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Developing and managing information flows to enhance field service efficiency and improve competitiveness

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ABSTRACT

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Logistic services are evolving and becoming more important, as many companies are outsourcing their logistics activities. Large international e-commerce retailers are striving to operate the entire supply chain themselves to ensure a good customer experience and create competition in the logistics field. Traditional logistics service providers must respond to the change in the market and the increased competition by creating efficient digital channels for sufficient operations management. Value-added services are becoming a key to competitiveness and a possibility for new revenues by building a new business on top of core operations.

The thesis presents a case study conducted for a postal and logistics service provider in Finland. The research aims to identify the most important information needed for efficient field service execution and digital service management. The thesis creates a visual representation of the data flows to enhance understanding of the process and data needs. Internal company interviews are used as a main data collection method.

The research results highlight the importance of data modeling in field service management. The data collection implicates that the important service information must be clearly defined already in the planning phase of the service. The case study explores the importance of digitalization of field services, offering a fully transparent supply chain and data-driven service management. The digitalization is seen as an important factor to bring benefits for the company and the customers, therefore enhancing the service experience. The findings of the research include the identification of the important information needed in field service production. Furthermore, the findings strongly indicate that the service-related data, whether it concerns the service execution or problems in the field, must always be available in real time. Therefore, the thesis recommends that both, B2B and B2C field services should be managed with effective digital channels to ensure competitiveness.

TIIVISTELMÄ

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Logistiikkapalvelut kehittyvät jatkuvasti yritysten ulkoistaessa toimintoja entisestään keskittyessään ydinliiketoimintaansa. Kilpailutilanne on kuitenkin muuttumassa suurten kansainvälisten verkkokauppojen siirtyessä operoimaan koko toimitusketjuaan parantaakseen asiakaskokemusta. Perinteisten logistiikkayritysten on vastattava muutokseen markkinoilla kehittämällä tehokkaita digitaalisia kanavia palveluiden hallintaan. Lisäarvopalvelut ovat muuttumassa kilpailukyvyn avaintekijäksi ja mahdollisuudeksi kasvattaa liikevaihtoa ydinliiketoiminnan ohella.

Tutkimus tehtiin tapaustutkimuksena posti- ja logistiikkapalveluita tuottavalle suomalaiselle yritykselle. Tutkimus pyrkii tunnistamaan tärkeimmät tiedot, joita kenttäpalveluiden kehitys ja tuottaminen digitaalisesti vaativat. Tutkimus luo visuaalisen esityksen tietovirroista, jotta palveluprosessien ymmärrys paranee ja tietotarpeet selkeytyvät. Pääasiallisena tiedon keruun menetelmänä on käytetty organisaation sisäisiä haastatteluja.

Tutkimuksen tulokset osoittavat tietomallinnuksen tärkeyden kenttäpalveluiden hallinnassa. Tiedonkeruun perusteella havaitaan, että tärkeä palveluita koskeva tieto on oltava tarkasti määriteltyä jo palveluiden suunnitteluvaiheessa. Tapaustutkimus tutkii digitalisaation tärkeyttä kenttäpalveluille tarjoamalla täysin läpinäkyvän toimitusketjun ja dataohjautuvan kenttäpalveluiden hallinnan. Digitaaliset kanavat voidaan nähdä tärkeänä tekijänä tuoden hyötyä sekä yritykselle että sen asiakkaille, parantaen näin asiakaskokemusta. Tutkimustulokset esittävät tärkeimmän tietosisällön, jotta kenttäpalveluiden tuottaminen olisi mahdollisimman tehokasta. Lisäksi, tulokset ilmaisevat vahvasti palvelukohtaisen datan reaaliaikaisen seurannan tärkeyden. Tämän vuoksi tutkimus ehdottaa, että sekä yrityspalveluita (B2B) että kuluttajapalveluita (B2C) on hallittava tehokkaiden järjestelmien avulla kilpailukyvyn ylläpitämiseksi.

