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MANAGING AND STANDARDIZING A COMPLEX INDUSTRIAL SERVICE DELIVERY SYSTEM

Master of Science Thesis

Prof. Miia Martinsuo has been appointed as the examiner at the Council Meeting of the Faculty of Business and Built Environment on June 3rd, 2015.

ABSTRACT

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Manufacturing companies need to develop efficient service deliveries in order to be able to operate in multi-customer, multi-equipment environment successfully. Efficient service deliveries require understanding of the service delivery system as a whole and standardization of the system should take place. The objectives of this research are to understand how manufacturing companies can develop their service delivery system towards fleet level, identify how companies manage the system and find out how the service delivery system can be standardized without jeopardizing customer satisfaction.

The research was conducted as a qualitative multiple-case study with three Finnish manufacturing companies. A literature review of previous research was done and 19 interviews were conducted in the companies with manager level employees. The interviews were recorded, transcripts were made and the data was analyzed by categorizing it. Every case company was observed individually and cross-case comparison was made across the companies.

The study reveals the importance of technology, customer participation and standardization in the management and development of the service delivery system. The technology can enable or hinder the development and standardization. Customers cause variation into the service delivery system and companies have to consider their role carefully in order to be able to achieve efficient service deliveries. Standardization is required to some level when developing the service delivery system towards fleet level. It can be achieved by standardizing the various sub systems of the service delivery system.

The results of this study can be used in manufacturing companies to understand and identify important factors in service delivery system that cause variation and require development. The results also arose several topics for future research. The standardization should be research more in the practical level. Also change management and customer participation should be studied more.

TIIVISTELMÄ

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Valmistavat yritykset pyrkivät kehittämään palveluliiketoimintaansa transaktionaalisista palveluista kohti proaktiivisia palveluita. Lisäksi yritysten tavoitteena on pystyä palvelemaan useaa asiakasta ja erilaisia laitteita samanaikaisesti. Tämän tutkimuksen tavoitteina on selvittää kuinka yritykset voivat kehittää palveluiden toimitusjärjestelmänsä laitekantatasolle, kuinka yritykset hallitsevat monimutkaista toimitusjärjestelmää ja kuinka järjestelmää voidaan vakioida vaarantamatta asiakastyytyväisyyttä liiaksi.

Tutkimus toteutettiin kvalitatiivisena monitapaustutkimuksena. Tutkimukseen osallistui kolme suomalaista valmistavaa yritystä. Kirjallisuustutkielma tehtiin aiemman tutkimuksen selvittämiseksi ja yrityksissä toteutettiin yhteensä 19 haastattelua. Haastattelut nauhoitettiin, litteroitiin ja saatu data analysoitiin jäsentämällä ja vertailemalla.

Tutkimuksen tuloksena huomattiin, että teknologialla, asiakkaan osallistumisella palvelutoimituksiin ja vakioinnilla on tärkeä rooli palveluiden toimitusjärjestelmän hallinnassa ja kehittämisessä. Teknologia voi toimia vakioinnin mahdollistajana tai ehkäistä sen toteutumista. Asiakkaan osallistuminen palvelutoimituksiin aiheuttaa variaatiota toimitusjärjestelmään ja yritysten tulee harkita, kuinka osallistumista tulee hallita tehokkaiden palvelutoimitusten saavuttamiseksi. Kehitettäessä palveluiden toimitusjärjestelmää kohti laitekantatasoa, vakiointia tarvitaan jollakin tasolla, jotta palveluita voidaan toimittaa monille asiakkaille ja laitteille samanaikaisesti ja tehokkaasti. Vakiointi voidaan saavuttaa vakioimalla palveluiden toimitusjärjestelmän osajärjestelmiä ja -prosesseja.

Tutkimukset tuloksia voidaan käyttää palveluiden toimitusjärjestelmän tärkeiden tekijöiden tunnistamiseen ja ymmärtämiseen. Tärkeintä on löytää ne tekijät, jotka aiheuttavat variaatiota järjestelmään ja, joiden kehittämisellä kasvatetaan tehokkuutta. Tulokset nostivat esiin myös useita aiheita tulevaa tutkimusta ajatellen. Palveluiden toimitusjärjestelmän vakiointia tulee tutkia lisää käytännöllisestä näkökulmasta. Lisäksi tarve on muutosjohtamisen tutkimukselle, kun järjestelmän osia vakioidaan, mutta toisia osia taas ei. Asiakkaan osallistumista palveluiden toimitukseen tulisi myös tutkia lisää.

PREFACE

The topic of this thesis was discussed together with my employer and professor Miia Martinsuo as the research was part of a bigger research program. I am very interested in service business and I added some of my own ideas of the standardization to the topic. I have studied all the service business related courses at our university and it is my passion.

Writing this thesis was a long and challenging process. It taught me many new things about service business but also about myself. The process lasted eight months and the completion of this thesis was my last task in my student career.

I want to thank professor Miia Martinsuo of guiding me and offering me valuable comments during this process. I also want to thank my friends and family who have encouraged me along the route. Especially I want to thank Niko Siltanen who reminded me of the importance of my thesis from time to time. I also want to thank my team members who supported and helped me whenever I had problems. Ilona Ryödi deserves thanks for helping me in technical issues.

Helsinki 15.10.2015

Elina Poikonen

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APPENDIX A: THE INTERVIEW STRUCTURE

1. INTRODUCTION

1.1 Background

The service sector is the fastest-growing and largest segment of economies in developed countries. (Chase and Apte, 2007) In the past decade the rapid development of Internet has effected for example on service products and processes. The development of information and communications technology has also effected on the globalization of services, the entry of nontraditional competitors and the heterogeneity and complexity of customers' demands in multiple channels. (Roth and Menor, 2003) In recent years sensor technology has developed rapidly and companies have started to utilize this new data collection technology in their service business. However, the data monitoring systems have been built for monitoring the data of individual units. This area needs to be researched more.

Roth and Menor (2003) introduce a framework for researching service operations management issues. Their framework is a good basis for the research of service delivery system design characteristics and contingencies (Ponsignon et al., 2011). The framework includes target market, service concept and service delivery systems design choices. The target market is about *who* is the right customer. The service concept addresses the question *what* is being provided and the service delivery system tells *how* it is provided to the customer. (Roth and Menor, 2003; Ponsignon et al., 2011)

Different approaches for service design and management are needed for different service concepts and markets (Roth and Menor, 2003). The driver of this thesis is the need of understanding fleet level service delivery systems and how they should be structured. In this context there is some kind of need for standardization when the service delivery system is extended to the fleet level and it is not only concerning one unit.

The standardization of the service delivery system is a trade between the efficiency of the delivery and the customer satisfaction. Standardization always reduces opportunities of customization. This means that the services cannot be totally customized for one customer but there has to be same kind of procedures for customers from same market to make the service business more effective and productive.

1.2 Research questions and objectives

The research concentrates on the service delivery systems the case companies use and the most important aspects that should be considered when developing the system towards

fleet level. The objective is to notice the most important aspects of the service delivery system and to model it. The most important research question is:

What are the most important aspects in service delivery system when developing it towards fleet level?

The research question can be divided into the following questions:

How do companies manage their service delivery systems?

How can the companies standardize their service delivery system?

The aim is to provide new theoretical understanding of the service delivery systems in a fleet level. For case companies the purpose is to offer concrete action proposals to develop their service delivery systems to better serve their customers in effective way.

1.3 Research context

This thesis is a part of FIMECCs (Finnish Metals and Engineering Competence Cluster) S4Fleet (Service Solutions for Fleet Management) research program. The aim of the research program is to research the variety of possibilities the development of sensor technologies and Internet of Things provide for companies in service business. In particular this thesis is part of one of the research programs projects called Dynamic service delivery systems for distributed fleet. In Finnish the project's name is Ennakoiva, liiketoimintaan lisäarvoa tuottava palveluiden toimitusjärjestelmä hajautetulle laitekannalle (ELLIS).

The research consortium includes participants from top national universities as well as leading technological manufacturing companies. There is also an international aim in the project and the consortium co-operates with many international operators. The program also has an international scientific advisory board which consists of the top researchers in the service business area.

1.4 Case companies and methodology

All the case companies are Finnish manufacturing or engineering companies that operate in global environment. Their service offering varies from traditional product related services to more developed services, such as consulting and optimization. The core of the case companies' service business is project deliveries but they also have transactional deliveries. The customers vary from consumers and small companies to big companies.

The first part of the data collection is literature survey to understand the theory behind the research problem. The survey will include articles and other scientific literature into which the empirical research will be based on.

The empirical data needed in this research is collected with qualitative theme interviews in the case companies. The persons who are interviewed will be chosen so that as many parts of the service delivery system as possible are covered. Also to understand the whole service delivery system, observations will be carried out in the case companies. The purpose of these observations is to find out the complete supply chain of the services to understand the system level aspects.

1.5 Structure of the thesis

The chapter two is a literature review of industrial service delivery systems and service chains. The chapter two also deals with standardization and the balance between standardization and customization in industrial service delivery systems.

The third chapter introduces the research method used in this research. It also presents the case companies which are under the survey. The chapter is divided in four sub chapters.

The fourth chapter lists the results of this research. It is divided in three sub chapters. The results are introduced a case company at the time.

The fifth chapter discusses the results. It points out the most important aspects found in the results and introduces two frameworks.

The last chapter is a conclusion. It consists of the action proposals for the case companies. It also concludes the research and forms the answers for the research questions.

2. LITERATURE REVIEW

2.1 Industrial service delivery systems

The service sector grows rapidly and there is a dearth of service operations management research. Therefore Roth and Menor (2003) introduce a service strategy triad in their article of research agenda for service operations management. The service strategy triad includes target market, service concept and service delivery system design choices. All of these aspects are linked with service encounters.

The target market refers to who is the right customer. Most companies segment their customers into groups. The segmentation can be done based on common characteristics or attributes. The customers can be segmented also based on operational attributes such as customization or degree of customer contact. (Roth and Menor, 2003)

In the literature there are many definitions for the service concept. For example Edvarsson and Olsson (1996) suggest that service concept is a detailed description of what wishes and needs are to be satisfied for the customer and how it is to be done. Johnston and Clark (2005) define service concept with four aspects:

1. service operation: The way of service delivery
2. customer´s direct service experience
3. service outcome: The results and benefits for the customer
4. value of the service: customer's benefits minus costs

Roth and Menor (2003) combine three different definitions and according to them the service concept consists of core service and peripheral services. The core service includes five elements:

1. Supporting facilities
2. Facilitating goods
3. Facilitating information
4. Explicit services (experiential/sensual)
5. Implicit services (psychological benefits)

The peripheral services offer additional benefits for the customer that add value and are supplementary to the core service.

Service delivery system consists of the technological, organizational and managerial aspects through which the service is delivered. In overall it refers to how the service is

delivered to the customer (Roth and Menor, 2003). The delivery system includes for example the equipment, technology, people, procedures and management needed in the service delivery (Heskett, 1987).

The service concept and the value proposition are provided to target customers through the design and configuration of the service delivery system. This part of the competitiveness of service businesses is contingent. (Johnston and Clark, 2005; Verma et al., 2002) To attain levels of performance in retention, customer satisfaction and overall profitability, there has to be an alignment between target market, service concept and service delivery system design (Ponsignon et al., 2011).

2.1.1 Service delivery system design

The service delivery systems have been studied in different contexts. Roth and Menor (2003) base their research in literature review as they consider a research agenda for service operations management. Ponsignon et al. (2011) conducted a single case study in one of the leading electricity supplier in UK. The case company is part of one of the largest power companies in Europe. A market leader was chosen to be able to identify service delivery systems' characteristics associated with market leading performance. (Ponsignon et al., 2011) Heskett (1987) uses many examples from different industries. The example companies vary from insurance company to airline. (Heskett, 1987)

According to Roth and Menor (2003), the strategic service system design choices consist of structural, infrastructural and integration choices. The structural choices concern for example technology and equipment, layout and facilities, capacity planning and service product-process interfaces. The infrastructural choices relate to people, practices, policies, performance systems and processes. Finally the integration choices involve service supply chains, operations organization and coordination, learning and adaptive mechanisms and integration technologies. (Roth and Menor, 2003) The strategic service delivery system choices and the service delivery system architecture are introduced in the Figure 2.1.

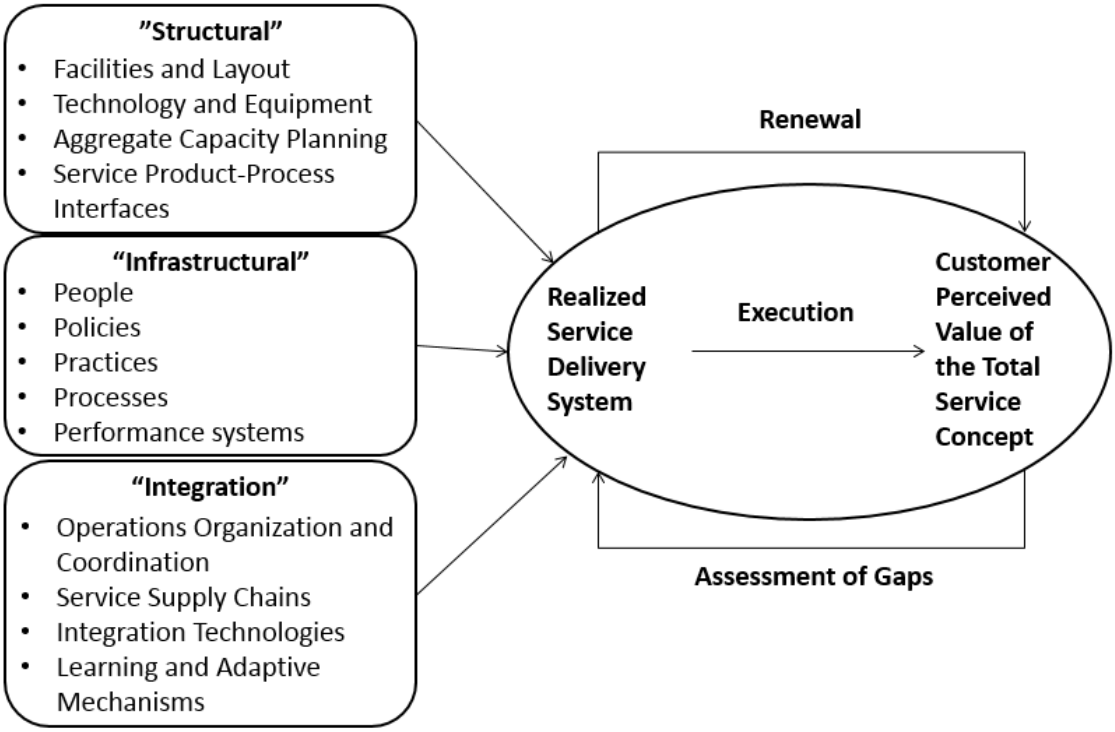

Figure 2.1. *The architecture of the service delivery system (according to Roth and Menor, 2003).*

Heskett (1987) propose that service delivery system design choices include the role of people, facilities, technology, layout, service processes, equipment, and procedures (Heskett, 1987). According to Ramaswamy (1996) the service system design decisions concern the processes through which the service is delivered and the facilities where the service is provided (Ramaswamy, 1996). In overall the extant literature highlight the role of people, technology, location, layout and equipment, when considering service delivery system design.

Ponsignon et al. (2011) introduce service delivery system design characteristics and contingencies based on an empirical study and Roth and Menor's service strategy triad. These characteristics and contingencies are shown in the Figure 2.2.

