customer's production process would be disturbed as less as possible. This was a creative idea after customers stated that their workspace was limited and maintenance work was therefore difficult to conduct at location. The idea turned out to be a big success and it sets an example of how companies can become pro-actively in selling services. Another company recognized that by collaborating with foreign offices, the company could offer a 24/7 availability service, without making any additional investments. This again sets an example of how companies can develop customized solutions and shows that expanding the service business does not necessarily require significant investments. Designing more customized solutions is therefore recognized as an important development opportunity for most companies.

Servitization goal #2: *Manufacturing companies have to design business models that meet the need of customers to eliminate a conflict of interest (Cohen et al., 2006).*

As stated above, most companies did not pro-actively sell services and merely worked on an ad-hoc base. They did therefore not use different business models to target different customer segments, which is another explanation of why the majority had a significant lower service adoption rate than the best in class cases. However, it should be noted that the best in class cases only focused on maintenance contracts in addition to the ad-hoc business models. Even the best in class case did not use performance based contracts for the customers that considered the minimization of downtime the most important value driver. As one manager explained: “although we considered this option, customers do not yet seem to be ready for such advanced types of contracts”. It therefore seems that in the capital intense markets, working towards performance based contracts is not necessarily a development opportunity. However, ad-hoc business models will not meet the need of customers that want to minimize their product's downtime and in addition make it difficult to plan services. Working towards maintenance contracts is therefore considered an important development opportunity for most companies.

Servitization goal #3: Manufacturing companies have to formulate communication strategies that clearly describe the value proposition of the service product to the customer (Mathieu, 2001).

The majority of the case companies did not actively sell the service product and did not formulate any communication strategies. The best in class cases however did. They presented their customers the costs and benefits of regularly conducting maintenance and did so by using hard figures. They for example calculated the cost of ownership, maintenance costs, and potential cost due to yield loss. In addition to the hard figures, these companies also used discount offerings to further convince customer to order more services. The managers of these companies recognized the effect of these communication strategies and emphasized the importance of sales strategies. Actively selling the services by the use of communication strategies and for example discount offerings, therefore seems a development opportunity for most companies.

Servitization goal #4: Manufacturing companies have to design attractive jobs and a stimulating work environment for service personnel (Edvardsson and Olsen, 1996) and have to support intra- and inter-organizational cooperation and teamwork to develop the knowledge and behavioural competences needed from service personnel (Neu & Brown, 2008; Olivia & Kallenberg, 2003)

There were only a few companies who achieved this goal. These companies for example formulated trainings for service employees and used personal development plans and incentives. These were used to develop the competences of employees and to motivate people towards self improvement. However, it were often the larger companies that used these approaches, although not all of them can be considered the best in class when it comes to successfully competing on the service market. It therefore seems that although it can certain be a development opportunity for a lot of companies, achieving this goal requires a more fundamental change. One manager for example recognized that this approach could certainly enhance their success in the service market, but stated that incentives and development plans have to be developed company-wide in order to eliminate conflicts. It is therefore recognized as a development opportunity, but not considered a so called “quick win”.

Servitization goal #5: Manufacturing companies have to design an integrated and advanced inventory management system to efficiently handle a large amount of spare parts that heavily vary in their characteristics. (Bacchetti & Sacconi, 2012; Cavalieri et al., 2008; Driessen et al., 2012)

Although literature quite extensively describes how companies could design an integrated and advanced inventory management system for spare parts, none of the case companies actually used such system. First of all, only a few companies formulated a spare parts portfolio. This portfolio was often the result of designing a web shop, but companies did apart from that not really recognize the need for doing so. They did not strategically decide what parts to stock and often did not consider which parts require to gather and maintain technical information. They in addition often did not categorize spare parts based on their characteristics and therefore did not efficiently allocate their effort for managing these parts. Literature furthermore points out that due to the sporadic demand of services, demand forecasting requires advanced mathematical models. However, none of the case companies actually used these methods. They all used forecast models that were not appropriate for the intermittent and lumpy demands patterns with which the demand of most spare parts is characterized. Even the best in class cases did not seem to be aware of the special characteristics of

spare parts and therefore often used the wrong methods and tools for the inventory management. Given the fact that spare parts inventories are often one of the largest cost generators, developing an advanced and integrated inventory management systems for spare parts is considered an important development opportunity for companies.

Servitization goal #6: Manufacturing companies have to design a distinctive after-sales service supply chain to support a geographically distributed installed base, by weighing the levels of response customers need, against the prices they are willing to pay (Cohen et al., 2006; Sengupta et al. 2006)

Most case companies did not design a distinctive after-sales service supply chain and often did not seem to recognize the need for doing so. The logistic and purchasement department almost never made a distinction between spare parts and production parts, and therefore used the same methods, tools and procedures for service as for production. However, although both businesses include the same physical parts, they differ significantly in many characteristics. Manufacturing can often be scheduled and parts can therefore be handled with a “just in time” approach to minimize costs. The service business however, includes a sporadic demand and considers time as the most critical value driver. Using the same methods, tools and procedures for both businesses will therefore always lead to a sub-optimal result. Adapting the supply chain structure, strategies and working methods for the service business, therefore seems an important development opportunity for most companies.

It was in addition noted that only one case company, who operated in the aircraft industry, used a repair facility. All the other companies did not, or only intentionally, repair a part. Several managers considered this option, but pointed out that repair strategies were only limited in their usefulness. The availability and lead times were only rarely an issue and acquiring repair capacity requires an significant investments. In the aircraft industry however, this is significantly different. Even parts on the lowest hierarchical level are often custom made. Parts are therefore expensive and have a long lead time, making it economic efficient to repair them. Repair strategies are therefore not a solution to all and is considered a less important development opportunity.

Further upstream the supply chain, there were less similarities between companies. Some larger companies possessed foreign service offices and stocks to service local customers, but most of the time these business units operated separately. These business units were for example owned by a subsidiary who serviced a different product or market, and therefore operated as a stand-alone business unit. Only two case companies (both of significant size) used foreign service offices that were integrated, i.e. controlled by the headquarter. However, even these companies did not pool parts but only used the foreign service office to allocate human resources at local customers. Spare parts were still stocked at the customer’s location and a central warehouse and none of the case companies used a multi-echelon structure to control their inventory. The best in class case company did consider this option, but explained that implementing such structure is complex and requires significant time. Their ERP systems was for example not yet compatible with that of foreign offices and they were therefore not able to implement such structure. Implementing such strategy therefore requires a certain maturity and is therefore only considered a long-term development opportunity for the minority.

Servitization goal #7: Manufacturing companies have to integrate both intra- and inter-company service processes, by aligning roles, tasks and responsibilities (Christopher, 2000; Neu, 2005).

Literature indicated that the service processes mainly consists of non-value added activities and that an integrated service process is therefore a critical success factor when competing on the service market. However, again most companies had not been able to meet this goal. As stated earlier, most companies worked on an ad-hoc base. They therefore never designed an integrated service organization. However, there were a few exceptions. One company for example included the service process in a total quality management approach. This company designed and visualized the maintenance process in detail with the use of flow schemes. They for example indicated the procedure for handling a customer complaint, and indicated who was responsible for which step in the procedure. By doing this, the company had integrated the internal processes and worked towards more efficient business processes. However, since the majority of the companies does not possess this capability, developing aligned roles and responsibilities to integrate the service process is considered an important development opportunity for most companies.

Servitization goal #8: Manufacturing companies have to develop control mechanism to efficiently and effectively manage a large number of highly integrated resources that causes managerial actions to have a low temporal order, covariation and continuity in time and space (Cohen et al., 1997; Atos Consulting, White paper, 2011; Neu, 2005).

Several companies used performance indicators to monitor the performance of business process. However, the indicators that were used were often not really valuable, since they only measured a specific part of a specific department. Only two case companies formulated performance indicators that directly measured the result of the service business. They measured the revenues per product and type of service, profit margins and so on. However, even these company barely monitored performance indicators that measured the result from the customer's point of view. The companies measured several internal pi's that were used to control the process, but for example did not measure the downtime of the machine or the customer satisfaction. Formulating a KPI-tree that relates both internally and externally oriented performance indicators is therefore considered an important development opportunity for most companies.

Servitization goal #9: Manufacturing industries have to design a virtual supply chain that indicates how actors in the network have to generate and disseminate value-generating in order to successfully address the uncertainty of the service market and to effectively respond to customers (Neu, 2005; Christopher, 2000)

The companies that considered service as a necessary evil did not share any other information than technical information, like lead times, prices and availability. Only the few companies that actively sold their service product, recognized the importance of information sharing to address the uncertainty of the service market. One company used guidelines that prescribed how often certain customer types should be visited. By keeping a regular contact with customers, the company tried to maintain their relations and to gain valuable information on the customer's need on the short and long term. As the manager of this company stated: "In the service business, you are constantly anticipating on what is happening at the customers. Knowing the ins and outs of your customers is

therefore crucial". The other best in class company also recognized the importance of information sharing and used a customer relationship management approach to store valuable information. Service engineers were for example provided with standardized forms to assure that each service manager would collect valuable (often technical) information when visiting the customer. This company in addition also collaboratively worked out a planning with customers at the beginning of the year. This provided the opportunity to anticipate on demand peaks and inform suppliers in advance when necessary. By collecting and storing valuable information, both companies were able to enhance the transparency and visibility of services. Designing a virtual supply chain is therefore considered an important development opportunity for most companies.

To summarize the above, an overview of the development opportunities for the case companies is visualized in Table 5. What should be noted here, is that not even the best in class cases possessed all the required competences indicated by literature, while still being successful.

Table 5: An overview of the development opportunities for the case companies

	Achievement	Group average	Best in class cases
Servitization goal #1	Customized service offering	Quick win	Done
Servitization goal #2	Customized business models	Quick win	Done
Servitization goal #3	Communication strategies	Quick win	Done
Servitization goal #4	Professional service personnel	LT development opportunity	Improvement possible
Servitization goal #5	Advanced inventory management	Quick win	Quick win
Servitization goal #6	After-sales service supply chain	Partial quick win	Improvement possible
Servitization goal #7	Integrated service process	Quick win	Done
Servitization goal #8	Control mechanisms	Quick win	Improvement possible
Servitization goal #9	Virtual supply chain	Quick win	Done

4.5 Conclusion

Since literature is still quite naïve in the field of servitization, a literature survey alone did not provide well-founded scientific evidence for the development of servitization framework. Therefore, as a second step of this research, case study interviews have been conducted to adequately diagnose the problem under review. The following research question have been answered during this stage:

Do business managers recognize the drivers for servitization?

The case study interviews revealed that although literature quite extensively describes the drivers for servitization, the fact that servitization can create an additional value for manufacturing companies is not a common belief in the manufacturing industry. Most companies still recognize services as a necessary evil, give priority to sales and are averse to the risks of the service market. This seems to indicate an important cause to the research problem, since a successful transition towards services requires investments, motivation and commitment. From the best in class cases, two steps have been derived that might help companies to meet these success criteria: (1) knowledge about the size of the installed base and the adoption rate of the service product and, (2) top management commitment.

(see Chapter 4.2: Company drivers for servitization)

What are the challenges that business managers experience while competing on the service market?

Implementing a servitization strategy raises decision making issues in four areas of expertise, namely: technical, marketing, logistic and organizational. These decision making issues are the result of the challenging characteristics of the service market. The large variety in customers and parts, combined with a geographically dispersed installed base and sporadic demand raises a significant amount of uncertainty. Companies therefore find it difficult to make adequate decisions and are often hesitating in making necessary investments. The four areas are therefore considered as important focus areas for the development of the servitization framework, since they (at least partly) explain why most companies fail to successfully servitize.

(see Chapter 4.3: Company challenges for entering the service market)

What are potential development opportunities for the case companies, based on the required competences indicated by literature?

The case study interviews revealed that companies often do not possess the required competences for successfully competing on the service market. Although achieving some of the competences requires significant investments, companies can also significantly enhance their ability by capturing several quick wins. It however seems that companies are often not aware of this. They generally lack a thorough understanding of the service market and its challenging characteristics and are also not aware of the available tools, techniques and knowledge to tackle these challenges. The underlying cause seems to be the fact that companies often recognize service as an enlargement of their product offering, instead of a complete new business. As a result, they fail to recognize that deploying services is completely different from manufacturing goods. They use the same methods, tools and procedures for the service market, while successfully capturing the service market's potential requires to set up a complete new business. An overview of the development opportunities for the case companies is visualized in Table 5.

(see Chapter 4.4: Development opportunities for companies)

5. Design preparation: formulating design criteria

The problem diagnosis indicated why most companies fail to capitalize the service market's potential and indicated criteria for a potential solution. With this knowledge and insight, design criteria have been formulated as the third step of this research. These criteria have operationalized the designing of a useful solution and therefore provided the guidelines for designing a valuable artefact. The following research questions have been answered during this stage:

- **What functions should the servitization framework fulfil for solving the problem under review?**
- **Given the problem diagnosis, what assumptions are required for designing the servitization framework?**
- **What functional and structural characteristics does the servitization framework need to posses for solving the problem under review?**
- **How can the previous results be assembled into a framework for the model?**



Figure 14: Formulating design criteria is the third research step

This chapter will explain how the design criteria are the result of the problem diagnosis. Chapter 5.1 will discuss the design requirements, which indicates the functions that the artefact should fulfil or enable to perform. Chapter 5.2 will discuss the assumptions, which indicates the conditions required for a fruitful use of the model. Chapter 5.3 will discuss the required specifications of the model and Chapter 5.4 will explain how all these criteria have been assembled into a framework. The chapter will end with a conclusion in Chapter 5.5, which will answer the research questions formulated above.

5.1 Design requirements

Design requirements indicate the functions that the artefact should fulfil or enable to perform. According to Verschuren & Doorewaard (2010), there are three types of requirements that could be distinguished:

- **Functional requirements**: indicate the functions that the artefact should fulfil or enable to perform;
- **User requirements**: indicate the requirements to be fulfilled on behalf of the future users of the artefact;
- **Contextual requirements**: prerequisites set by political, economical, juridical and or social environment.

The requirements of the artefact to be designed, have been grouped under these three categories and will be discussed next.

5.1.1 Functional requirements

The problem diagnosis has revealed that most companies fail to successfully servitize due to a number of reasons. However, what has been most revealing is that most companies are not aware of the fact that entering the service market is inherent to establishing a new business. Services are often recognized as an add-on to sales and companies do often not recognize the distinctive characteristics between the goods and the service market. They lack a thorough understanding of the challenges of the service market and are also not aware of the available tools and techniques for tackling these challenges. Hence, they fail to recognize that becoming successful with services requires a significant change process in order to develop the competences required for successfully competing on the service market. It can therefore be concluded that, in the current situation, companies are unconscious, as well as incompetent. This is the first stage of the “conscious competence” learning model in psychology, as visualized in Figure 15.

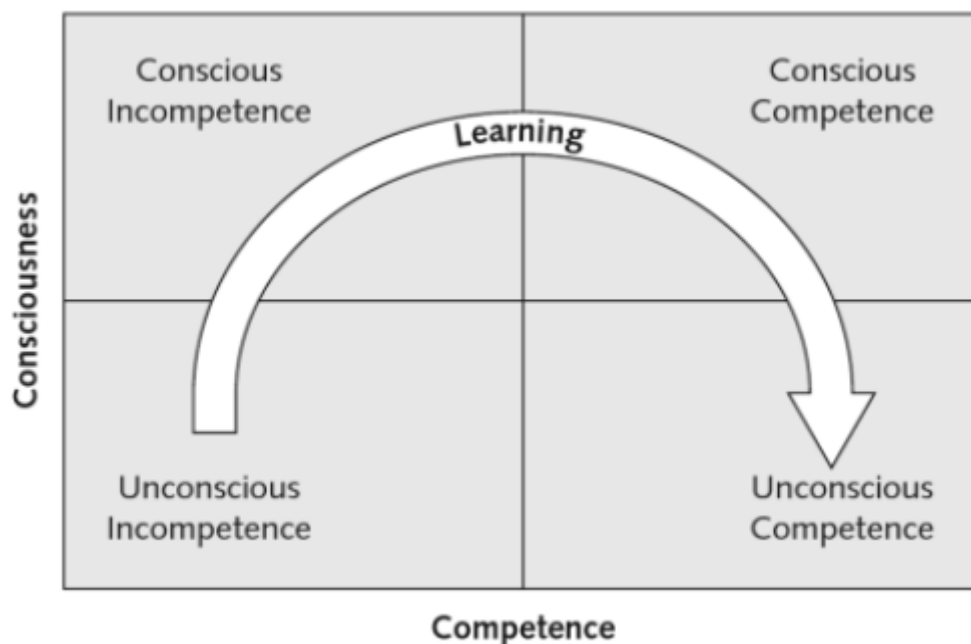


Figure 15: Conscious competence model (Dean et al., 2010)

So in order to solve the problem under review, the servitization framework has to fulfil two purposes:

- **Functional requirement #1:** The servitization framework has to create awareness by indicating why most companies fail to successfully implement a servitization strategy, after which:
- **Functional requirement #2:** the servitization framework has to provide a helpful tool for developing the required competences.

By fulfilling these two purposes, the servitization framework can change the current situation in which services are recognized as a necessary evil, to the desired situation in which services provide a healthy sustainable business. This intervention is visualized in Figure 16.

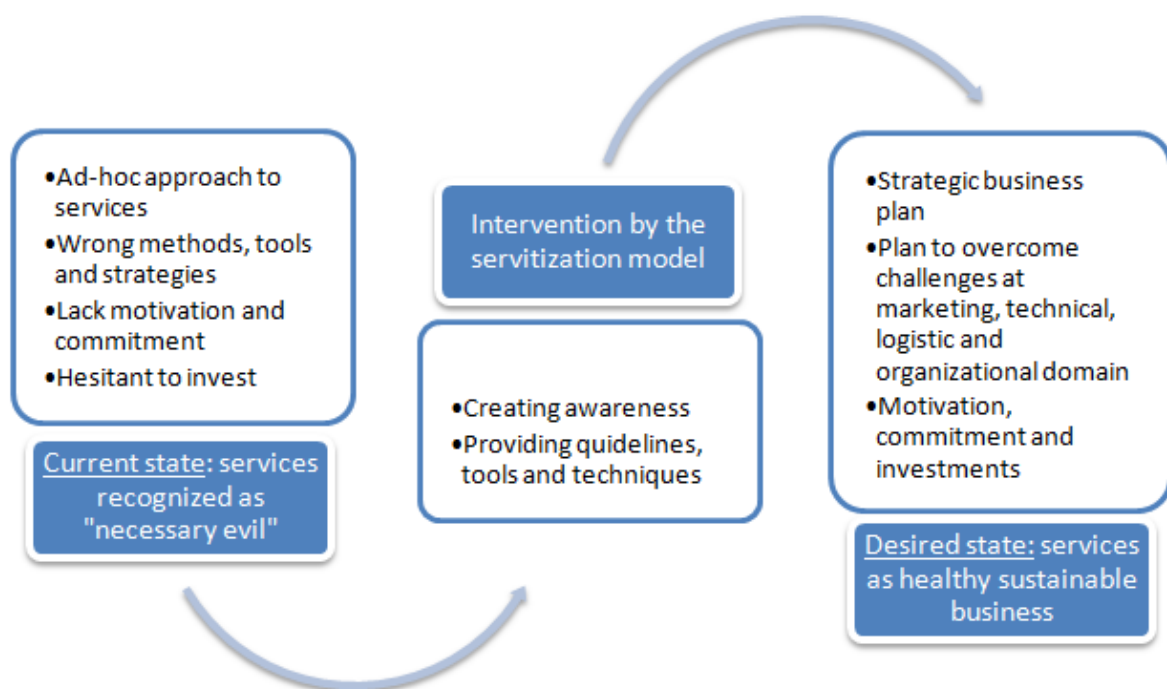


Figure 16: the intervention of the servitization framework visualized

Creating awareness is considered an important aspect, since as stated earlier, a successful transition requires investments, motivation and commitment. In addition, it was noted that even the best in class cases of the empirical analysis did not possess all the required competences, while still being successful.

5.1.2 User requirements

By designing a servitization framework, it is meant to provide guidance, tools and techniques on how to successfully servitize (see research objective #2). This way, it is optimal to provide a problem solver a helpful tool for enhancing a company's ability in successfully capitalizing the service market's potential. Providing a roadmap for development however, first requires to assess a case company's current ability. The model should therefore be of both descriptive and prescriptive nature. Hence, the user requirements are formulated as:

User requirement #1: the model should provide a helpful tool for objectively assessing a case company's current ability in managing services, after which:

User requirement #2: the servitization has to indicate important focus areas that can enhance a company's ability in managing services.

Assessing a case company's current capabilities is considered an important step, since it will help a problem solver to effectively use the servitization framework. It is therefore an important requirement for designing an applicable model.

5.1.3 Contextual requirements:

With regard to the contextual aspects, the following two requirements have been formulated:

Contextual requirement #1: the model should include references and be free from plagiarism;

Contextual requirement #2: the model only has to support the English language.

The next chapter will discuss the assumptions that have been made for designing the model.

5.2 Assumptions

The assumptions indicate the conditions under which the servitization framework is applicable. According to Verschuren & Doorewaard (2010), there are three types of assumptions that could be distinguished:

- **Assumptions about future users**: indicate the assumptions about future users of the artefact;
- **Assumptions about functionality**: indicate the assumptions about the functionality of the artefact;
- **Assumptions about contextual aspects**: indicate the assumptions about the contextual aspects of the artefact.

The assumptions of the artefact to be designed, have been grouped under these three categories and will be discussed below.

5.2.1 Assumptions about future users:

The servitization framework will provide a problem solver a helpful tool for enhancing a company's ability in successfully capitalizing the service market's potential. To make a fruitful use possible, it is assumed that a future user should:

- Possesses basic knowledge about business process improvement (BPI), i.e. has insight into the strategic, tactical and operational implications of the model;
- Possesses a thorough company knowledge;
- Possesses analytical skills;
- Possesses people skills;
- Is motivated and committed to work towards improvement.

5.2.2 Assumptions about functionality:

The servitization framework is designed to help capital equipment manufacturers to successfully capitalize the service market potential. The following assumptions are therefore made with regard to the functionality of the model:

- The model is applicable for manufacturers that did not yet capture the service market potential, i.e. companies that are still relative immature;
- The manufactured good is a primary factor of production for the customer;
- The manufactured product has a significant acquisition cost, making it worthwhile to service;
- The manufactured product has a lifetime that make it worthwhile to conduct maintenance;
- The company has a significant installed base to sell services to.

5.2.3 Assumptions about contextual aspects (A_U):

It is assumed that the servitization framework will provide a valuable tool, since servitization as a differentiation strategy is becoming more and more attractive. This reasoning is based on the assumption that:

- Due to the commoditisation of markets, differentiating strategies based on product innovation, technological superiority or cost-leadership are becoming incredibly difficult to maintain (Mathieu, 2001; Gebauer and Fleisch, 2007).

5.3 Functional and structural specifications

Specifications have been derived from the previous results of this research. These specifications describe, in more detail, what characteristics the model should possess. The following two categories of specifications have been distinguished:

- **Functional specifications**: specify in detail what functions the artefact should fulfil;
- **Structural specifications**: specify in detail how the model should be structured.

The design specifications of both categories will be discussed next.

5.3.1 Functional specifications

The servitization framework has to provide a helpful tool for enhancing a company's ability in successfully capitalizing the service market's potential. Based on the all previous results, the following functional specifications have been formulated:

- The servitization framework should indicate and motivate the competences required for successfully competing on the service market;
- The servitization framework should indicate through what steps manufacturing companies can develop these competences;
- The servitization framework should provide strategies, guidelines and methods that can help companies to successfully conduct these steps;
- The servitization framework should indicate the success factors for conducting these steps;
- The servitization framework should indicate relevant literature as reference work.

These specifications describe on a lower level of hierarchy what functions the artefact should fulfil. Based on these specifications and the problem diagnosis, structural specifications have been derived that will be discussed next.

5.3.2 Structural specifications

The problem diagnosis has revealed that capitalizing the service market's potential is difficult for two reasons: (1) the service market is characterized by a complex, dynamic and hostile environment, and (2) achieving the required competences requires a significant change process. To provide a helpful tool for solving both problems, the following structural specifications have been formulated:

Structural specification #1: the servitization framework should indicate and motivate the steps to be taken at three business layers: strategic, tactical and operational.

Literature has indicated that a comprehensive overview on how companies can servitize is currently lacking. Existing prescriptive models have namely either merely focused on the operational aspects or the strategic aspects, but have not yet combined these aspects to provide a comprehensive overview. Identifying the steps to be taken at all three decision making levels is therefore considered a critical structural specification.

Structural specification #2: the servitization framework should include four business areas: marketing, technical, organizational and logistics.

The theoretical and empirical analysis have identified that, when implementing a servitization strategy, challenges can be expected at four different areas of expertise: marketing, technical, organizational and logistics. Identifying how the challenges can be tackled at each of the four business areas is therefore considered a critical structural specification.

Structural specification #3: the servitization framework should indicate that there are at least the following eight development opportunities for manufacturing companies: develop (1) customized service offerings, (2) customized business models, (3) communication strategies, (5) an advanced inventory management, (6) an after-sales service supply chain, (7) integrated service process, (8) control mechanisms, (9) a virtual supply chain.

The theoretical analysis has identified that there are at least nine service components to be designed when entering the service market. Based on the empirical analysis, it has been concluded that only eight of these can be considered as “quick wins”. The model should therefore at least include these development opportunities as potential solutions to the problem under review.

Structural specification #4: the model should emphasize that there are three critical success criteria for becoming successful in capitalizing the service market: investments, motivation and commitment.