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Helsinki, 24th of May 2018

Mari Korhonen

TABLE OF CONTENTS

FIGURES

TABLES

ABBREVIATIONS

1st PL	First Party Logistics
2nd PL	Second Party Logistics
LSP	Logistic service provider
3rd PL	Third Party Logistics
ERP	Enterprise resource planning
CRM	Customer relationship management
SLA	Service Level Agreement
LDM	Logical data model
DFD	Data Flow Diagram
AR	Augmented Reality
AI	Artificial Intelligence
B2B	Business to Business
B2C	Business to Customer
EDI	Electronic Data Interchange
PETS	Postal Events Tracking System
TMS	Transportation Management System
NGT	Nominal Group Technique

1 INTRODUCTION

Digitalization is ruling the business in many industries. Furthermore, as service development and service innovations are becoming increasingly more important, emphasis should be put on how the services are controlled and monitored. Companies worldwide are, to a greater extent, creating services to the side of their products to enhance the customer experience and create added value. Unanticipated customer needs are a challenge, while different needs in different areas may arise. (Parida et al. 2015) Therefore, the management of services and varying customer needs should be made easy.

Logistic service providers are facing the need to develop their services. Multiple companies are outsourcing their logistics activities to professionals and focusing on their core business instead. (Yeung et al. 2012) Nevertheless, some of the large international marketplaces are emerging to the market and competing with the traditional logistic service providers of the demand. Large retail customers can become players in the logistics field, by also offering logistic services to other retailers. The best possible customer experience is pursuing the international companies to handle their entire supply chain by themselves. Furthermore, another possible threat to traditional logistic companies are the small software operators and start-ups that exploit new technologies, such as platform or crowd-sharing solutions. (Tipping & Kauschke 2016) Comprehensive additional services are a way for the traditional logistic service providers to produce value for the customers.

Services can often be divided in two. The first major group is facility-based services and the other, field-based services. The difference between the two service categories can be described with where the service is provided. In the facility-based model, the customer is accessing the service facility, whereas in field-based services the service is provided at the customer's location or site and the service provider is in charge of providing the service to the customer. (Agnihothri et al. 2002) Need for efficient field services is growing, as companies aim to offer more value to their customers. Furthermore, the measurement of field service efficiency becomes important as the demand increases.

The management of new service innovations becomes difficult due to the market being heterogeneous. Companies should, therefore, create capabilities to support better relationships and interaction with the customers and service partners. Key competencies include the integration of knowledge through the organization, creation of global or national

service offerings, and capabilities to be able to build effective digital channels to enhance the service development. Ultimately, new service innovations are increasing the influence of actively sharing knowledge to maintain a good level of service all around. (Parida et al. 2015)

1.1 Background

This Master's thesis is made as an assignment from a postal and logistics service company in Finland. The company is aiming to identify growth in other business segments and is currently focusing on developing field services. The company is pursuing to scale its field service operations to larger areas and to multiple more customers. This topic for this Master's thesis is therefore relevant to the company, as changes are currently in action to enhance mobile solutions in field services and in customer interface tools. The company is aiming to develop the process flow to better monitor the services and to offer more value and fluency for the customer.

The thesis offers insight into the data flows and data content to increase the understanding of how different information can be categorized and modeled to create a straightforward platform for efficient management of field services. Furthermore, resource optimization is becoming increasingly important in field service management. Competitiveness can and should be increased with the effective internal planning of services. Maintaining a smooth flow of the service order to the customer is important to keep up with the changes in the competitive field.

The topic is important for the company, as there is a need to evaluate the information flows and data content that is needed for efficient services. New field services are under development, and it is important to identify the process of the service development and map all the important stakeholders and data needed for efficient planning and eventually, service execution. Furthermore, the company is renewing their whole field service management system to better plan the resources and create greater efficiency. This development needs sufficient data flow and content mapping to make the planning of the whole systems easy and productive.

1.2 Research gap and objectives

The case company has a need to identify effective ways to improve the management of field services. The objective of the thesis is to understand and identify the most important information needed for development of new services, field service management and scaling of the business. The thesis is concentrating on field service management and identification of the important data flows.