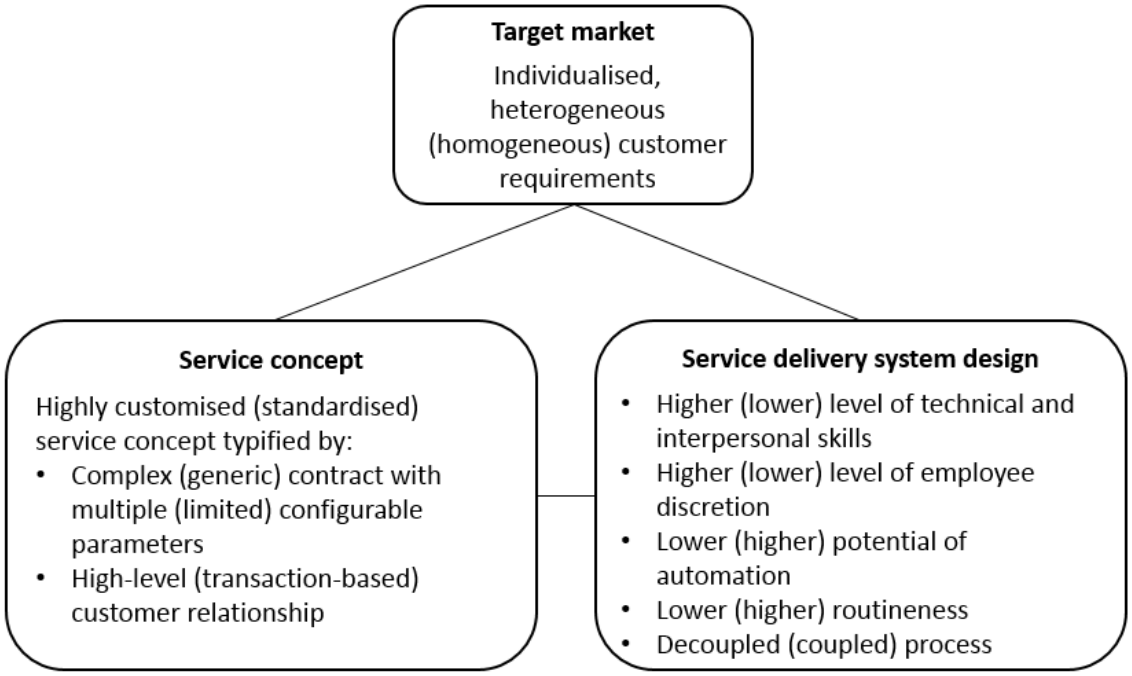

Figure 2.2. *Service design characteristics and contingencies (according to Ponsignon et al., 2011).*

It can be seen from the Figure 2.2 that there are different kind of service delivery system design characteristics depending on the heterogeneous/homogeneous of the target market and the level of customization/standardization of the service concept.

2.1.2 Comparison of the earlier research of service delivery system

As mentioned earlier, the research made of service delivery systems is relatively narrow. Heskett (1987) mentioned some important issues regarding service delivery system management in 1987. But the research that made the difference is the literature review of Roth and Menor in 2003 where they highlighted the importance of service delivery system. They created a research agenda and emphasized that is essential to study this matter furthermore. After that Ponsignon et al. (2011) used the research agenda and developed a framework for service delivery system contingencies and characteristics (Ponsignon et al., 2011). Information about the earlier research of service delivery systems is shown in the Table 2.1.

Table 2.1. *Studies on service delivery system.*

Authors	Industry	Key findings; possible gaps
Heskett, 1987	Several industries, e.g. insurance and aircraft industries	Service delivery system design choice are related to people, facilities, technology, layout, service processes, equipment, and procedures.
Ponsignon et al., 2011	Power industry	Service delivery system contingencies and characteristics framework include target market, service concept and service delivery system design aspects.
Roth and Menor, 2003	No particular industry	The service delivery system consists of design choices that effect to the realized service delivery system. These design choices are divided into structural, infrastructural and integration choices. Gap: How service delivery system's different aspects can be standardized and managed?

Earlier studies of service delivery system and its design choices do not refer to how the service delivery system and its characteristics can be standardized. The frameworks are useful to understand the service delivery system and its sections but how this understanding can be used in managerial decisions? Service delivery systems have to be studied further in practical situations.

2.2 Industrial service chains

In the global competitive environment, companies no longer compete directly, but the competition is based on their respective supply chains. Even though the economy evolves from manufacturing towards services, the majority of the supply chain management research has focused on the manufacturing sector. However it is important to understand the complexities within service supply chains and the attention is being directed into these aspects. (Sengupta et al., 2006)

There are many definitions to a supply chain. Essentially, a supply chain is the context in which services, goods and information flow from the earliest supplier to the end user.

Nowadays the supply chain is expanded to include also reverse logistics, which means the flow to the opposite direction. When expanding the definition into service supply chain, it is a network of service providers, suppliers, consumers and other supporting units, which performs transaction functions of resources that are needed to produce services. It also transforms these resources into core and supporting services and performs the delivery of the services to customers. (Baltacioglu et al., 2007) Ellram et al. (2004) define service supply chain management as management of processes, service performance, information, capacity and funds from the earliest supplier to the ultimate customer.

Many benefits emerge from the efficient supply chain management. Companies can achieve for example boosted revenues, increased customer satisfaction, reduced costs and improvements in service or product quality and in delivery. (Baltacioglu et al., 2007) These benefits increase the productivity and efficiency of the company.

2.2.1 Service supply chain models

There are a couple of service supply chain models. Ellram et al. (2004) restrict their scope of research into professional services. They combine two models, the SCOR model and the GSCF framework to introduce a service supply chain model. The SCOR model is developed by the Supply-Chain Council and it is a tool for charting supply activities and processes. The GSCF aka the Global Supply Chain Forum Framework is a model to conceptualize a supply chain with three aspects. The three aspects are the structure of the chain, the business processes and the management components. (Croxton et al., 2001) The service supply chain model developed by Ellram et al. (2004) is shown in the Figure 2.3.

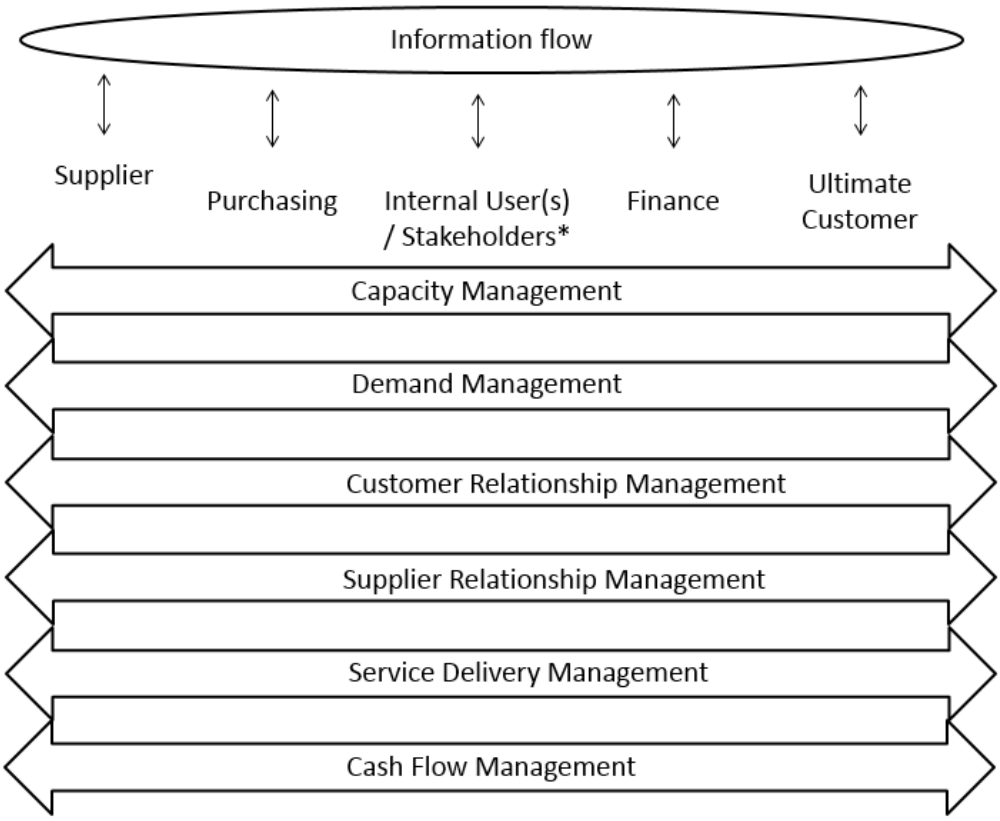

Figure 2.3. *Service Supply Chain model (according to Ellram et al., 2004).*

Baltacioglu et al. (2007) introduce another service supply chain model which is based on the SCOR model and Ellram et al. model. Their model contains three basic units in the service supply chain. These are supplier, service provider and customer. The supplier provides additional services to the service provider or directly to the customer. The service provider in this model is the company that performs the service. The customer is same as the end-customer because the simultaneity of services. Baltacioglu et al. the IUE-SSC model is introduced in the Figure 2.4.

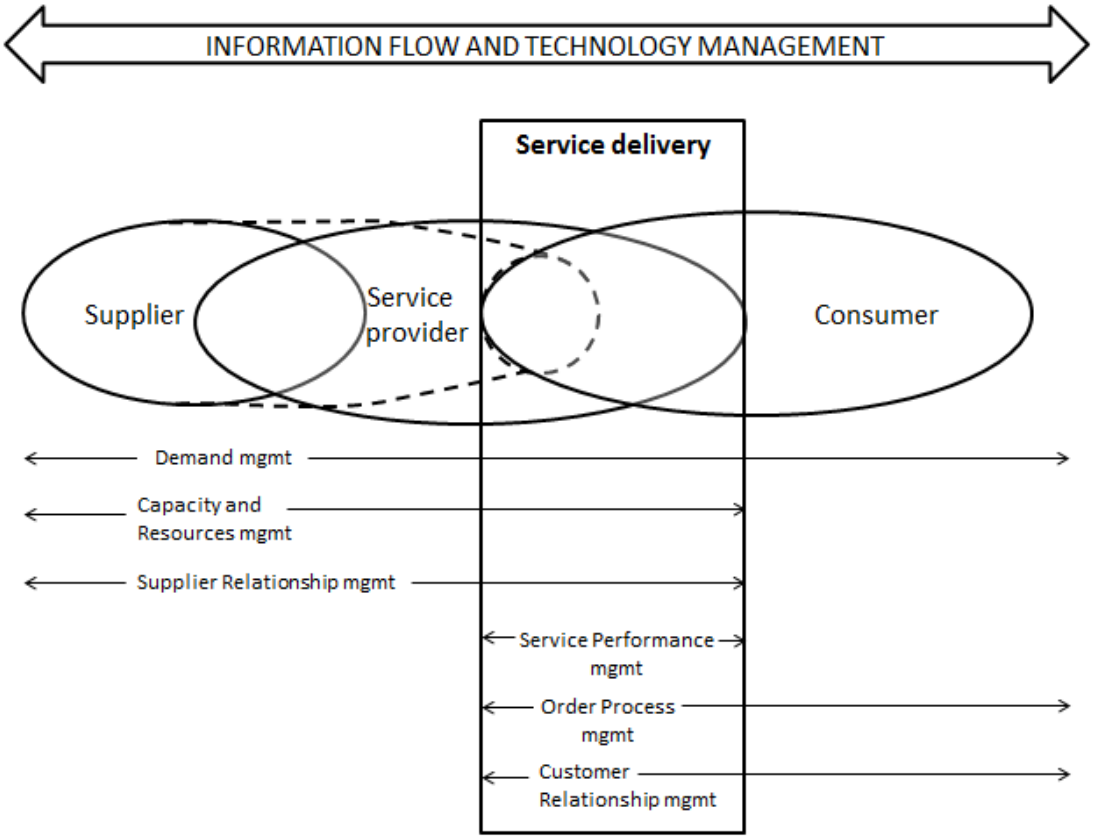

Figure 2.4. *The IUE-SSC model (according to Baltacioglu et al., 2007).*

There are lots of similarities in these models. They both are including management processes as an important aspect of service supply chain. Also information flow through the whole chain is considered as a significant characteristic in the service supply chains in both models. The chains start from supplier and end to ultimate customer or consumer. However there are also differences. The Ellram et al. model is made for professional services and the IUE-SSC model is for all services. Baltacioglu et al. have taken more delivery based view in their model. Also the management issues have different scopes in the models.

2.2.2 Service networks and triads

Service supply chains are complex systems where multiple parties can participate in the service delivery. It can be seen for example in the IUE-SSC model where the service can be delivered by the supplier, a service provider or both (Baltacioglu et al., 2007). In many cases service network research focuses in service triads. The reason for this is that triad is the smallest unit that includes network's two characteristic elements. These elements are nodes and links, and triad consists of three nodes and the links between them. (Choi and Wu, 2009)

The structure of a service triad varies. Rossetti and Choi (2008) have studied a service triad which consists of a supplier, an intermediate player and an end customer. They conducted a survey in the commercial aerospace industry in USA. In their research they focused disintermediation between the supplier and the customer. They found out several aspects that increase buyer-supplier goal incongruence, which leads to increasing supply chain disintermediation. (Rossetti and Choi, 2008)

Wu and Choi (2005) and Dubois and Fredriksson (2008) have studied a triadic setting which consists of two suppliers and a buyer. Wu and Choi (2005) conducted a multiple case study, which included eight case companies from different industries. These industries varied from manufacturing to logistics. As a result of their study Wu and Choi introduced five different supplier-supplier archetypes. These archetypes are conflicting, contracting, dog-fighting, networking and transacting. (Wu and Choi, 2005) Dubois and Fredriksson (2008) conducted a single case study that had two phases. The first phase involved Volvo Cars and all of its module suppliers and the second one focused on triad between Volvo and two module suppliers: Lear and JCI. As a result they introduced a concept of "triadic sourcing" where the buyer has a joint sourcing strategy for two separate suppliers. (Dubois and Fredriksson, 2008)

The third triadic network type includes two buyers and a supplier. Choi and Kim (2008) focus on this kind of network in their research. According to them the buyer should not evaluate the supplier in isolation but in the network context. They call this structural embeddedness. When using this kind of evaluation it can be seen, that the supplier's performance depends on how it acts with its customers and suppliers in its network. (Choi and Kim, 2008)

In this research the focus is in a triadic setting where the supplier sells its products through integrators or distributors. The aim is to study how the supplier could promote the service sales to its end customers in this kind of setting. When selling products through distributors or integrators, the end customer can remain invisible for the supplier. This can seriously complicate the supplier's after sales opportunities and service production. Peng et al. (2010) have studied this kind of triadic setting. They identify six triad types in their research and focus on three of them. These three triad types are:

1. The company's role is equal in the triad. There are links between all the companies.
2. The company's role is peripheral. It has a link only to one of the connected partners.
3. The company is connected to two disconnected partners in the triad so its role is a bridge.

These three types were chosen because of the research samples. The found out that a focal company can utilize different triad management mechanism based on its role. Also the

focal company's position in the triadic setting affects to the performance of the triad. (Peng et al. 2010) In this research the focus is on the triad type number two.

2.2.3 The performance of the service supply chain

To be able to measure the performance of a service supply chain, the metrics that are measured have to be determined. The performance measurement deals with service supply chain processes. These are for example customer relationship management, capacity and resource management, demand management, supplier relationship management, information and technology management, service supply chain finance and service performance. (Cho et al., 2011)

Fitzgerald et al. (1991) suggest six service performance dimensions. These dimensions are quality of service, financial, competitiveness, resource utilization, flexibility and innovation. There are different types of measure for each dimension. The service performance dimensions and types of measure are shown in the Table 2.2. There are trade-offs and interactions between these six dimensions. These actions should be considered during the strategy formulation process, to be able to create better-balanced strategic plans.

Table 2.2. *Six service performance dimensions (according to Fitzgerald et al., 1991).*

Dimension	Type of measure
Quality of service	Overall service indicators: Reliability, Responsiveness, Cleanliness / tidiness, Aesthetic / appearance, Friendliness, Comfort, Courtesy, Competence, Communication, Availability, Access, Security
Financial	Liquidity, Profitability, Market ratios, Capital structure
Competitiveness	Relative market, Sales growth, Share and position, Measures of the customer base
Resource utilization	Efficiency, Productivity
Flexibility	Volume flexibility, Specification flexibility, Delivery speed flexibility
Innovation	Performance of individual innovations, Performance of the innovation process

Gaiardelli et al. (2007) propose a performance measurement model for after-sales service. Their model has four aspects: business level, process level, activity and organizational unit, and development and innovation. The business level has three measures: financial results, market and cost. The process level includes operational measures such as customer satisfaction, flexibility and productivity. Gaiardelli et al. (2007) divide the activity and organizational unit into front office and back office measures. The front office measures are reliability and responsiveness. The back office measures include internal lead time, waste and costs, and assets utilization. The base of their model is development and innovation, which includes such aspects as research and service portfolio, human resources and IT and service capacity.