Successfully managing the transition towards services requires to overcome significant hurdles. Investment, motivation and commitment are therefore considered critical success factors for capitalizing the service market’s potential. However, as was noted from the both the theoretical and empirical analysis, companies do not always meet this criteria. It therefore indicates another important reason why companies fail to successfully servitize.

The next chapter will discuss how the design criteria have been assembled into a framework for the servitization framework.

5.4 The framework of the servitization framework

Based on the design specifications, a framework for the servitization framework has been designed as visualized in Figure 17. The framework includes the three business layers and four focus area's as defined by the structural specifications. The eight servitization goals that have been considered as quick wins, have then each been assigned to a relevant business area.

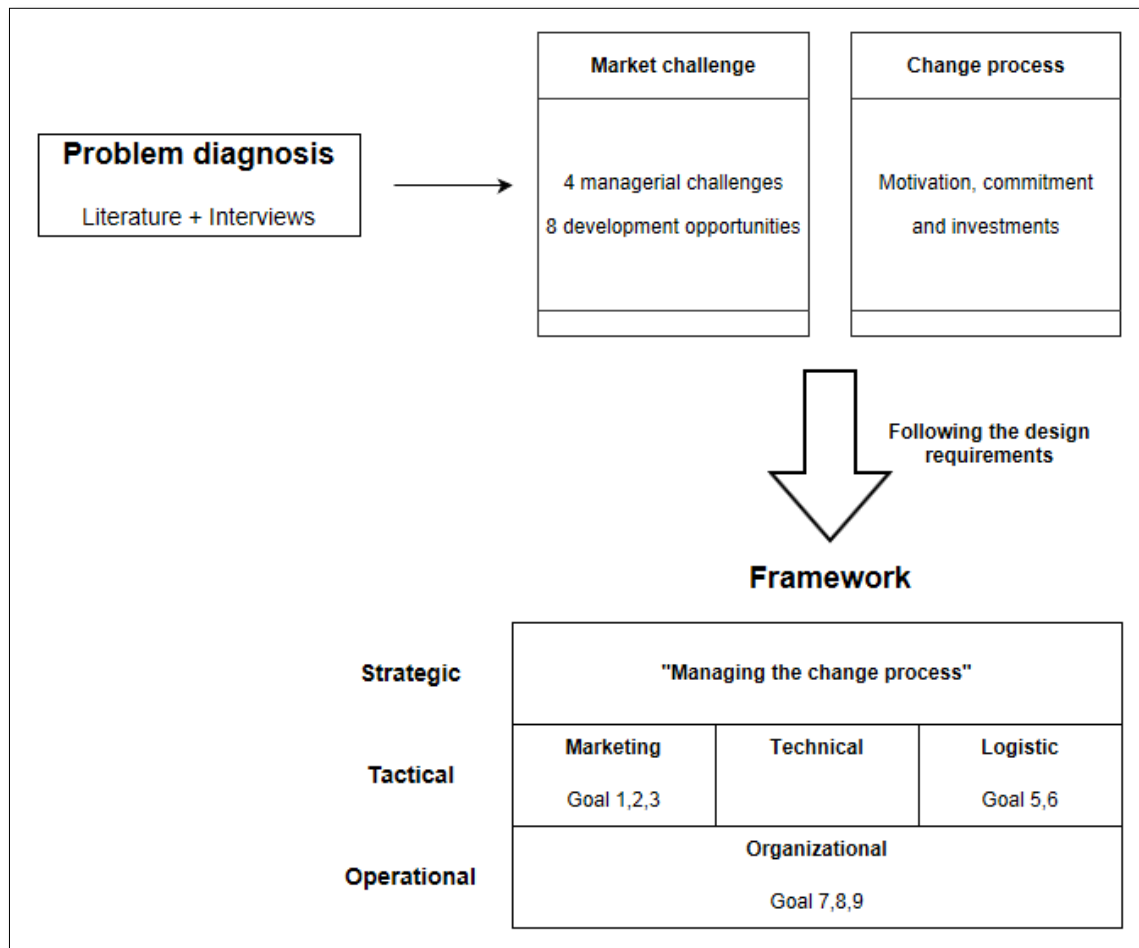


Figure 17: The internal logic of the servitization framework's framework

NOTE: What can be concluded from the framework, is that there are no development opportunities indicated for the technical focus area. As it turns out, the technical aspects of servitization have not played a substantial role in servitization literature. These service components were therefore earlier missed and were added after a feedback loop in which literature was more carefully studied. Two important aspect have been noted in this stage: (1) companies have to identify which products to cover (Cohen et al., 2006) and (2) companies have to design a spare parts portfolio (Driessen et al., 2012). Both of these "goals" have been added to servitization framework.

5.5 Conclusion

As a third step of this research, design criteria have been formulated to operationalize the design process. The following research questions have been answered during this stage:

What functions should the servitization framework fulfil for solving the problem under review?

The servitization framework has to fulfil two purposes: (1) it has to make companies aware of why they fail to successfully compete on the service market, after which (2) it can provide a helpful tool for developing the required competences. From the perspective of a future user, the model should (1) provide a helpful tool for objectively assessing a case company's current capabilities, after which (2) it can indicate important target areas for further developing a case company's ability in successfully capitalizing the service market's potential.

(see Chapter 5.1: Design requirements)

Given the problem diagnosis, what assumptions are required for designing the servitization framework?

It has been assumed that the servitization framework provides a valuable tool for capital equipment manufacturers, since differentiation strategies based on product innovation, technological superiority or cost-leadership are becoming incredibly difficult to maintain (Mathieu, 2001; Gebauer and Fleisch, 2007). It is furthermore assumed that in order to successfully use the servitization framework, a future users has to be committed, motivated, should posses a thorough company knowledge, basic knowledge on business processes improvement and has to posses both people skills and analytical skills.

(see Chapter 5.2: Assumptions)

What functional and structural characteristics does the servitization framework need to posses for solving the problem under review?

The model should provide a comprehensive overview on how to successfully servitize, by (1) indicating the steps to be taken at all three business layers (strategic, tactical and operational), (2) indicating how the challenges at each of the four business areas (marketing, technical, logistic and organizational) can be tackled, (3) indicating the eight quick wins indicated by problem diagnosis and (4) emphasizing that a successful transition towards services requires investments, motivation and commitment.

(see Chapter 5.3: Design specifications)

How can the requirements, assumptions and specifications be assembled into a framework for the model?

The framework of the servitization framework has been developed as visualized in Figure 15.

(see Chapter 5.4: The framework of the servitization framework)

6. The servitization framework designed: the model presented

To help capital equipment manufacturers in successfully implementing a servitization strategy, a servitization framework has been developed. This model provides companies a helpful instrument, since it contributes knowledge, information and insight that can lead to adequate decisions. The design stage is the fourth research step and the following research questions have been answered during this stage.

- **Through what steps can companies enhance their capabilities required for successfully competing on the service market?**
- **What are the tools and techniques that can be used by practitioners to enhance a company's capabilities required for successfully competing on the service market?**



Figure 18: The design stage is the fourth research step

This chapter will present the servitization framework. Chapter 6.1 will introduce the servitization framework and will discuss how the model should be used. Chapters 6.2, 6.3 and 6.4 will then discuss and motivate the steps to be taken at the strategic, tactical and operational business layer in sequential order. Chapter 6.5 will discuss the conclusion of this chapter, which will summarize the internal logic of the servitization framework.

6.1 Introduction

A servitization framework has been designed with the use of the framework discussed in the previous chapter. During the design process, the main goal was to translate theoretical premises into managerial practices, i.e. the steps to be taken for successfully competing on the service market. The framework has been designed on the assumption that companies can experience five major challenges on three different business layers. For each of these challenges, steps have been identified that will allow companies to tackle these challenges. By prescribing the steps that companies should take, the servitization framework provides both a descriptive and a prescriptive tool. With the use of the servitization framework, it is namely quite easy to objectively assess a case company's current abilities, i.e. what steps the company has yet been taken. Based on such assessment, the model can then indicate important target areas for future development, i.e. steps that have not yet been taken. What is again important to notice here, is that the servitization framework can thus be used to identify a roadmap, but does not yet provide a recipe for success. The success of mechanisms is namely limited by contextual constraints and developing a plan for intervention requires to design a solution that more accurately fits the specific problem, situation and context of the company (Sven, n.d.).

The servitization framework is visualized in Figure 19 and will be further explained in the next chapters. As stated in Chapter 5,1, the servitization framework has to serve two purposes, it has to (1) make companies aware of why they fail to successfully compete on the service market, after which (2) it can provide a helpful tool for developing the required competences. For each of the five steps, it will therefore first be motivated why that step is important, after there will be explained how that step needs to be conducted.

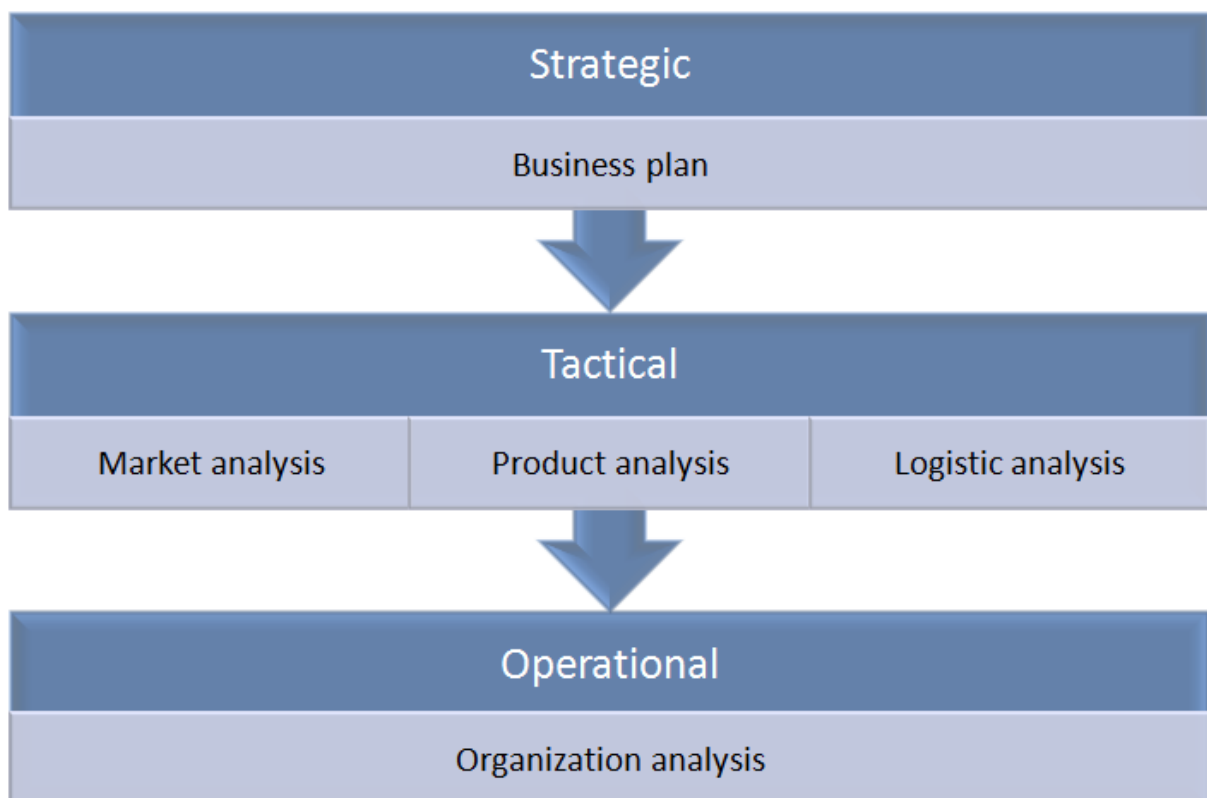


Figure 19: The servitization framework

6.2 The strategic business layer

On the strategic level, decisions are made on the executive level of an organization. These decisions provide an overall direction to the enterprise and indicate a plan for the following two, three, five or ten years. Decisions made on this level are considered the first necessary step, since it will guide further decisions and determine what investments are going to allow the organization to achieve their plan. The importance of these decisions will be explained in more detail below.

6.2.1 The reason for a strategic business plan

Before a company implements a servitization strategy, it should formulate a strategic business plan and motivate why it will intend to pursue a servitization strategy. Although one might argue that formulating a strategic business plan seems quite trivial, companies do often not realize that the need for doing so. As pointed out by (Brax, 2005), there is a common implicit view that manufacturers can steadily shift towards services, which may actually be hazardous. Implementing a servitization strategy namely requires a radical approach, in which a whole company re-focuses its attention. The required competences for successfully pursuing a servitization strategy are namely often in stark contrast with that of a traditional product manufacturer and it is therefore that:

“high service revenue will not just happen; it will be the outcome of essential investments in the service business” (Gebauer & Fleisch, 2007)

As (Cohen, Agrawal, & Agrawal, 2006) see it, companies “have to make investments to “purchase” options to deliver services to customers, and random events that occur, determine how they exercise those options to fulfil demand”. Unfortunately, it seems that top management generally lacks the awareness of the required time and resources (Wagner & Lindemann, 2008) and managers cannot be easily motivated to invest resources in extending the service business (Gebauer & Fleisch, 2007). Despite the broad range of literature on the financial opportunities of services, managers namely often fail to recognize the financial potential (Oliva & Kallenberg, 2003). The low cost transparency of services (costs are more variable than fixed and more indirect than direct) namely make it difficult to recognize profit margins (Gebauer & Fleisch, 2007; Mathieu, 2001). In addition, managers are often highly averse to the risks associated with service that are the result of a sporadic demand and a high number of integrated resources that causes managerial actions to have a low temporal order, covariation and continuity in time and space (Neu, 2005). In line with this reasoning, Gebauer & Fleisch (2007) emphasizes that managers should start learning the service management approach, by understanding the financial opportunities of services. This same conclusion was drawn from the empirical analysis. Several service managers were aware of the opportunities that service provided, but were unable to capitalise them. Their management did not recognize the potential of services and were hesitant to invest time and resources. These service managers were therefore often limited in their capabilities, which hampered their success in the service market.

The second aspects that emphasizes the importance of a strategic plan, is the required change process. As pointed out by Baines et al. (2009):

“The adoption of a servitization strategy raises significant cultural and corporate challenges” (Baines et al., 2009)

Companies namely have to “(1) change their culture from a product-centered organization to a service-centered organization”, (2) “their focus of customer interactions from transaction- to relationship-based” and (3) “the value proposition to the end-user from product efficacy - whether the products work - to the products efficiency and effectiveness within the end-user’s process” (Oliva & Kallenberg, 2003). Implementing a servitization strategy therefore requires companies to adapt their organizational principles, structures and processes as well as their corporate culture (Gebauer & Fleisch, 2007). However, service management principles are often at odds with traditional manufacturing practices and companies therefore face the risk of internal resistance from areas within the organization where the service strategy is not understood or because of a fear of infra-structural change (Mathieu, 2001; Gebauer & Fleisch, 2007). It is therefore that Gebauer & Fleisch (2007) have emphasized that companies should: “focus on acceptance of the service strategy in all the relevant business units or departments by ensuring their strong involvement in strategy formulation”. Companies thus have to formulate a service vision, mission and strategies that can guide further implementation and eliminate (potential) internal conflicts. The importance of this was again also noted during the interview rounds. The interviews with service managers indicated that a shared vision was often lacking and that sales often had priority over service. Managers were therefore confronted with internal conflicts that hampered the development of the service business. It was in addition noted that the case companies that did formulate a strategic plan, were far more committed and motivated to strive towards success and recognized opportunities that others did not.

The above reveals that there is both theoretical and empirical evidence that stresses the importance of top management commitment. Making a strategic business plan is therefore considered a critical first step in pursuing a servitization strategy. The next chapter will discuss how companies can make an adequate business plan for the service market.

6.2.2 How to make a strategic business plan

There are three critical steps for formulating a strategic business plan. These steps are visualized in Figure 20 and will be discussed in more detail below. What should be noted is that these steps do not reflect the complete procedure of formulating a business plan. They do however emphasize the most critical steps to take into consideration when formulating a business plan for the service market.

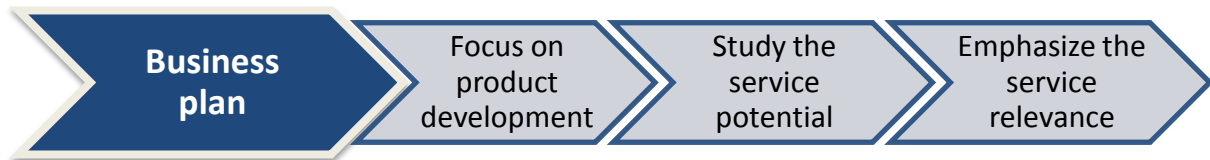


Figure 20: The steps for formulating a business plan

Step 1: Focus on product development

“A strategic plan must be forward looking, robust but flexible, with a keen focus on accommodating future growth” (Mikoluk, 2013). One of the main attractive characteristics of the service market, is that future growth can be developed through an already existing customer base. Growth in the service business is namely inherent to penetrating the installed base, i.e. servicing as much existing customers as possible. Although companies can consider to go beyond the installed base, by servicing complementary or rivalry products, they should in that case be warned that only a few companies have made money by becoming a so called one-stop service provider (Cohen et al., 2006). Only one strategy of the “Product-Market Growth Matrix” as defined by Ansoff, therefore really applies to the service market: product development. Customers heavily vary in their need and willingness to pay and companies therefore have to develop customized service offerings to satisfy different customer segments (Cohen et al., 2006). The importance of customized solutions was also recognized from the empirical analysis. Most case companies did not recognize the need for product development and primarily focused on selling spare parts and some intentional maintenance jobs. As a result, these companies only reached an adoption rate of 40% or less, while the best in class case company sold services to 80-90% of its installed base. This best in class example was also able to sell more service offerings to a single customer and therefore also relatively generated far more revenues. Focussing on product development as a growth strategy should therefore be the point of departure, when developing a business plan.

However, the required competences for successfully developing customized service products are often in stark contrast with that of traditional product manufacturers. It has therefore earlier been motivated that there are two important success criteria for making the required transformation: (1) investments and (2) motivation and commitment. There are therefore two additional critical steps for formulating an adequate business plan. Both of these steps will be discussed next.

Step 2: Study the service potential

Managers cannot be easily motivated to invest resources in extending the service business, since they often fail to recognize its financial potential (Oliva & Kallenberg, 2003). It is therefore that Gebauer & Fleisch (2007) pointed out that: “managers should start learning the service management approach, by understanding the financial opportunities of services”. A good way to indicate this profit potential, is by studying the service adoption rate among the installed base. During the interview round it was noted that the best in class companies all knew the size of their installed base and the adoption rate of their service product, while the other companies did not. It has therefore been concluded that companies should study the adoption rate of their service product, since this can quite accurately indicate the potential of their service business that has not yet been capitalized. The analysis could be made more specific by segmenting the potential revenues on criteria like:

- **Service offering**: studying the adoption rate of service offerings among the installed base, might identify service offerings that are currently not been exploited. Companies are namely often primarily focussing on selling spare parts, but are for example not pro-actively selling maintenance contracts, trainings or for example product upgrades.
- **Customer type**: Analyzing the adoption rate among certain customer segments, might identify certain customer segments that can further be exploited. Companies often treat their customers like a black box with an intentional demand and do not recognize how aspects like for example culture, labour costs and technical knowledge influences the demand and willingness to pay off their customers.
- **Geographically**: segmenting customers geographically might identify geographical locations that can be further penetrated. Manufacturing companies often focus on a global sales but on a local service, due to the logistical challenges.
-

Including an analysis of the service adoption rate among the installed base is considered an important step in formulating a strategic business plan, since it will provide a better insight on how companies can achieve future growth. It will in addition create a better understanding of the service potential that has not yet been captured. This is considered an important aspect for formulating a business plan, since companies have to identify what investments are going to allow the organization to achieve their plan.

Step 3: Emphasize the service relevance

Companies that implement a servitization strategy often meet resistance from areas within the organization that have conflicting interests or where the service strategy is not understood (Mathieu, 2001; Gebauer & Fleisch, 2007). It is therefore important that companies focus on acceptance of the service strategy (Gebauer & Fleisch, 2007). A good way to do this, is by formulating a service vision, mission and strategies that emphasize the relevance of service for the company. This will namely eliminate / reduce the risk of internal conflicts, guide further implementation and cause employees to be committed and motivated. Commitment and motivation are the most quality creating aspects in the service business (Edvardsson and Olsen, 1996) and have been recognized as critical success factors for a successful transition towards services (Gebauer & Friedli, 2005). This was also noted during the interview rounds. The best in class case companies recognized the relevance of service and were far more committed to work towards success. As a result, managers in these companies recognized opportunities that others did not. Formulating paraphrases that emphasize the relevance of service for the company is therefore a third important aspect that companies should take into consideration when developing a strategic business plan.

The next chapter will discuss the steps to be taken at the tactical business level.

In works cited section:

Mikoluk, Kasia (June 2013). Planning in Management: Strategic, Tactical, and Operational Plans
Retrieved from: <https://www.udemy.com/blog/planning-in-management/>.

6.3 The tactical business level

The next stage of the implementation of a servitization strategy, are the decisions made by managers on the tactical level. The decisions on the tactical level require to make a trade-off between the customer's demand and the internal costs of services. It is therefore advised to periodically evaluate these decisions, i.e. once a half year, year or two years.

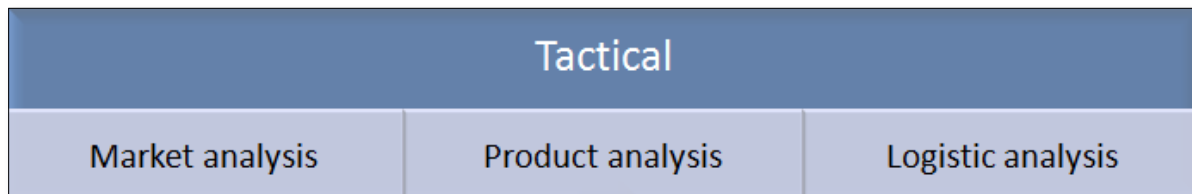


Figure 21: The three steps of the tactical business layers

As visualized in Figure 21, three different analysis are required to come to these decisions: a (1) market analysis, a (2) product analysis and a (3) logistic analysis. It should be noted that these three different business areas are interrelated and that efficient decision making therefore requires to integrate the results of all three analysis. This chapter will motivate why companies have to conduct these analysis and will identify how to conduct each analysis.

6.3.1(a) The reason for a market analysis

A crucial step in implementing a servitization strategy, is the design of the service product. The service product should fulfil the customer's need and thereby enhance the product value for the customer. This is however difficult, since manufacturing companies have to provide service to customers that are located in separate, possibly unrelated, industries and vary in sizes and are dispersed across geographic regions (Neu, 2005). Customers therefore heavily differ in their need and willingness to pay and it is therefore that Cohen et al. (2006) have noted:

"companies have to study the variety of customers and create products and pricing strategies that satisfies different customer segments" (Cohen et al., 2006)

When a company fails in designing customized service offering or does not formulate communication strategies that clearly describe the value proposition of their service offering, they will not capitalize the aftermarket's full potential. This was noted during the interview round. The majority of the case companies merely worked on an ad-hoc base. They primarily delivered spare parts and only intentionally carried out inspections or maintenance. These companies did not design a customized service product or sales strategies and the adoption rate of their service product was therefore low. The company that could be considered the best in class however did. This company designed several "modular service units" that could be combined, according to the customer's liking and was able to achieve a service adoption rate of 80-90%. This company even went beyond the traditional service offerings and recognized opportunities that others did not. They for example recognized that a number of customer's had a limited work space and maintenance jobs were therefore difficult to execute without disturbing the ongoing production. As a result, customers often delayed preventive maintenance jobs, since production was running tense. The company then developed the idea of a mobile workspace in the form of a container. This way, the maintenance staff could work on its own and the customer's disturbance would be minimized. The customers were willing to pay for this extra

service and the idea turned out to be a great success. It therefore sets an example of how a certain creative thinking can help to design customized service solutions. This company in addition also succeeded in communicating the value proposition of service products to their customers. They for example presented the costs of a lower production yield versus maintenance costs, periodically presented their customers the cost of ownership and used discounts in their pricing strategies to create economies of scale. It was because this company was able to create a mutual value, that they had become far more successful in capitalizing the service market. This particular example therefore provides additional empirical evidence of what has been stressed in many marketing related literature. How companies can enhance their abilities in creating a mutual value, will be discussed next.

6.3.1(b) How to do a market analysis

In order to sell service to a large variety of customers, companies have to design customized service solutions. Companies therefore have to study their installed base and design service offerings that meet the need and willingness to pay of different customers segments. The goal of this step is to generate a maximum amount of profit from the installed base. Four critical steps have been identified for an adequate market analysis, which are visualized in Figure 22.



Figure 22: The steps for a market analysis

Each of these steps will be discussed in more detail below. What is important to bear in mind, is that services have an intangible nature that make the value proposition of the service product less clear to the customer. During the complete design process, companies therefore have to focus on communication strategies that clearly describe the value proposition of the service product to the customer (Mathieu, 2001).

Step 1: Segment customers

The first step in designing an effective customized service offering, is studying the variety of customers. During the interview rounds, several managers indicated that due the variety in customers, they struggled to or deliberately choose not to, become pro-active in selling their service product. They however, never studied this variety and treated their customer base like a black box with an intentional demand (ad-hoc). To study the variety, companies could start by segmenting customers to create a better understanding of the variety in need and willingness to pay. Criteria that could be used to segment customer, are for example:

- **Product use:** the product use is a an important aspect to consider, since it directly influences the criticality of the product. The type of production (continues, batch) for example has a major influence on the product's criticality and its required uptime. Another aspect to consider is for example the product's capacity. If this is limiting the production speed, the machine forms a crucial role in the production process and again the uptime is critical. Such aspects therefore have a major influence on the customers need and willingness to pay.