The thesis is aiming to find the best possible solutions of how information should be modeled end-to-end through the whole customer experience. The information flow starts from the customer order and ends to the billing of the service. Furthermore, all the information that should be offered to internal stakeholders taking part in the process, are identified. As an output, the thesis offers a suffice visualization of the important information needed to enable fluent services and easy scaling of the business. The emphasis is laid on increasing efficiency and making it possible to easily add new services to the service portfolio and effectively manage the growing business of field services in the organization.

The work is limited to field services, as the service business within the company is developing and there is a need to generalize and identify the processes and the most important information for digitalization of the service data. The service segment of field services is growing in the company. A new digital channel is being created to assist in field service activities and reporting. The data content is therefore limited to services offered in customer's own premises. Furthermore, data connected to resource optimization as well as worker training and knowledge is a part of the total data content modeling and end-to-end information flows. The thesis work and research do not examine integrations of different systems or declare any interface types in a technical manner.

Research questions for the thesis are:

1. **What kind of data content is important in field service management?**

The objective of the first research question is to identify the most important information to execute field services effectively, digitally, and manage them in the easiest possible way. This includes the data content both on the side of the customer and of the side of the service production. This question seeks answers from the customer interviews and from the benchmarking of the field service business through the literature review.

2. **What is the future operation model for digitalized field service operations?**

The objective is to identify the information flows between all the service stakeholders. This question uses input from the focus-group based workshop to develop the initial data flow modeling further. The aim is to develop the data flows towards the best possible operation model and offer suggestions to create efficiency to the processes.

As a result, from the literature review and the data collection, the thesis offers a framework that can also be distinguished as the result of design science methodology used in the research. The modeling of the information flows acts as an artifact that is produced with the help of the research conducted in the interviews. The end-to-end data model and flow diagram are the important output of the research, and much of the time is used for the data collection to make sure the data modeled is as sufficient as possible.

1.3 Execution of the research

The research is concentrating on identifying the most important factors for service development and the important information needs through semi-structured interviews with the business personnel, operations personnel and in addition, with one key customer. Furthermore, internal data is gathered in a workshop that is organized to develop the information flows and data modeling as a complete entity. Possible problems are solved in the workshop and the solutions are found through iterative development of the information flow framework. This focus-group based research method offers the possibility to develop the model to be the best possible tool for the company's development initiatives.

The thesis consists of different parts, that have all been worked on simultaneously. Therefore, clear phases of the thesis work are hard to identify. The literature review is an important part of the research, as it creates a framework by introducing various concepts important to the thesis subject. The interviews for internal data collection are started in the early phase of the thesis work to get the basic knowledge of the information needs. After this, the whole model for the end-to-end information modeling can begin, and the development of it will follow.

The thesis work requires the identification of the service needs in the background of the information modeling. Parallel with the research work, data content modeling was created for the application that is under development to ensure that the field service operations are

effective. This data modeling was partly created based on one customer and their service needs. The same service customer was interviewed about their service needs and importance of an external service provider. This customer integration to the thesis work offered practical value to the work by helping the company to model their information needs with a specific customer case.

1.4 Report structure

To be able to answer the research questions, a literature review is conducted to understand the basic framework covering the thesis topic. Chapter 2 presents the theoretical background for the research. This chapter focused mainly on field service management, data content and information flows, as well as data flow visualization. These concepts are important for the thesis, as the main goal is to understand how information flows in the case company could be modeled and how it could enhance the efficiency of the field services. Chapter 3 presents the methodology choices of the thesis. In this chapter, the research and data collection methods are described to a higher extent.

Chapter 4 begins the empirical analysis of the thesis. This part describes the development of field services and the information needs based on the gathered interview data. Chapter 5 prescribes the first stages of the end-to-end modeling of the information flows. The topics in this chapter include the data modeling and the initial and current stages of the data flow diagram. Chapter 6 presents the final data flow diagram and discusses the future desired state of the data flows. In chapter 7, the analysis and conclusions of the research results are presented and possible topics for further research are identified. Finally, the chapter 8 summaries the findings of the research. Figure 1. presents the structure of input and output of each chapter in the thesis.