According to Parasuraman et al. (1988) there are five dimensions in service quality. These dimensions are empathy, tangibility, reliability, responsiveness and assurance. They conceptualize an instrument called SERVQUAL for assessing customer perceptions of service quality using these five dimensions.

Cho et al. (2011) combine the SCOR model and Parasuraman's et al. (1988) and Fitzgerald's et al. (1991) performance measure classifications into a hierarchical structure of system and subsystem levels. Their model is divided into three assessment areas: supply chain operation, customer service and corporate management. The hierarchical structure is shown in the Table 2.3.

Table 2.3. *Hierarchical structure of service supply chain performance measures (according to Cho et al., 2011)*

Assessment areas	Criteria
Service supply chain operation	Flexibility
	Responsiveness
	Reliability
Customer service	Empathy
	Tangibles
	Assurance
Corporate management	Cost
	Profitability
	Asset
	Resource utilization

According to Cho et al. (2011) flexibility includes performance metrics such as quality of service, supplier risk sharing initiatives and flexibility (delivery speed, volume, specification). The responsiveness metrics are customer query time and service delivery. For reliability Cho et al. suggest for example such metrics as quality of supplier's service level, the customer service order path and service order lead time. These metrics are grouped in the hierarchical structure into service supply chain operation metrics.

Empathy has one metric, which is customer relationship. Tangibles have two metrics: range of services and service capacity. Assurance measures knowledge of personnel and their ability to inspire confidence and trust. To measure these aspects, Cho et al. suggest two metrics: customer loyalty/retention and customer satisfaction. The assessment area of these metrics in the model is customer service.

Cho et al. (2011) suggest several metrics for the assessment area of corporate management. Cost includes such metrics as total service delivery cost and supplier related cost measures. Profitability has only one metric in the structure and that is average customer spent per visit per store. Asset includes capital related metrics, which are ROI and total cash flow time. The final aspect of corporate management in the hierarchical structure is resource utilization. It includes for example such metrics as productivity, total cycle time and effectiveness of scheduling techniques.

Many metrics discussed above appear in several service supply chain performance models. Also Cho's et al. (2011) hierarchical structure combines several models so that different aspects of the service supply chain performance can be measured. Some of the metrics are also relevant for measuring the performance of manufacturing supply chains. The special characteristics of services, such as intangibility and uniqueness, add complexity for measuring the performance service supply chains.

2.2.4 Comparison of the earlier research of ssc models

Also the research of service supply chain models is quite limited. Ellram et al. (2004) restrict their scope of research into professional services. They combine two models, the SCOR model and the GSCF framework to introduce a service supply chain model. The SCOR model is developed by the Supply-Chain Council and it is a tool for charting supply activities and processes. The GSCF aka the Global Supply Chain Forum Framework is a model to conceptualize a supply chain with three aspects. The three aspects are the structure of the chain, the business processes and the management components. (Croxton et al., 2001)

Baltacioglu et al. (2007) have created the IUE-SSC model that combines the SCOR model and Ellram et al.'s model. It includes three main parties and all of these of only two can participate in the service delivery. Information and technology management extends

through the chain. (Baltacioglu et al., 2007) Comparison of earlier research regarding service supply chain models is shown in the Table 2.4.

Table 2.4. *Studies on service supply chain models.*

Authors	Key findings; possible gaps
Baltacioglu et al., 2007	The IUE-SSCM combines SCOR model and Ellram et al.'s model. It has three main parties: the supplier, the service provider and the consumer.
Croxton et al., 2001; Ellram et al., 2004	SCOR model is a tool for charting supply processes and activities. It considers services as process driven.
Croxton et al., 2001; Ellram et al., 2004	GSCF model is based on a supply chain with three elements: the business processes, the management components and the structure of the chain.
Ellram et al., 2004	Ellram et al.'s model includes five parties: supplier, purchasing, internal user(s)/stakeholders, finance and ultimate customer. Management issues through the chain refer to capacity, demand, customer and supplier relationships, service delivery and cash flow. Gap: How understanding the service supply chain can ease the standardization of the delivery related processes?

The literature of service supply chain models does not explain how understanding of the service supply chains can be used in standardizing service delivery processes. The models include many parties and management issues but how this information can be exploited in service process development? The models offer a simplified view of complex system but this theme needs to be researched more.

2.3 Customer participation in service production

2.3.1 Front-office and back-office operations

One of the distinctive features of delivering services is the amount of customer contact. Service production and delivery are simultaneous and many services cannot be delivered without the customer participating in the service delivery system. (Nie and Kellog, 1999; Zomerdijk and de Vries, 2007) Customer interaction in service delivery system causes uncertainties and variation. It also makes demands on the design of staff, technology and facilities in the production system. (Safizadeh et al., 2003)

In the literature there are two views, how customer contact activities should be arranged. The customer contact approach suggests that the activities that require customer interaction should be de-coupled from those that do not include customer participation. The activities should be divided into front-office and back-office activities. (Chase, 1978; Chase, 1981; Chase and Tansik, 1983) However, according to Metters and Vargas (2000) coupling front-office and back-office activities can be a viable strategy in several situations. This means that same staff is responsible for both, front-office and back-office jobs.

The front-office refers to those activities that require customer contact. The front-office is directly experienced by customers. The back-office includes those operations that do not require customer participation and which cannot be experienced by customers. (Johnston and Clark, 2005) The customer contact approach suggests that all services are not equal in terms of efficiency they can achieve. This claim is based on the differences in the extent of customer contact and participation when creating a service. (Chase, 1978; Chase, 1981; Chase and Tansik, 1983) The customer causes disturbances in high-contact activities and these kinds of activities are more difficult to control as low-contact activities (Zomerdijk and de Vries, 2007). The back-office operations or the low-contact activities can be isolated from the environment, which generates a higher degree of efficiency (Thompson, 1967). Front-office and back-office interfaces are shown in the Figure 2.5.

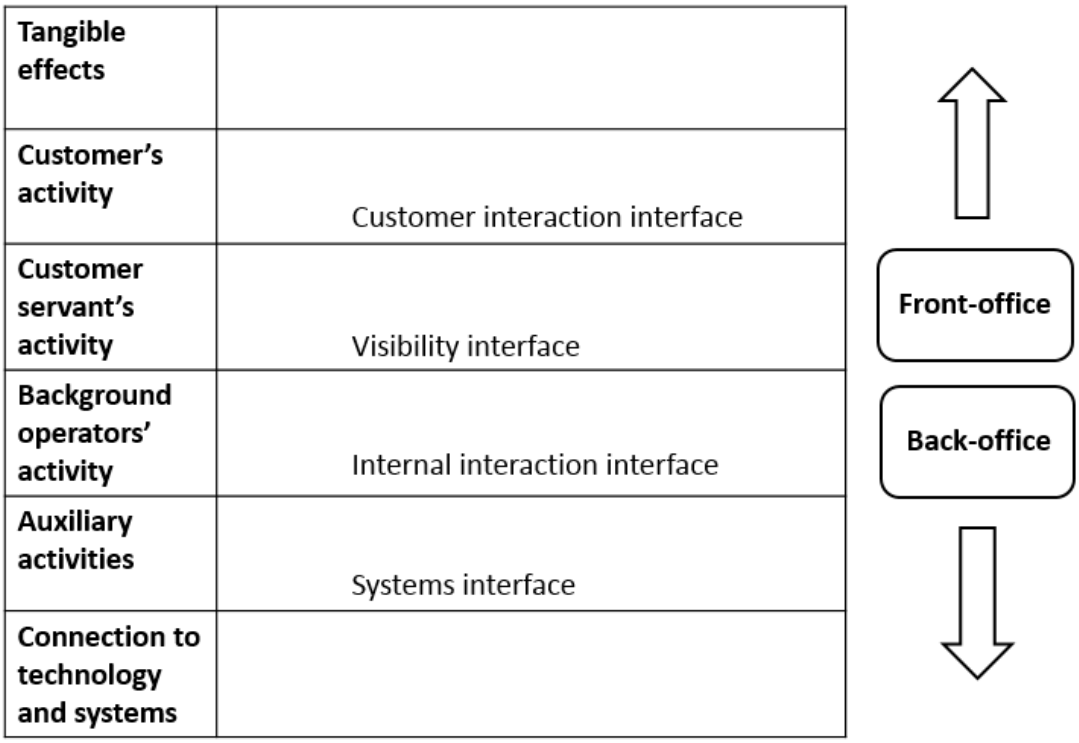

Figure 2.5. *Front-office and back-office interfaces (according to Bitner et al., 2008).*

Zomerdijk and de Vries (2007) suggest that there are three design decisions when structuring front-office and back-office work. The first design decision is to decide in which

part of the process customer contact occurs. Secondly they propose that the activities that are decoupled should be decided. The third design decision is to decide how employees are grouped together.

2.3.2 Customer's role in service supply chain

Customer participation requirements vary across services. In the case of low participation, only customer's presence is needed. When the participation requirements are moderate, customer inputs are needed in the service creation. In high participation case customer co-creates the service. (Bitner et al., 1997)

Bitner et al. (1997) identify three different customer roles based on a literature review. These roles are:

1) the customer as resource
2) the customer as contributor to value, satisfaction and quality, and
3) the customer as competitor

The customer can have multiple roles in same time, so these roles are not exclusive.

Lovelock (1983) uses a service classification based on what customer components the service provider acts upon. His categorization has four classes: services can act on 1) customers' minds, 2) customers' bodies, 3) customers' physical possessions, or 4) customers' information. (Lovelock, 1983) This means that customers can have the role of component supplier. Customers can also play the role of labor in the service supply chain. The services can be produced in co-operation with the customers, where the customers function as labor and assist in the service production. (Grönroos, 2008) If Bitner et al. (1997) suggestion is taken account, the customer acts as a resource in these situations.

When customers are contributors to value, satisfaction or quality, they can act for example as design engineers. According to Sampson and Spring (2012) customers very likely have strong opinions how services should be designed and delivered. Some companies even involve customers in new service development process (Matthing et al., 2004; Lundkvist and Yakhlef, 2004). The customer can also have the role of production manager. A service product is created under the direction of the customer, during the service encounter (Namasivayam and Hinkin, 2003). Hence, to some extent, customers direct and influence to some aspects of the supplier's activities (Sampson and Spring, 2012). Customers can also act actively in quality assurance. According to Parasuraman et al. (1985) and Lengnick-Hall et al. (2000) customer feedback is a primary mean to measure service quality. Especially in B2B context, customers are often heavily involved in managing, controlling and assuring service quality (Sampson and Spring, 2012).

When customers act as competitors, the concept is called internal exchange (Lusch et al., 1992). The customers process their inputs individual without using an external service

provider (Sampson and Spring, 2012). This is a significant issue in service business, because the customer participation is higher than in traditional product-based business. Because the customer participation, barriers to entry are lower, customers have control over the services, and services are heterogeneous. (Sampson, 2001. p. 230)

2.3.3 Comparison of the earlier research of customer's role in service production

Customer's participation in service deliveries is an important aspect. However, the existent literature mainly does not cover this aspect sufficiently. Customer's role in service production is often neglected and found as minor (Xue and Harker, 2002; Tuunanen and Cassab, 2011). Summary of customer participation related literature is shown in the Table 2.5.

Table 2.5. *Comparison of studies of customer participation in service production.*

Authors	Key findings; possible gaps
Carlborg and Kindström, 2014	There are three different production modes: firm production, customer production and joint production.
Tuunanen and Cassab, 2011	In a few existing studies that have usually an internal supplier-oriented point of view, the customer's co-producing role is often neglected.
Xue and Harker, 2002	Customer participation in service production has mainly been viewed as minor and supplementary. Gap: How customer participation effects to the service delivery system and how it can be managed?

The literature does not give answers to how the customer participation can be managed and how it effects on the service delivery system. Customer participation cause uncertainty to the service delivery system and this uncertainty complicate the standardization. Customers can participate in service production in many ways and companies should know how to manage and lead the customers without interfering too much in their part.

2.4 Standardization of service delivery system

When a manufacturing company starts to provide services to their customers' fleet instead of a one machine, the hypothesis is that standardization is needed in both: services and

delivery system. The standardization of services has been researched to some extent but there appears to be a gap in the research of the standardization of industrial service delivery systems.

2.4.1 Service process standardization

In order to remain competitive, manufacturing companies need to balance the meeting of customer needs and acceptable level of service development efficiency, when creating new services in addition to their core product business (Carlborg and Kindström, 2014). Balancing these aspects is difficult, because the customer needs tend to become more heterogeneous and diversified (Bask et al., 2011). Service modularization is a mean to effectively manage the complexity of balancing customized services. Modularization is also related to the standardization of various products and sub processes (Jacobs et al., 2007).

Modularization means that an object is separated into components. These components are called modules and they can be used to create customizable offerings by combining them differently. (Carlborg and Kindström, 2014) In service business, services are often considered as processes. In the process perspective, service is defined as a combination of physical and non-physical elements. These elements are integrated into different customer-specific configurations. (Davies et al., 2007; Pekkarinen and Ulkuniemi, 2008)

According to Böttcher and Klingner (2011) there are many advantages in service modularization. These advantages are explained in the Table 2.6. In order to achieve these advantages, the company needs to consider three aspects: the module architecture, the testing standards to confirm module's compliance with the design rules, and the interface describing module interaction (Böttcher and Klingner, 2011).

Table 2.6. *Service modularization advantages (according to Böttcher and Klingner, 2011).*

Aim	**Effect**
Reduction of efforts	Using modularization in resource management and allocation can reduce efforts
Enhancement and improvements	Modularization can lead to improved and enhanced service, because service improvement is easier at the modular level
Configuration	A higher level of customization can be attained from restricted amount of standardized modules
Improved transparency, reduced complexity	The complexity is reduced by a structured portfolio, which also increases the transparency of service offering
Reuse	Economies of scale and reduced efforts can be achieved with re-use of modules

Customer participation in service production is an important issue, when deciding a modular strategy (Ulkuniemi and Pekkarinen, 2011). There are three different types of service production modes. These are firm production, joint production and customer production. In firm production, customer is passive and the supplier company produces the service. In joint production, the company interacts with the customer and both parties participate in the service production. The customer operates the service in customer production and the supplier does not participate in the production. (Carlborg and Kindström, 2014)

Wemmerlöv (1990) classifies service processes into rigid and fluid processes. Also Ostrom et al. (2010) deal service processes into two groups. According to them services can be designed so that they are either standardized, rigid, and produced for customers or dynamic, flexible, and created with customer participation. Carlborg and Kindström (2014) synthesize these service processes into one framework. According to them also service process can be either rigid or fluid. The rigid service process is standardized, it is highly formalized and centralized, and it does not require high level of technical skills or information exchange between the supplier and customer. The fluid service process is the opposite of the rigid service process. It is customized, high level of technical skills are needed as well as a lot of information exchange during the process. The rigid service process is directed towards customer's possessions whereas the fluid service process deals with customer's processes.

2.4.2 Remote monitoring

The concept of Internet of Things (IoT) is a dynamic network of networked devices in the area of manufacturing. According to Mazhelis et al. (2013) various things are integrated into the Internet structure securely and flawlessly by using standard communication protocols. These internet-enabled tools can be used in different fields, such as smart grids or home appliances. (Mazhelis et al., 2013) There are four key components in IoT. These are heterogeneous access, sensing, applications and services, and information processing. (Chen et al., 2012) The means of remote monitoring explained next have been chosen based on the case companies and there are also other remote monitoring technologies.