- **Geographical location:** the geographical location is a good indicator for the customer's behaviour and willingness to pay. The culture differs, the currency and the cost of labour. Customers in England could for example want to outsource the complete maintenance, while a customer in Asia only demands spare parts and a supervisor for the maintenance process.
- **Type of market:** the type of market can be another indicator for the customer's product use, need and willingness to pay. Seasonality patterns, norms, regulations and profit margin can for example differ significantly and influence the customers need and willingness to pay.
- **Technical knowledge/capacity:** companies with a larger technical knowledge/capacity often have their own maintenance staff and are therefore able to operate individually. These companies would therefore probably only be interested in the availability of spare parts. Companies that do not possess this knowledge/capacity might want to outsource the complete maintenance or invest in gaining this knowledge by for example trainings.
-

The segmentation of customers can help to design an effective customized service offering, since it can help to indicate target areas. A company can for example choose to start focusing on the customer segment that is currently covered the least, has the highest revenue potential or requires the smallest investments. It will thus allow remedial effort to be directed where it will produce the greatest value. By specifically targeting one group at a time, the chance of success will also be increased, since it makes the step of designing a service product more manageable.

Step 2: Determine service offerings

After customers are segmented and the target areas are indicated, the company can start designing a service product by determining the service offerings. Effective customized service offerings can either be achieved by combining a base package of standard services with particular service options or by designing modular units that can be "mixed and matched" in different combinations (Baines et al., 2009). Basic service offerings are for example:

- Delivery of spare parts;
- Inspections;
- Preventive / corrective maintenance;
- 24 hours availability;
- Training;
- Modifications / retro-fits;
- Installation / refurbishment / disposal;

However, as pointed out by the example of the best in class case company, other offerings might fit the customer's need as well. Companies could thus be creative and offer services that even a customer or competitor did not think of yet, as long as the customer is willing to pay for it. In general it can be stated that the more mature companies offer more service products. They have identified a range of service products that can be combined to satisfy each customer segment and therefore in general, have a higher adoption rate of the service product among their installed base.

Step 3: Determine business models

While designing an effective and customized service offering, companies also have to develop multiple business models. They have to design revenue models and adapt these to the customer's need. Like the service offerings, the business models also have to be customized to match each customer segment. The business model drives the incentives and will eliminate a (potential) conflict of interest between the customer and the manufacturer. Examples of different business models have been illustrated by Cohen et al. (2006) and are presented in Figure 23.

Models of After-Sales Services		The value companies place on after-sales services will determine the business models that firms can use to deliver them. When services are all-important, manufacturers may choose to sell services rather than the products that generate them.		
SERVICE PRIORITY	BUSINESS MODEL	TERMS	EXAMPLE	PRODUCT OWNER
None	Disposal	Dispose of products when they fail or need to be upgraded	Razor blades	Consumer
Low	Ad hoc	Pay for support as needed	TVs	Consumer
Medium-high	Warranty	Pay fixed price as needed	PCs	Consumer
Medium-high	Lease	Pay fixed price for a fixed time; option to buy product	Vehicles	Manufacturer; leasing company
High	Cost-plus	Pay fixed price based on cost and prenegotiated margin	Construction	Customer
Very high	Performance based	Pay based on product's performance	Aircraft	Customer
Very high	Power by the hour	Pay for services used	Aircraft engines	Manufacturer; service provider

Figure 23: Several business models based on the service priority of the customer (Cohen et al., 2006)

Based on the customer's priority of service, Figure 20 indicates seven possible business models that companies can adapt. Moving towards a higher service priority, the business models become more difficult and it is therefore that existing literature emphasizes that companies should slowly work towards more complex contract types. In general, it can be stated that the more mature companies use more types of business models, since due to the different customer segments, different needs have to be fulfilled. However, the numbers of business models or the degree of the responsibility that the manufacturer takes, do not per se reflect the maturity of a company. Many existing servitization maturity models (Atos Consulting, 2011; Meijl, 2012; Neff et al., n.d.) see lease contracts and performance based contracts (used for example in the automotive and copier market) as the last maturity state in the servitization development. Although performance based contracts require a certain effectiveness and efficiency in the after sales service process to become successful, it might be that it will not match the customers need. This was namely found during the interview rounds. The best in class case had reached an adoption rate of 80-90 percent without offering lease or performance based contracts, simply because their customer did not demand such service. So the

effectiveness of these business models largely depends on the maturity of the market and its customers. Striving towards more complex business models should thus not be a target on its own. However, the empirical analysis has shown that most companies primarily focus on ad-hoc business models and do not sell any maintenance contracts. The majority of the case companies were namely often averse to the risk of making any service level agreements, which hampered the further development of their service business. Established service contracts can namely generate additional income, while at the same time reducing the variability and unpredictability of demand. It will therefore allow a higher average capacity utilization (Oliva & Kallenberg, 2003) and thereby enhances both the effectiveness and efficiency. Moving towards service contracts is therefore considered an important development opportunity in the capital intensive market.

Step 4: Determine pricing strategies

The fourth step of the market analysis is to determine pricing strategies. Companies have to study the price sensitivity of several service offerings, to create a better understanding on how to price services. What for example especially holds for spare parts, is that companies can face fierce competition outside their usual domain (Mathieu, 2001; Oliva and Kallenberg, 2003). Companies should therefore differentiate pricing strategies on the price sensitivity of parts. While consumables are readily available, parts that have to be manufactured are not. Both categories therefore have to be priced differently. Otherwise, customers might order a significant part of their spare parts at their local supplier, which eliminates the opportunity of creating an economy of scale. This same price differentiation should also be applied to maintenance jobs. Preventive maintenance for example has to be cheaper than corrective maintenance, to motivate customer to conduct regular maintenance. Regular maintenance can be planned and therefore reduces the variability and unpredictability of demand. The win-win scenario from a cost perspective for both parties should therefore be reflected by its prices (for example by using discount offerings). Modificative maintenance requires special attention. It could namely be that replacing an obsolete part or upgrading the capacity might delay a customer's purchase. It might therefore be in conflict with sales and companies therefore carefully have to consider how to price such offering.

Long-term development opportunities

A critical success factor for designing an effective service product is customer knowledge. Companies might therefore consider implementing a customer relationship management (CRM) strategy to enhance their ability of creating a mutual value for the company and its customers. However, CRM is not considered a necessity and might require a significant investment. It is therefore considered as a potential long-term development opportunity.

The next chapter will discuss the second analysis to be conducted on the tactical business level; a product analysis.

6.3.2(a) The reason for a product analysis

Service is provided to attain a desired functionality. Manufacturing companies should therefore study their product and decide how the downtime for the customer can be minimized. They have to design maintenance plans that can prevent product failures and have to identify critical spare parts that need to be stocked. In other words, the product analysis is concerned with the following decision making issues:

(1) How to pre-plan and pre-schedule maintenance work for sophisticated equipment under a complex operating environment? (2) How to reduce the high inventory cost for spare parts? (3) How to avoid the risk of catastrophic failure and eliminate unplanned forced outage of equipment or systems? (Yam et al., 2001)

An important step of implementing a servitization strategy is therefore a product analysis. During the interview round multiple managers pointed out that the variety in products and product use made it difficult for them to become more pro-active in selling services. Products are often customized and operate in a complex environment. Formulating adequate maintenance plans is therefore difficult and since most managers were highly averse to risks, companies were hesitating in making any service level agreements (SLA'S) about the products performance or the availability of spare parts. These companies often provided the customer with a recommended spare parts list and approached service with an ad-hoc approach. They were therefore only servicing customers after a breakdown, which makes it extremely difficult to capitalize the service market's potential. First of all, breakdowns are not prevented and the whole purpose of providing service is to attain a desired functionality for the customers. In addition, it becomes impossible to plan services, which means that everyone is running tense and delays and mistakes happen more often. This combined with the fact that these companies only focused on delivering general parts and some intentional maintenance, also made it difficult to compete on the service market. These companies barely offered any more service than suppliers and distributors and such organizations often benefit from an economy of scale.

Next to the "worst cases", were the companies that did formulate maintenance plans and conducted some intentional preventive maintenance. However, also these companies were hesitating in making any commitments and still merely worked on an ad-hoc base. This means that also these companies never made a trade-off between the costs and revenues of servicing a part. Even if companies work on an ad-hoc base, servicing a part means that employees have to collect technical information, make agreements with suppliers on unit price and lead times and have to communicate this to the customer. Before doing all this it should be considered whether the costs are worth the benefits. These companies were therefore more effective, but not necessarily also more efficient.

The "best case" that was found during the interview, was a company that was pro-active in selling services. These companies formulate maintenance plans and took over the complete maintenance for 20 percent of the customers. Maintenance time and costs were scheduled at the beginning of the year and this planning was used for the allocation of resources (both human and spare parts). They in addition formulated a spare parts portfolio and distinguished consumables parts from repairable parts. They even designed retro-fits for parts of their product that became obsolete (product software). This company experienced the same challenges as the other case companies, but invested resources in gaining technical product knowledge. They for example used a software tool in which inspections, maintenance jobs and products failures were logged, which gave them the opportunity

to better understand their product and its complex operating environment. This company was therefore extremely effective in attaining a desired functionality for the customer and were able to do so while generating substantial profit. It therefore sets a perfect example to motivate the importance of a product analysis. How a product analysis should be conducted, will be discussed next.

6.3.2(b) How to do a product analysis

To design the service offerings from a technical point of view, companies have to study their product and its functioning. Companies therefore have to study the trade-off between product functioning and maintenance costs. For this step, the goal is to maximize the uptime of the product, while minimizing the costs. Three critical steps have been identified for an adequate product analysis and are visualized in Figure 24.



Figure 24: the steps of a product analysis

The three steps will be discussed in more detail below.

Step 1: Study the product and determine portfolio

The first decision in the product analysis is concerned with defining a product portfolio, i.e. the products that will be serviced. A company can decide to support all of its products completely, a part of it, or maybe even rival or complementary products (Cohen et al., 2006). This last can be considered, if a company can generate economies of scale due to synergies in the product. It however has been noted by Cohen et al. (2006) that only a few companies were successful in becoming a “one-stop service provider”. For the products that the company sold itself, there are several options to consider. They can for example service all parts, only the parts that are core business (in the case of assemble/configure to order), or only current product generations (depending on the products life cycle). To adequately make this decision, companies have to gain a better insight into the variety between their products. The challenge that companies face in defining a product portfolio is namely caused by the customization of products. During the interview rounds multiple managers pointed out that a significant part of their product was customized, which made it difficult for them to become more pro-active in delivering services. However, what was quite revealing, is that none of these managers could indicate the range of customization. By studying the customization of their product, these companies might have quite easily enhanced their service performance. Assuming for example a relative worse case, namely that 70 percent of the product is unique and only 30 percent would be standard. The company could then at least actively service the 30 percent of the product that is standard. For the remaining 70 percent of the product, the product hierarchy could have been studied to decide whether it would be beneficial to even service a larger part of the product. If for example multiple customized parts can be made from one basic part, it could consider to include that basic part in the assortment (Huiskonen, 2001). This strategy might reduce the costs of the part and significantly shorten its lead time, making it attractive to service it. Another strategy might be to find one or more specialist of which its core business is to offer customized solutions (Huiskonen, 2001). The benefits from the economies of scale might make it

worthwhile to include the part in the assortment. In addition to studying the customization of the product, companies also have to identify potential obsolete parts. For (potential) obsolete part, a company might decide to offer modificative maintenance offerings that will allow the extension of the product life cycle. However, implementing such strategy might require close consultation with top management, since it can lead to a conflict of interest with the manufacturing business.

Step 2: Develop maintenance plans

After the product portfolio has been identified and companies indicated what products will be actively serviced, they should develop maintenance plans that are necessary for attaining a certain functionality. A good way to develop such maintenance plan, is by conducting a failure mode and effects analysis (FMEA, FMECA or FAMECA). These analysis are related to reliability engineering and are for example covered in the book “Reliability handbook of engineering”, by Dimitri Kececioglu. Failure mode analyses are used to study the failure modes and effects on either the functional or piece-part level. The result highlights failure modes with relatively high probability and severity of consequences, allowing remedial effort to be directed where it will produce the greatest value. These analysis therefore provide a structured methodology for formulating an effective and efficient maintenance plan. Maintenance strategies can either be:

- Time-based: periodically replacements (based on for example mean-time-to-failure);
- Operational-based: operational hours determine maintenance activities (restricted life time based on manufacturers advice or regulations);
- Condition-based: subjective judgment or sensors are used to indicate the technical state (inspections or CBM);
- Failure-based: parts are repaired or replaced after failure (ad-hoc).

Each of these strategies has their own condition under which they suit the best. Parts that wear can for example be managed with a condition-based strategy, parts that do not wear (e.g. electronic parts) can be replaced periodically and non-critical parts could for example be repaired or replaced after-failure. It should however be noted that the customer’s need and the internal costs for implementing each of these strategies should be carefully considered as well. Condition based maintenance (CBM) for example is a complex and expensive strategy to implement, and the customer might therefore not be willing to pay for such service. So although it might be the best option from a technical point of view (i.e. maximize the product’s functionality), it might not be the most successful strategy.

Step 3: Define a spare parts assortment

The product portfolio and maintenance policies provided an overview of all the relevant spare parts. With this information, a spare parts assortment can be defined, which will identify the spares that need to be actively managed. It can be considered an important step, since it will form the decision criteria for the logistic analysis on the tactical level and all the processes on the operational level. The spare parts assortment can therefore be considered a “handbook” that provides an overview of all the relevant spares and their technical information. Examples of technical information that can be included have been identified by Driessen et al. (2012):

- Criticality: based on the change of failure, impact of failure and detectability;
- Commonality: how often a part is used;
- Specificity: the extent to which a parts is tailored;
- Substitution; whether a parts has the same form, fit and function;
- Shelf life: the time a parts quality remains acceptable for usage;
- Reparability: whether a part is repairable.
-

Additional information can be included in the assortment as well, but one has to bear in mind that gathering and maintaining technical information raises operational costs. Defining a spare parts assortment therefore requires making a trade-off between the cost of including the part and the customer’s need. When a part is included but never needed, there are unnecessary operational costs while a part that is not included can result in an additional delay after a breakdown (Driessen et al., 2012).

An important aspect to consider when formulating and maintaining the spare parts assortment, is the often growing amount of articles in the database. During the interview rounds several managers pointed out that defining a spare parts assortment is difficult, since the database of articles is not fixed, but constantly evolves over time. Engineers namely kept adding new article numbers to the database. This was first of all, since they liked to design new and better solutions and were not aware of the additional handling costs for the other departments. The second reason for an engineer to add new article numbers, could be an already contaminated article database. If searching an existing article becomes a lot of work, he can save time by making a new article. To illustrate the above, an example of a company was found that critically went through the article database. Of all the articles that were listed, only 10 percent turned out to be unique. All the other articles were duplicates or same articles with a slight adjustment (like for example an extra hole or a different tolerance). Since the article database was so contaminated and engineers kept entering new articles, this article database kept growing with 3% a month. While defining a spare parts assortment, one therefore has to critically go through the existing article database and manage the conflict of interest between the service department and the engineering department.

Long-term development opportunities

A critical success factor for effectively and efficiently maintaining equipment, is technical knowledge. The better a company understands how their product operates and functions, the better they can develop adequate maintenance plans. However, it was noted during the interview round that only a few companies monitored and stored technical information like failure data. These companies might therefore consider to more actively gather and collect relevant technical information to build the required insight and expertise for effectively and efficiently maintaining their equipment.

Another critical success factor for effectively and efficiently maintaining equipment, is the degree of standardization. Standardization in the product design will not only enhances the transparency of the product performance, but will also reduce handling costs. As pointed out by Donders (2009), less standardization in the design of the product will namely lead to higher logistical costs. As a long-term development opportunity, one might therefore consider to work towards more standardization in the product design, i.e. a customer order decoupling point (C.O.O.P) that lies more downstream. This might namely lead to cost efficiencies in both the manufacturing business and the service business.

The next chapter will discuss the third analysis to be conducted on the tactical business level; a logistic analysis.

In works cited section:

Jürgen Donders (September 2009). Gebrek aan standaardisatie in het ontwerp veroorzaakt hoge logistieke kosten, Retrieved from: www.logistiek.nl

6.3.3 (a) The reason for a logistic analysis

To support a geographically distributed in installed base, manufacturing companies have to set up a distinctive after-sales services supply chain. As visualized in Figure 25, the service supply chain differs in many ways from the manufacturing supply chain. The service network has to cope with more stock keeping units, more locations, more uncertainty and often has to be contend with reverse logistics (Cohen et al., 2006). It is therefore that:

Effective supply chain strategies for the manufacturing business may not be appropriate in the service sector (Sengupta et al., 2006).

Two Chains Compared Companies neglect after-sales services supply chains because they're tougher to manage than manufacturing supply chains. Their performance suffers by comparison, too.	PARAMETER	MANUFACTURING SUPPLY CHAIN	AFTER-SALES SERVICES SUPPLY CHAIN
	Nature of demand	Predictable, can be forecast	Always unpredictable, sporadic
	Required response	Standard, can be scheduled	ASAP (same day or next day)
	Number of SKUs	Limited	15 to 20 times more
	Product portfolio	Largely homogeneous	Always heterogeneous
	Delivery network	Depends on nature of product; multiple networks necessary	Single network, capable of delivering different service products
	Inventory management aim	Maximize velocity of resources	Pre-position resources
	Reverse logistics	Doesn't handle	Handles return, repair, and disposal of failed components
	Performance metric	Fill rate	Product availability (uptime)
Inventory turns (The more the better)		Six to 50 a year	One to four a year

Figure 25: Differences between a manufacturing and after-sales service supply chain (Cohen et al., 2006).

However, it has been noted by both Cohen et al. (2006) and from the empirical analysis, that most companies do not recognize this distinction. In fact, they often use a single supply chain for both businesses, while the two differ in many ways. Since companies often fail to recognize this distinction, they used the same strategies, methods and tools for both businesses, even though literature emphasizes that the processes and tools that for the manufacturing business are not suitable for the service market. Huiskonen (2001) for example point out that: "the impact of a shortage of a critical part may be a multiple of its commercial value, which makes an ordinary ABC-analysis an insufficient control tool ". In addition, there are academics and business consultants that emphasize that most enterprise-resource-planning (ERP) systems are not suitable to determine stock sizes, given the intermittent and lumpy demand patterns of spare parts (Cohen et al., 2006; Donders, 2009). The fundamental problem is that the manufacturing business can be planned and scheduled and can therefore often be managed with a just in time approach (JIT) to minimize costs. In the service business however, time is the most critical value driver and the demand is a lot more flexible and sporadic. The service supply chain therefore has to be more agile than lean and matching the demand and supply requires flexibility. As noted by Cohen et al. (2006):

“to win in the aftermarket, executives need to recognize that after-sales services are a commitment companies make to respond within a specific time frame to the customer’s need for support” (Cohen et al., 2006)

However, as was noted during the interview round, most companies do thus not seem to recognize that they have to make such commitment and they are instead often focused on minimizing their logistic costs. They for example provide the customer with a recommended spare parts list and are hesitant to make any service level agreements about lead times or availability. With such risk averse behaviour, selling service contracts and successfully competing on the service market becomes extremely difficult. These companies namely barely offer any more service than wholesalers and distributors and such organization often benefit from an economy of scale. The best in class case companies however, did make such commitment. These companies designed a distinctive after-sales service supply chain and made significant investment in stockpiles of spares. These companies made service level agreements about the availability of spares and lead times and were rewarded with loyal customers and revenues. Although even these companies still often used the wrong methods and tools for handling the service logistics, committing themselves to on time deliveries had already made them more successful. However, also these companies could significantly increase their efficiency when adapting the appropriate methods and tools for the service market. How companies should conduct a logistic analysis will be discussed next.

In works cited section:

Jürgen Donders (Maart 2009). Sturing op servicegraad werkt niet bij spare parts, Retrieved from: www.logistiek.nl

6.3.3 (b) How to do a logistic analysis

To support a geographically distributed in installed base, manufacturing companies have to set up a distinctive after-sales services supply chain. Companies therefore have to weigh the levels of response customers need against the prices they are willing to pay (Cohen et al., 2006), by conducting a logistical analysis. The goal of this step is to design a supply chain that can deliver spare parts to the right place within an agreed-upon time, while minimizing costs. Four critical steps have been identified for conducting an adequate logistic analysis and are visualized in Figure 26.



Figure 26: steps of a logistic analysis

Each of these steps will be discussed in more detail below.

Step 1: Design an after-sales network

An after-sales service supply chain is often a multilevel distribution network (Cohen et al., 1997) and having a clear overview of the exact flow of material and information might therefore be difficult. Developing a supply chain map which clearly shows the entities, their contributions, the various flow types, and the way the business is organized, can therefore lead to effective supply chain decision during the planning or implementation of a supply chain strategy (Barroso et al., 2011). There are several aspects that need to be considered when developing a supply chain map for the service market.

- **Supply chain entities**

The supply chain mapping should start by identifying the amount and location(s) of the relevant entities in the supply chain, like suppliers, repair centres, warehouses, service centres and customers. The analysis can be further detailed by distinguishing supplier types (wholesalers/manufacturers) and customer types (loyal, impulse etc). Mapping the entities in the supply chain provides a better view of the hierarchy of locations from which the company can supply parts.

- **Relational links:**

After the entities are mapped, there should be indicated how the entities are related to one another. To provide a comprehensive overview of these relations, companies have take reverse logistics into consideration as well as direct deliveries from suppliers to customers. During the interview round it was noted that almost none of the case companies used such relation, while it can significantly reduce lead times and handling costs.

- **Material flows:**

Companies have to identify the type of material flows between the entities. In general, three types of material flows can be distinguished: preventive, corrective and modificative maintenance (Driessen et al., 2012). It is important to make this distinction, since the material flows differ in value driver and should therefore be handled differently (for example the mode of transportation). A fourth flow that might be distinguished, is the disposal of products.

Step 2: Categorize spare parts

The second step of the logistic analysis is studying the variety of spare parts. Both the theoretical as the empirical analysis have shown that companies face a significant challenge in managing the large variety of spare parts. Companies therefore have to study their spare parts portfolio in order to create a better insight into this variety. Characteristics that can be studied are for example:

- Criticality: the criticality of a part can be considered the most important feature to for designing a logistic network, since it relates to the consequences caused by the failure of the part. An exact determination of the criticality is not needed, but it is important to determine a few degrees of criticality;
- Price: the price is another important aspect to consider, since it directly indicates the handling costs of the part. Several ranges can be used;
- Availability: the availability relates to the specificity of a part and indicates the complexity of acquiring a part. Groups that can be distinguished are for example: consumables, repairables, customized parts and potential obsolete parts;
- Lead time: lead times are important to consider since they indicate the potential risk of a stockout;
- Demand: services typically includes a large amount of spares with a very low demand volume, which limits the handling options;
- Demand pattern: indicates the predictability of demand and therefore indicates the uncertainty of handling the part;
-

Additional characteristics can be used as well (i.e. size and weight of parts), but the above mentioned characteristics are considered the most important for developing an after-sales supply chain. These characteristics namely directly indicate the challenges of service logistics and creating a better understanding of these challenges will allow remedial effort to be directed where it will produce the greatest value. It is therefore recognized as an important qualifier for successfully conducting the next two steps of the logistic analysis.

Step 3: Determine supply chain strategies

After companies have mapped the supply chain structure and studied their portfolio, they can adequately decide upon supply chain strategies. By using distinct groups of spare parts, companies can differentiate a distribution operation, which is considered an important step due to the large variety in characteristics of spare parts. Several supply chain strategies and their applicability will be discussed in more detail below.

- **Pooling**: when there are a few closely located customers a company can consider to set up a collaborative stocking pool for low volume, high value parts (Huiskonen, 2001). A pooling strategy can namely smooth out the sporadic demand of individual users and significantly lower the required capital investment.
- **Partnering**: a possible development strategy for customized parts, is to search for a smaller local manufacturer in order to subcontract the fabrication of these special parts (Huiskonen, 2001). When providing the required drawings and tools, this supplier might be able to fabricate and deliver parts with shorter lead times, eliminating the need for expensive safety stocks. It could therefore create a win-win situation for all actors.
- **Outsourcing**: outsourcing the warehousing and transportation might be worth considering for parts that are not core business or for geographical locations that are difficult to cover. In such case, the services are physically handled by a third-party distributor but still owned and often controlled by the capital equipment manufacturer (Cohen et al., 1997). Outsourcing can reduce the fixed costs and allows focusing on the core business / customers. It might in addition be that the third-party distributor has an advantage over individual companies, due to the presence of economies of scale and scope.
- **Repair strategy**: for parts that are repairable, one might consider a repair strategy. Repairing a part can be economically efficient and shorten lead times. It might therefore save significant maintenance and inventory costs (Driessen et al., 2012).
- **Collaboration**: for consumables that are widely used it might be worth to collaborate with either customers or suppliers to create an economy of scale. For parts that are often demanded, suppliers for example might be willing to hold stocks and offer special services, like 24-hour delivery (Huiskonen, 2001). On the other hand, by forming a pack with customers, one might be able to enhance the buying power and therefore be able to negotiate better contract terms.
- **Safety stocking**: safety stocks are necessary for all the parts of which the lead times are longer than the time to tolerate a stockout situation in case of a machine failure (Huiskonen, 2001). Safety stocking is therefore considered the most important supply chain strategy for the service business. This strategy however, can be used in several ways and companies should therefore study the interplay between the geographical and product hierarchy, since it quite easily reveals the trade-off between the costs and response time of several configurations. Stocking complete products at the customer location would for example be the fastest but most expensive option, while stocking parts at suppliers might be the slowest but cheapest option to restore the product. Companies should therefore first decide upon where to stock which parts, before developing inventory policies in the next step.