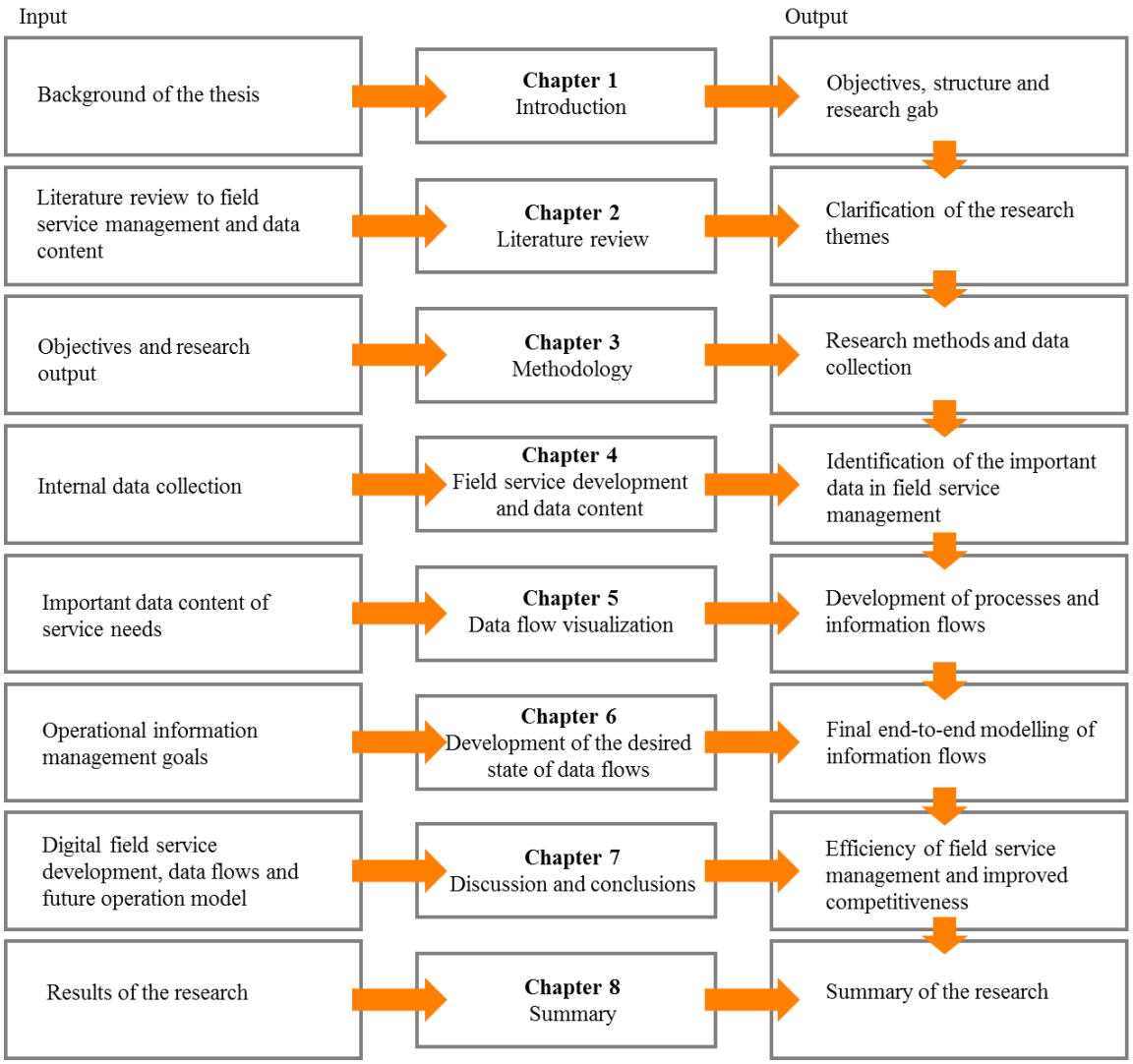


Figure 1. Thesis structure

2 LITERATURE REVIEW

This chapter presents the theoretical framework used to help in the analysis of the information flows in field services. The concepts include logistic services and field service management, data flow diagrams and data modeling.