Radio-frequency identification

Radio-frequency identification (RFID) is a wireless sensor technology that catches electromagnetic signals. An RFID system usually includes three units: a coil or antenna, a transceiver and a transponder that is programmed electronically with specific information. (Domdouzis et al., 2007) RFID is used in several industries and it is the approach to IoT that has achieved most attention.

Many RFID applications have been studied. It has been utilized for example in assembly in car- and oil industries in order to ensure the correct placement of components (Johnson, 2002; Domdouzis et al., 2007). In manufacturing industry it has been used in just-in-time ordering, to create a smart Kanban system and to control resource flows (Zelbst et al., 2012; Zhang et al., 2008; Huang et al., 2008).

There are many benefits in RFID technology usage. Zelbst et al. (2012) categorize the benefits into three groups. These are automation, informational and transformational effects. Automation effect means that the process becomes more automated and efficient. With RFID the time to process shipping and receiving, and the labor costs can be reduced. Also inventory replenishment can be improved. The informational effect means that for example the usage of resources and responsiveness can be improved. Lastly the transformational effect refers to the ability to make process transformation and innovation, for example process redesign. (Zelbst et al., 2012)

Remote monitoring system

Remote monitoring system (RMS) is a technology used to collect data from equipment. This data is then analyzed and based on the analysis the company can do right decisions and actions in the right time. According to Lee (1998) equipment failures are notable problems in many factories, because it is difficult to identify the reasons behind a machine breakdown. The difficultness is based on for example the complexity of the equipment as well as the shortage of tools to detect the failure. (Lee, 1998) RMS can be used to detect the problems and their causes.

RMS includes sensors and data transmitters that are installed in products. Through RMS the manufacturer can provide remote monitoring services to its customers. The sensors offer real-time data, such as unusual use, current status and signs of breakdown, about the equipment. (Westergren, 2011) The sensors are placed on the critical components. When RMS is installed in multiple factories, the manufacturer has an opportunity to collect and analyze data from several components and production systems across organizational boundaries. (Johnsson et al., 2009)

In addition to proactive maintenance, RMS provides also other benefits for the manufacturer. By monitoring the components and equipment the manufacturer is able to track where its machines are. Also the knowledge about the products increases, which enables the manufacturer to predict and identify its customers' service needs. (Johnsson et al., 2009) This is a major competitive advantage for the manufacturer as it is essential for the service provider to understand its customers' needs.

2.4.3 The balance between standardization and customization

There is a belief that companies should be superior in both productivity and customer satisfaction. However it is possible that these two goals are not always compatible. (Anderson et al., 1997) If so, this is a question of balancing standardization and customization in service business.

Competitive performance includes outcomes of quality, cost, cycle time, and flexibility. Jacobs et al. (2007) suggest that modularity have positive impacts to all these issues. However modularity can have a negative impact to the satisfaction customer perceives.

According to Parasuraman et al. (1985) customers develop their expectations for service attributes based on previous experiences and marketing messages. The expectations differ across nationalities and cultures (Pullman et al., 2001). According to Donthu and Yoo (1998) there is a relationship between cultural orientation and service quality issues, such as empathy, reliability, responsiveness and assurance.

Hu et al. (2009) suggest that service quality and perceived value have a positive impact to the customer satisfaction. The service quality can improve through modularization, because the quality of the modules is easier to manage. This means that modularization can have a positive effect to the customer satisfaction.

If the service is able to be bundled with technology, it makes it possible to balance customization and standardization (Davies et al., 2007). Innovative service supply chain that is based on bundled services and products is linked to the transition towards service orientation (Gebauer, 2007). This means a change from transactional customer relationship to a relational relationship (Penttinen and Palmer, 2007). This can be one mean to add customer satisfaction when modularizing services.

2.4.4 Comparison of the earlier research of standardization

Service process modularization and remote monitoring

The literature of service process modularization explains how customizable offerings can be created by using modules. Service processes can be divided into physical and non-physical elements and these elements are called modules. (Davies et al., 2007; Pekkarinen and Ulkuniemi, 2008) Service process modularization increases customization by standardizing the modules (Bask et al., 2011). Remote monitoring can be used to predict service needs but it also makes service processes more automated and efficient. It also eases for example resource management. (Zelbst et al., 2012) The comparison of earlier studies of these subjects is shown in the Table 2.7.

Table 2.7. *Comparison of earlier research of service process modularization.*

Authors	Key findings; possible gaps
Bask et al., 2011	Customization can be achieved on a higher level by breaking down processes into standardized sub-processes.
Davies et al., 2007; Pekkarinen and Ulkuniemi, 2008	Service process is a mixture of physical and non-physical elements. Customer-specific configurations can be created by combining these elements.
Zelbst et al., 2012	Process becomes more automated and efficient. Gaps: How process modularization can be used in efficient service deliveries? How remote monitoring technologies can be used in standardization of complex systems?

There is a research gap regarding how service process modularization can be used to develop service deliveries to be more effective. When service delivery processes are modularized, the management of sub-processes should ease. How companies can use process modularization to manage and develop their service deliveries in order to achieve efficient and more profitable operations? There is also a research gap related to usage of remote monitoring technologies in system standardization. As the remote technologies can be used to increase automation in the processes, their role as enabler of standardization should be researched more.

Standardization versus customization

The balance between standardization and customization in service processes has been researched to some extent. Mostly service processes are seen either rigid and standardized or flexible and dynamic (Wemmerlöv, 1990; Carlborg and Kindström, 2014; Ostrom et al., 2010). Yu et al. (2008) highlight that service process sequence is difficult to predict and this means that the processes have to be flexible enough. Comparison of the studies of this theme is shown in the Table 2.8.

Table 2.8. *Comparison of earlier research of standardization vs. customization of service processes.*

Authors	Key findings; possible gaps
Carlborg and Kindström, 2014	Flexible service processes cause requirements for technical skills and tasks vary highly, rigid service processes are highly formalized and task variety and the level of technical skills are low.
Wemmerlöv, 1990; Carlborg and Kindström, 2014; Ostrom et al., 2010	Services can be designed to be flexible, dynamic and co-created with the customer or rigid, standardized and produced by the supplier only.
Yu et al., 2008	Industrial service process is related to the production planning, customer demands and maintenance demands. Because predicting the exact sequence of a service process is often impossible, the process must be flexible in order to be able to answer changes in the three aspects. Gap: How co-created service processes can be standardized in order to increase efficiency?

In many cases customer participation in the service processes is unavoidable. The literature does not note how service processes with customer participation can be standardized. In order to achieve efficient service processes the need for standardization can be assumed to exist. The existent literature has a black-and-white view of the service processes and it can be discussed if there is only two options how service processes can be designed.

2.5 Service delivery system framework

Figure 2.6 summarizes the literature review and introduces a service delivery system framework. This framework includes the main points of Roth's and Menor's (2003) service delivery system framework and Baltacioglu et al.'s (2007) and Ellram et al.'s (2004) service supply chain models. This framework is used to analyze the case companies' results and it is updated based on these results.

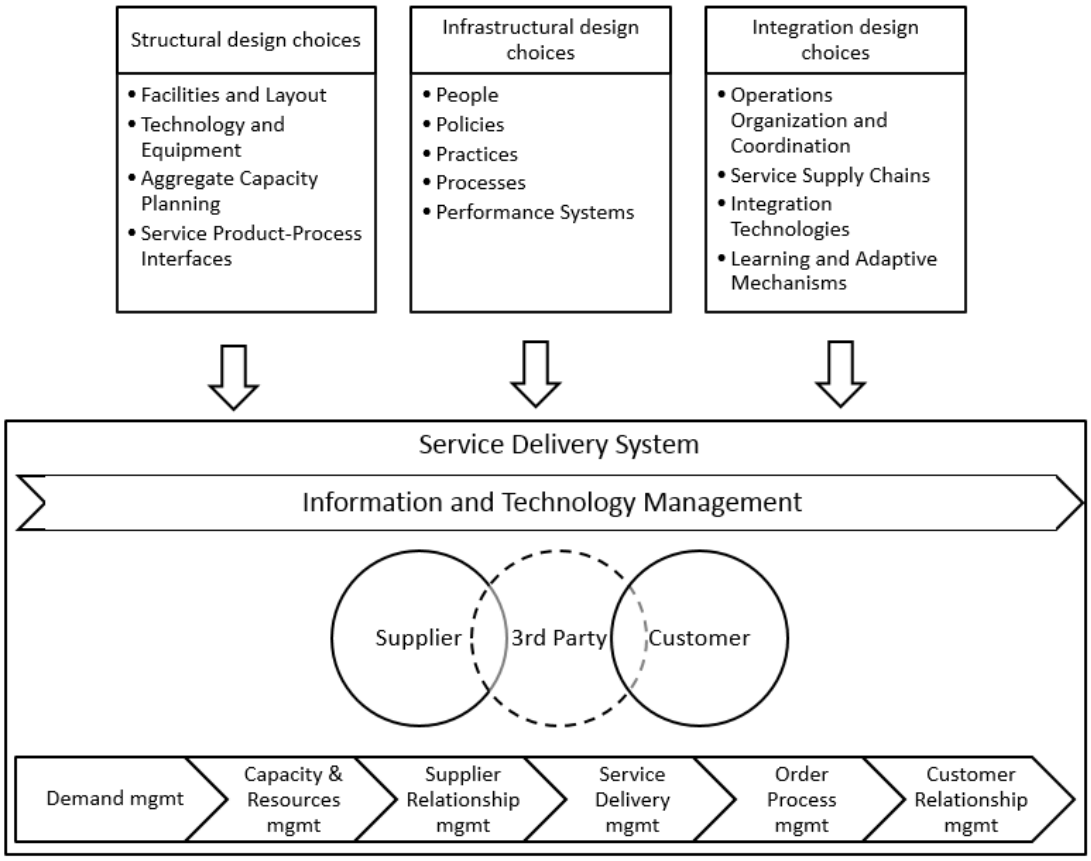

Figure 2.6. *Service delivery system framework (adapted Roth and Menor, 2003; Baltacioglu et al., 2007; Ellram et al., 2004).*

The service delivery system framework has been created by combining Roth's and Menor's (2003) service delivery system architecture model, Baltacioglu et al.'s (2007) and Ellram et al.'s (2004) service supply chain models. This framework includes three parties: the supplier, possible third party (e.g. outsourced service provider) and the customer. The service delivery exists between the supplier and the customer, between the third party and the customer or between all of the parties.

The supplier has to make strategic service system design choices that consist of structural, infrastructural and integration choices. The structural choices concern for example technology and equipment, layout and facilities, capacity planning and service product-pro-

cess interfaces. The infrastructural choices relate to people, practices, policies, performance systems and processes. Finally the integration choices involve service supply chains, operations organization and coordination, learning and adaptive mechanisms and integration technologies. (Roth and Menor, 2003)

The framework contains also several management issues that have to be considered in the service delivery process. Their sphere of influence varies from service delivery process level to system level. However, the management issues do not refer to how the service delivery system should be managed as a whole. The framework also leaves a question of how the complex service delivery system can be managed efficiently and how the efficiency of the system can be increased. When the service delivery system develops toward fleet level, the system becomes more complex and its management becomes more difficult.

3. RESEARCH METHOD

3.1 Research methods

A multiple case study strategy was applied in this research. According to Yin (2009, p. 4) when the aim of the research is to understand a real-life situation holistically, a case study is suitable method. The case study can also be used when acquiring knowledge of an individual, group or phenomenon (Yin, 2009, p. 4). The benefit of a multiple case study is that the results of the cases can be compared and one case's results can be verified using the others. This enables the generalization of the findings. (Saunders et al. 2009)

According to Silverman (2010, p. 139) multiple cases are useful when studying a general phenomenon. In this case the phenomenon is the service delivery system and its standardization. Also artificial conditions and uniqueness can be avoided with multiple cases (Yin, 2009, p. 61). These are the reasons why this research method was chosen.

Multiple research methods were used in this research. According to Tashakkori and Teddlie (2003) when research data is collected with multiple methods from multiple cases, it is easy to make inferences. Also by using multiple methods the researcher can confirm the reliability of the results. (Tashakkori and Teddlie, 2003) Moreover, in case of several research questions, Silverman (2010, p. 132) justifies the usage of several research methods. There are several research questions in this research so the usage of several research methods is rational.

The research methods used in this research are literature review, interview and observation. Also one of the case companies offered some documents of their sales processes and services. The literature review was conducted to get familiar with the topic and to find gaps in the former research. The interviews were structured based on the literature review. In one of the case companies the operations in a repair shop were observed.

3.2 Case companies

In this research three case companies were studied. These companies were selected based on their current situation and their aims towards a fleet level service delivery system. This thesis is part of a research program in which all of these companies participate. According to Silverman (2010, p. 139) cases are seldom selected randomly and this claim is accurate also in this research.

All the case companies are product-oriented manufacturing companies. They operate actively in the engineering industry. In this research the case companies are called Company

A, Company B and Company C in order to maintain the anonymity of the companies. Table 3.1 offers background information of the companies.

Table 3.1. *Background information of the case companies*

	Company A	**Company B**	**Company C**
The nature of the industry	Both project and transactional deliveries, focus on component manufacturing	Both project and transactional deliveries, focus on assembly manufacturing	Mostly project deliveries, focus on both component and assembly manufacturing
Number of employees	> 5000	> 10000	> 10000
Net Sales (million euros)	> 2000	> 2000	> 2000

Company A offers both products and services for several market segments and it is a market leader or second biggest operator in all of these segments. It also offers some bulk products for consumers. Company A operates as a supplier as well as a subcontractor for its customers. Its service portfolio consists of services for every stage of the product's life cycle. They provide services from maintenance to end-of-life services.

Also Company B's offering consists of both industrial products and services. Likewise Company A, Company B has a broad service portfolio. It includes services such as wear and spare parts, maintenance and life cycle services. Company B operates as a supplier for its clients. Its customers vary from small operators to big ones.

The third case company is called Company C. It has many similarities compared to the other case companies. It operates as a supplier for its customers and its service portfolio is typical for an engineering company. Company C also offers product related services such as maintenance and spare parts for its customers.

All the case companies have many similarities but also differences. All the companies are product-oriented companies offering product related services. They all belong to same size class considering their net sales. However Company A has significantly less employees than Company B and Company C. Also the case companies operate in different industries.

3.3 Data collection

The empirical data was collected mainly through interviews but also other sources were used. These other sources were informal discussions, observation and documents offered

by one of the case companies. The data collection started with informal discussions in all of the case companies. The aim of these discussions was to coordinate the objectives of the researcher and the companies.

After the objectives of the research were clarified, the interview questionnaire was conducted. The development of the interview structure was an iterative process. The questionnaire was formed based on the literature review and it was improved after the supervisor of this thesis provided feedback.

The data collection started in one of the case companies. Semi-structured interviews were conducted. The interviewees were selected using snowball sampling method. The name of the first interviewee was provided by the contact person of the case company. The latter interviewees were selected based on the recommendations of the interviewees. Minor modifications were made to the questionnaire during the first interviews.

In the second and third case companies, the interview process was similar compared to the first one. Semi-structured interviews were conducted and the sampling was made in the same way. The difference between the interviews in different case companies was that some modifications were made to the questionnaire in every company. These modifications were due to case specific aspects.

All the interviewees were managers. The interviews lasted from 26 minutes to 112 minutes. The average duration of an interview was 55 minutes. The first interview was conducted in April 2015 and the last one in July 2015. Table 3.2 offers more information about the interviews.

Table 3.2. *Number of interviews in the case companies and the roles of the interviewees.*

	Company A	**Company B**	**Company C**
Number of interviews	7	5	7
The roles of the interviewees	Service and product sales managers, service managers	Sales managers, service managers	Sales managers, service managers
The duration of the interviews (min)	33 - 69	39 - 112	25 - 52

Despite the beforehand structured questionnaire, the questions were discussed with the interviewees in flexible order. The order was based on the natural course of the discussion and the questionnaire was used to support the leading of the discussion. The interviews

were audio-recorded and transcribed. The researcher also wrote some self-memos when needed. For example the informal discussions and observation were recorded using self-memos. These self-memos transformed in electrical documents.