Step 4: Define inventory strategy

After there is decided upon where to stock which parts, companies have to develop an inventory management system that can guarantee necessary lead times, while minimizing costs. To formulate an effective and efficient inventory management system, companies have to differentiate stocking policies on the characteristics of spare parts. There are several options for defining such inventory policy, but it should be noted that: “the impact of a shortage of a critical part may be a multiple of its commercial value, which makes e.g. an ordinary ABC-analysis an insufficient control tool” (Huiskonen, 2001). A good example of how to formulate stocking policies is provided by Driessen et al. (2012) and visualized in Figure 27.

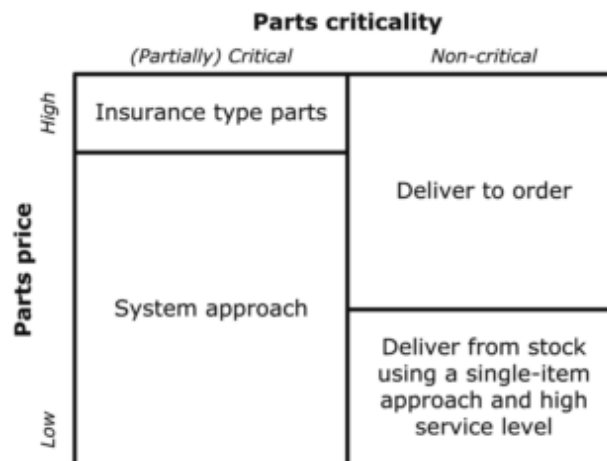


Figure 27: An example of a multi-item inventory management approach (Driessen et al., 2012)

Driessen et al. (2012) distinguishes four subsets of spare parts based on the criticality and price and differentiates stocking policies for each subset, to allow remedial effort to be directed where it will produce the greatest value. Parts that are both cheap and non critical are delivered from stock using a high service level. Non-critical, high-value parts are delivered to order. For critical parts, different strategies are used. The availability of critical parts is required to reduce system downtime and to efficiently manage these parts, one has to differentiate the service levels based on its price. In other words, the lower the parts price, the higher its service level. This approach will namely minimize the costs of achieving a certain service level. The fourth group that Driesen et al. distinguishes are insurance parts. Insurance parts are expensive critical parts. For this group, it is relevant to consider additional characteristics (like availability, lead time, etc) to determine an appropriate stocking policy.

The example of Driesen et al. does not provide a unambiguous method for all companies, but does emphasize two important aspects to consider when formulating stocking policies in the service business. Companies first of all have to focus on the criticality of spare parts, since minimizing downtime should be the main value driver. Second of all, companies have to use a system-approach in order to minimize costs. A system approach implies that service levels are system-oriented, i.e. they are not defined for individual components, but for the system as a whole (Kranenburg, 2004). This is an important aspect to consider, since spare parts inventories are often a significant cost factor and companies therefore have to strive for efficiency to minimize inventory costs.

Long-term development opportunities

There are two potential long-term development opportunities for managing the logistic of the service market. First of all, several case companies used an online ordering system for managing spare parts orders. Online ordering allows customer to order spare parts 24/7, from almost any location around the world and can therefore be considered an additional service for customers. For the company itself, it might eliminate certain handlings and therefore allow a higher efficiency.

Another long-term development opportunity might be a multi-echelon inventory system. A multi-echelon inventory incorporates the inventory levels across the supply chain, while taking into account the impact of inventories at any given level or echelon. It therefore allows the optimization of inventories across the end to end supply chain and might therefore lead to a significant increase in efficiency. Nonetheless, multi-echelon inventory structures are certainly not a development opportunity for the majority. They are complex to implement, require a significant investment and a certain scale of economy. The best in class case company had considered to use such structure, since they operate globally and hold several inventories at multiple locations. However, the ICT infrastructure of the echelons was not compatible and the required investment was therefore not deemed profitable. A multi-echelon inventory system might be a potential long-term development opportunity, but as pointed out by this example, is certainly not an opportunity to all.

Another long-term development opportunity that might be more widely applicable, is a dedicated spare parts management tool. As stated earlier, most enterprise-resource-planning (ERP) systems are not suitable to determine stock sizes, given the intermittent and lumpy demand patterns of spare parts (Cohen et al. 2006; Donders, 2009). Companies might therefore consider buying a dedicated spare parts management tool. Such tools are designed to cope with the sporadic and volatile demand with which most spare parts are characterized. They therefore allow companies to study this variety and to determine stock levels based on more advanced forecasting methods. It might therefore help to determine adequate stock levels and thereby enhance the efficiency of the inventory management.

The next chapter will discuss the steps to be taken on the operational level.

6.4 The operational level

As pointed out by Oliva & Kallenberg (2003) most challenges at the implementation level are in the organizational change domain. Companies therefore have to conduct an organization analysis to indicate how they can manage the operational business processes and gradually enhance their capabilities in doing so. This chapter will first emphasize the importance of an organization analysis, after which it will indicate how companies can conduct such analysis.

6.4.1 (a) The reason for an organization analysis

Companies have to deploy parts and people at a geographically dispersed installed based and have to do so within a certain timeframe to meet service level agreements. In addition, “once the service system is in place, it becomes a fixed cost and the main driver of profitability is capacity utilization” (Oliva & Kallenberg, 2003). The organization of service processes therefore requires to design the whole service process in detail, including micro-processes and individual activities (Edvardsson & Olsson, 1996) and to integrate these processes (Christopher, 2000; Neu, 2005). Integrating both the inter- and intra-company processes can enhance the operational performance in terms of speed and quality (Sengupta et al., 2006). This has also been noted by Durmusoglu & Kulak (2008), who recognized that:

“In service firms, studies show that approximately 98 percent of customer lead time consists of non-value-added activities. Therefore, if such activities were eliminated, customer lead time could be reduced, considerably” (Durmusoglu & Kulak, 2008)

However, here companies face a significant challenge. The highly integrated resources in the service business causes managerial actions to have a low temporal order, covariation and continuity in time and space (Neu, 2005). Service in addition includes a volatile and unpredictable demand and effectively addressing the uncertainty of the service market requires higher levels of information processing (Neu, 2005). It is therefore that Oliva & Kallenberg (2003) pointed out that: “Two new capabilities have to be developed to run a distributed service network effectively: the capability to diffuse knowledge across the network and the ability to manage large organizations of service personnel”. However, the empirical analysis has shown that most companies do not yet possess these capabilities. Most companies worked on an ad-hoc base and allocated service tasks to employees, as an add-on to their daily job. This often leads to capacity problems due to internal conflicts, but also made it difficult to manage the service organization. Roles and responsibilities were in-transparent and managing a large number of highly integrated resources then becomes extremely difficult. These companies did also often not monitor any control variables and were therefore unaware of their inefficiencies.

The company that can be considered the best case in class had developed these capabilities over time. They analyzed the service process and identified roles and responsibilities for each actor in the process. Both the external performance and internal performance were constantly monitored and periodically evaluated. This company also recognized the importance of intra- and inter-company information sharing. Due to these aspects, this company was able to enhance its ability in effectively and efficiently managing the service processes. The company had developed an agile organization that was able to effectively and efficiently operate in the challenging service market. Like this best in class case, companies have to design an effective and efficient service organization. They therefore have to study their organization and indicate how they will gradually enhance their abilities.

6.4.1 (b) How to do an organization analysis

Companies have to design an organization that is capable of managing a large amount of integrated resources in a dynamic environment. The goal of this step is to define an organization that will manage the operational processes in the most effective and efficient manner. Companies therefore have to study the service processes and indicate how they will be managed. Five critical steps have been identified for designing an adequate service organization and are visualized in Figure 28.



Figure 28: steps of an organization analysis

Each of these steps will be discussed in more detail below.

Step 1: Model the service processes

As pointed out by Edvardsson & Olsson (1996), the organization of service processes requires to design the whole service process in detail, including micro-processes and individual activities. Companies should therefore start the organization analysis by modelling the service processes. This can be done by indicating how several (fictitious) service orders are processed. What is important to bear in mind, is that different service orders have different value drivers. Preventive maintenance can be scheduled and planned to minimize costs, but for corrective maintenance, time is the most critical value driver. Each of these orders should therefore be handled differently.

In Business Process Modelling, the following aspects have to be indicated: (1) activities, (2) actors, (3) communication, (4) decisions, (5) control signals or triggers, (6) order status (Hartmanis & Leeuwen, 2000). What can furthermore be useful to consider, is that the following three types of business processes can be distinguished:

1. Management processes that govern the operation of a system;
2. Operational processes, that constitute the core business and create the primary value;
3. Supporting processes.

Modelling the service processes will provide a better insight and understanding of all the relevant aspects of organizing the business processes and will therefore provide the input for integrating the services processes.

Step 2: Indicate roles and responsibilities

After the modelling of the business processes has identified the relevant actors and their activities, it is important to formulate clear roles and responsibilities. Indicating the roles and responsibilities is considered an important step for designing an integrated service organization, since it will provide coordination, clarification and alignment of the parties concerned. The roles and responsibilities of the actors involved can be visualized by for example a RACI-table. In a RACI-table, each of the actors are linked to a result, process or task and given a responsibility. As visualized in Figure 29, there are four types of responsibilities that can be distinguished.



Figure 29: RACI definitions visualized⁴

What is furthermore important to bear in mind while formulating roles & responsibilities, is that there should clearly be described what is expected from each actor. In other words, if someone is given a task, it should be explained what the person have to do in order to successfully complete it. This is considered important, since simply making someone responsible will not yet lead to the desired outcome of integrated operational processes.

Step 3: Design a monitoring system

An organization that wants to change its orientation from products to services needs to adapt its performance measures to anchor the transition successfully” (Servitization in product companies, Atos Consulting, White paper, 2011). Designing a monitoring system is considered an important step, since the highly integrated resources in the service business causes managerial actions to have a low temporal order, covariation and continuity in time and space (Neu, 2005). It will therefore provide the visibility required for managing and controlling the service processes. As pointed out by Donders (2008), a good way to develop such monitoring system, is by designing a so-called “KPI-tree”. A KPI-tree represent an overview of the relevant performance indicators and their relation to one another and assigns each performance indicator to an actor, department, business unit or supply chain entity. The following procedure can be followed for formulating a KPI-Tree:

⁴ Source: <http://www.theilm.com/leadership-solutions/project-management/raci/>

1. Formulate one or more service goals (e.g. internal and external oriented);
2. Indicate key performance indicators that can measure the goal;
3. Divide these key performance indicators into underlying performance indicators;
4. Further subdivide performance indicators;
5. Assign performance indicators to actors;

The KPI-tree can be as detailed as one seems valuable, but it has to be kept in mind that monitoring indicators requires time and effort. Designing an effective and efficient monitoring systems therefore requires to make a trade-off between the enhanced transparency of the service processs and the monitoring costs.

In works cited section:

Jürgen Donders (Mei 2008). Stappenplan voor succesvolle KPI's, Retrieved from: www.logistiek.nl

Step 4: Formulate targets

After one has identified a KPI-tree that indicates relevant performance indicators and their relation, targets can be defined. Targets will align actors and in addition lead to motivation and commitment of employees, which are the two aspects that can be considered the most quality creating factors in services (Edvardsson and Olsen, 1996). In addition, the empirical analysis pointed out that managers that were motivated to work towards improvement, recognized opportunities that others did not. Formulating targets is therefore considered a critical step in the organization analysis. What is important to bear in mind, is that targets have to be aligned and realistic to ensure a systematic and well-structured transformation effort. A good way for formulating targets is again provided by Donders (2008). Donders sets out the following procedure for formulating targets:

1. Measure the performance indicators for several (at least three) months and share the results with those involved;
2. Determine challenging targets based on the current performance that will motivate those involved to search for development opportunities;
3. Determine the desired future performance;
4. Determine the difference between the current and desired performance and determine what actions can close the gap;
5. Periodically adapt the targets to close the gap and ensure that those involved stay challenged to work towards improvement.

What is furthermore important to bear in mind while formulating the targets, is the SMART-principle. Targets have to specific, measurable, acceptable, realistic and time bounded.

Step 5: Manage information sharing

As a last step of the organization analysis, one has to identify how actors are expected to collaborate and disseminate value-generating information, by designing a “virtual supply chain” (Christopher, 2000). This is considered an important step, since effectively addressing the uncertainty and complexity of the service market requires higher levels of information processing and close intra- and inter-company collaboration (Neu, 2005; Neu & Brown, 2008). One therefore has to identify what kind of information needs to be collected, with who it needs to be shared and how often it needs to be shared. Regular contact with customers regarding schedules and forecasts can for example allow the integration of plannings and eliminate potential capacity problems (for example with seasonality patterns). Suppliers that hold a safety stock could periodically share their inventory status to reduce or eliminate the chance of stockouts. Within the company, the engineering, service, logistic and purchasing department can form a project team and schedule regular meetings to evaluate KPI's, decisions and results. This will secure regular information sharing department-wide and will therefore enhance employees' knowledge, motivation and commitment, which are all crucial aspects for working towards a success.

Long-term development opportunity

As pointed out by Edvardsson and Olsen (1996), the customer's perception of the service quality largely depends on how customers perceive the staff. Designing attractive jobs and a stimulating work environment will therefore probably be the most important quality-creating factor in services, since it will enhance the motivation and commitment of employees. This was also noted by the best in class case company who used incentives and personal development plans to motivate employees. However, creating attractive jobs and a stimulating work environment requires a more fundamental change and is therefore considered a long-term development opportunity.

A second development opportunity might be to establish a separate service organization with its own profit and loss responsibility. Oliva & Kallenberg (2003) and Gebauer & Friedli (2005) both pointed out that using a separate organization might be a good way to implement a servitization strategy, since it provides managerial focus and effectively protect the emerging service culture. However, during the interview round, several managers were sceptical about this idea. They pointed out that such approach requires additional capacity, might eliminate economies of scale and makes it even more difficult to efficiently allocate resources. According to them, it was therefore arguable whether such approach would really be beneficial. It was in addition noted that of the two best in class case companies, did not use a separate organization. Although the service department had its own profit and loss responsibility, the other departments all played a collaborative role in both businesses. Separating the service organization might therefore allow tackling the challenges of both business separately, but does not necessarily have to be beneficial. It is therefore considered a potential development opportunity.

The next chapter will summarize all the above, by presenting the model in short.

6.5 Conclusion

To help capital equipment manufacturers in successfully pursuing a servitization strategy, a servitization framework has been developed during the fourth step of this research. The following research questions have been answered during this stage:

Through what steps can companies enhance their capabilities required for successfully competing on the service market?

As stated above, the servitization framework prescribes to conduct five major steps at three different business layers. This chapter will summarize the internal logic of the servitization framework as visualized in Figure 30, by briefly motivating and describing each of these steps.

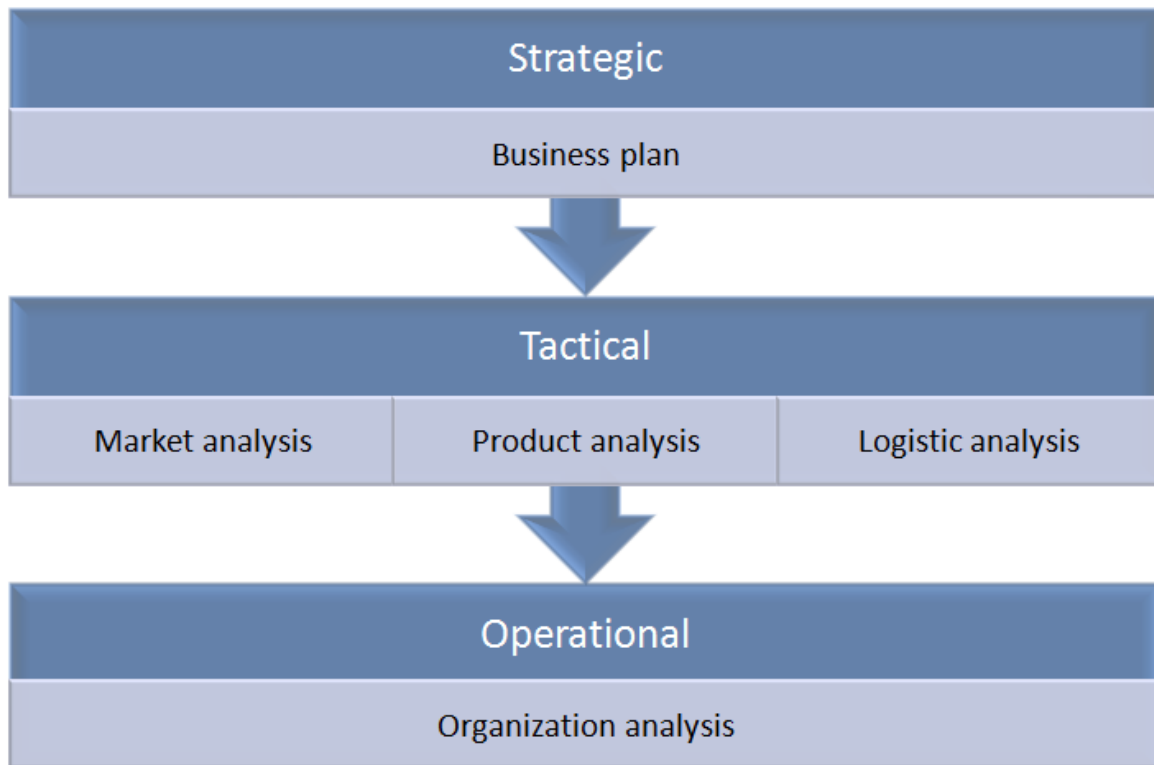


Figure 30: The servitization framework visualized

6.5.1 Business plan

The first step of implementing a servitization strategy is making a strategic business plan. A strategic business plan will indicate what investments are going to allow the organization to achieve its plan and will set out the company course for the next few years. Formulating a strategic business plan is important since:

- “high service revenue will not just happen; it will be the outcome of essential investments in the service business” (Gebauer & Fleisch, 2007);
- The adoption of a servitization strategy raises significant cultural and corporate challenges” (Baines et al., 2009).

Successfully implementing a servitization strategy thus requires investments, motivation and commitment. Unfortunately, it seems that top management generally lacks the awareness of the required time and resources (Wagner & Lindemann, 2008) and managers cannot be easily motivated

to invest resources in extending the service business (Gebauer & Fleisch, 2007). Three critical steps have therefore been identified for formulating a strategic business plan:

4. Focus on product development;
5. Study service potential;
6. Emphasize the service relevance.

These three steps do not cover the complete scope of developing a business plan, but indicate the essence that should be considered when developing a strategic business plan for the service market.

6.5.2 Market analysis

A crucial step of implementing a servitization strategy, is the design of the service product. The service product should fulfil the customer's need and thereby enhance the product value for the customer. However, customers heavily vary in their need and willingness to pay, since customers are located in separate, possibly unrelated industries, vary in sizes and are dispersed across geographic regions (Neu, 2005). Companies therefore have to:

“study the variety of customers and create products and pricing strategies that satisfies different customer segments” (Cohen et al., 2006)

Conducting this step will help to strive towards the goal of generating a maximum amount of profit from the installed base. Four critical steps have been identified for an adequate market analysis:

5. Segment customers;
6. Design service offerings;
7. Design business models;
8. Indicate pricing strategies.

What is important to bear in mind, is that services have an intangible nature that make the value proposition of the service product less clear to the customer. During the complete design process, companies therefore have to focus on communication strategies that clearly describe the value proposition of the service product to the customer (Mathieu, 2001).

6.5.3 Product analysis

The next step of implementing a servitization strategy, is designing the service offerings from a technical point of view. During this step, companies are confronted with the following decision-making issues:

(1) How to pre-plan and pre-schedule maintenance work for sophisticated equipment under a complex operating environment? (2) How to reduce the high inventory cost for spare parts? (3) How to avoid the risk of catastrophic failure and eliminate unplanned forced outage of equipment or systems? (Yam et al., 2001)

To adequately solve these decision-making issues, companies have to conduct a product analysis. They have to study the trade-off between the product's functioning and maintenance costs to strive towards the goal of maximizing the uptime of the product, while minimizing maintenance costs. Three critical steps have been identified for an adequate product analysis:

4. Study the product and determine portfolio;

5. Developing maintenance plans;
6. Identify spare parts assortment.

The product analysis will thus identify: (1) which product to cover, (2) how to cover these products and (3) which spare parts need to be actively managed in order to minimize any potential delays.

6.5.4 Logistic analysis

The fourth step of implementing a servitization strategy is a logistic analysis. A logistic analysis is important since:

“after-sales services are a commitment companies make to respond within a specific time frame to the customer’s need for support” (Cohen et al., 2006)

Companies therefore have to conduct a logistic analysis in which they weigh the levels of response customers need, against the prices they are willing to pay (Cohen et al., 2006). To support a geographically installed base, companies then have to have to set up a distinctive after-sales services supply chain. Setting up a distinctive after-sales service supply chain is important, since:

Effective supply chain strategies for the manufacturing business may not be appropriate in the service sector (Sengupta et al., 2006).

The service network namely has to cope with more stock keeping units, more locations, more uncertainty and often has to be contend with reverse logistics (Cohen et al., 2006). Four critical steps have been identified that can help companies to strive towards the goal of delivering spare parts to the right place within an agreed-upon time, while minimizing costs:

5. Develop a supply chain map;
6. Study spare parts portfolio;
7. Define supply chain strategies;
8. Define inventory policy.

6.5.5 Organizational analysis

To implement a servitization strategy on the operational level, companies have to design a service organization. Managing operational service processes is difficult, since services are characterized by a volatile and unpredictable demand and companies have to manage a large number of integrated resources that causes managerial actions to have a low temporal order, covariation and continuity in time and space (Neu, 2005). It is therefore important that companies design an integrated organization that is capable of diffusing knowledge across the network (Christopher, 2000; Neu, 2005; Oliva & Kallenberg, 2003). These aspects are important since:

- “In service firms, studies show that approximately 98 percent of customer lead time consists of non-value-added activities. Therefore, if such activities were eliminated, customer lead time could be reduced, considerably” (Durmusoglu & Kulak, 2008);
- “Once the service system is in place, it becomes a fixed cost and the main driver of profitability is capacity utilization” (Oliva & Kallenberg, 2003);
- “Effectively addressing the uncertainty of a complex market requires higher levels of information processing” (Neu, 2005).

To design an organization that is capable of managing a large amount of integrated resources in a dynamic environment, companies have to design the whole service process in detail, including micro-processes and individual activities (Edvardsson & Olsson, 1996). This can namely help companies to strive towards the goal of defining an organization that will manage the operational processes in the most effective and efficient manner. Five critical steps have been identified for adequately designing a service organization:

6. Model the service processes;
7. Indicate roles and responsibilities;
8. Design a monitoring system;
9. Formulate targets;
10. Manage information sharing.

A complete overview of all the steps in all three business layers is visualized in Figure 31.

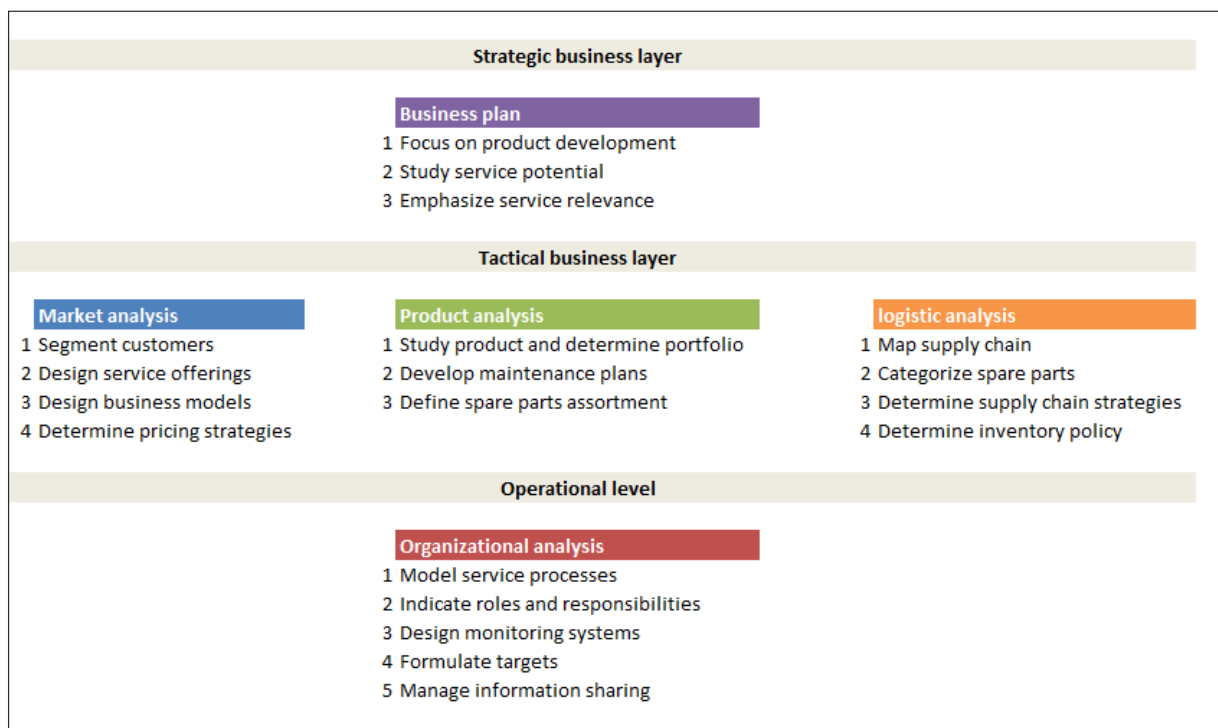


Figure 31: A complete overview of all the steps prescribed by the servitization framework

A table that includes the internal logic of the servitization framework can be found in Appendix B: The internal logic of the servitization framework visualized in a table.