2.1 Logistic services

The market for logistics services is extremely dynamic. As businesses are globalizing and the competitive pressure is getting higher, companies are under increasing stress to deliver products quickly, all over the world. Therefore, the competition has driven multiple enterprises to concentrate on their core business to survive, and the logistic activities are often outsourced from delivery and warehousing specialists. (Ho & Chang 2015; Yeung et al. 2012) Nevertheless, large international retail companies, such as Amazon, aim for insourcing the entire supply chain. Amazon is already providing its own ocean freight business. The company is acting as its own forwarder of freight by handling the customs clearings themselves as well. The company has large warehouses all over the world and has expressed plans for building their own air cargo hub. In addition, the company's own operations handle last mile deliveries. (Banker et al. 2018) Business performance must be efficient as customers require constantly more integrated services from one service provider. This change in the market structure requires the companies to take their customers' needs better into account and streamline their own processes to create more value to the customers. (Xiao et al. 2009)

Three different levels for logistic services exist. First party logistics (1st PL) means that a company operates their own shipping and warehousing related logistics by themselves. With second party logistics (2nd PL) the enterprises use logistic service providers (LSP) to aid them in logistic tasks. The last level, third-party logistics (3rd PL) means the complete outsourcing of logistics services of a company. Nowadays, the 3rd PL service providers are replacing the more traditional, often 2nd PL's. (Trappey et al. 2016) For example, logistics operations can be costly and hard to manage to get sufficient performance. 3rd PL business is expanding rapidly to fill the needs for advanced logistic services. Currently 3rd PL provider has a major role in supporting the flexibility in the customer's supply chain networks. Customers are increasingly relying on 3rd PL to manage the entire logistics flow of multiple suppliers in the supply chain. This means that there must be good performance measures to

select appropriate sub-contracted logistic service providers, while their performance has a direct effect on the performance of the entire supply chain. (Xiao et al. 2009)

Trappey et al. (2016) have expressed that companies can improve their operations by integrating outsourced logistics services to their business. Creating long-term relationships with 3rd PL service providers, the companies can build competitive advantage. Furthermore, outsourcing enables the customer to gain superior performance through the development of the main resources and dynamic capabilities. (Yeung et al. 2012) It is therefore becoming more important for logistic companies to increase customer and service satisfaction by building durable service capabilities (Ho & Chang 2015).

3rd PL's can offer multiple different services to their customers based on their service capabilities. These offerings cover often at least transportation, but may also be expanded to warehousing, packaging, inventory management, information related services or in some cases even assembly and possible manufacturing of products for the customer. (Wagner & Sutter 2012) According to Yeung et al. (2012) the service providers can be segmented to produce two kinds of services: standard logistics and value-added logistics services. These services create the company to have two types of competencies, core and dynamic competences. The core competence allows the company to create competitive advantage, however, the dynamic competences support sustaining of the competitive advantage. In relation to competencies, the 3rd PL providers possess basic capabilities that offer the ability to produce basic services. The so-called augmented capabilities refer to the skills to provide customized and more value-adding services, beyond what is necessary. Nevertheless, the successful 3rd PL companies are familiar with their customers and the market and are constantly creating new value to the customers. The development is needed to establish competitive advantage and grow the brand identity. (Rajesh et al. 2011)

Many industries recognize logistic merely as a cost factor, but also as an influencer of competitiveness as well. Therefore, outsourcing of logistics services has become a growing trend and logistic service providers benefit from synergies and scale effects. This has created a shift from classical transportation and warehousing towards more individualized and complex logistics services. The customers today are demanding individual services that are flexible and extensive, offer added-value and individual logistic processes, and produce a high transparency of cost and performance data. Furthermore, they may require short-term contracts of the services. (Holtkamp et al. 2010) Nevertheless, the 3rd PL may require specific

investments or development of new capabilities to be able to perform the supplementary services needed by the customers. When considering the transaction costs of service development, in all cases the offering of supplementary services may not be the best solution to enhance relationships with customers. (van Hoek 2000) Figure 2. presents the supply chain services offered by most of the 3rd PL service providers. The orange circled services present the core competencies. Additionally, the grey circled services can be considered as dynamic competencies, enhancing competitive advantage. Efficient IT solutions are needed for good service management.