3.4 Data analysis

The data analysis was conducted in several steps. An external service provider transcribed the audio-recorded interviews. The researcher checked the transcripts in order to find and correct gaps and mistakes. After the transcripts were corrected, the data was categorized. The categories followed the themes and structure of the interviews. The researcher used a couple of software tools to code and to categorize the data. These tools were Atlas and MS Excel.

A cross-case comparison was done to compare the results across the cases. The aim was to find similarities and differences between the case companies. The findings were presented to the case companies in workshops. The cross-case comparison was made after the case companies' feedback in order to ensure the validity and the correctness of the results. The key findings are demonstrated in the Results chapter using cross-tabulation and excerpts from the interviews.

4. RESEARCH RESULTS

4.1 Case Company A

Company A has been offering services to its customers for years and its service portfolio is relatively extensive. Company A's service organization is an individual unit separated from the product related units. Company A has several different sales channels for its products. This causes challenges for the service business because in some cases Company A does not have a direct link to the end customer.

4.1.1 Structural design choices

Facilities and Layout

Company A delivers services both in customer's premises as well as in their own premises. For example equipment mapping service is delivered in the customer's premises together with the customer. This particular service requires customer's knowledge and its purpose is to map what pieces of equipment the customer has.

One example of a service delivered in Company A's premises is a repair shop service where the piece of equipment is send to Company A's repair shop. The piece of equipment is then repaired and sent back to the customer. According to a manager most of the services are delivered in Company A's premises because the customers have their own maintenance units and they are able to change the piece of equipment.

Technology

Technology embedded in the equipment

Because of the long life cycles of Company A's products, the installed base includes many different technologies from several decades. These technologies cause some challenges regarding service delivery system. A manager says: *"Some of the customer's pieces of equipment can be several decades old when others are new. Challenges arise when we have to compare substitutive products to these pieces of equipment."* Technology develops fast and in some cases it is more rational for the customer to have a substitute product than repair the old piece of equipment. However, some customers do not want to give up their old pieces of equipment. For this kind of situations Company A has such services as retrofit.

The technology embedded in the installed base cause also requirements for Company A's resources. Another manager explains: *"In some customer premises the maintenance men working in there have to have security certificates. This means that all our maintenance*

men cannot work in all locations." When considering reactive services, the problem is that there might not be certificated maintenance men available. Nowadays the resources are managed in Company A through spreadsheets. However, they are transferring the resource data into their installed base IT-system to ease the resource management in future.

Remote technology

Company A offers remote monitoring services for some product lines. They can monitor remotely for example the condition of batteries or some values that illustrate the performance of the equipment. However these services are not available to all equipment and these kind of services have a minor role in Company A's service business. A manager tells: *"There are not sufficient business models for remote monitoring services yet."* However, Company A's aim is towards the fleet level services. They are mapping their installed base so that they could use this information in their service business. They have an IT-system in use where the information can be recorded.

Even though Company A has some remote monitoring services, there still are many issues that have to be solved before these services can turn into a profitable business. Only Company A's new products have the possibility to gather information remotely. Their products have long life cycles and this means that only small portion of the installed base is new products. One manager tells that: *"Some customer's pieces of equipment can be 30 to 40 years old."* Based on this it is going to take a long time before the installed base is renewed and remote monitoring services can be offered to all products.

There are also other issues related to remote data usage. For example it is not clear how the data can be used. Company A´s sales manager highlights: *"There are no databases where the data could be gathered or people who would analyze it. Also it is unclear who owns the data and could it be exploited even though there were not contracts of its use."* Because there are no clear rules how the data gathering and analysis can be done, companies are wary with the remote monitoring services. Also some customers do not want to let Company A inside their systems and gather data of their business.

Before Company A can extend the remote monitoring services, the issues mentioned above have to be solved. There are also issues that may need some kind of legislation to ensure that the data is not misused and every company has the same rules. However, it can be seen that Company A is considering these issues and the aim is to provide remote monitoring services to the whole installed base in future.

Capacity planning

In case of reactive services, Company A is unable to predict and schedule service requests. This increases the uncertainty of the service delivery system. This hinders Company A's possibilities to plan the capacity. In proactive services the capacity planning is

easier and Company A can discuss with the customer when it would be the best time for the service delivery. Also resource planning is easier in case of proactive services.

Company A tries to serve its customers the best possible ways. However, the reactive services are difficult in many ways. A manager tells: *"We are trying to direct the customers' actions to be more proactive so that during the stoppages the pieces of equipment could be ordered to customers' premises beforehand."* Many management issues become easier if the service production transforms towards proactive services, including the capacity management.

4.1.2 Infrastructural design choices

Service delivery process

Company A offers both service contracts as well as reactive services for its customers. The service delivery system varies between these service deliveries. In case of service contracts the service deliveries are arranged with the customer beforehand. Then the service is delivered at the arranged date. Depending of the service there may be different participants involved in the service delivery. For example if the service in question is a repair shop service, first the customer sends the piece of equipment to the repair shop using an external logistics provider. When the machine has arrived, it is checked by Company A's employee. Then the spare parts are ordered from a subcontractor by Company A, if necessary. Finally the piece of equipment is repaired by Company A's employees and it is sent back to the customer by using an external logistics provider again.

Another example of a service, that can be planned beforehand, is an auxiliary equipment service. The service delivery starts with mapping of the customer's equipment. The mapping is done by Company A's employee together with the customer. After the mapping Company A compares the customer's equipment to their auxiliary equipment service stock. If there are some critical pieces of equipment that the existing stock is not able to cover, Company A orders these pieces of equipment from their factory. When the auxiliary equipment stock is updated, it is possible for Company A to plan equipment replacements together with the customer and time those for example when there is a stoppage in the customer's site. However, the auxiliary equipment service can also be reactive and the customer can contact a 24/7 phone number in cases of emergency.

When the service deliveries are reactive, the system transforms a bit. For example if the customer's piece of equipment breaks suddenly, the customer can contact Company A's service center or the sales department. The service center can try to help the customer on the phone to fix the problem. However, if the situation cannot be solved remotely, Company A tries to find a vacant maintenance man who can go to the customer's premises and fix the problem. In these kinds of cases, the service delivery varies case-by-case. For example, if there are not necessary spare parts needed, the piece of equipment might not

be repairable immediately. The resource management is difficult in reactive services and maintenance men can be engaged in other tasks. Then Company A negotiates with the customer and tries to find the best solution possible.

Customer participation in service deliveries

In many Company A's service deliveries customer's role is crucial. For example in auxiliary equipment service it is important that the mapping of equipment is complete. A manager explains: *"The mapping of a factory's equipment is long and difficult process. Customer's role is important because it is impossible for us to design the size of the auxiliary equipment stock if we do not know what pieces of equipment the customer has in its production and close stock."* Also in this service the customer normally does the installations by itself.

Also when considering reactive and proactive services, the customer has a significant role. It depends on the customers' working methods, how well Company A is able to plan the service deliveries beforehand. Even though a customer has a service contract with Company A, it is possible that the customer does not give the information about stoppages and the pieces of equipment that need repair early enough. This causes challenges for Company A and increases the uncertainty of service delivery system.

4.1.3 Integration design choices

Information systems

The base of the service deliveries is an ERP-system. The whole order-delivery process as well as reporting goes through this system. The usage of ERP-system standardizes the steps in these processes. However, a manager explains: *"Our ERP-system is joint for all products, but then every product has own specific tools that are integrated into factories' systems."* And when asked about how well the existing systems serve different service deliveries, another manager highlights that *"Our systems are defective and cumbersome. It hinders for example service sales and marketing, because the calculation of a service offer is laborious."* Because of the many systems, same information may be added in several systems separately. Also all the systems of Company A's service organization are not integrated into the other systems so the management and usage of the systems is difficult.

Company A has also gathered data of its installed base for years. However, the data is fragmented and it is recorded in several places. Thus, they have taken a database in use where they are collecting the data from different sources. A manager explains the situation: *"The data gathering into the system is not centralized. If the history data was transferred into the system that would already make a big difference. But there are not clear*

processes how the data should be transferred." Because the data is not updated and easily available, it cannot be used with its total potential in service development and sales.

4.1.4 Standardization of the service delivery system

Company A is able to offer its services to many customers as well as many pieces of equipment at the same time. For example in a repair shop, the tasks can be planned and resourced inside the shop. In the case of maintenance according to one manager: *"A maintenance man can have his own customer base and contacts, and he can time and plan his tasks together with these customers."* Company A uses subcontractor maintenance companies in locations, where the logistic costs would increase too much, if they used their own employees. This also makes their resource management more flexible and helps to balance their capacity.

Even though the different services require different service delivery systems, there are many things common in the processes. A manager tells: *"In practice the service processes are quite similar, so it would be a good idea to standardize these processes and see if the service business could be developed that way."* Also another manager highlights that *"Because the service processes are not standardized and the services are not productized enough, the pricing and the offering of the services is much more difficult than products."* It can be seen, that there is unexploited potential in Company A's service operations. If the service processes were standardized and the systems supported the service business properly, Company A could increase its service sales. Nowadays in many cases the customer contacts Company A instead of that Company A would sell its services actively. Also because it is so difficult to make a service offering, Company A usually offers products and services separately. A product sales manager explains: *"If someone asks for an offer from us, we make it in one day. But if there are some services involved, the calculation can take several days. This naturally hinders the product offering process and normally we offer the services separately."*

4.1.5 Other notable aspects

Company A has several channels for its product sales. These sales channels include distributors, integrators and straight sales to the customers. A manager explains the product sales: "-- We sale mostly to integrators and integrators export all over the world." In case of distributors and integrators Company A does not sometimes have a direct link to the end customer. This causes challenges for the service business.

There are also cases when Company A knows the end customer but they lack of information about the location where the piece of equipment is situated. This kind of situation also hinders the service after sales and follow-up of the installed base. Company A's aim is to collect knowledge about the end customers and their equipment in order to ease service sales.

Company A has launched a registration service which aim is to provide an additional guarantee for the customers who register their piece of equipment. However, this service has not been very successful. A manager explains: "-- There has not been a big campaign about the service or we have not given a good benefit from it." According to the same manager Company A's products either break down immediately or they function 15 years. An additional guarantee is not a very good benefit for the customer in this kind of situation. Also other manager comments: "I do not know if the registration method has been too difficult or something else that it has not been successful."

For service sales and new service possibilities it is important for Company A to map where the pieces of equipment are. Company A's aim is to develop methods for mapping the end customers and their pieces of equipment. Also their information systems need development. The mapping has to be done centralized and systematically. Company A is also developing an extranet page for their customers where they can see their pieces of equipment and service plans. They have also developed a registration method that is based on RFID-technology.

4.2 Case Company B

Service business is an important part of Company B's business operations. Especially wear part services have a big business potential and Company B is an experienced operator in this area. Company B's client base varies from big customers to mobile small clients. This causes challenges and variation to Company B's service processes.

4.2.1 Structural design choices

Facilities and Layout

Company B delivers services both in customer's premises as well as in their own premises. Mostly the services are delivered in the customer's premises, but in cases when the piece of equipment is not repairable at the site, it is transferred to the Company B's repair shop. A manager explains: *"When we are not able to repair the piece of equipment in field or it is not profitable, the piece of equipment is transferred to the repair shop in here."*

The nature of Company B's customer base causes challenges for them to offer services for multiple customers at the same time. In many cases the mobility of the customers is great and this makes it hard for Company B to offer proactive services to these customers. Company B is trying to answer this mobility challenge with mobile field teams. A manager explains: *"In many locations the distances can be long and also the infrastructure there can be undeveloped. For these kinds of cases we have small field service teams."* However, these small field service teams cannot serve multiple customers at the same time and they do not solve the planning problem for Company B.

Technology

Technology embedded in the equipment

The technology embedded in the installed base cause requirements mostly to the maintenance men's competence. Different pieces of equipment require different know-how and different spare and wear parts. A manager explains: *"We have to check who we can send to a location so that he knows the piece of equipment."* Superiors are responsible of the resource management in Company B. They do not have a competence pool or a special tool for resource management.

Another important issue is the logistics. A manager tells: *"It is a logistic nightmare to replace thousand parts that weight 400 kilos."* The environment where the customer's piece of equipment is has a great impact to the logistics also. It is possible that there is no room for an intermediate storage and the spare and wear parts have to be installed immediately. Also some tools Company B uses in its maintenance services are big and it is possible that in the customer's site there is not enough room to use them.

Remote technology

Company B offers a service contract for their customers that include remote data gathering from the equipment. With the data Company B can follow the usage of the equipment and plan the maintenance schedule. A manager tells: *"We have this service which includes that we check the equipment every year. We gather data of the equipment that tells us how many hours it has been used."* However, this is the only purpose what for Company B gathers remote data.

Company B does not use the data for example to predict customers' service needs or to offer them services proactively. However, they show interest for these kinds of services. A manager tells: *"There are lots of opportunities to exploit the data. -- The idea behind it has to be the willingness to help the customer."* It is important to approach the customers carefully with these kinds of services. The manager highlights: *"The point is not to annoy the customer."* Too straightforward approach can make the customer reserved even though the idea is to help the customer in its production.

4.2.2 Infrastructural design choices

Service delivery process

Company B offers reactive services and service contracts to its customers. In the case of service contracts the time of the delivery is set well beforehand. A manager tells: *"We know at least two months before the time of the delivery, how long it will take and what is the size of the team we are going to send to the customer's premises."* Company B has contract responsible employees who plan and time the maintenance work together with

the customer. The contract responsible employees answer for communicating with the customer. After the plans are made, the spare and wear parts needed are ordered to the customer's premises. If the maintenance service in question regards wear parts, the speed of the service delivery is crucial. Stoppages are extremely expensive to Company B's customers, so the service deliveries have to be done in time. In these cases service contracts ease the planning and resourcing of the services.

In reactive services the customer contacts Company B's order processing center or seller. For example if the customer needs a spare part, it can order it from Company B, in which case they send a confirmation of order to the customer. If the customer wants a request of quotation, Company B answers to the customer with an offer. Then the customer sends a purchase order to Company B and they answer with a confirmation of order. After this, Company B's warehouse sends the spare part to the customer. The logistics can be handled by Company B or the customer.

Also maintenance services can be reactive. In these cases the service normally is more expensive to the customer. A manager explains: *"In case of ad hoc requests, the service is more expensive to the customer because logistic costs increase. Also we cannot know beforehand how long the maintenance man has to be in the customer's premises or what the tasks are that have to be completed."* If many of the service requests are reactive, the service deliveries may become longer. In case of service contract the maintenance man visits the customer's premises and works with its equipment regularly. In reactive services it is possible that the maintenance man sees the piece of equipment in question a couple of times during his work history. And if he does not know what the customer expects him to do beforehand, the problem solving is going to take more time. Also in many places security training is required. A manager tells: *"In many industrial areas you have to have security training. If this training takes for example an hour, every time you lose time."* This also means that the service delivery takes more time.

Customer participation in service deliveries

The customer's role in the service delivery varies between customers. Some customers participate a lot in the service delivery and some customers do only the necessary things. Company B has supervisors who control the service deliveries, but in many cases the customer participates in the service delivery. A manager explains: *"We agree the areas of responsibility and the customer delivers their part of the scope and we deliver ours."* The responsibilities can also overlap to some extent. The manager tells: *"Sometimes it overlaps a bit. We can for example borrow things from each other."* In order that this kind of interaction is possible, Company B has to have a good and trustful relationship with the customer. Without the good relationship, this kind of action model causes uncertainty to the service delivery system. Nevertheless, it can cause uncertainty in spite of the good relationship if the responsibilities are not clear enough for both parties.

In the cases where the customer's role is not that significant, the customer leaves the responsibility totally to Company B. A manager tells: *"In many big cases it is even possible that our employees do not get the proof of delivery signature from the customer."* It can be seen that the big customers trust that Company B delivers what they promise. However, problems arise if the delivery is not what has been promised. If Company B's employees do not get the proof of delivery signatures, it will weaken Company B's position in case of reclamation.