What are the tools and techniques that can be used by practitioners to enhance a company's capabilities required for successfully competing on the service market?

Tools and techniques that can be used by practitioners have been identified for each step of the servitization framework. These will however not be discussed here, due to the inconvenience.

(see Chapter 6.2,6.3,6.4).

7. Design testing: Case study at SFDS

A case study has been conducted as a last step of this research. Implementing the model in a real life case provided the opportunity to gain a profound insight into the validity and applicability of the model and thereby helped to answer the following research questions:

- **What potential development opportunities have yet been captured by the case company?**
- **What are the case company's potential development opportunities, based on the servitization framework ?**
- **How does the client evaluate the recommendations generated by the servitization framework?**
- **What adjustments can further improve the content of the model?**



Figure 32: The case study is the last research step

This chapter provides an overview of the case study findings. Chapter 7.1 will discuss and motivate how the case study has been conducted and why Stork Food & Dairy Systems (SFDS) is a good candidate for testing the model. Chapter 7.2 will briefly introduce the case company, by sketching a company profile. Chapter 7.3 will discuss the case company's current ability and Chapter 7.4 will indicate what potential development opportunities have been identified by the model. Chapter 7.5 will discuss the company's feedback that has been received after the results were presented to the management board. Chapter 7.6 will discuss the conclusion that were drawn from the case study and will answer the research question formulated above.

7.1 Introduction

To first test the servitization framework, a single-case study has been conducted. A case study allowed to test and evaluate the content of the model. With the generated insight from this single application, steps have been identified that might enhance the model's usefulness. There is deliberately chosen to use a single-case, since it will allow the most profound examination of the complex environment, e.g. it will allow to study motivations and considerations of managers and the reasons for them having these (Verschuren & Doorewaard, 2010). This is important, since as pointed out by Gebauer & Friedli (2005), a company's transition towards services is strongly influenced by behavioural processes. It is therefore important to generate a thorough understanding of these behavioural processes and their implications for the model.

The case company that has been studied is Stork Food & Dairy Systems B.V. Stork Food & Dairy Systems (SFDS) develops, produces and supplies integrated processing and filling lines for dairy, juice, food processing and pharmaceutical industries⁵. The products that are sold by SFDS are part of the customer's primary production process and SFDS therefore strives to offer their customer a maximum availability, while minimizing the costs of ownership. From the headquarter in Amsterdam, the Netherlands, SFDS boasts a global network that serves customers in Europe, America and Asia. Although the company has significantly developed their service business over the years and has become quite successful in generating a constant flow of income through services, managers within the company still believe that there is room for improvement. However, many debate has been going internally on what capabilities have to be further developed and the company therefore lacks a development plan for the near future. The company wants to re-focus its attention and with that, provided a perfect case for testing the model.

The case study consisted of three trajectories. First, general company information was studied to indicate the company profile. In this stage, relevant information was gathered by conducting open interviews and by studying the company's website and folders. After a better insight was gained about the company in general, a thorough data gathering was conducted to indicate the company's maturity, i.e. the degree to which SFDS had moved along the transformational path towards services. At each of the five focus areas of the servitization framework, the company's current capabilities were identified by using several data gathering methods and sources. This triangulation of both methods and sources (Verschuren & Doorewaard, 2010) allowed to objectively assess the company's ability, since it reduced the change of any biases and/or misinterpretation of information. Working methods were for example compared with those prescribed in the company manual and performance data was compared with the opinion and evaluation of managers. In addition to the company data and open interviews, data was gathered by a servitization questionnaire. This questionnaire was developed from the case study interviews (see Appendix C: servitization questionnaire) and provided a structured data gathering from three relevant departments: the service-, logistic and purchasing department. The gathered information and data was then processed and analyzed. How this data has been analyzed and processed, will be discussed in this chapter. The next chapter will introduce the case company, by briefly sketching a company profile.

⁵ <http://www.sfds.eu>

7.2 Case company profile: SFDS

SFDS in a nutshell

Business scope:	Engineering, Manufacturing, Service
Geographical scope:	Europe, America, Asia
Market:	Food, Dairy and Pharmaceutical
Product life cycle:	15 years +
Number of employees:	+/- 150 in the Netherlands
Average company turnover:	70 Million a year

Stork Food & Dairy Systems (SFDS) develops, produces and supplies integrated processing and filling lines for dairy, juice, food processing and pharmaceutical industries since 1930. Depending on the customer's wish, it can provide a single machine or a complete integrated line for the processing and packaging of these products. The main areas of expertise are (aseptic) filling, (UHT) processing, plastic bottle making and packaging technology of liquid food products. The company's mission is formulated as:

Company mission: *"To be the best partner in the processing and filling of safe, healthy, long-life dairy products and juices under aseptic conditions".⁶*

SFDS tries to achieve this mission by constantly working towards better, more effective and more efficient solutions for their customers. Innovation and development are the core of the company's success and play an essential role in their business activities. Approximately 8% of the sales are invested in research and development, while competitors show R&D budgets around 4% and below⁷. By making these investments, SFDS opts to become a top 3 player worldwide in UHT Processing and Aseptic Filling for the Nutraceutical, Dairy & Juice industry.

A recent development at SFDS has been the reorganization in 2007. The company had experienced rough economical times and was forced to take drastic measures to secure the company's future. The company started to work towards more standardization in the product design and shifted the customer order decoupling point (C.O.O.P) from "Engineer-To-Order" towards "Configure-To-Order". With this change process, SFDS was able to:

- Lower the order risk by enhancing the predictability of configurations;
- Increase the delivery performance due to more predictable and controllable manufacturing process;
- Reduce the production costs with 17%;
- Reduced the production time with > 90%.

Source: <http://www.postendekker.nl/pages/nl/Projecten/Sterideal>

⁶ <http://www.sfds.eu/mission-and-vision/2.html>

⁷ <http://www.sfds.eu/our-company-and-sustainability/15.html>

After the company had significantly reduced the manufacturing lead times, the company also started focussing on service lead times. Over the years, the company had developed a service product and sales planes, but was in more than 30% of the orders not capable to meet the service level agreements (Integratie service producten voor global accounts at Stork, Ton, 2012). In 2011, the service department therefore took the initiative to work out an inventory plan for spare parts. The company made significant stock investments and was able to gradually enhance its service performance over the years. However, today the development of the service business has reached an impasse. Managers believe that there are still a lot of development opportunities but many debate has been going on internally about what capabilities have to be further developed. SFDS wants to re-focus its attention and with that, provided a perfect case for testing the model.

7.3 Model application: assessing SFDS' maturity

The model prescribes that a company should possess certain capabilities at four different areas of expertise: marketing, technical, logistic and organizational. By assessing whether SFDS has conducted the steps prescribed by the model, SFDS' current capabilities at each of these areas have been assessed. This chapter will discuss the maturity assessment of SFDS, which has been the first step towards generating a development path for the company. It should be noted that the strategic business layer has not been deemed relevant for the assessment, since SFDS is already far along the implementation process.

7.3.1 The marketing area

The model prescribes that a company should conduct a market analysis to provide the required input for designing a service product that is capable to meet the need and willingness to pay off a large variety of customers. This chapter will discuss SFDS' capabilities in designing a customized service solution by evaluating whether it conducted the four steps of a market analysis: (1) segment customers, (2) design service offerings, (3) design business models, (4) determine pricing strategies.

Step 1: segment customers

SFDS' installed base consists of more than 300 customers and SFDS has grouped these customers in silhouettes that are visualized in figure 17. SFDS distinguishes five customer types, based on their pro-activeness in conducting maintenance and their dependency on SFDS. With the use of these segmentation, SFDS has identified relevant strategies and approaches for each customer type. For each silhouette, it has differentiated the number of visits, the type of communication, the type of offering and support, sales argument, differentiation strategy and so on. The approach of SFDS allows remedial effort to be directed where it will produce the greatest value and it therefore makes them capable of achieving both goals that are formulated in Figure 32; customer satisfaction and the right balance between effort and effect. They have therefore successfully conducted this step and only have to maintain/update their customer evaluation over time.

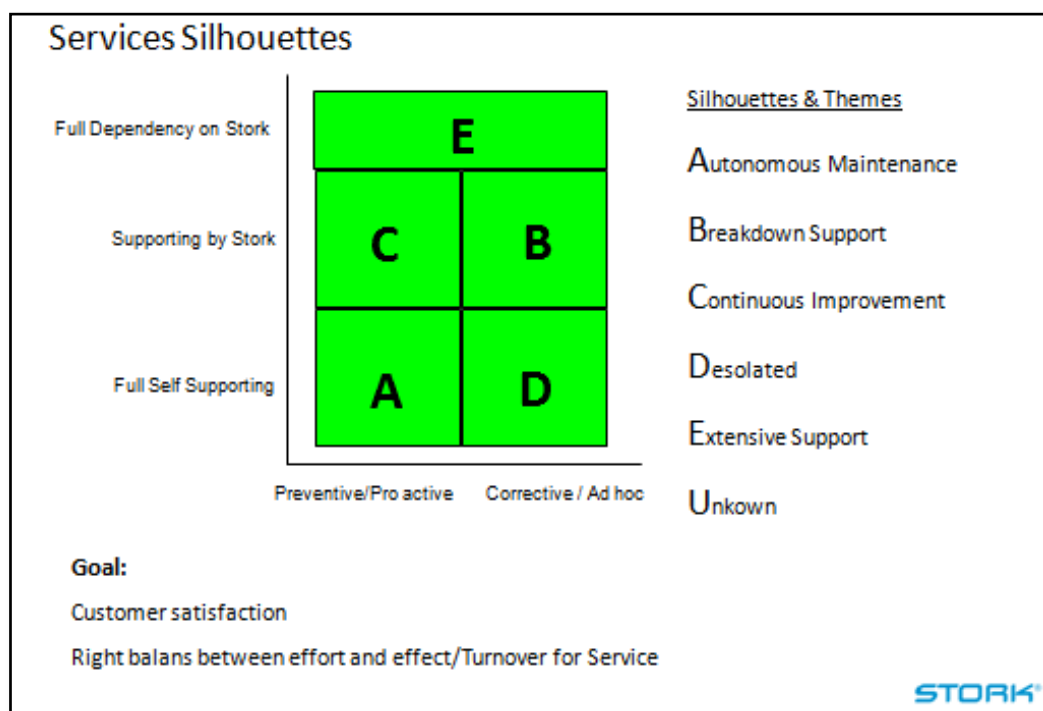


Figure 32: The five customer silhouettes defined by SFDS

Step2: Design service offerings

SFDS offers a width variety of operational support, like advice, training, repair, modifications , spare parts supply and trouble-shooting. These offerings can be mixed and matched according to the customer's liking and SFDS is therefore able to satisfy a large variety of customer needs. The company can therefore be considered quite mature in the marketing area. Over the years, the company has developed standard retro-fit packages for five modules (31 configurations) and has designed standard maintenance kits for three different lifetime intervals. While developing these offerings, SFDS has also thought of communication strategies that clearly describe the value proposition to the customer. On the website for example, the standard retro-fits are visualized and evaluated on the following criteria⁸:

- Maintainability;
- Reliability;
- Accuracy/hygiene;
- Efficiency;
- Flexibility;
- Capacity improvement;

Such information enhances the value proposition to the customers and can therefore play an important role in selling services. SFDS also offers customers the service to order spare parts online. This provides customers the opportunity to order spare parts at any given moment while at the same time reducing the handling costs for SFDS.

Step 3: design business models

On the website of SFDS it can be found that the company offers the following three types of maintenance contracts⁹:

- **Daily care:** In the event of problems, assistance is rendered and parts are delivered quickly and efficiently. With service centres around the globe, Stork offers efficient and quick repairs, maintenance, inspections and supply of spare parts.
- **Preventive care:** Breakdowns are prevented by conducting inspections, proper maintenance and replacement of parts in a timely fashion by Stork's well-equipped, trained service specialists. Several inspection programs are available to keep equipment in optimal condition. Extensive on the spot check ups of the machines are executed and a detailed report about the condition of the equipment as well as recommendations about repairs, maintenance and parts replacements will be supplied.
- **Lifetime care:** Herewith Stork ensures that an installation does not have to be replaced by a new one, in the event you switch over to a new product, a new method of packaging or a new process.

SFDS thus uses different business models. Customer that want to minimize costs can use an ad-hoc business model (daily care) and customers that consider the uptime the most critical value driver will be best suited with a maintenance contract (preventive care).

8 <http://www.sfds.eu/retrofits/index.html>

9 <http://www.sfds.eu/services-support/operational-support-2>.

Step 4: determine pricing strategies

SFDS has categorized their spare parts into five so called “factor groups”. These factor groups are:

- **Simple trade good:** parts without any SFDS specification that are widely available. Parts are easy traceable in a catalogue or on a website;
- **Complex trade good:** parts that might have a SFDS specification (size, tolerance etc). More difficult to find a price reference;
- **Simple manufactured goods:** goods that have an SFDS specification but are easy to manufacture. Parts can be ordered somewhere else;
- **Complex manufactured goods:** manufactured goods that require specific knowledge. Involves multiple production steps and specific tolerances. SFDS is the only supplier;
- **Image parts and third party parts:** Expensive trade goods or trade goods with transparent prices. Plus parts delivered by partners (electrical components).

Source: flow chart sales prices (SFDS), file: Flowchart pricing_8.xls

Since the price elasticity differs among the factors groups, SFDS has differentiated their pricing strategies for spare parts. This way, SFDS strives to achieve satisfied customers and to balance effort and effect. To provide an example of the effort and effect mechanism, Figure 33 visualizes the average order and turnover distribution over two years. As can be concluded from this figure, most spare parts revenues are generated from complex trade goods and simple manufactured goods, of which the last can be considered the most profitable.

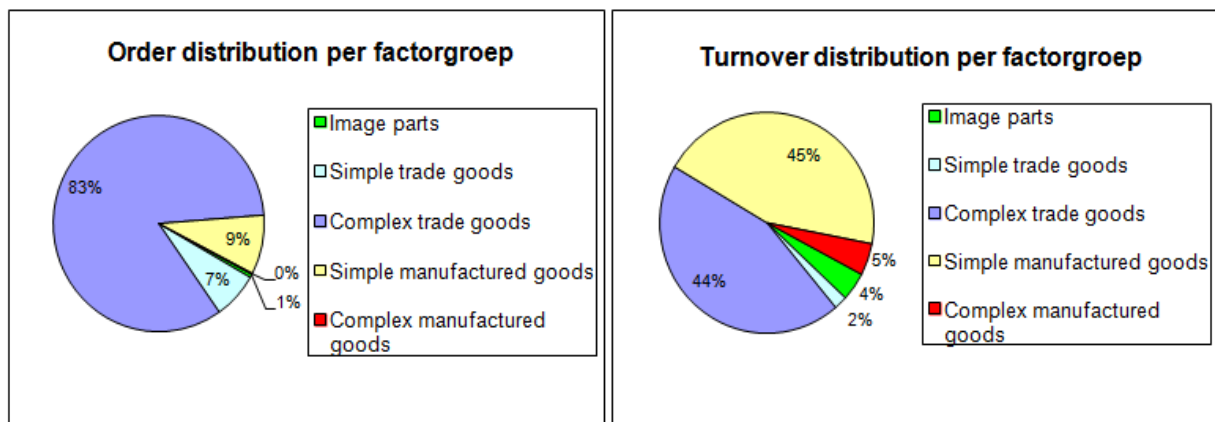


Figure 33: Order & turnover distribution per factor group (2 years average)

Note: concluding upon the overall effectiveness of SFDS’ pricing strategies requires additional information about the performances of parts. In addition, it should be noted that for simple trade goods, companies like SFDS face fierce competition from companies that often possess an economy of scope and scale.

7.3.3 Product analysis

The model prescribes that a company should conduct a product analysis to provide information that can help to design effective and efficient maintenance plans. This chapter will discuss SFDS' capabilities in effective and efficient equipment maintenance by evaluating whether it has conducted the three steps of the product analysis: (1) determine service portfolio, (2) develop maintenance plans, (3) define a spare parts assortment.

Step 1: Study the product and determine portfolio

As stated earlier, SFDS has worked towards a configure-to-order production process. It has defined approximately 1200 modules that can be mixed and matched to suit the customer's specific operating conditions. By designing these modules, SFDS has worked towards standardization on a higher level of the product hierarchy, i.e. there are not only parts that are common, but even complete modules. It has therefore enhanced the transparency of the product and almost completely eliminated the problem of determining the service portfolio. SFDS is thus relatively mature with regard to the production process and has therefore been capable to quite accurately identify what product portfolio is worth servicing.

Step 2: Develop maintenance plans

SFDS has defined maintenance plans by conducting a failure mode and effect analysis. For each part of the machine, the criticality has been identified by studying the:

- Chance of failure;
- Impact of failure;
- Detect-ability .

The analysis has categorized parts in "master" categories (valves, pumps etc.) and a criticality of 1 to 3 has been assigned to each part. Given the criticality and characteristics of parts, appropriate maintenance strategies have been chosen and the complete maintenance procedures are recorded in manuals. SFDS even went one step further. The company has designed standardized maintenance kits for three product lifetimes. The customers of SFDS often have their own technical staff and therefore prefer to conduct their own maintenance. In that case, SFDS can offer their customers maintenance kits. These maintenance kits include all the required spares in a sorted order and therefore make it relatively easy for the customer to conduct its own maintenance. It can therefore be concluded that SFDS has properly defined how their products have to be maintained.

Step 3: Define a spare parts assortment

With the input from the failure mode and effect analysis, SFDS has studied their portfolio and formulated a spare parts assortment. Approximately 6000 unique spare parts have been distinguished and categorized in the following three categories:

- **Maintenance parts:** parts that wear have to be periodically maintained (repaired, replaced etc) and are listed as maintenance parts.
- **Critical parts:** parts that are critical for the product performance but have not been listed as maintenance policies (e.g. electrical components that “run to failure”)
- **Historical parts:** parts that are neither listed as maintenance or critical parts, but have been ordered in the recent past.

The spare parts assortment indicates which articles need to be actively managed to eliminate potential administrative or logistic delays in the case of a breakdown. However, several data analysis give reason to think that the assortment defined by SFDS lead to unnecessary operational costs. The purchasement department has namely noticed that 40% of the articles that have been actively managed (maintaining info-records), have not been ordered in two years. In addition, the logistic department has indicated that approximately 25% of the inventory has not moved in two years. On the other hand, there have only been approximately 90 orders in which info-records of parts were missing. It therefore seems that the assortment has not accurately be defined or properly be maintained. Although services include lumpy and intermittent demand patterns, the fact that many of these parts are listed as maintenance parts seems to indicate that SFDS can enhance its efficiency by updating its spare parts portfolio. After all, it seems quite unlikely that none of the customers have ordered maintenance parts in two years.

A two-year data analysis has indicated that:

- 40% of the portfolio actively managed by the purchasement department has not been ordered in two years. 53% of these parts were listed as maintenance parts.
- 25% of the inventory has not moved in two years. 44% of these parts were listed as maintenance parts.

7.3.4 Logistic analysis

The servitization prescribes to conduct a logistic analysis to define a network that can efficiently and effectively match the demand and supply of services. SFDS' ability to manage the service logistics will be discussed in this chapter, by evaluating whether it conducted the four steps of a logistic analysis: (1) map supply chain, (2) categorize spare parts, (3) determine supply chain strategies, (4) determine inventory policy.

Step 1: Map supply chain

As visualised in Figure 349, SFDS' supply chain consists of approximately 200 suppliers that deliver over 5000 parts to SFDS. These parts are stocked at SFDS' central warehouse in the Netherlands, from which it supplies more than 300 customers worldwide. To manage these customers globally, SFDS boast a global network of service offices in Brazil, France, Indonesia, Mexico, Spain, Thailand, the UK and the USA¹⁰. These service offices are used to allocate human resources at local customers, but do not hold any inventories. SFDS has conducted a cost-benefit analysis to investigate the idea of using a local warehouse in the United States, but concluded that one central warehouse is most suited for SFDS. The installed base is dispersed and if an emergency would arrive, SFDS would still be able to deliver a part at any given customer location within 18 hours. It would therefore only lead to an incremental time saving for a small number of emergency cases, while it requires a significant investment.

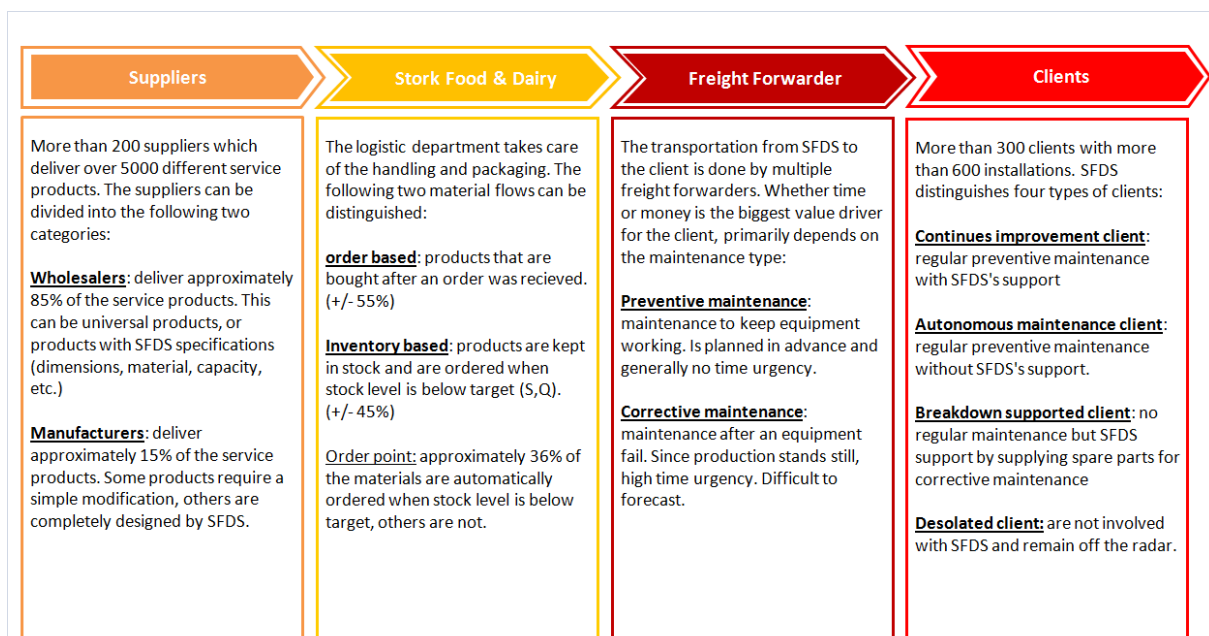


Figure 2: relevant supply chain information of SFDS

¹⁰ <http://www.sfds.eu/contact/index.html>

Step 2: Categorize spare parts

The model prescribes to categorize spare parts on their characteristics. Spare parts namely heavily differ in their characteristics and efficiently managing them requires to recognize this variety. In the case of SFDS, spare parts have been categorized on their technical relevance (maintenance, critical and historical categories) and their price sensitivity (the five factor groups). In addition to these two categorizations, SFDS has studied demand patterns of spare parts. By studying a two year data sample, spare parts have been classified by one of the four categories defined by Ghobbar and Friend (2002):

- **Smooth demand:** parts frequently demanded with a modest variation in demand size;
- **Intermittent demand:** random demand pattern but modest variation in demand size;
- **Erratic demand:** parts frequently demand with large variety in demand size;
- **Lumpy demand:** random demand and highly variable demand sizes.

As visualized in Figure 35, most spare parts are characterized by intermittent and lumpy demand patterns (Demand forecasting for spare parts at Stork, Gerrits, 2012). Studying the demand patterns of spare parts has therefore enhanced SFDS' insight. The company has namely recognized that the current forecasting method (moving average) is not suitable for managing the majority of spare parts. However, no further actions have yet been taken and the company therefore still determines the majority of stock levels with an inappropriate forecasting method.

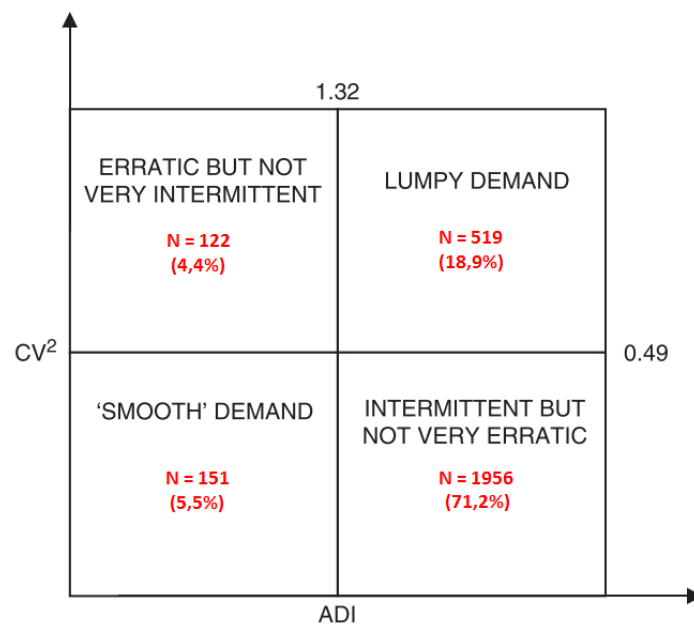


Figure 353: SFDS' spare parts classification based on Ghobbar and Friend demand categories (Cavalieri et al., 2008)

An important characteristic of spare parts that have not been studied by SFDS, are lead times. Studying the spare part portfolio revealed that none of the spare parts had a lead time shorter than 28 days. As it turned out, SFDS has deliberately normalised the lead times of parts to include a safety margin. However, it has done so with the intention to enhance the planability of the manufacturing business, but did not consider the consequences for the service business. The lead times are no longer competitive while time is often the most critical value driver in the service business. It might in addition lead to unnecessary inventory costs, since the effect of a stockout might be misjudged.