4.2.3 Integration design choices

Service supply chains

The services are mainly delivered by Company B's own employees but they also use subcontracting to some extent. Subcontracting eases the resource and capacity management. Company B's aim is to develop their subcontractor network. A manager explains: *"-- Of course we aim to develop that area so that we would have a good and responsive subcontractor network. --"*

Company B manages the third parties by having their own supervision of work. The maintenance persons may be subcontracted but the supervisors are always Company B's own employees. This ensures that Company B's brand is shown to the customer.

Information systems

The base of Company B's service delivery system is the ERP-system they use. Their whole order-delivery process is directed through this system. When a service request comes from a customer, a request for quotation is opened into the system. Then as the process moves on, the request transforms into an order and finally the customer is invoiced via the system.

Company B gathers service history data from their installed base into their ERP-system. The problem is that different units of Company B have different ERP-systems. This complicates the data management and updating. A manager tells: *"If the ownership of the piece of equipment changes during the delivery inside our company, the setup to gather installed base data has to be same in the sending unit and the receiving unit."* Company B also offers service contracts to these mobile customers, but they do not have a proper system to manage the contracts. Another manager explains: *"We do not have a system to manage the service contracts and we do not get the trigger for service deliveries. That is a big problem at the moment."* Company B is trying to change their service business for mobile customers towards proactive services. However, the challenges mentioned above have to be solved before this aim can be achieved.

4.2.4 Standardization of the service delivery system

Company B has three different service delivery processes that are invoiced differently. In service contracts the invoicing is normally cost per ton based. This means that the invoicing is bound by the amount their customer's plant produces. In these kinds of cases Company B maintains the equipment in a way they see is the best. Another service delivery process is for reactive services, where the invoicing is fixed. In these cases Company B offer the service with fixed price and does then what is needed. The third case is a reactive service delivery where the invoicing is per an hour. There the customer wants something to be done and Company B does it and invoices the customer based on the hours the work took. A manager explains: *"Our service delivery system varies between proactive and reactive services. We have three service delivery process models and every one of these has standardized working methods."* Company B is trying to simplify their processes and ease the resource management and scheduling of service deliveries. In reactive service deliveries they have had cases, where the maintenance man has been on the customer's site, but the spare parts have delayed. These kinds of situations increase the costs of service deliveries.

4.3 Case Company C

Company C has a relatively wide selection of services. Company C has several service centers where repair shop services have scattered. The most important thing for Company C is the background information customers offer in order to be able to plan and schedule services properly. At the moment Company C is seeking means to engage customers to offer more accurate information and participate in service production increasingly.

4.3.1 Structural design choices

Facilities and Layout

Company C delivers services both in customers' premises as well as in their own repair shops. Company C has multiple maintenance centers where some of the maintenance tasks can be performed. The tasks that can be performed in the customer's premises are done there. It depends on the service need and the piece of equipment how the service is delivered. The different service delivery processes are explained further.

Technology

Technology embedded in the equipment

Company C has a large amount of different products. Different technologies embedded to these products cause challenges to the service delivery system. According to a manager the simplest maintenance works differ greatly from the complex maintenances in terms

of resources and equipment needed. The maintenance works divide inside Company C to multiple maintenance centers. This means that one maintenance center can do only some same kind of maintenance works in a year. Company C has to have good work instructions and procedures in order to ensure the quality of service deliveries.

Also if the piece of equipment is not Company C's own product, the offer process becomes more complex. It is impossible for Company C to know what spare parts the piece of equipment needs if they do not have its blueprint. In these kinds of cases Company C estimates the maintenance costs when they make the offer to the customer. Then after they have received the piece of equipment and they have found out what parts are needed and how long the maintenance will take, they will make a new offer to the customer. A manager explains the situation: *"If do not have the blueprint, we can only use some kind of model drawing to make the offer. Then if the deal realizes, we make the real blueprint and hope that the costs are substantially accurate."* Evidently this kind of process takes more time and it may be more expensive to the customer.

Remote technology

Company C has some remote services, but most of their services require going to the customer's premises. For example software repairs could be done remotely in theory, but in practice the problem can be caused for example a broken sensor which requires that someone goes there and replaces it. A manager tells: *"-- We could upload new or repaired software remotely but the risks start to be so big that in practice we do not do that. If the connection broke in midstream, what would we do then? Then we would have an automation specialist without connection and problematic piece of equipment in stoppage there, so we do 95 percent on the spot."* Even though technology enables remote service deliveries, the processes are not developed enough. Also some things just cannot be done remotely. However, Company C is developing data analysis tools at the moment and their goal is to offer more remote services, such as process optimization, in the future.

Company C gathers remote data from their customers' equipment actively. At the moment the remote data usage is mostly reactive and it is limited to the contract customers. A manager explains: *"-- For contract customers we have a particular service level and we help them in certain problems."* The remote data is used to solve problems when they arise.

Company C's aim for the future is to develop the remote data usage so that it can be used proactively in service business. The manager tells: *"We have done this automatic processing of the data. -- It is not solving the problem from zero but we are trying to standardize certain findings and catch them."* Their aim is to offer for example such services as condition monitoring and optimization. *"You should monitor multiple pieces of equipment at the same time, not only how many stops there are in there in a year but online,*

how some parameter is. If it starts to move away from the average, then it would be wise to do something", a manager describes the aim.

Company C's customers react to this development different ways. Some customers allow Company C to connect into their systems easily but others are more conservative in opening their systems. A manager explains: *"At the moment they do not necessarily give the access to the data just like that. But of course if the value of the service concept is big enough to the customer, certainly we have to have access to the required data."* Company C has noticed this problem and they are aware of that they have to have good models for how they connect into customers' systems and how they ensure the customers' information security and confidentiality.

Capacity planning

Company C is able to offer some services to multiple customers at the same time. Repair shop service is an example of these kinds of services. However, at the moment Company C is facing problems in their capacity. A manager explains: *"-- We try to keep the delivery deadlines, but we do not succeed every time. At least not at the moment when we are operating at full capacity."* This hinders Company C's possibilities to offer services for multiple customers at the same time.

Company C has a business unit that answers of the spare and wear parts. According to a manager they are facing problems with the delivery times of these parts. The delivery times are not exact enough and this may lead to situations where the customer's stoppage starts but the parts are still not delivered. This complicates the capacity and resources planning of Company C. Also service deliveries may delay.

4.3.2 Infrastructural design choices

Service delivery process

In Company C's case the focus is in repair shop, spare part, wear part and field maintenance services. In repair shop services during a stoppage the customer removes such parts from their equipment that need maintenance. Then they send the parts to Company C's repair shop where the parts are maintained and sent back. This process can start so that the customer sends a request for quotation to Company C or as a manager explains: *"This offer process can start so that the customer sends -- the part to us first."* In the first case Company C sends an offer to the customer and if the customer accepts it, the part is sent to Company C's repair shop. After the part arrives into the repair shop, Company C makes a receiving inspection to it to find out what kind of part it is and is it possible to do the repair tasks that were agreed on. If there need to be changes made to the order, Company C makes a new offer to the customer and agrees on extra work. When everything is clear, the maintenance can be done and after it the part is sent back to the customer. If the

background information is not sufficient and extra work is required, the service delivery clearly will take more time. Also the uncertainty of the service delivery system increases if plans have to be changed and new spare parts have to be ordered. If the process starts in the latter way, Company C contacts the customer and finds out what the customer needs to be done. After this the offer is done, and after the customer accepts it, the process proceeds to the maintenance.

In spare part services the delivery process is more transactional. A manager tells: *"A typical spare part transaction is a deal where spare parts are restocked because of a shortage."* Usually the customer makes a request for quotation or an order to Company C and Company C answers to the customer with an offer or a confirmation of order. After the customer has accepted the offer the spare parts are ordered. In the latter case the spare parts are ordered after the confirmation of order has been sent. Company C then delivers the spare parts to the customer in the agreed delivery time.

In field services the service delivery system varies between regular maintenance services and ad hoc maintenance requests. In regular maintenance cases the customer usually contacts Company C's sales department when they are planning a stoppage. *"When the customer makes a budget and maintenance plan for the next year, the offers and discussions are started well beforehand, months before the stoppage",* A manager explains the situation. Company C's maintenance men check the equipment with contract customers and give them recommendations which pieces of equipment they should send to a repair shop. In many ad hoc service requests the customer has a problem, but they do not know the reason for that. It can take a long time for Company C to define the problem and its cause. A manager explains: *"It is possible that first we sell an audit where we map the situation. The problem is that the symptom and the cause can be in different pieces of equipment. We have to know so much about the situation that we can send that kind of man there who can audit the right piece of equipment."* In these cases the communication with the customer is very important. In order to have a successful service delivery, the customer has to offer enough background information for Company C. Also in these kinds of services the management of the service delivery system is challenging because so many things are uncertain.

Customer participation in service deliveries

Customer's role in Company C's service deliveries is very important. For example in repair shop services Company C needs lots of background information from the customer. They need the blueprint of the piece of equipment as well as the specification what is needed to be done. A manager highlight: *"In my opinion we could give more responsibility to the customer regarding the validity of background information. There could be some kind of automatic procedures because there often are quality errors. This means that some piece of background information is wrong and the service is done based on that correctly, but it does not help because of the error in the information."* Errors in the

background information cause service deliveries to be delayed and also wrong things can be done to the piece of equipment. This increases costs and reserves Company C's capacity unnecessarily.

In some cases Company C offers also services, where the supervision comes from Company C and the resources come from the customer. For example a supervisor can be from Company C and maintenance men from the customer. It is also possible when subcontracting is used that the customer makes the deal with the subcontractor and the supervision still comes from Company C. Some customers also want to come to Company C's premises to see how a repair shop service is done.

4.3.3 Integration design choices

Service supply chains

Company C has a relatively extensive subcontractor network. It eases their capacity and resource planning. According to manager their subcontractors locate also relatively near their customers, that reduces costs.

The supervisors of work are always Company C's own employees. This is their method for managing the third parties. Company C also manages the level of know-how of their subcontractors by organizing trainings for them.

Information systems

Company C has an ERP-system that directs the service delivery system partly. A manager highlights that at the moment their reporting is a big problem for them. The maintenance reports are delayed. When asked what the cause for this problem is, a manager explains: *"It is capacity and also the system a bit; it is too laborious to do at the moment."* This leads to a situation where the service deliveries are not ended properly and the customers do not get the reports what have been done. This complicates the quality management and can be a big problem in case of reclamations.

4.3.4 Standardization of the service delivery system

The service delivery system varies between services in Company C. They have four business areas in the unit which this research focuses. Some of these business areas are well standardized but others are not. For example in wear part services, even though Company C has a hundred different products, twenty of these products are big volume products for which they sell wear parts. The service delivery system for wear part service is well standardized. A manager tells: *"We produce these almost in every production unit with same pieces of equipment and with same procedures and definitions. So that is well standardized."* The service delivery system for field maintenance services varies more. A manager

compares it to car repair. Every product needs a bit different maintenance. However, if the piece of equipment is Company C's own product, they have the blueprints for it and it eases the maintenance. But in overall the service delivery system for field maintenance services is more uncertain and the services differ depending on the equipment and the customer.

4.3.5 Other notable aspects

Company C's aim is to find out how they can promote customer participation in their service deliveries. Customer's role in Company C's service delivery system is important and Company C needs lots of information of the customers. Their aim is to give more responsibility for their customer's regarding the information flow. At the moment Company C has to ask information many times from the customers and often they lack of information in spite of the inquiries. This complicates and delays their service deliveries.

4.4 Cross-case analysis

This section concludes the results presented previously. The similarities as well as differences between the case companies are discussed. All the case companies are big Finnish manufacturing companies. They operate mostly in different industries. However, the state and nature of the service business in the case companies is quite similar. All case companies offer traditional services to their customers but they are interested in developing remote and digitalized services.

4.4.1 Structural design choices

Facilities and Layout

All the case companies deliver services in their customers' premises as well as in their own repair shops. However, there is variation between the companies in which kinds of services are delivered in repair shops. Company A delivers most of its services in the repair shop because their customers have their own maintenance units and equipment installation know-how. Companies B and C in the other hand deliver most of their services in their customers' premises. Only those services that cannot be delivered on the site are delivered in the repair shops.

Technology

Technology embedded in the equipment

Different technologies embedded in pieces of equipment have an effect to the case companies' service delivery systems. All the case companies noted that different technologies

cause requirements for resource management. Different pieces of equipment require different know-how. In all the case companies supervisors are in charge of resource management. Only Company A has made competence mapping but it is not updated. Also in Company A's case some of their customers require security certificates of the maintenance men working in their premises. This makes resource management more complex. Also the fact that individuals have a lot responsibility in resourcing complicates the situation.

Also other challenges aroused in the interviews. Company A noted that they are facing challenges in finding substitutes for very old pieces of equipment. Their products have such long life-cycles that when the substitution is topical, the technology has changed a lot. If no substitute can be found, Company A offers a retrofit service for their customers. Company B is facing logistic problems. Their spare parts are big and heavy and the environment where the parts have to be delivered is often difficult. This causes challenges to how the spare parts are moved. The different technologies cause challenges for Company C also. It is possible that Company C's service centers do only few same kind of maintenance work in a year. This means that they have to have good procedures and work instructions in order to ensure successful service deliveries. Company C also needs a blueprint of the piece of equipment so that they can plan the maintenance, order right spare parts and predict the time and costs of the service delivery. In some cases it is difficult to find the blueprint, especially if the piece of equipment is originally their competitor's product.

Remote technology

All the case companies are in the beginning in remote service production. They all show interest in that kinds of services but at the moment the significance of remote services to case companies' service business is minor. However, the development is ongoing and the case companies' future plan is to expand remote services.

The remote data usage has also similarities and differences between the case companies. Companies A and C are the only ones that use the data to solve problems. And even though they are using the data, they are using it reactively. Also Company A noted that they gather installed base data, but the data is located in several systems and it is fragmented. This hinders its use in service business. The comparison of remote data usage in case companies is shown in the Table 4.1.

Table 4.1. *Comparison of remote data usage in the case companies.*

	Company A	Company B	Company C
Remote data usage	•Used reactively to solve problems •Installed base data fragmented	•Used for scheduling maintenance tasks	•Used reactively to solve problems

Company B uses remote data to plan their maintenance tasks. They gather data of hours that the piece of equipment has been used and based on that make their yearly maintenance plans. In every case company it can be seen that the development of remote services is only in the beginning. None of the companies is using the remote data to predict customers' service needs and to offer them new services.

Capacity planning

Capacity planning was noted in the interviews in the case companies A and C. Company B's employees did not discuss about the matter. Company A is facing capacity planning challenges related to reactive services. The basis of these challenges is the fact that Company A is unable to predict and schedule the reactive service requests.

Company C in the other hand is operating at full capacity at the moment. This leads to delays in service deliveries as well as problems in multiple customer situations. Company C is has also spare- and wear part delivery problems. The delivery times are not exact enough and they have had situations where the parts have delayed and the customer's stoppage has begun.

4.4.2 Infrastructural design choices

Service delivery process

All the case companies offer both reactive and proactive services to their customers. However, Company C's interviewees did not use these exact words, but the services they discussed can be divided into these categories. These service types have different challenges and impacts to the service delivery system. These challenges are shown in the Table 4.2.

Table 4.2. *Challenges in case companies service delivery systems.*

Challenges in reactive services	Challenges in proactive services
Service delivery system variation case-by-case	Unique challenges, depending on the service, customer, context and other factors
Resource management	Customer participation in information collection
The costs increase	Unexpected changes in the customer's premises or the environment where the delivery takes place
The delivery time increases	
Defining the problem and its cause	Spare parts are not at the right time at the customer's premises even though ordered in time
Unexpected changes in the service specifications	

The case companies highlighted their aim to develop their service business towards proactive services. In reactive services the challenges faced by the case companies arise from the unexpected service requests and situations. The case companies are not able to plan the service deliveries sufficiently and the deliveries become expensive and time-consuming. The case companies experienced that the management of proactive service deliveries is at relatively good level. In proactive services the challenges vary much more depending for example on the customer and service. In proactive services the customer participation was emphasized as an important aspect in service deliveries and a cause of variation.

There are some similarities in the problems the case companies face. For example both Company B and Company C have challenges in problem solving. However, the causes for these challenges are different. Company B has problems in problem solving when a maintenance man meets a piece of equipment that is not familiar to him. Company C in the other hand faces challenges when the background information is not sufficient and the symptom and the cause exist in different pieces of equipment.

Also the communication with the customer is similar in the case companies. The ways of communication are both formal and informal, and in many cases the customers have certain contact persons in the case companies with whom they have special relationships. This kind of communication model has advantages as well as disadvantages. When the communication is based on personal relationships, the customer satisfaction may increase because the customers feel that the supplier cares about them. However, if this leads to unwritten agreements and old school tie, the communication has become too informal.

There are also differences between the case companies. For example the important issues are different for every company. This is because their customer base, service portfolio and processes differ. The important issues originate from the problems the case companies face. It is natural that the things that would ease their problems are the things that arise when asked of the important things.

Customer participation in service deliveries

Customer's role in service deliveries and how it is managed is an important aspect when the standardization of service delivery system is considered. Companies A and C are dependent of the information the customers offer. For example Company A needs information about the customer's pieces of equipment in order to be able to plan auxiliary services. On the other hand Company C needs the blueprint of the piece of equipment to be able to plan and schedule the maintenance. Also the information about the problem is important for the case companies. Company C has for example faced situations where they have had to change service offer afterwards because lack of background information.

In Company B the customer's participation in the service deliveries vary. In some service deliveries the customer participates a lot and can for example do some of the maintenance tasks by itself. In other service deliveries the customer can play a minor role and participate only that much that is necessary.

In all the case companies the importance of communication with the customer is emphasized. Still the case companies do not have properly standardized communication models but the communication is based on personal relationships. Company C has some information they ask from the customer every time but still they are often forced to contact the customer several times. Standardized communication models would ease planning and scheduling the service deliveries and decrease delays. Company C is showing interest in how to engage the customers more in their service production and information offering.

4.4.3 Integration design choices

Service supply chains

All the case companies use subcontracting in their service deliveries. Subcontracting decreases travel costs and reaction time. It also helps the case companies in their resource and capacity planning. The case companies manage the third parties by having their own supervision of work. This leaves the power and responsibility for them. Company C also manages the know-how of their subcontractors by organizing training for them.

Information systems

All the case companies have ERP-systems in use. In Companies A and B the whole order-delivery process is directed through the system. In Company C the ERP-system directs

the service delivery system partly. The case companies have different challenges related to their information systems. Company A has several different systems and they are not integrated enough. Information has to be added into several systems and it is laborious and takes time. In Company C the maintenance reports are delayed because it is too laborious to make them and they have capacity problems.

Companies A and B gather installed base data from their equipment. In Company A the data is fragmented and it is located in several places. Thus, they have taken a database in use where they are collecting the data so it would be in same place. In Company B problems arise if the ownership of the piece of equipment changes inside the organization during the delivery. In order to be able to collect the installed base data the setup has to be same in the sending unit and in the receiving unit. Company B faces also information system challenges related to their mobile customers. Company B offers service contracts to these customers but they do not have an information system with which they could manage these contracts.

4.4.4 The level of standardization in service delivery systems

All the case companies have an ERP-system which standardizes the steps in their service delivery processes. This is the only similarity between the case companies. The comparison of the level of standardization in the case companies is shown in the Table 4.3.

Table 4.3. *Comparison of the service delivery systems' level of standardization.*

	Company A	**Company B**	**Company C**
ERP-system	Directs service deliveries	Directs service deliveries	Directs service deliveries partly
Important issues	In order to enable active service sales, services and processes should be standardized	The processes are standardized but they have to be simplified	Ensuring sufficient background information
Problems	Lack of standardization complicates service sales Used information systems are defective and cumbersome	Resource management Delivery scheduling	Field maintenance service deliveries vary case-by-case Reporting
Development activity	Ongoing system integration	Ongoing research of common factors in the processes in order to simplify them	Activities did not arise in the interviews

The case companies face different kind of standardization related problems. In Company A the lack of standardization in their systems and processes hinders their ability to sell services actively. They are trying to ease this problem by integrating their information systems. Company B has standardized delivery processes but they are too complex. They have resource management and scheduling problems that they are trying to solve by simplifying their processes. Some of Company C's delivery processes are standardized but for example field maintenance services vary. They are also facing reporting problems that are caused by their information systems as well as lack of capacity.

4.4.5 Service delivery system in complex environment

The most notable issues that arose in the interviews were the role of technology, customer participation and standardization of the service delivery system. The case companies have different approaches to these themes and also different aspects are important for them. The difference of these issues is shown in the Table 4.4.

Table 4.4. *Comparison of case companies' approach to technology, customer participation and standardization.*

	The role of technology	**Customer participation**	**Standardization**
Company A	Long product life cycles -> competence management, remote monitoring business models, how to expand remote services to old pieces of equipment	The information the customers offer important for production planning and stock planning	The level of standardization not sufficient, hinders service sales and offering
Company B	The environment at customer's site is important, remote services to monitor operating hours	The relationships with customers are quite informal and trustful	3 standardized delivery processes, aim to simplify these processes to ease scheduling and resource management
Company C	Blueprints of the equipment are essential, remote services offered but not to predict customer needs	The background information about the pieces of equipment is crucial	Some processes are well standardized and others are not

It can be seen from the table above that different aspects are important for the case companies and different things cause challenges for them. The most urgent issue for Company A is the standardization of the service processes. Company B's most important aspect in the other hand is the environment at customer's site and they have to consider how to decrease its impact to their service deliveries. The most crucial aspect for Company C is the information that the customers provide and the lack of it.

Companies B and C have similarities in producing services for multiple customers or multiple pieces of equipment. Both companies are able to produce services at the same for some of their customers and to some pieces of equipment. According to a manager at the Company A they are able to serve multiple customers and multiple pieces of equipment in every case. Comparison of the case companies' fleet approach to service production is shown in the Table 4.5.

Table 4.5. *Comparison of case companies' service production for fleet.*

	Company A	**Company B**	**Company C**
Service production for multiple customers	To all	To some	To some
Service production for multiple pieces of equipment	To all	To some	To some
Remote services	For some pieces of equipment, limited offering	For some pieces of equipment, limited offering	For some pieces of equipment, limited offering
Challenges	•No sufficient business models for remote monitoring services •Remote monitoring possibilities only in new pieces of equipment	•In some cases the mobility of the customers is great •No sufficient interfaces between different departments' ERP-systems which leads to installed base data management issues •No proper system to manage mobile customers' service contracts	•Operating at the full capacity at the moment •Processes not developed enough for remote services

The challenges the case companies are facing when developing their service production towards fleet level vary. Company A's challenges are related to remote services. Because they are in the beginning of developing these kinds of services, they still do not have proper business models for remote service business. Also only their new pieces of equipment have the ability for remote services. The life-cycles of Company A's products are long and this hinders the development of remote services.

Company B has different problems. In some cases their customers' mobility is great and it is possible that for example a customer orders field maintenance today, but tomorrow

they are in different location. This makes it impossible for Company B to plan these services. Also they have service contracts for these mobile customers but they do not have a proper information system to manage the contracts. Company B also gathers installed base data of their pieces of equipment. However, their ERP-systems differ between the units and if the ownership of the piece of equipment changes during the delivery, the information do not update to all systems.

In Company C's case they are operating at the full capacity at the moment. This has led problems in keeping delivery times. Also even though technology enables remote services, in practice some services are too risky to deliver remotely or they require a maintenance man's presence.

5. DISCUSSION

5.1 The revised service delivery system framework

The case companies' aim is to develop their service delivery system towards fleet level. They want to be able to serve multiple customers and multiple pieces of equipment at the same time. Though, this is partly possible already, they do not consider their service delivery systems as a whole but focus on managing the sub systems. The case companies have different delivery processes for different customers and services, and they have not modeled the complex system that would include all these processes.

The most notable management issues highlighted by the case companies were customer participation management, information management, resource management and technology management. At the moment all these aspects vary between different services and different customers. In order to serve multiple customers and multiple pieces of equipment at the same time, the companies should design a service delivery system that is standardized enough to be efficient and considers all the sub systems and processes as parts of one system.

Figure 5.1 adapts the results of this research to the framework created in the chapter 2.6. Relevant factors revealed in the research have been added to the framework. Even though every service delivery system design choice did not come up in the interviews, the design choices shown in the framework are experienced relevant and they have not been removed from the framework.

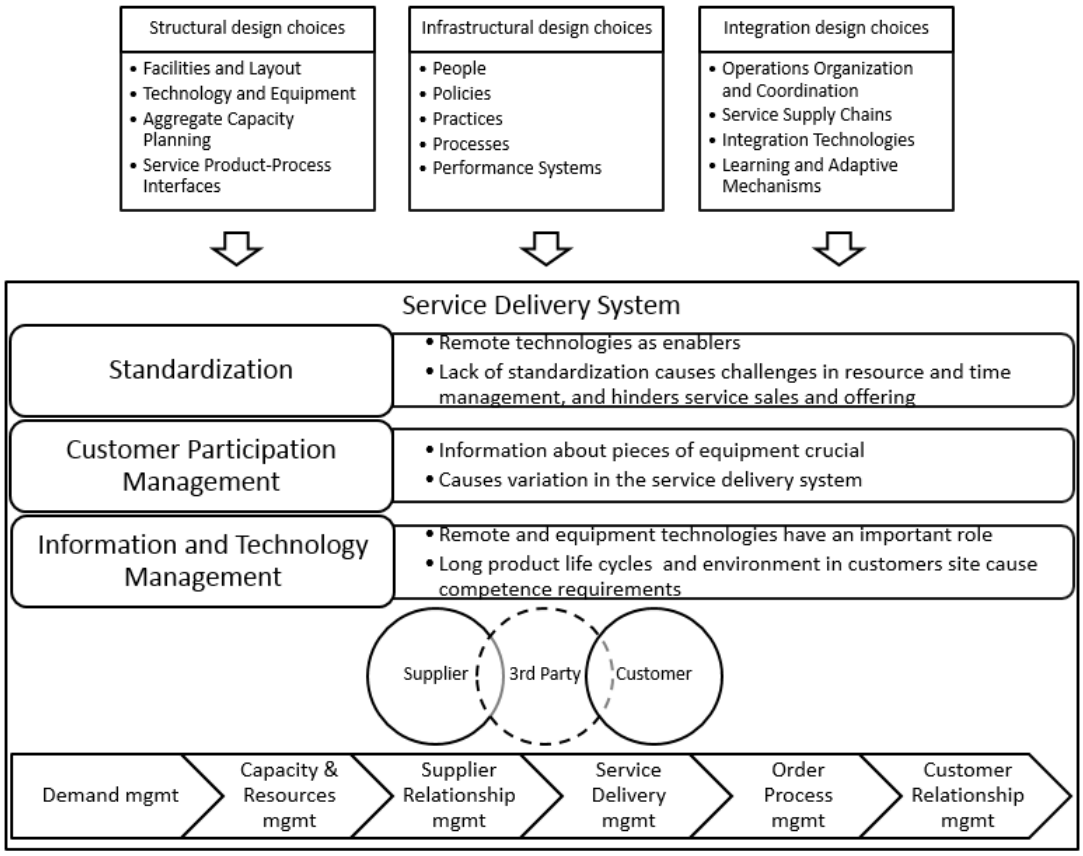

Figure 5.1. *The revised theoretical service delivery system framework.*

The service delivery system design choices have remained unchanged. In order to be able to create an efficient service delivery system that can also be managed efficiently, these design factors has to be considered carefully. The service delivery system design choices can be used to create the sub systems that build the whole system. The sub systems have to be optimized so that the whole system is effective.

Standardization and Customer Participation Management have been added to the framework. These aspects were found to be highly relevant in managing the service delivery system. The service delivery system has to be standardized to some level in order to achieve the effectiveness. Also standardized sub systems are easier to manage. Customer participation was also highlighted in the interviews and it causes variation in the service delivery system. Companies have to create sufficient models and processes to manage the customer participation in order to achieve a manageable and efficient service delivery system. Especially companies have to ensure the information flow between them and the customers. Customer participation was seen as different from the customer relationship management. Customer participation highlights customer's role in service delivery and service production.

Information and Technology Management has also been left unchanged in the framework. Both of these aspects were noted in the interviews and were experienced relevant in managing the service delivery system. Companies have to have efficient and usable information systems so that they are able to collect and exploit data in their service deliveries. Technology was also considered highly relevant and a cause of variation in the service delivery system. Different technologies cause requirements especially for the resource and competence management. Companies have to be updated of the technological changes and they have to change their processes and methods along with the technology.

The service supply chain in the framework has also been left untouched. Service delivery system can include several service supply chains with different parties. The framework is a simplification and that is the reason why the service supply chain is so simple. However, the service supply chains are the core of the service delivery system and they have a great impact to the service deliveries. Companies have to build their service supply chains as transparent as possible and manage the chains with such methods that they can exploit the whole potential of these chains. Companies also have to control the other parties of the chains so that their service deliveries are timely and effective.

All of the management issues were noted in the interviews to some extent. That is the reason why they are also unchanged in the framework. The management issues in the framework are related to service supply chain in Baltacioglu et al.'s (2007) and Ellram et al.'s (2004) models. However, this research reveals that these management issues can also emerge from other parts of the service delivery system. That is why the management issues are in the framework inside the service delivery system.

5.2 Structural design choices

The structural design choices noted by the case companies agree relatively well with the earlier research. Roth and Menor (2003) introduced the design choices for service delivery system in their research. The structural design choices mentioned in this research are related to Roth's and Menor's findings.

However, technology's role was emphasized in this research and found as a critical aspect when managing service delivery system. In Roth's and Menor's research the technology was seen as one design choice among other choices. This research reveals that technology has a great impact to the service delivery system and it also causes many management issues that lend support to Baltaciouglu et al.'s (2007) research of service supply chains. Technology causes requirements for example to the resource management as different technologies embedded in the equipment require different competencies. Especially Company A highlighted this issue, because they have very long product life cycles and the technology changes quite rapidly. This causes requirements to their employees' competence and expanding remote monitoring services to their entire installed base is difficult. The case companies experienced remote technologies as enablers when developing

the service business towards proactive services. Company C is especially developed in remote technologies among the case companies and they are focusing on developing digital services at the moment. The other case companies are in the beginning of the development and they are just in the idea level. The technology embedded in the customer's site and the environment there are especially important for Company B. Their products are big and the maintenance on site can be difficult. All the case companies noted how they intend to develop their service business towards proactive services. The case companies are highly dependent of the information the customers provide and with remote technologies this challenge would be eased. Even though the technology enables remote monitoring services, the case companies face other challenges in their development process. They for example lack business models and data management has to be developed so that they are able to analyze and utilize the data.

The interviews revealed also the importance of capacity planning and management. This aspect is also noted in Roth's and Menor's (2003), Baltacioglu et al.'s (2007) and Ellram et al.'s (2004) researches. Especially Company C is having challenges in their capacity management and they are operating at full capacity. This kind of situation hinders the company's possibilities to serve their customers the best way. It also causes the service deliveries to delay and decreases the customer satisfaction.

5.3 Infrastructural design choices

The infrastructural design choices noted in the interviews also lend support to earlier research. All the case companies offer both reactive and proactive services to their customers. These service types have different service delivery processes. The service delivery process varies case-by-case in the reactive services and this causes several challenges. The resource management becomes complex, costs increase, the delivery time increases, problem solving becomes more complicated and there may be sudden changes in service specifications. Many of these challenges are related to Baltacioglu et al.'s (2007) and Ellram et al.'s (2004) introduced management issues. For example demand management, capacity and resource management, service performance management and order process management need to be considered carefully when offering reactive services. These aspects can also be impossible to manage at an acceptable level and it can be noted from the interviews that the case companies struggle with these issues.