Step 3: Determine supply chain strategies

Since spare parts differ in their characteristics, the servitization framework prescribes to differentiate supply chain strategies. SFDS however, only uses one single supply chain strategy for managing the logistics of a wide variety of spare parts, which is safety stocking. These safety stocks are primarily at the customer's location and the central warehouse, but SFDS quite recently also recognized the opportunity to push back stocks to suppliers. The effectiveness of this strategy is however limited. The majority of spare parts are characterized by intermittent and lumpy demand patterns and suppliers are often not willing to stock parts without any buying agreement. Other supply chain strategies like pooling, partnering, outsourcing, repair or collaboration are currently not being used by SFDS.

Step 4: Determine inventory policy

As visualized in Figure 36, SFDS differentiates its stocking policies on the categorization of parts technical relevance. For the critical spares, SFDS stocks one item of each and these parts are only available for breakdown orders. For maintenance and historical parts, the inventory levels are based on the average usage. For these categories, SFDS opts to reach a service level of 95%. Parts that are frequently being ordered have an order point, which means that they are automatically replenished. The inventory policy of SFDS is thus quite straightforward and does not take into account what has been emphasized by the servitization framework, i.e. a multi-item approach. Since SFDS does not differentiate service levels based on characteristics other than their technical relevance, the current policy does not allow remedial effort to be directed where it will produce the greatest value. In addition, forecasting methods like moving averages are not suitable for the intermittent and lumpy demand pattern with which most spare parts are characterized. However, what seems even more revealing, is that SFDS does not seem to recognize that safety stocking is an appropriate strategy for parts of which the lead times are longer than the time to tolerate a stockout situation (Huiskonen, 2001). The majority of the spares in stock are namely maintenance parts, while maintenance jobs can be planned in advance.

Inventory policy by category		
Inventory policy		
Critical	Criticality (1 to 5) = $\frac{(\text{chance} * \text{impact})}{\text{detectability}}$	Parts are only available for breakdown orders 1 of each item is kept in stock
Maintenance	Maintenance kits or Maintenance parts	Inventory level is based on average usage
Historical	Parts that are neither critical nor maintenance, but are ordered at least twice in the last four years	Inventory level is based on average usage

Figure 36: SFDS' inventory policy for spare parts

7.3.5 Organizational analysis

The servitization prescribes to conduct an organizational analysis to design a network that is capable to efficiently and effectively manage a large number of highly integrated resources in a dynamic environment. SFDS' ability to manage the operational service processes will be discussed in this chapter, by evaluating whether it conducted the five steps of organization analysis: (1) model the service processes, (2) define roles & responsibilities, (3) design a monitoring systems, (4) formulate targets, (5) manage information sharing.

Step 1: Model the service processes

SFDS operates in the food industry, where there are strict regulations about hygiene & safety and quality management is therefore an important aspect for the company. Hence, the company has developed detailed descriptions that prescribe how certain business processes have to managed. These descriptions can be found in the company manual and quite accurately describe the activities, actors, decisions and control signals for important business processes. The company manual therefore provide transparency, which is an important criteria for designing integrated business processes. The company manual however mainly focuses on the manufacturing business and it therefore lacks a complete overview of the relevant service processes. In addition, it does not provide simple visualizations of how certain service orders are processed through the company. To provide an example, Figure 37 visualizes the complete process of a spare parts order with the information that is gathered from the company manual. The figure clearly indicates the relevant business processes, their interrelation and the actors that are responsible for managing each process. It therefore provides additional transparency that might be of importance when conducting the next steps of the organizational analysis. However, the spare parts order process was the only order type that could be visualized with the information from the company manual. The operational processes of corrective-, preventive- and modificative maintenance orders were for example not included in the company manual.

Step 2: Define roles and responsibilities

As stated above, the company manual does not completely describe all the service related business processes. SFDS did therefore not define clear roles and responsibilities. Although each department and employee has a task, the roles do not cover the complete scope of the service processes. This was noted during interviews. The service department once took the initiative to workout an inventory policy and from that moment on, there has been an ambiguity about who is responsible for what. While the service manager states that the logistics are the complete responsibility of the logistic department, the logistic manager points out that he is in many aspects bounded by the policy that is formulated by the service department. SFDS has thus not clearly defined who is responsible/acountable for the inventory management and who should be consulted or informed. Since SFDS has not defined clear roles and responsibilities for each of the three type of processes (management, operational, supportive), it has not been able to align actors and eliminate conflicts of interest. This was again noted during the interviews. The service department for example offers customers a two week delivery for maintenance kits and at the same time allows customers to order spare parts in any given amount. As a result, the logistic department is confronted with demand peaks that make it extremely difficult to effectively and efficiently manage the inventory. Such problems could quite easily be eliminated if SFDS would understand the interrelations between processes and would formulate roles and responsibilities that are aligned and coherent.

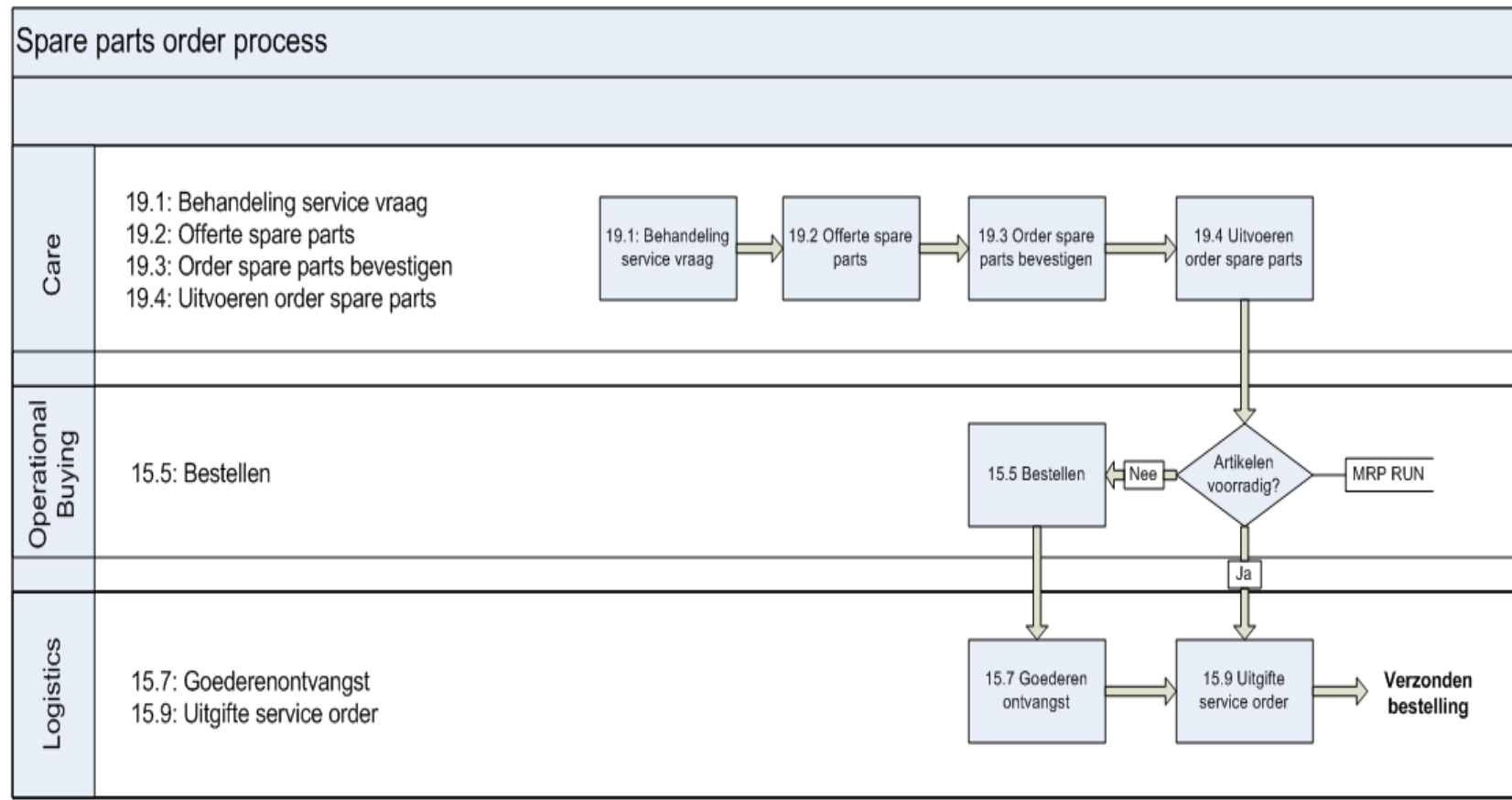


Figure 37: Spare parts order process of SFDS

Step 3: Design a monitoring system

SFDS monitors several performance indicators to generate objective information about how several processes are managed. Performance indicators that have been identified at each department are:

- **Service department:** Revenues per service offering and their profit margin;
- **Logistic department:** fill rate (order/line), delivery performance, inventory cost (per category, obsolescence stock and turnover);
- **Purchasement:** supplier performance (ask/confirmed);
- **Engineering:** ?

The above performance indicators are useful for measuring several processes, but do not provide a comprehensive overview. First of all, no direct feedback is gathered from customers about how they value SFDS' services, since the customer satisfaction is currently not being measured. In addition, SFDS did not formulate adequate performance indicators for measuring the service costs, lead times and product performance, while each of these aspects are important qualifiers for successfully operating in the service market. The company does therefore not poses reliable information about its current performance, which also seems to explain why there has been internal debates upon what capabilities have to further developed. Operating in the service market requires to make several trade-offs (e.g. costs vs. lead times and machine performance), but the company is currently not able to adequately make these trade-offs, since it does not measure its variables.

Step 4: Formulate targets

As stated earlier, many internal debate has been going on upon what capabilities have to further developed. Due to this ambiguity, SFDS did also not really pro-actively formulate targets. Although several managers stated that they have a goal to strive for, such targets where not really presented and shared with others. Employees for example did not really seem to be aware of strategies that could lead to achieving that target and it did therefore not lead to the desired commitment and motivation. It can therefore be concluded that the employees are currently not pro-actively seeking future growth.

Step 5: Manage information sharing

The model prescribes to design a virtual supply chain to determine how actors are expected to collaborate and disseminate value-generating information that will help to address the uncertainty and complexity of the service market. In the case of SFDS there are only a few steps taken to manage information sharing. Area service managers for example are instructed to regularly visit customers. This way, SFDS tries to secure close contact with customer and remain up-to-date about ongoing developments that might affect their sales. However, although service area managers have to prepare these visits, they have not been instructed to use these visits to periodically plan services. Maintenance jobs are often planned way in advance since it affects production and it is therefore quite easy for SFDS to enhance the planibility of services. This is one of the aspects that has been debated internally, but so far, no actions have been taken to change the existing situation in which SFDS recognizes their customers as a black box with an intentional demand. With regard to the intra-company collaboration and information sharing, SFDS took several steps. Regular meetings are for example scheduled with the service, purchasement and logistic department, to evaluate order statuses. However, overall it seems that the company could more accurately indicate what kind of information needs to be collected, with who it needs to be shared and how often it needs to be shared.

7.3.6 Summary of the assesment

From the above mentioned information, the conclusion has been drawn as visualized in Figure 38. The third step of the product analysis is conducted, but there is reason to doubt that the current portfolio is up-to-date. Apart from that, there are several steps at the logistic analysis and organizational analysis that have not been conducted. Overall, SFDS meets 7 of the 16 prerequisites formulated by the model.

Tactical business layer					
Market analysis		Product analysis		logistic analysis	
1 segment customers	done	1 study product and determine portfolio	done	1 map supply chain	done
2 design service offerings	done	2 develop maintenance plans	done	2 study portfolio	x
3 design business models	done	3 define assortment	~	3 determine supply chain strategies	x
4 determine pricing strategies	done			4 determine inventory policy	x
Operational level					
Organizational analysis					
		1 model service processes	x		
		2 indicate roles and responsibilities	x		
		3 design monitoring systems	x		
		4 formulate targets	x		
		5 manage information sharing	x		

Figure 38: An overview of the complete assessment of SFDS

7.4 Model application: indicating a roadmap for SFDS

The previous chapter discussed SFDS' current competences, by indicating whether the company met the prerequisites of the model at four different focus areas. Based on the assessment, this chapter will discuss the recommendations that have been presented to SFDS. The presentation can be found in *Appendix D: Presentation of the development path for SFDS*.

7.4.1 The development path

What was concluded from the assessment, is that SFDS quite accurately tackled the marketing and technical related challenges of the service market. With regard to the logistic and organizational domain however, SFDS is quite immature. These two areas are therefore considered as important target areas for developing the company's ability in successfully capitalizing the service market. The development path for SFDS is visualized in Figure 39 and will be discussed in more detail below.

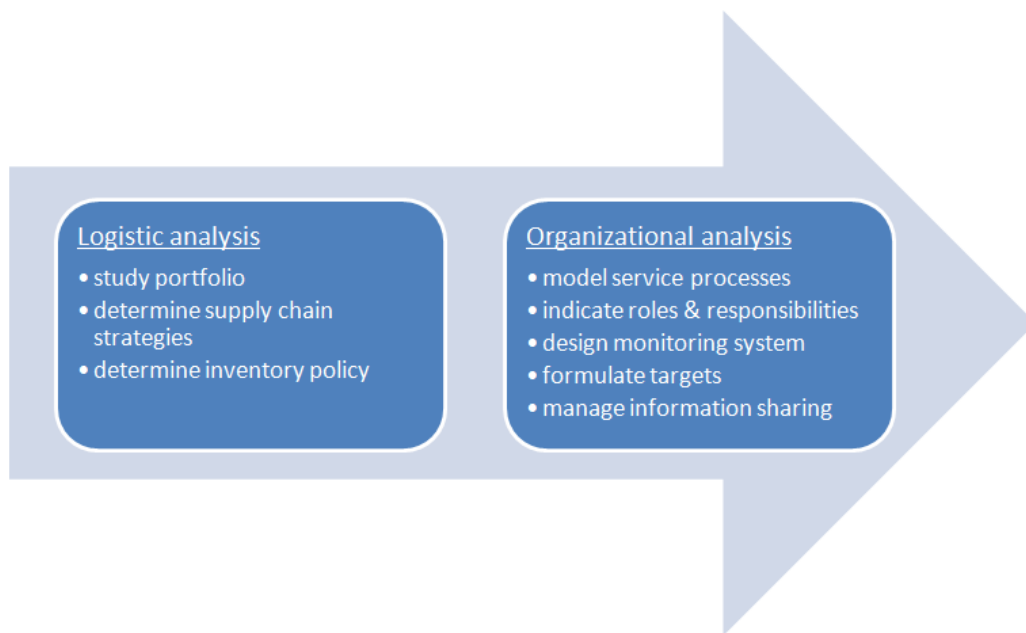


Figure 39: The development path for SFDS

7.4.2 Target area #1: Logistic analysis

The first step on the development path, is a logistic analysis. The capability to successfully manage service logistics can be considered an important qualifier for the service market, since “after-sales services are a commitment companies make to respond within a specific time frame to the customer's need for support” (Cohen et al., 2006). Although SFDS seems to recognize this commitment, it does not seem to be aware of the distinctive characteristics of service logistics. Service logistics are characterized by a large variety of spare parts that differ in characteristics like criticality, price and availability. In addition, services include a sporadic and volatile demand which raises the risk of stock obsolescence. Service logistics are therefore different from any other type of logistics. It can be considered an advanced logistical challenge that requires a sophisticated approach for effectively and efficiently matching the demand and supply. However, SFDS does currently not possess the knowledge and insight to develop such sophisticated approach. It should therefore conduct a logistic analysis to study the variety of spare parts and to match their characteristics to suitable strategies, policies and methods. In addition, SFDS has to bear in mind that there is a trade-

off between costs and lead times. The faster the response they promise, the greater the costs will be. SFDS does currently not distinguish material flows on their value driver (preventive vs. corrective maintenance), while this is key for achieving the logistical goal, i.e. match the demand and supply of spare parts within the agreed upon time, while minimizing costs.

7.4.3 Target area #2: Organizational analysis

The second step on the development is the organizational analysis. Successfully managing a service organization is an important qualifier for the service market, since: “once the service system is in place, it becomes a fixed cost and the main driver of profitability is capacity utilization” (Oliva & Kallenberg, 2003). In addition, eliminating non-value-added activities like administrative delays can significantly shorten customer lead times (Durmusoglu & Kulak, 2008). However, efficiently managing the operational processes of after-sales services is difficult. The service market is a complex market, since the integrated resources causes managerial actions to have a low temporal order, covariation and continuity in time and space (Neu, 2005). In addition, companies have to be able to effectively deal with the sporadic and volatile demand of services. Aligned actors and intra- and inter-company collaboration and information sharing are therefore critical succes factors for effectively managing a service organization. However, SFDS’ organization does currently not meet these criteria. It should therefore conduct an organizational analysis that covers the complete scope of after-sales services. Currently it has only conducted several steps of certain fragments and the company is therefore not capable to achieve the organizational goal, i.e. managing the operational business processes in the most effective and efficient way.

After SFDS has conducted both analysis, it has to adapt its strategic business plan. Top management has to formulate adequate objectives that will lead to motivation and commitment and has to identify what investments will allow the organization to achieve its new goal.

7.5 Company feedback

The result of the case study have been presented to the logistic, purchasement and service manager. Each of these managers have been closely involved in the case study and were recognized as key actors for the generated development path. They were therefore considered good candidates for evaluating the knowledge gained from the model. The main goal of the presentation was to create awareness, since as stated in Chapter 5.1, it has been assumed that people first need to become conscience, before they can become competent. In addition, each of the managers were asked about their overall opinion on the recommendations.

The development path indicated that there are two potential target areas for SFDS: a logistic analysis and a organizational analysis. Overall, the managers seemed to agree that especially in these two areas, significant improvements are possible. They for example recognized that:

- Change management and actor alignment are the most difficult aspects;
- Close contact with customer could enhance the planibility;
- Unlimited order sizes of spare parts, standardized lead times (28 days) and a two week delivery agreement for maintenance kits lead to inefficiencies;
- The spare parts portfolio needs to be updated;
- There are additional supply chain strategies worth considering.

Managers also recognized that the marketing and technical business areas are fairly well covered. The feedback round did therefore not lead to any eye openers with regard to the content of the servitization framework.

However, as stated earlier, the main goal of this feedback round was to convince the managers of the development possibilities that have currently not been captured. With regard to this aspect, it has been noted that the servitization framework as it is now, only has a limited influence. The servitization framework is founded on logic reasoning and as it turns out, logic reasoning alone does not provide the best instrument for convincing people. What was noted from the case study interviews as well as from the feedback round, is that, after manager were presented the logic reasoning behind arguments, they often asked whether there was hard data that supported this reasoning. Managers seem to attach a great value to benchmark results, since such information is not based on theoretical premises, but on real life data instead. It is in addition often a lot easier to interpreted and might therefore also be a more efficient tool that can prevent information overload.

The above conclusions is more or less in line with what was concluded by Huiskonen (2001). Huiskonen namely recognized that advanced inventory models for spare parts are difficult to implement. "Most managers do not feel comfortable if they do not understand on what the specific results of models are based. This may be one important reason why different rules-of-thumbs are so popular in managerial practice" (Huiskonen, 2001). A purely qualitative approach might therefore be a good way to understand a certain situation or problem, but seems to have a limited effectiveness for offering a solution. Adding benchmark data to the servitization framework therefore seems to biggest opportunity for enhancing the effectiveness of the model. Drawing any conclusions with regard to the content of the model, is difficult based on a single-case study.

7.6 Conclusions

As a last step of this research, a single case study has been conducted to test the content of the model. The following research questions have been answered during this stage:

What potential development opportunities have yet been captured by the case company?

Overall, SFDS meets 7 of the 16 prerequisites formulated by the model. It has successfully managed the marketing and technical related challenges of servitization.

(see Chapter 7.3 Model application: assessing SFDS' maturity or 7.3.6: summary of assessment)

What are the case company's potential development opportunities, based on the servitization framework ?

Since SFDS did not conduct the steps prescribed for the logistic and organization analysis, these areas are considered important focus areas.

(see Chapter 7.4 Model application: indicating a roadmap for SFDS)

How does the client evaluate the recommendations generated by the servitization framework?

The client seems to agree on the fact that especially in these two areas, improvements are possible.

(see Chapter 7.5 Company feedback)

What adjustments can further improve the content of the model?

Empirical data like benchmarks result could be added to model to support certain claims. This might namely improve the model's ability of convincing managers that they use the wrong strategies, methods and tools.

(see Chapter 7.5 Company feedback)

8. Research conclusion and discussion

This chapter will reflect upon the complete research. Chapter 8.1 will discuss the overall conclusion of this research. Chapter 8.2 will discuss the limitations of this research and Chapter 8.3 will indicate recommendations for future research.

8.1 Research conclusion

In this report, a servitization framework is presented that can provide capital equipment manufacturers a helpful tool for capitalizing the service market. This model aims to emphasize that entering the service market requires a well-founded business plan, since moving into services is inherent to setting up a new business. The service market is completely different than the goods market and manufacturing companies therefore have to go through a significant change process to develop new competences. However, companies do often not seem to be aware of this. Services are often recognized as an add-on to sales and companies often use the methods, tools and procedures of the good markets for competing on the service market. Since these are the wrong methods, tools and procedures, companies fail to develop a healthy sustainable business through services.

The servitization framework is therefore designed to fulfil two purposes: (1) it has to make companies aware of why they fail to successfully compete on the service market, after which (2) it can provide a helpful tool for developing the required competences. Each step prescribed by the servitization framework is therefore first thoroughly motivated, after the model indicates in more detail, how companies can take that step. In total, the model prescribes to conduct 19 steps at three different business layers (strategic, tactical and operational) and four focus areas (marketing, technical, logistic and organization). What should be noted, is that these steps are formulated to provide guidance, tools and techniques that can be used by practitioners. The servitization framework in itself does therefore not yet offer a recipe for success. The success of mechanisms is limited by contextual constraints and developing a plan for intervention therefore requires to design a solution that more accurately fits the specific problem, situation and context of a company. However, the servitization framework helps companies to develop such plan for intervention, since it can (1) help to objectively assess a case company's current abilities, after which (2) it can identify important focus areas for enhancing a company's ability in managing services.

The model has proved its usefulness during a real life case study. It has objectively assess the case company's current abilities and helped to identify a roadmap for development. However, it has also been noted from this case study that the servitization framework as it is now, only has a limited influence in creating awareness, i.e. convincing business managers of the fact that they use the wrong strategies, methods and tools. The model is namely merely founded on logic reasoning and does not incorporate any hard data (like benchmark data) that can support certain claims. It is therefore believed that, although the servitization already turned out be a valuable tool, improvements are still possible by conducting additional research. The next chapter will therefore discuss the limitations of this research to indicate the boundaries of this research and its outcome; the servitization framework. Based on this, Chapter 8.3 will discuss potential avenues for future research.

8.2 Limitations of the research

It is believed that both the success and the potential threats have been in the scope of this research. On the one hand, studying the problem in breadth, is what caused the success of this research. Servitization is an interdisciplinary field and providing a comprehensive overview on how to successfully servitize, required a holistic approach that incorporated the interrelation between each of these fields (the marketing, technical, logistical and organizational domain). At the same time, working towards an intervention plan, required to conduct two consecutive research stages: a problem diagnosis that indicated the causes to the servitization problem, and a design stage to design the servitization framework as a plan for intervention. Both the research topic and the research approach were therefore broad. While it is believed that studying the problem in breadth, is what caused the external and face validity of this research, it is also where the limitations of this research can be found.

For practical purpose, conducting the research required to constantly evaluate the returns of certain steps. By following the concept of saturation (Glaser & Strauss, 1967), trade-offs have been made throughout the research between studying the problem in depth and studying the problem in breadth. Despite the triangulation of both methods and sources (theoretical and empirical problem diagnosis and a strategic sample), these trade-offs have raised the risk of drawing conclusion based on incomplete information. The whole research approach can therefore best be described as an abductive approach, since designing the servitization framework has required to begin with an incomplete set of information and observations (scarce literature and 10 case study interviews) and to proceed with the likeliest possible explanation for the set. The final conclusions of this research are thus based on intuitiveness and creativity; a though experiment. There have therefore been listed several avenues for future research to test and possibly improve the reliability and internal validity of the servitization framework, which will be discussed in the next chapter.

8.3 Recommendations for future research

To further test and possibly improve the servitization framework, three potential steps have been identified: (1) conducting a Delphi method to further test the content of the model, (2) collecting and adding empirical data that can support certain claims (like benchmark data), (3) testing the model's interface with a future user. Each of these steps will be briefly discussed below.

A Delphi method can be used to evaluate the content of the model and to further conclude upon the reliability and internal validity of the servitization framework. The single case study that was conducted during this research did namely not provide solid evidence to conclude upon these aspects. Servitization is a complex matter and as can be noted from the research problem, practitioners often lack the required knowledge and insight to critically evaluate the content of the model. However, what might be an even bigger problem, is the fact that these people are often biased, since they have a strong urge to justify their decisions. Questioning independent experts has therefore been recognized as an important next step for testing and possibly improving the reliability and internal validity of the servitization framework.

Another step that might improve the content of the model, is collecting and adding empirical data to the servitization framework. As was concluded from the case study, the servitization framework as it is now, only has a limited capability of creating awareness, i.e. convincing business managers of the fact that they use the wrong strategies, methods and tools. The model is namely merely founded on logic reasoning and does not include empirical data (like benchmark data) that can support certain claims. Collecting supportive data and incorporating it in the servitization framework is therefore recognized as another good opportunity to test and possibly improve the reliability and internal validity of the framework.

A third step that was deliberately not conducting during this research, is testing the model's interface with a future user. The model is designed to help practitioners in solving the problem under review. Testing and possibly adapting the interface with a future user, is therefore an essential step for testing the applicability of the framework. This is however considered a last step of solving the problem under review and is therefore deliberately carried on to a future time period.

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Appendices

Appendix A: Case study interview format

NOTE: The interviews were conducted in Dutch. The interview questions and answers have not been translated to English to prevent information loss or distortion due to linguistic problems.

Deel 1: Business model

1	Hoe wordt er tegen service aangekeken?
a.	Nodig om producten te kunnen verkopen
b.	Als een bron voor extra inkomsten
c.	Manier om te competieren en zo klanten te winnen
d.	Service is core business
e.	Het bieden van oplossingen is core business

2	Welke relatie wordt er nagestreefd met klanten?
a.	Er wordt gefocust op het verkopen aan nieuwe klanten
b.	Er wordt gefocust op het verkopen aan nieuwe en bestaande klanten
c.	Er wordt gefocust op het verkopen aan enkele partners

3	Welke aspecten behoren tot het service product?
a.	Leveren van spare parts
b.	Reparatie
c.	Onderhoud
d.	Aanpassingen / optimalisatie
e.	Advies
f.	Training

4	Wat voor een verdienmodel wordt er gebruikt?
a.	De klant betaald voor de gevraagde service (a.d.h.v. een offerte of op basis van nacalculatie)
b.	De klant betaald voor de gevraagde service en er zijn (enkele) vaste prijsafspraken
c.	Het product wordt geleased voor een vast bedrag
d.	Het product wordt geleased en er wordt betaald aan de hand van geleverde performance

Deel 2: Supply chain configuratie

5		Op welke locaties zijn er voorraden van reserve onderdelen aanwezig?
	a.	Bij de klanten
	b.	Bij de leveranciers (leveranciersafspraken)
	c.	Bij ons centraal
	d.	Bij ons op verschillende locaties (multi-echelon)

6		Wie zijn er allemaal verantwoordelijk voor deze voorraden?
	a.	De klant
	b.	De leverancier
	c.	Wij
	d.	Derden (pooling)

7		Is er nagedacht over welke onderdelen waar liggen?
	a.	Nee
	b.	Ja, er wordt rekening gehouden met kritikaliteit
	c.	Ja, er wordt rekening gehouden met hierarchy
	d.	Ja, er wordt rekening gehouden met prijs

Deel 3: Interne organisatie

8		Is de service voorraad gescheiden van nieuwbouw?
	a.	Nee, de onderdelen voor beiden worden uit 1 centrale voorraad geleverd
	b.	De voorraden worden apart gepland en beheert
	c.	De voorraden zijn fysiek van elkaar gescheiden

9		Wordt er een budget vrijgemaakt voor het op voorraad leggen van service onderdelen?
	a.	Nee
	b.	Ja, eens per jaar wordt van bovenaf bepaald hoeveel hiervoor beschikbaar wordt gesteld
	c.	Ja, periodiek wordt a.d.h.v. een kwalitatieve forecast bepaald hoeveel hiervoor nodig is (persoonlijke beoordeling is van invloed)
	d.	Ja, periodiek wordt a.d.h.v. een kwantitatieve forecast bepaald hoeveel hiervoor nodig is (op basis van cijfers)

Deel 4: Primaire processen

10		Welke criteria worden gebruikt voor het samenstellen van het service assortiment?
	a.	Geen, er is geen duidelijk assortiment bepaald
	b.	De kans dat onderdeel faalt
	c.	De interne kosten
	d.	De kosten van de klant bij falen
	f.	Mogelijkheid tot reparatie
	g.	Persoonlijke mening

11		Hoe wordt bepaald of een onderdeel op voorraad gelegd moet worden?
	a.	Er is geen voorraad
	b.	Prijs
	c.	Kritikaliteit
	d.	Vraagpatroon
	e.	Beschikbaarheid
	f.	Grootte
	g.	Budget
	h.	Persoonlijke mening

12		Hoe wordt er herbevoorraad?
	a.	Er is geen voorraad.
	b.	De voorraadbeheerder kijkt periodiek naar de voorraadniveaus
	c.	Het ERP systeem meldt dit en een ATB wordt aangemaakt

13		Welke criteria bepalen de minimale voorraad hoeveelheden?
	a.	N.V.T.
	b.	Leverancierscontract
	c.	Transport kosten

	d.	Voorraad kosten
	e.	Bestelkosten
	f.	Vraag
	g.	Prijs
	h.	Kritikaliteit
	i.	Persoonlijke mening

14		Welke criteria worden gebruikt voor het classificeren van onderdelen?
	a.	Geen, er worden geen onderdelen geclassificeerd
	b.	Het type (lagers, pakkingen etc)
	c.	Vraagpatroon
	d.	Kosten
	e.	Slijtgedrag
	f.	Beschikbaarheid
	g.	Kritikaliteit
	h.	Persoonlijke mening (VED)

15		Welke methodieken worden gebruikt voor het voorspellen van de vraag?
	a.	Geen, de vraag wordt niet voorspeld
	b.	Reliability based forecasting (life data analysis, data bank)
	c.	Simple time series based forecasting (moving average, exponential smoothing etc)
	d.	Complex time series based forecasting (croston, bootstrapping etc)
	e.	Er wordt hiervoor een software pakket gebruikt
	f.	Persoonlijke mening (judgmental adjustments)

Deel 5: Management en aansturing

15		Hoe wordt de geleverde service gewaarborgd?
	a.	Dit valt onder de verantwoordelijkheid van de betrokkenen
	b.	De service performance wordt gemeten en periodiek geëvalueerd
	c.	Er wordt continu aangestuurd op verbeteringen d.m.v. KPI's, targets en doelstellingen

16		Is er een visie en/of missie bepaald m.b.t. het service product?
	a.	Nee, niet voor service specifiek
	b.	Ja, maar hier gebeurt niet veel mee
	c.	Ja en deze is dusdanig uitgewerkt dat het de leidraad vormt voor de dagelijkse operatie

17		Is er een eindverantwoordelijke voor het service resultaat?
	a.	Nee
	b.	Ja, die bevindt zich op het management niveau
	c.	Ja, die bevindt zich op het executives niveau
	d.	Ja, die bevindt zich op het CEO niveau

18		Wordt er onderscheid gemaakt tussen strategisch, tactisch en operationeel plannen?
	a.	Nee (reden?)
	b.	Ja, maar er vindt geen evaluatie plaats
	c.	Ja en er vindt periodiek een evaluatie plaats

19		Wat is het opleidingsniveau van een onderhoudsmonteur?
	a.	MBO
	b.	HBO
	c.	WO

20		Wat is het opleidingsniveau van een service manager?
	a.	MBO
	b.	HBO
	c.	WO

21		Wat is het opleidingsniveau van een voorraad beheerder?
	a.	MBO
	b.	HBO

	c.	WO
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22		Worden er service gerelateerde KPI's gemeten?
	a.	Nee
	b.	Ja, proces gerelateerde (omloopsnelheid, obsolete etc)
	c.	Ja, financieel gerelateerde (omzet, voorraad waarde etc)
	d.	Ja, klant gerelateerde (klant evaluatie)

23		Wordt het personeel aangestuurd tot verbeteringen?
	a.	Nee, hier wordt niet direct op aangestuurd. Het is de verantwoordelijkheid van de betrokkenen om zelf tot verbeteringen te komen.
	b.	Ja, op basis van het verleden worden targets / doelstellingen / KPI's bepaald die periodiek geëvalueerd worden
	c.	Ja, op basis van de gewenste toekomst worden targets / doelstellingen / KPI's bepaald die periodiek geëvalueerd worden
	d.	Ja, d.m.v. incentives

Deel 6: Informatie

24		Worden de prestaties van onderdelen bijgehouden?
	a.	Nee
	b.	Ja, maar hier gebeurt niet zoveel mee
	c.	Ja, wanneer een onderdeel vaker kapot gaat wordt er meer van op voorraad gelegd
	d.	Ja, wanneer een onderdeel vaker kapot gaat wordt dit gemeld bij engineering

25		Van welke ICT tools wordt er gebruik gemaakt voor de planning, order handling and demand forecasting van reserve onderdelen?
	a.	Een standaard ERP pakket
	b.	Een ERP pakket met Add-ons (magazijn beheer optie, service optie)
	c.	Dedicated spare parts management software

26		Waarover wordt gecommuniceerd met leveranciers?
	a.	Levertijden
	b.	Prijzen
	c.	Lever betrouwbaarheid
	d.	Product
	e.	Forecasts
	f.	Risico's

27		Waarover wordt gecommuniceerd met klanten?
	a.	Levertijden
	b.	Prijzen
	c.	Lever betrouwbaarheid
	d.	Product
	e.	Forecasts
	f.	Risico's

28		Waarover wordt intern gecommuniceerd?
	a.	Levertijden
	b.	Prijzen
	c.	Lever betrouwbaarheid
	d.	Product
	e.	Forecasts
	f.	Risico's

Evaluatie (20m)

Welke aspecten kenmerken de kwaliteit van uw service?	
•	
•	
•	

Op welk gebied zou er verbeterd kunnen worden?	
•	
•	
•	

Welke belemmeringen zijn er?
<ul style="list-style-type: none">•••

Welke uitdagingen zijn er?
<ul style="list-style-type: none">•••

Appendix B: The internal logic of the servitization framework

What steps?	Why?	So, what to do?
Strategic business plan	<p>“high service revenue will not just happen; it will be the outcome of essential investments in the service business” (Gebauer & Fleisch 2007)</p> <p>“The adoption of a servitization strategy raises significant cultural and corporate challenges” (Baines et al., 2009)</p> <p>Unfortunately, it seems that top management generally lacks the awareness of the required time and resources (Wagner & Lindemann, 2008) and managers cannot be easily motivated to invest resources in extending the service business (Gebauer & Fleisch, 2007).</p>	<p>Companies have to indicate what investments are going to allow the organization to achieve its plan</p> <p>Companies have to create motivation and commitment, since both of these aspects are critical success factors for managing the required change process</p>
Marketing analysis	<p>Customers heavily differ in their need and willingness to pay, since they operate in separate, possibly unrelated, industries, vary in sizes and are dispersed across geographic regions (W. a. Neu 2005)(M. A. Cohen et al. 2006)</p>	<p>“companies have to study the variety of customers and create products and pricing strategies that satisfies different customer segments” (M. A. Cohen et al. 2006)</p>
Technical analysis	<p>While designing the actual service offerings, companies are confronted with decision-making issues like:</p> <p>(1) How to pre-plan and pre-schedule maintenance work for sophisticated equipment under a complex operating environment?</p> <p>(2) How to reduce the high inventory cost for spare parts?</p> <p>(3) How to avoid the risk of catastrophic failure and</p>	<p>A company has to decide whether to support all of its products completely, a part of it, or maybe even rival or complementary products (M. A. Cohen et al. 2006)</p> <p>Companies have to define a spare part assortment to indicate for which spares info records need to be collected and maintained (Driessen et al. 2012)</p>

	eliminate unplanned forced outage of equipment or systems? (Yam et al. 2001)	
Logistic analysis	<p>Effective supply chain strategies for the manufacturing business may not be appropriate in the service sector (Sengupta et al. 2006), since:</p> <ul style="list-style-type: none"> • Service often has to be provided to multiple product generations and configurations and the service supply chain therefore has to manage a larger variety of parts and suppliers (M. A. Cohen et al., 2006; Boylan and Syntetos [10]); • The service business requires a network structure to deploy parts at a geographically dispersed installed base (M. A. Cohen et al. 2006); • Demands for repairs crop up unexpectedly and sporadically, making it difficult to forecast demand (M. A. Cohen et al. 2006); • The service supply chain often has to be contend with reverse logistics of failed parts (M. A. Cohen et al. 2006). 	<p>“to win in the aftermarket, executives need to recognize that after-sales services are a commitment companies make to respond within a specific time frame to the customer’s need for support. (M. A. Cohen et al. 2006)</p> <p>“Companies have to weigh the levels of response customers need against the prices they are willing to pay” (M. A. Cohen et al. 2006)</p>
Organizational analysis	<p>“once the service system is in place, it becomes a fixed cost and the main driver of profitability is capacity utilization” (Oliva & Kallenberg 2003).</p> <p>“In service firms, studies show that approximately 98 percent of customer lead time consists of non-value-added activities. Therefore, if such activities were eliminated, customer lead time could be reduced, considerably” (Durmusoglu & Kulak, 2008)</p>	<p>Companies have to integrate both the inter- and intra-company processes to enhance the operational performance in terms of speed and quality (Sengupta et al. 2006)</p> <p>“Companies have to develop two new capabilities to run a distributed service network effectively: the capability to diffuse knowledge across the network and the ability to manage large organizations of service personnel” (Oliva & Kallenberg 2003).</p>

	<p>The highly integrated resources in the service business causes managerial actions to have a low temporal order, covariation and continuity in time and space (W. a. Neu 2005).</p> <p>Effectively addressing the uncertainty of the after-market requires higher levels of information processing (W. a. Neu 2005).</p> <p>Motivation and commitment can be considered the most quality creating factors in services (Edvardsson and Olsen; 1996).</p>	<p>Companies have to adapt their performance measures to anchor the transition successfully” (Servitization in product companies – creating business value beyond products, Atos Consulting, White paper, 2011).</p>
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Appendix C: Servitization questionnaire

NOTE: this questionnaire was based on a previous version of the servitization framework (see Chapter 7.5: reflection). The framework and structure of the questionnaire therefore do not match the current model.

Servitization questionnaire

The questionnaire is based on the servitization framework that is visualized in figure 1. The servitization framework is a framework that can help manufacturing companies in effectively and efficiently pursuing a servitization strategy. According to this model, ten critical steps at three different business layers (strategic, tactical, operational), determine the success of a servitization



strategy.

Figure 4: the servitization framework

The questionnaire will help to evaluate the company's current ability, by indicating its maturity at each of these ten critical aspects. An analysis of this questionnaire will then indicate the focus area's for improving the successfulness of the service strategy. Based on these results, a plan for improvement can be made in consultation with the client.

Part 1: Strategic business layer

Part 1-A: Business case

Note: The company under review sells two types of products, a linear filler (LV) and an in piping system (IPS). The IPS is an old machine with a large installed base. The machine does not include many mechanical parts, is relative cheap and not so critical. Customers are known with the product and quite independent. The largest group of customers therefore only orders spare parts. The LV however is a newer, more expensive, more critical and more complex machine. For this machine more maintenance contracts are sold, as the uptime of the machine is more critical and customers are less independent.

1. What are the average service revenues (absolute and % of total revenues)?

9 mil. (10-15% of total revenues)

Goal is to reach break-even point with service revenues, so that sales revenues are profit.

Acceptable . However, a research of 200 manufacturing companies in Germany and Swiss revealed that approximately 35% of the companies earned more than 20% of their revenues with service (Gebauer & Fleisch 2007).

1a. Can you further categorize these revenues? (for example hours vs parts or product types)

Spare parts 6.5 mil against 45% margin

Roughly 9 percent of total turnover. A case study of ten companies revealed similar results (Bacchetti & Saccani 2012). Only 3 companies scored higher of which 2 companies operated in the automotive industry and one in the heating & air conditioning.

Service 1.0 mil against 29% margin

Roughly 1.4 percent of total turnover. No data, but seems low.

Retrofits 1.5 mil against 30% margin

Roughly 2.1 percent of total turnover. No data.

(+/- 30% LV – 60 % IPS)

Difficult to draw conclusion. Although IPS has a much larger installed base, the LV is a more critical, more complex and more expensive product.

2. What are the service costs?

Difficult to prognose while we are using all the departments of the BU

Problematic. Difficult to strive for cost efficiency and unclear what is invested.

2a. Can you further categorize these costs? (product type or activity based)

Most of the cost outside the service department are made by engineering, purchase department and production

3. What is the current installed base? (categorize on product, market and/or geographical location if possible)

IPS: 678 installations (old product)

LV: 20 installations (new product)

(year 2012)

3a. What is the growth rate of the installed base? (categorize if possible)

2013: 26 machines

Average 9 machines but the install base decrease also with ?? 10 machine a year

Growth rate is 4% or less > mature market.

4. What is the service adoption rate? (again, categorize if possible)

Approximately 65% - 70% (Not sure how reliable this answer is)

At first, this seems to indicate that the effectiveness can still be improved. However, it has to be kept in mind that the majority of customers have an extensive knowledge about the product due to their years of experience. They are thus quite independent.

5. What is the ratio between existing and new customers?

70% of the machine we deliver is to existing customers, 30% new

Quite mature, but indicates that there will be more opportunities for service (contracts) in the near future, as the installed base is getting younger (more new customers).

5a. What is the repeating sales ratio? (% of sales to existing customers)

See 5

6. How would you score your company's service performance on a market average (e.g. worst, average, best in class). Explain your reasoning.

More than average but not the best ("there is always room for improvement").

We classify customers based on the place **they** want to be. If a customer wants to be complete depended of Stork we are offering this by SLA's. If a customer is very independent we adjust also the approach to this. We are working with customer silhouettes were the customer can identify their selves.

What is the most valuable type of customer and do you seek to transform/convince customers to become this type?

7. What is the company's current differentiation strategy? (e.g. technological superiority, costs leadership etc)

Reliable and sustainable by offering a technical good machine for a reasonable price.

There is also formulated a service vision, but focus remains on sales.

Part 2: Tactical business layer

Part 2-A: Market analysis

1. How large is the customer base? (approximately)

200 customers

1a. Can you further categorize customer types? (e.g. based on market, geographical location, product use)

Each service centre has its own customers, based on its geographical location. Furthermore, customers are categorized on their type and assigned to one of the four silhouettes, indicating the dependency on SFDS. For each silhouette, policies are in place that indicate how much time should be spend on visitations.

What is the most valuable group of customers and what is distribution among groups?

These silhouettes can provide a starting point for formulating different business models/contracts. The customer can choose a service contract based on its value driver (e.g. cost minimization, performance maximization), resulting in for example in a platinum, gold, silver contract. By using multiple business models, customers can weigh the level of response against the price they are willing to pay. The manufacturer on the other hand, can achieve a cost-efficient supply chain, by determining the required investments / costs (M. A. Cohen et al. 2006).

2. What types of services are being offered? (e.g. inspections, maintenance, 24 hours support, training etc)

- Inspections and maintenance jobs
- Delivery of spare parts and maintenance kits
- Retrofits
- 16 hours support (*from 24.00h to 06.00h we are not reachable for technical support*)
- Trainings (basic, advance, expert)

2a. How are these offered? (e.g. as a total service package, a base package with additional options, as separate products)

Most of the time separated, but we try to combine long term maintenance with retrofits and inspections. In other words, selling the complete service product.

2b. Could you elaborate on the type of service level agreements (SLA's) that are made?

We try to fulfil the customer's need as much as possible, but in practice this would result in a very expensive contract. (customers for example, want to have a FSE on place within 2 hours, which means that we have to offer them one FTE for the complete period)

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Reliability of 90% > once formulated as goal

Maintenance spares /kits must be delivered within two weeks

Critical spares must be delivered within 24 to 48 hours (also at customer)

> 95%, 5 days and same day sending as order, formulated as future goal

Customers need and willingness to pay are not distinguished (see 1a), which leads to a non-optimal situation. Besides, promising a two week delivery time for maintenance kits turned out be a problem for internal handling. Customers hand in orders at the last moment. Planning is therefore difficult. It could be questioned whether this SLA should be there, as customers plan there maintenance jobs in a much larger time frame than 2 weeks.

3. How does a customer pay for its service? (e.g. based on an offer/post calculation, price agreements, price of service is incorporated in lease contract)

Most of the time based on timesheets (real cost). Sometimes a fixed price is used.

3a. Can he choose a contract according to its own liking?

Yes, but is not regular

It should be (see question 1a)

3b. Are there any discount offerings?

We don't give any discount on services

Could be a motivator for bigger contracts (leading to different silhouettes).

4. How is the value proposition of service communicated to the customer?

By using presentations. Service area managers have to formulate their goal before visiting a customer. (maintenance jobs and costs are forecasted)

Yield calculations are not an option, but are there any other criteria that can be used to convince/advice a customer about service offerings? In other words, how do you make a customized advice?

5. How is the customer's need being indicated?

By visiting the customer, we try to actively indicate the customer's need.

And is creative thinking allowed? Employees for example could have a creative meeting and try to come up with offerings that a customer might not even have thought about. Or a customer workshop can be organized in which customers together can make suggestions. A survey can be used, idea generator on the website and so on. So instead of following customers/market patterns, it can be opt to lead.

6. How well do you think the service product meets the need of the customer? Explain your reasoning. (e.g. customer satisfaction, potential service adoption rate)

All of our quotes have to be based on realistic starting points were the needs of the customer are summarized.

Customer satisfaction is currently not monitored and only complaints are. Providing service is all about fulfilling the customer's need, feedback is thus key.

Part 2-B: Product analysis

1. What is being serviced? (e.g. complete product, only a part, complementary / rival products)

Being serviced is that you try to fulfil the expectations of the customer within your own range of products.

1a. Do you know the number of parts that are being serviced? (is there a service portfolio defined?)

Yes, the service portfolio consists of approximately 6500? parts and we have a maintenance program in which we have defined these products. The products are furthermore categorized as critical, maintenance or historical.

2. Where lies the customer order decoupling point? Engineer / configure / assemble to order (ETO/ CTO/ ATO), make to order (MTO), make to stock (MTS)

Configure to order. Both products are offered in several capacities with modular options.

2a. Are customized spare parts distinguished from standard spare parts?

Yes, and known at the customer to avoid surprises at delivery time while we don't have them on stock

2b. What is the ratio between the two? (If they are not distinguished, can you still give a rough estimate?)

10% of the parts could be customized but getting less by more standardization of our site but there is still an old install base of machines

Is product hierarchy considered? In other words, is it possible to stock (more) general parts that can be customized later on. This could help to decrease lead times.

3. Are spare parts being classified? If so, on what criteria? (e.g. price, criticality, demand volume, availability etc)

Yes, parts that wear are maintenance parts and are included in the maintenance plans. Parts that do not wear but can still cause machine failure are labelled as critical. By indicating the impact, chance and detect ability, the criticality level is indicated (1 to 3). Parts that are neither assigned to the maintenance group or the critical group but are still demanded, are listed as historical parts, the third group. Apart from that, parts are assigned to a so called "factor group". The factor group is merely based on the part's availability but price is also a criteria. This classification is used for the pricing strategy.

The factor group is currently only used by the service department for pricing strategies. This classification however could also help the logistics and purchasing department to prioritize efforts. Another criteria that could be useful is the demand. Parts could be classified as fast movers and slow movers. Price, demand and availability can then be used to indicate the most critical parts that should get the most attention, and the least critical parts that are less important to continually monitor. This could lead to a more cost-efficient operation.

3a. Is there decided upon what parts require gathering and maintaining technical information?

Yes, we have defined when a part have to be replace during inspection /maintenance

Regularly updated? (Earlier analysis showed that the classification could be questioned).

3b. Are there pricing strategies formulated for spare parts?

Yes, we are having a pricing policy based on the parts price and availability.

4. Are consumables distinguished from repairables?

Yes, but these are the "older" customer. Repair on coils is common a repair of a parts is a very small business (max 1%)

4a. Is there a level of repair identified? (e.g. LORA analysis)

No

5. Are (potential) obsolete parts identified?

Yes, caused by the fact that we are maintain an old install base we sometimes can't supply parts anymore. Also program Siemens S5 is obsolete and customer know that they have to retrofit the machine while we (and Siemens) can't support this anymore.

Is there a trade-off made between retro-fits revenues and continuing service revenues? Are retro-fits offered for a competitive price? Do you use any type of costs calculations (depreciation) to convince

customers? In other words, provide the knowledge to make an educated decision.

5a. What are the strategies to deal with obsolete parts?

If possible we retrofit or trying to offer a replacement

6. Are there condition monitoring sensors in the product? Elaborate (for what part, continues or read-out etc).

Hour counter give a impression of the running hours so that a customer know with our inspection/maintenance program what should being done

Are customers willing to share this information? In other words, can you take over this role for them? That you contact them for scheduling a maintenance job?

Part 2-C: Organization analysis

1. Is the service office a department, business unit or a subsidiary?

Department (commented that company is too small for making it a standalone business unit)

1a. Does the inventory supply both sales as service? If so, is the planning of both inventory types separated?

Yes, but Sales is most of the time on order and we are checking this so that the influence of the sales is as less as possible so that the service process is not disturbed

1b. Does the purchasing department supply both sales as service? If so, are the two supplies separated or seen as one?

Yes, see 1.

2. Could you draw the service supply chain in as much detail as you think is necessary? (suppliers, distributors, wholesalers, service centres, inventories, customers)

2a. Are there multiple spare part inventories? If so, is there any link between them or do they function as separate units?

3. Could you draw the internal organization of service in as much detail as you think is necessary? (offices, functions, roles and responsibilities)

3a. What is the educational level of the service manager, logistic manager, supply manager and service mechanic in respective order?

Education level is average, product knowledge and knowing the complete process could always being better. (indicated that the biggest challenge are service area managers. They got to have years of experience to function independently, as the installed base is an old installed base).

3b. Is there an educational / training program for service personnel (e.g. front office, mechanic)?