The case companies also noted that customer participation is a crucial aspect in two of the companies and important in one. The customer participation and customer relationship management has been noted also in Roth's and Menor's (2003), Baltacioglu et al.'s (2007) and Ellram et al.'s (2004) researches but in this research the topic was seen more important that in either of the earlier researches. The most important aspects in the customer participation were the information the customers provide and communication with the customers. The information customers provide is critical for Company C and they need a blueprint of the piece of equipment before service delivery. It is also important for

the other case companies and for example Company A needs information from the customer so they can plan their service production and stock level. Customers participate in the service deliveries in many different ways and this causes variation to the service delivery system. In order to achieve efficient service deliveries, the companies have to consider how they can manage customers and standardization of the processes and procedures is needed.

5.4 Integration design choices

Service supply chains and information systems were noted several ways in the interviews. All the case companies use third parties, such as service providers and spare part distributors, in their service deliveries. This kind of service supply chain structure causes requirements for supplier relationship management and customer relationship management. Also in Company A the service supply chain causes challenges because it is not transparent enough. Company A sometimes loses the link to the end-customer and this hinders their service sales. Thus, the service supply chain was noted quite relevant in managing service delivery system. These aspects agree with earlier research well and the importance of service supply chain design can be noted in this research also.

The information systems were also highlighted in the interviews. Especially Company A has several information systems and the data is fragmented. When information systems are not linked to each other at acceptable level, it may hinder the service sales and decrease the efficiency of service delivery processes. The information systems have to serve their purpose of use and be usable enough so that the employees can easily use them and get access to relevant data. Information systems have also an important role when developing remote monitoring services. The companies have to be able to analyze the data and have sufficient data warehouses to store the data. In the case companies the development is only in the beginning and these are challenges they are facing. These noted aspects lend support to Baltacioglu et al.'s (2007) and Ellram et al.'s (2004) researches of service supply chains.

5.5 Standardization of the service delivery system

The third research question dealt with the standardization of the service delivery system. There is no previous research regarding the standardization of service delivery system. The existent research deals with modularization and standardization of service processes but the system level has been neglected.

Service delivery system is a complex system including for example people, processes and equipment. In other words the service delivery system is everything that is related to delivering a service. In this research the hypothesis was that in order to have an effective service delivery system, it has to be standardized to some extent. When standardizing a

complex system, the easiest way is to divide the system into part systems and standardize them, in order to increase the level of standardization of the whole system.

This research revealed that there is need for standardization in the case companies' service delivery systems. Particularly reactive services cause challenges and uncertainty to the case companies' service deliveries. The case companies try to serve their customers in the best possible ways and this has led them to offer reactive services. However, these services are expensive, they cause the case companies several problems e.g. resource management becomes more complex, costs increase and capacity planning is difficult. Company A noted that because they lack of standardization, it is difficult to them to sell services and make service offers. Company B has relatively well standardized service delivery processes and now their aim is to simplify those processes and ease resource management and scheduling. Company C has well standardized delivery processes (e.g. wear parts) but in other processes they lack of standardization (e.g. field maintenance services).

Standardization of the service delivery system is a compromise between the customer satisfaction and the efficiency of the system. When the system is standardized, the efficiency increases but the company is no longer able to answer the customer needs individually. The company needs to balance these aspects and consider carefully the degree of standardization that is expedient.

Change management is also needed when a company standardizes its service delivery system. Standardization includes organizational change as well as process changes. When part systems are standardized the company needs to consider how they manage the remaining part systems and how they implement the changes into the organization. Also customer relationship management is an important aspect because the standardization may decrease the service options and the customer satisfaction may suffer.

5.6 Development process model for service delivery system

Figure 5.2 introduces a framework for developing service delivery system to the fleet level. The framework is based on Roth's and Menor's (2003) model of service delivery system design choices and the development process has been created based on the interviews conducted in this research. The framework contains five phases.

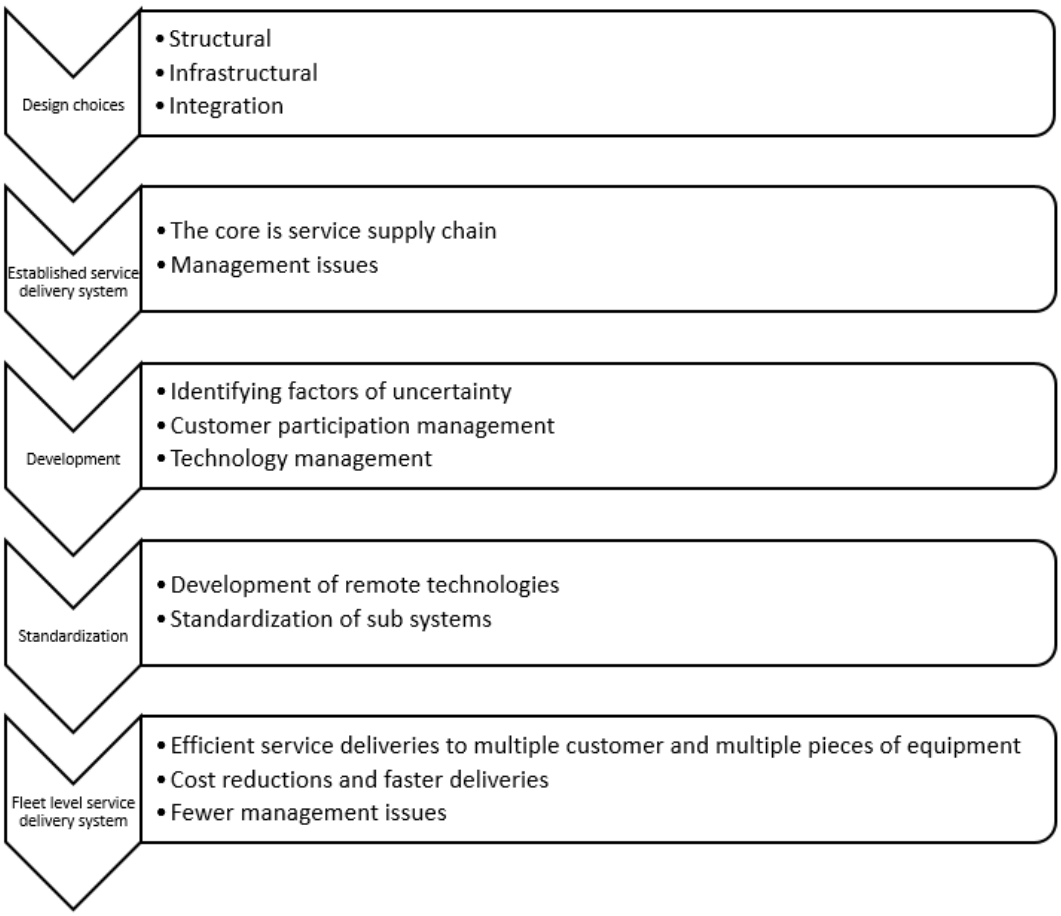

Figure 5.2. *Development process model for service delivery system.*

The first phase of the process is to identify and plan the service delivery system design choices. These choices include structural, infrastructural and integration choices. The design choices are the base of the service delivery system and companies have to plan carefully how they establish their service delivery system and what parts it contains.

The second phase is the established service delivery system. After identifying and planning the design choices, the company has a model of its service delivery system. This research shows that companies tend not to consider their service delivery system as an entity but they focus on the sub processes. In order to be able to develop the service delivery system to the fleet level, it is essential that companies recognize the system level and keep it in their minds when planning service deliveries.

In the third phase of the development process, companies have to identify factors that cause uncertainty to their service delivery system. This research also noted the importance of customer participation management and technology management, and these aspects have to be considered as well during the development. Customer participation and technology can enable or hinder the development. Both of these factors cause uncertainty to the service delivery system but if the companies take advantage of them properly, they can support the development.

The fourth phase is standardization. In order to be able to serve multiple customers and multiple pieces of equipment at the same time, the companies have to standardize their service delivery system so that they have efficient sub processes that serve the fleet ideology. Remote technologies can enable standardization and companies should exploit these technologies more. The service delivery system can be standardized by standardizing the sub processes. However, in this phase the companies should not forget customer satisfaction. Standardization may jeopardize it and companies should decide the agreeable level of standardization before taking actions.

The result of the development process is the fleet level service delivery system. This service delivery system enables companies to have efficient service deliveries for multiple customers and multiple pieces of equipment. Also the delivery costs and time reduce. Standardized sub systems also ease the management issues and the management of the service delivery system simplifies.

6. CONCLUSIONS

6.1 Academic contribution

This research contributes to earlier research of service delivery systems and service supply chains by discussing the standardization and management of the service delivery system. Especially the standardization of a complex system has been neglected in the previous research and managing the system has only been bypassed. The approach to these topics was a qualitative case study in three manufacturing companies that offer industrial services. The researched had three research questions. The main research question was answered by answering to the two sub questions.

This study revealed companies intention to develop their services towards proactive services. This intention requires standardization and standardization possibilities were found in both reactive and proactive services. These standardization possibilities existed at three levels: in micro-level operations, customer participation and service delivery system level. The standardization of service delivery system was experienced as important and necessary. However, standardization of the service delivery system is difficult and it is always a compromise between customer satisfaction and efficiency. The whole service delivery system cannot be standardized and companies have to consider carefully what sub systems they are standardizing.

Customer participation in service production was highly noted in this research. It causes variation into the service delivery systems and if badly managed, hinders the service deliveries. Especially the information that customers offer was experienced highly relevant in managing the service delivery system and increasing efficiency. Companies are willing to increase customers' responsibility in the service deliveries.

Technology's role in service delivery system was also perceived as relevant. The technology embedded in the equipment cause requirements for resource and competence management. Technology may also be an enabler in service delivery system standardization when using remote monitoring technologies. Companies are intending to develop these kinds of services and digitalization of the services is on progress.

An extended service delivery system framework was also proposed. The framework emphasizes the importance of standardization, customer participation management and technology management in a complex industrial service delivery system. The framework was created by combining Roth's and Menor's (2003), Baltacioglu et al.'s (2007) and Ellram et al.'s (2004) models.

6.2 Managerial implications

This research has revealed several factors in manufacturing companies that need standardization. Standardization of service delivery system increases the efficiency of service deliveries and eases the management of the system. This study can be used to identify these factors in service delivery system and to understand the relevance of standardization.

Customer participation was also highlighted among the case companies. This research can be used to understand customers' different roles and their importance in the service delivery system. Customer participation has to be managed efficiently so that the variation in the service delivery system decreases.

The role of technology was also perceived as highly relevant. Technology can hinder service delivery system or promote its standardization. Resource and competence management becomes complex when technology differs. Remote monitoring services can ease the service delivery system standardization and this study shows their relevance in the development.

The proposed theoretical service delivery system framework can be used to identify the different sub systems in the service delivery system. It can also be used to design the service delivery system. The framework proposes managerial issues that have to be considered when managing a complex service delivery system. The proposed development process model can be used when developing the service delivery system towards fleet level. It shows different phases in the development process and eases companies to plan the process.

6.3 Evaluation of the research

There are many factors that decrease the reliability and validity of this research. First, the interview structure did not include all the relevant questions from the beginning of the research. Even though the structure was revised during the research, some important aspects may have not come up in the interviews. Also the researcher have possibly influenced by her presence and comments to the answers of the interviewees. The semi structured interviews give a lot of power to the interviewer and this decreases the reliability of this study.

The relatively low amount of interviews decreases the validity of this research. 19 interviews were conducted and all of these with manager-level employees. Other points of view and aspects might have occurred if there were more interviews with different employees. Also 7 interviews were conducted in two of the case companies and only 5 in one. There should have been an even amount of interviews in all the case companies. In

addition, the translation of the quotations may have led to inaccuracies in some places. Thus, the results may be misinterpreted.

The proposed theoretical service delivery system framework was not tested during this research. It also combines three different frameworks that are related to service delivery system design and service supply chains. Combining frameworks with different scopes may have led to errors and it decreases the validity of the proposed framework. Also the development process model for service delivery system was not tested during the research. It may have errors and the use of the model in management may be difficult.

6.4 Future research

This research has revealed several possibilities for future research. The standardization of the service delivery system should be researched more and especially in a practical level. This research has shown the need for standardization but future research should examine how the standardization has to be done in order to maintain the customer satisfaction at acceptable level.

Change management is an important aspect when considering standardization of the service delivery system. Future research should concentrate on how the change is managed during and after the standardization. Future research should also look into to how those sub systems are managed that have not been standardized after the standardization process.

Also the customer participation management should be examined more. Customers cause variation into the service delivery system and the management of their participation is difficult to manage in a multi-customer environment. The future research should look into managerial implications and practices to ease the customer participation management in the companies. Also means to promote the customers to be proactive in service production in efficient way should be examined.

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APPENDIX A: THE INTERVIEW STRUCTURE

1. **Haastateltavan taustatiedot**
    a. Mikä on nimesi ja roolisi?
2. **Yrityksen liiketoiminta**
    a. Millainen tarjooma yrityksellä on?
    b. Millaisia palveluita yritys tarjoaa?
    c. Tarjotaanko palveluita kilpailijoiden laitteille?
        i. Millaisia palveluita nämä ovat?
        ii. Kuinka paljon palveluita tarjotaan?
3. **Asennetun laitekannan rakenne**
    a. Millainen asennettu laitekanta on?
    b. Missä laitteet sijaitsevat?
    c. Onko yhdellä asiakkaalla tyypillisesti vähän vai monta laitetta?
4. **Palveluiden toimitusprosessi**
    a. Millaisia vaiheita palvelun tilauksen ja toimituksen välillä on?
    b. Millaisia rooleja prosessiin sisältyy?
    c. Mitkä ovat tärkeimmät päätöksentekokohdat ja kuka päätökset tekee?
    d. Käytetäänkö palvelutoimituksissa kolmansia osapuolia?
    e. Toimittavatko palvelut yrityksen oma henkilökunta vai muut henkilöt?
    f. Toimitetaanko palvelut asiakkaan tiloissa vai etänä?
5. **Kustomointi vs. vakiointi**
    a. Kuinka vakioituja palvelutoimitukset ovat?
    b. Jos ne eivät ole täysin vakioituja, onko toimituksissa vakioituja ja kustomoituja osia?
    c. Vaativatko erilaiset teknologiat erilaisia palveluja?
6. **Fleet-näkökulma palvelutoimituksiin**
    a. Voidaanko palveluja toimittaa useille asiakkaille tai laitteille samanaikaisesti?
    b. Tarvitaanko kustomointia?
    c. Voidaanko palveluja toimittaa etänä?
    d. Otetaanko maantieteelliset etäisyydet huomioon palvelutoimituksissa?
7. **Datan käyttö**
    a. Kerätäänkö asennetusta laitekannasta tietoa?
    b. Jos kyllä, millaista tietoa kerätään?
    c. Voidaanko tietoa käyttää palvelutarpeiden ennustamiseen?
    d. Millaisia tietojärjestelmiä on käytössä?
    e. Palvelevatko tietojärjestelmät palvelutoimituksia?
8. **Asiakasrajapinta**
    a. Kuinka asiakkaiden kanssa kommunikoidaan?
    b. Onko kommunikaatio formaalia vai epäformaalia?

c. Käytetäänkö kommunikointiin IT-järjestelmiä?
d. Tekeekö asiakas aina palvelutilauksen vai tarjoaako toimittaja aktiivisesti palveluita?
e. Onko etävalvontaa käytössä?
f. Ovatko kaikki palvelut saatavilla kaikille asiakkaille?
g. Kuinka kustomoitavia palvelut ovat?
h. Mikä on asiakkaan rooli palvelutoimituksissa?

9. Asiakasarvo

a. Kuinka asiakasarvoa lisätään palvelutoimitusten aikana?
b. Mitkä ovat asiakastyytyväisyyden kannalta tärkeimpiä asioita palvelutoimituksissa?
c. Kuinka reklamaatiot hoidetaan?
d. Mitkä ovat yleisimpiä reklamaatioiden syitä?

10. Teknologian rooli

a. Kuinka erilaiset teknologiat asennetun laitekannan sisällä vaikuttavat palvelutoimituksiin?
b. Kuinka teknologiaan liittyvät asiat huomioidaan palvelutoimituksissa?
c. Millaisia teknisiä järjestelmiä / -ratkaisuja palvelutoimitusten aikana käytetään?