Yes/No. We having a program but during the large intact this goes to a second plan which makes that lots of FTE learning during the job

4. Could you list the (service relevant) KPI's that are actively being measured?

Intake (spare parts, coils, retrofits, services)

Turn-over (spare parts, coils, retrofits, services)

Gross Margin (spare parts, coils, retrofits, services)

Guarantee orders

Occupation of the FSE

Reliability of deliver of order

Complaints

Good basis, but could be further transformed in a "KPI boom", in which dependencies are known and KPI's are targeted to specific functions / people (trade-off between required extra time/cost and potential benefits).

4a. Are there any incentives for service personnel? (e.g. bonus, award)

NO.

Could be used to motivate people and to create a better focus on service.

5. Are there any internal conflicts regarding service? (e.g. capacity, resources)

One day you have enough FTE and another day you have to disappoint a customer. Luckily this happens "twice" a year. A good planning should avoid this. (Manager recognizes that sales always gets priority over

service)

6. Could you list the ICT tools and their purpose?

SAP, SIS, Excell.

Knowledge could be better stored and shared with an additional service related software package. Apart from that an dedicated spare part management package could help to forecast demand and increase the efficiency of inventory management. (also noted by previous graduate). Again, trade-off between costs and benefits.

Part 3-A: Demand forecasting (not relevant for SFDS)

No forecasting at all seems problematic. A service demand originates at a machine failure, which is a random event. As noted at question 5 above, planning of service capacity is difficult due to this volatile demand. A forecast is therefore vital for efficient handling. Simple methodologies and tools that are used for manufacturing can also be used for the planned service demand, which could relative easily lead to efficiency gains. The unplanned demand however requires more complex measures. Forecasting for example lumpy demand patterns, require to use complex mathematical tools. A planner should thus have the required knowledge and software tools, which could require a substantial investment.

1. Is there a distinction between planned and unplanned demand in the forecast?

NO

2. Which parts are forecasted? (e.g. all parts, critical parts, expensive parts, parts with a high demand)

Maintenance parts and we are trying to convince customer to order on time this parts.

This goal conflicts with the SLA of 2 weeks delivery for a maintenance kit.

3. Are failure rates of parts used to forecast demand? (reliability based)

NO

3a. According to which methodology(s)? (e.g. market regulations, data base, calculation)

4. Is the average demand or the demand patterns used to forecast demand? (time series based)

Our stock managers is trying to oversee the patterns and adjust the parameter on this if necessary

4a. According to which methodology(s)? (e.g. simple average, moving average, Poisson, Croston)

??

5. Who receives/uses the forecast? (e.g. service-, logistic-, purchasing department, suppliers)

6. What kind of ICT tools are being used?

SAP ERP, Excell

7. Is the forecast performance being measured? (e.g. KPI's, evaluation)

Yes, but on high level of intake and turn-over not on specific parts

Part 3-B: Front office

1. How many customers are being served?

200

1a. Are there any prioritization rules? (e.g. are they ranked in order of importance)

Officially yes while with the silhouettes we should be able to work with that. On this parts we are still a “old fashion” service department. We are helping every one with a machine of us.

2. Is the service product actively being sold? How?

Yes, visiting customer by area service manager. Defined in a plan

2a. Are there any guidelines/policies regarding customer visitations? Can you elaborate on this?

Visits are defined in a plan, goals are defined before we visit a customer.

3. How are faults diagnosed? (e.g. by customer itself, inspections, condition monitoring, plc)

Most of the time by the customer. Sometimes by using remote access (PLC). Only in 10% of the cases, a service engineer has to visit the customer to make a fault diagnoses.

3b. What is being documented after a fault diagnosis?

4. What is internally being reported after a service call?

Not, while this is handled by a ASM which is connected with their customers.

In case of a complaint it has to be reported

Do ASM's share knowledge and experiences?

4a. Is customer satisfaction being monitored? How?

When is a customer satisfied? Not done at the moment.

The only goal of service is to satisfy the customer. How can you know your performance without feedback?
Plus, if you want to strive for an effective and efficient result, the performance of ASM's should be

monitored and compared.

5. What is internally being reported after a customer visit?

Every visit have to finalized in a report. FSE and ASM have to report

6. What kind of documentation does a customer receive after an order closure?

Depends what kind of order. They always receipt an order acknowledgement but in case of a retrofit they receipt also an adaption of their manual

7. What kind of ICT tools are being used?

8. Are there any other performance indicators being measured, which are relevant for this business process?

Part 3-C: Back office

1. How many different parts are managed by the service department (size of service portfolio)?

What are different parts, we maintain 3500 parts.

1a. How often are info records of parts missing (e.g. rarely, incidentally, quite often, often)? Could you elaborate on this, for example whether this is for old or new parts?

"15%" but getting less

Getting less? Is this being checked regularly?

2. Are there currently any capacity or resource problems? Can you elaborate on this?

Yes, to maintain the maintenance program

2b. Do you experience any internal conflicts with other departments? Can you elaborate on this?

There is always a tension while the service department can have every week a breakdown (700 machines

!!)

3. Are fault diagnosis being analyzed? With who is this information shared?

Fault diagnosis are being analyzed to be convinced that the problem is solved. This information will be share with the department which are involved.

3b.Is there any other internal documentation being analyzed? With who is this information shared?

??

4. Which service related KPI's are being measured? (e.g. service performance, reliability)

Reliability of order

Production process

The primary focus should be the uptime of the machine. Lead times are thus crucial (more important than reliability).

4a. Are internal order lead times being monitored? (e.g. administrative / logistic delay)

Yes, daily

They are monitored, but not analyzed. This last could be a tool to strive for a more efficient internal handling and a better knowledge for capacity allocation

4b. Are external order lead times being monitored? (e.g. setup time, diagnostic time, repair time, start-up time)

Yes, daily

See 4a.

5. What kind of ICT tools are being used?

Part 3-D: Inventory management

1. How many different parts are being kept in stock and what is the current stock value?

3300 in total. Current stock value is 2.000.000 (balance sheet value is 1.6 M).

1.200.000 classified as service (700.000 estimated by service as required)

240.000 LV

385.000 IPS

47.000 general

720.000 non classified parts

268.000 historical

95.000 manufacturing IPS

Could be further analyzed/specified to indicate service costs. Ratio service, manufacturing and IPS vs. LV.

1a. Is the planning of service parts separated from manufacturing?

On an operational level it is not. Inventory is used for both sales as service and SAP creates an ATB when inventory level drops below order-point. Demand is thus seen as 1, but can be traced back in SAP.

For the strategic / tactical planning both demands are separated.

Could it be possible separate certain orders?

1b. Are (spare) parts categorized? (e.g. based on criteria like criticality, availability, price)

Yes, approximately 2/3 of the inventory is categorized (sales, service). For spare parts there are three types of categories: critical (level 1 to 5), maintenance and historical.

This classification however can be questioned. 200.000 euro's of the inventory did not move in 2 years. 70.000 were critical parts and 130.000 were maintenance parts. It seems odd that maintenance parts did not move in 2 years. It is also noted that the turnover rate of both categories are merely the same, which again seems odd.

Of parts that were not categorized, another 80.000 euro's did not move in 2 years.

First of all, it seems that stocking strategy could be updated / revised. Second of all, by using a multi-item approach, a efficiency gain could be reached. Parts could be classified based on price and demand, criticality and based on these aspects, replenishment strategy can be chosen. This could lead to a more efficient handling, since it sets an order of importance and resources could be allocated better.

2. How is there decided upon what parts to stock?

For one of product groups this is merely based on historical data (40 years +). For the new product group, the service department determined which parts should be kept in stock (see question 4).

3. Could you elaborate on the type of replenishment strategies that are used? ($Q,r / s,S / T,R / S-1,S$)

Every order follows from an ATB created by SAP (continues review). Some articles have an order-point, some do not. Some have an order-size, some do not. The criteria used for these decision are:

Order-point: pace of demand, order size, staffel;
Order-size: staffel, demand

Could be based on classification of parts to lead to more efficient handling.

4. How are replenishment parameters (stock size and order quantity) determined? (e.g. what criteria/methodologies)

Subjective input (based on criteria above) and trial and error. For a year it has been monitored when a order was too late and what the purpose was. In cases where the inventory was too low, the order-point was raised. However another substantial problem are the order sizes. Large service orders are delivered from stock and create demand peaks that make it difficult to determine an appropriate stock level.

The input for one product group was given by the service department. For ALL critical spares, one item is kept in stock for breakdown orders. For maintenance and historical parts, appropriate levels were determined based on average demand.

Order sized should be limited as it creates demand peaks that trouble an efficient handling/stock management.

Stocking strategy for spare parts should be revised. An multi item approach where service performance are based on price, demand, criticality could again lead to a more efficient handling.

5. What kind of ICT tools are being used?

SAP and Excell

Dedicated spare parts management tool could be helpful, but manager was previously did not see the need for such a large investment. It could be questioned whether the inventory value en size is large enough.

6. Are there performance indicators being measured? Which one?

Delivery performance, fill rate, turnover, obsolete, internal handling.

Part 3-E: Repair management (not relevant for SFDS)

1. How is there decided upon whether to repair or to replace/discard a part? (e.g. test, subjectively)

Depends which part

2. How are repair lead times determined?

Not, in case of coils we do this by ourselves

In case of third party it difficult

2a. Are these being monitored?

Not really

3. How are the required resources determined? (e.g. budget constraints, forecast)
--

Not

4. Is parts' return forecasted?
--

Not

5. Are there other performance indicators being measured, which are relevant for these business processes?

--

Part 3-F: Supply management

1. How many suppliers are there?

300

1a. Can you further categorize them? (e.g. ratio between wholesalers, manufacturers, specialist)

No. we don't actively categorize them and manage the suppliers within a dedicated category.

Conflicting information with what I heard from service manager. However, categorizing suppliers could lead to an efficiency gain, as it prioritizes resource allocations.

2. Is the service supply separated from the manufacturing supply?

We have one purchase department who is taking care of both supplies. But the material flow is separated and the service supply is monitored separate from the manufacturing supply. Within the purchase department we have one dedicated buyer who is responsible for the service supply performance.

This is then only for the spare parts that are not stocked.

2a. Are service orders distinguished from regular orders?

For non-stocked items this can be distinguished by the order code, but this is only used for internal matters. For stocked items there is no distinction, but in SAP it can be traced back where the demand came from.

Could be used for external matters as well, as suppliers can use this extra knowledge. They could for example deliver sooner when possible, instead of JIT.

2b. Do service orders include an urgency indicator?

Not flagged as such

Could be useful to indicate criticality and therefore help allocate resources.

3. How many spare parts are actively managed (info record maintained) by the purchasing department?

5000

There are 3500 spare parts, and 3300 parts in stock. How can this number be 5000?

3a. How many different spare parts are actually being ordered in a year?

Based on turnover 2013; 25% of the spend is spare parts.

??? 25% of total orders? Then these should all be non stocked items?

3b. How often are info records of parts missing (e.g. rarely, incidentally, quite often, often)? Could you elaborate on this, for example whether this is for old or new parts?

Rarely for the 5000 because we update them on yearly base. Besides the 5000 spare parts we deal with spare parts which are not maintained. These so called, "service meldingen" are quoted per case.

Service manager indicated 15% of the cases.

Approximately 80-90 "service meldingen" a year.

4. Could you elaborate on the type of supply contracts that are being used? (e.g. agreements about price, lead time, performance)

Since 2013 we are expanding the supply contracts with more focus on the spare parts and material availability. These agreements are made on price and lead time. The performance is not included (yet).

Could be a goal that would result in more efficient handling. ISO 55000 known?

5. What KPI's are being used to monitor supply performance? (e.g. quality, reliability etc)

Quality and delivery performance. The monitoring is consolidated, so with manufacturing and service supply together, although we are able to make a deep dive per PO when necessary.

Is it monitored in total or per supplier? Only this last one makes it possible to really attack the problem at its core.

6. Do you know the replenishment strategies of suppliers?

This will vary per supplier. We deal with traditional suppliers like sheet metal construction till suppliers with fully automated replenishment systems.

Could be interesting to check, since suppliers could use a JIT planning, while there is an urgency for the customer.

7. What kind of ICT tools are being used?

Delivery performance in SAP and Quality is done manually within Excel.

8. Are there other performance indicators being measured, which are relevant for this business process?

No.

Sharing forecast and other knowledge could be considered to reduce lead times and increase an efficient handling.

Appendix C: Presentation of the development path for SFDS

Developing a servitization model

“A roadmap for capital equipment manufacturers for pursuing a servitization strategy”

Case: Stork Food & Dairy Systems B.V.

Juli 2014
Bas van Gool
1327771

Content of the presentation

- The research;
- The challenging after-market;
- The servitization model;
- The assessment of SFDS;
- Recommendations for SFDS.

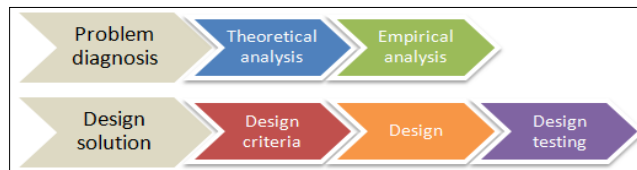
How do you value my recommendations?

The research

Servitization: “the innovation of an organisation’s capabilities and processes to better create mutual value through a shift from selling a product, to selling a product-service system” (Baines et al. 2009).

The Research Problem: most capital equipment manufacturers are struggling when making the transition towards services and therefore squander the after-market’s potential

Main research question: What guidelines, tools and techniques can help capital equipment manufacturers to successfully implement a servitization strategy?



Why a servitization strategy?

Financial drivers

- Stable income with high profit margin;
- Generate additional income from already existing customers;
- Service sales are counter cyclical.

Marketing drivers

- Attract new customers;
- Increase repeated sales due to dependency and loyalty;
- Increase knowledge on customers and products.

Strategic drivers

- Sustainable competitive advantage.

Source: Baines, Lightfoot, Benedettini, & Kay; 2009

Why do companies struggle?

The after-market is characterized by a **complex, dynamic and hostile** environment, due to its following characteristics:

- Large variety in customer need and willingness to pay;
- Large variety in products and parts;
- Sporadic and volatile demand;
- Geographically dispersed installed base;
- Integrated resources;
- ...

How to deal with these challenging characteristics?

> **9 competences that indicate the right prerequisites**

Why do companies struggle? (2)

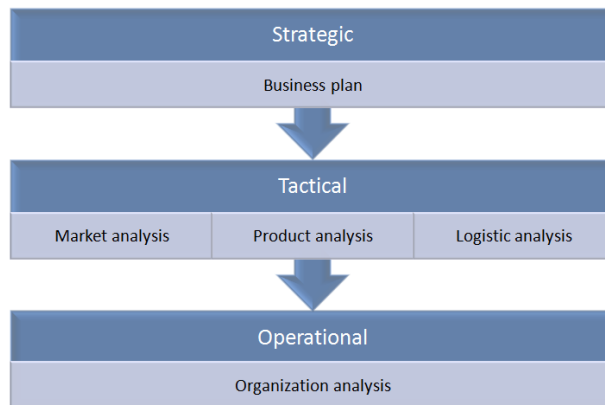
To successfully compete on the after-market, companies have to:

1. **Change their culture** from a product-centered organization to a service-centered organization;
2. **Change their focus** of customer interactions from transaction- to relationship-based;
3. **Change the value proposition** to the end-user from product efficacy - whether the products work - to the products efficiency and effectiveness within the end-user's process.

Companies face the risk of internal conflicts, since service management principles are often at odds with traditional manufacturing practices.

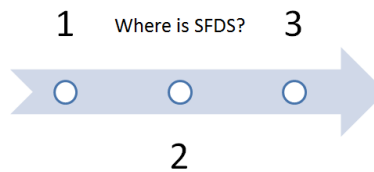
Source: Mathieu, (2001); Gebauer & Fleisch, (2007); Oliva & Kallenberg, (2003)

How to successfully servitize?



Assessing SFDS' capabilities

- Interviews;
- Data analysis;
- Questionnaire;
- Previous research;
- On site observations.

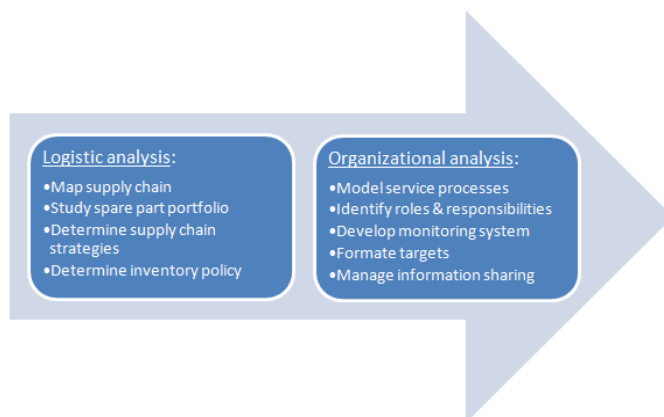


Tactical business layer					
Market analysis		Product analysis		Logistic analysis	
1 segment customers	done	1 study product and determine portfolio	done	1 map supply chain	~
2 design service offerings	done	2 develop maintenance plans	done	2 study portfolio	x
3 design business models	done	3 define assortment	~	3 determine supply chain strategies	x
4 determine pricing strategies	done			4 determine inventory policy	x
Operational level					
Organizational analysis					
		1 model service processes	x		
		2 indicate roles and responsibilities	x		
		3 design monitoring systems	x		
		4 formulate targets	x		
		5 manage information sharing	x		

SFDS' competences



The development path for SFDS



Why a logistic analysis?

“After-sales services are a commitment companies make to respond within a specific time frame to the customer’s need for support” (Cohen et al., 2006).

This is however challenging, since services include a:

- Large variety of spare parts (criticality, price, availability, etc)
- Volatile and sporadic demand (90% of spare parts portfolio is characterized by intermittent and lumpy demand patterns).

Companies therefore have to:

1. **Study the variety of spare parts** and match their characteristics to suitable strategies, policies and methods;
2. **Analyse the trade-off between costs and lead times.**

How to conduct a logistic analysis?

1. **Map supply chain:** distinguish material flows and their value driver (preventive vs. corrective maintenance)
2. **Study spare parts portfolio:** categorize spare parts (Pareto principle: 80-20 rule)
3. **Determine supply chain strategies:** pooling, partnering, outsourcing, repairing, collaboration, safety stocking etc. (currently SFDS only uses safety stocking)
4. **Determine inventory policy:** use a multi-item approach and use appropriate forecasting methods.

Goal: match the demand and supply of spare parts within the agreed upon time while minimizing costs, by developing a sophisticated and integrated logistic network

Why an organizational analysis?

The service organization is a fixed cost and the main driver of profitability is capacity utilization (Oliva & Kallenberg 2003).

Eliminating non-value-added activities like administrative delays can significantly shorten customer lead times (Durmusoglu & Kulak, 2008).

This is however challenging, since:

- In the after-market, managerial actions have a low temporal order, co-variation and continuity in time and space;
- Most services cannot be stored and carried forward to a future time period.

Aligned actors and intra- and inter-company collaboration and information sharing are therefore critical success factors

How to conduct an organizational analysis?

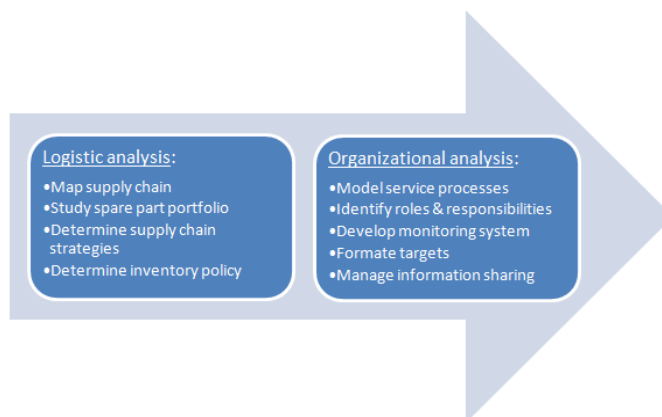
1. **Model service processes:** operational, management and supportive processes for all service orders
2. **Indicate roles & responsibilities:** align actors and provide transparency
3. **Design a monitoring systems:** generate objective feedback for all important business processes
4. **Formulate targets:** motivation and commitment are the most quality creating factors in the service business! (Edvardsson and Olsen; 1996).

How to conduct an organizational analysis? (2)

5. **Manage information sharing:** addressing the uncertainty and complexity of the after-market requires higher levels of information processing and close intra- and inter-company collaboration (W. a. Neu 2005) (W. a. Neu & Brown 2008).

Goal: manage the operational business processes in the most effective and efficient way by developing a flexible and integrated organization

The development path for SFDS



Potential action points

- SLA maintenance kits (preventive maintenance can be planned)
- Limit order quantities or deliver to order (unnecessary demand peaks)
- Update portfolio (40% never ordered in 2 years, 25% of inventory obsolete)
- Information sharing (preventive maintenance can be planned)
- Revise inventory policy (current policy does not allow remedial effort to be directed where it will produce the greatest value)
- Differentiate supply chain strategies (safety stocking is an appropriate strategy for parts of which the lead times are longer than the time to tolerate a stockout situation (Huiskonen, 2001))
- Roles and responsibilities (who maintains portfolio?, who is end responsible for the inventory management?....etc)
- KPI's and target's (current KPI's do not cover complete scope and their are no clear targets >>> keep working towards self improvement)

Developing a servitization model

"A roadmap for capital equipment manufacturers for pursuing a servitization strategy"

Case: Stork Food & Dairy Systems B.V.

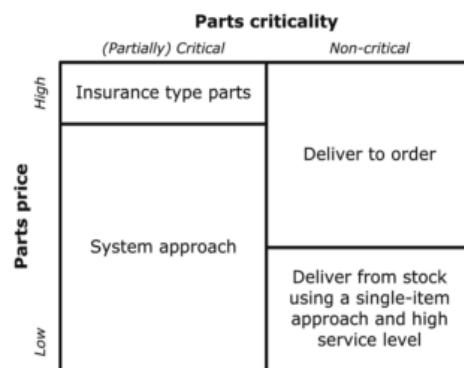
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A multi-item inventory approach

1. Define spare parts categories (e.g. price vs. criticality)
2. Set appropriate service levels for each category
3. Determine replenishment policies for each category
4. Manage inventory levels with appropriate forecasting methods

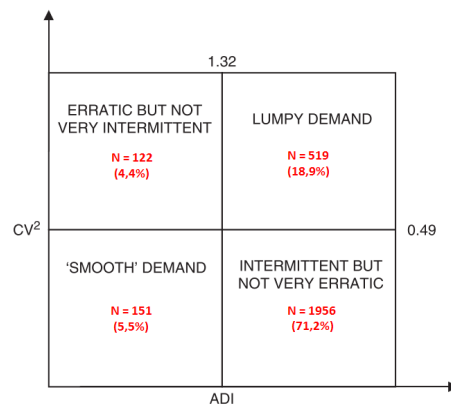
Note: The inventory levels of 90% of the spare parts portfolio are currently determined with an inappropriate forecasting method (simple moving average)

The multi-item inventory approach of Driessen et al. (2012)



Multi-item inventory approach (Driessen et al. 2012)

Spare part's demand patterns



The four demand patterns

Resultaten data analyse

Tabel 4 – Aantal artikelen per categorie (data 2009-2011)

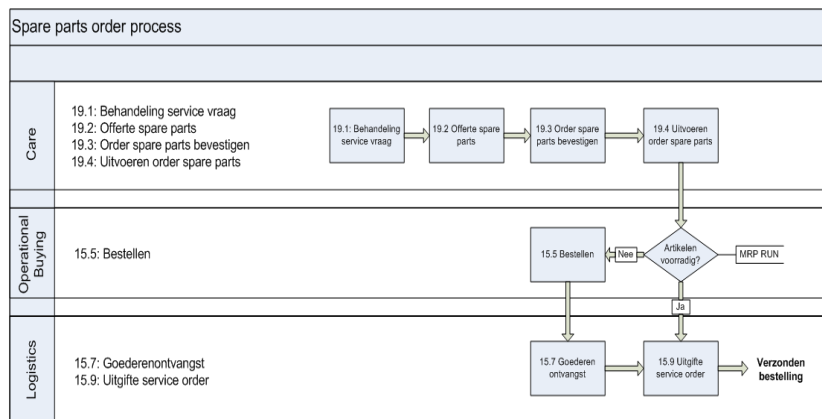
Minimum aantal vraagmomenten	Smooth	Erratic	Lumpy	Intermittent	Totaal
30	88	120	89	52	349
20	90	120	165	115	490
1	151	122	519	1956	2748

Source: Berry Gerrits, 2012

SFDS' current inventory policy

Inventory policy by category		
Inventory policy		
Critical	Criticality (1 to 5) = $\frac{(\text{chance} * \text{impact})}{\text{detectability}}$	Parts are only available for breakdown orders 1 of each item is kept in stock
Maintenance	Maintenance kits or Maintenance parts	Inventory level is based on average usage
Historical	Parts that are neither critical nor maintenance, but are ordered at least twice in the last four years	Inventory level is based on average usage

Spare parts order process



Current forecasting accuracy

“Hoe is de huidige wijze van vraagvoorspelling en wat is de kwaliteit hier van?”

*De huidige manier van voorspellen wordt gedaan aan de hand van een vierjaarlijks gemiddelde. De vraag per jaar wordt geacht uniform verdeeld te zijn over het jaar. De gemiddelde **voorspelfout (A-MAPE)** bleek **96,64% te zijn**, de **Number of Shortages (NOSp)** **39,80%** en uit de lineaire regressie bleek dat de **cumulatieve voorspelling sneller stijgt dan de cumulatieve vraag.** “*

Source: Berry Gerrits, 2012