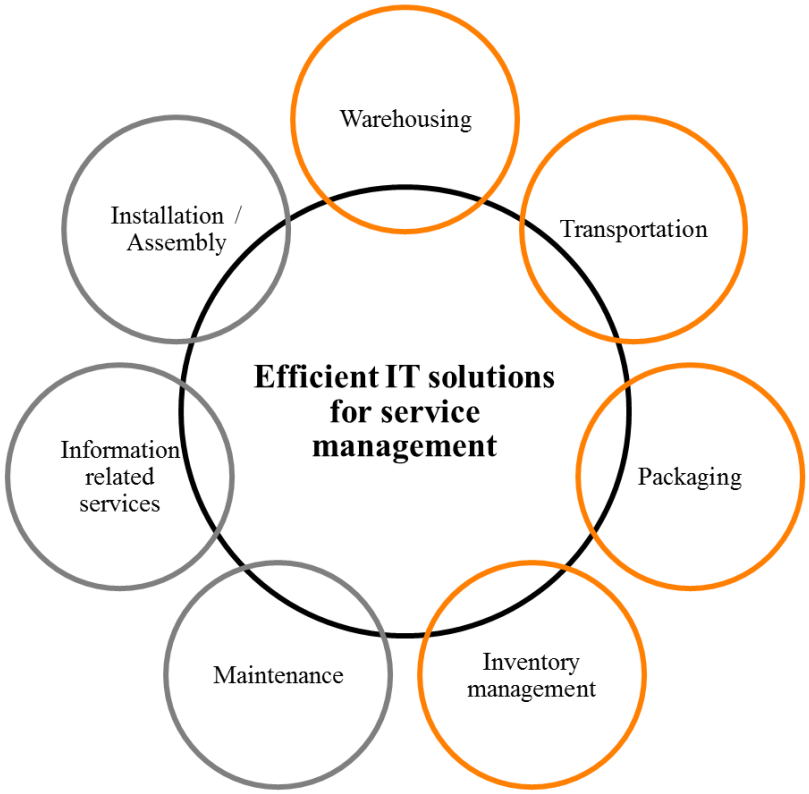


Figure 2. Logistic services of 3rd PL service providers

Logistic service providers, according to researchers, perform rather poorly on innovating new services. The innovation of new services is nevertheless, critical in strengthening customer relationships and generating customer loyalty. Furthermore, competitive advantage could be achieved through innovative and effective service, and innovations could improve the financial performance of the company. (Wagner & Sutter 2012) When further evaluating the innovation of services, often the value-added services produced to the customer are not a part of the traditional warehousing or transportation-related services, but rather, offer a higher problem-solving ability to execute more differentiated services. The

service opportunities for 3rd PL providers in the delivery chains of customer goods can include packing or final assembly of the products. Furthermore, installation of goods at the customer's service site, inventory management or technical advisement and product demonstrations, can be a part of the service portfolio. Just in time (JIT) deliveries or maintenance services can be included in the needs of customers. Nevertheless, most of the supplementary services offered, are in many cases outside of the conventional expertise of the 3rd PL companies. (Huttu & Martinsuo 2015)

Third-party service providers must invest in technology, as the customers are more demanding when it comes to supply chain event management (SCEM), transportation management (TMS) or warehousing management systems (WMS). The important customer and technology specific knowledge and expertise can be gained through customer interaction. Ultimately, IT solutions allow the company to be more productive and can help in reducing costs, providing innovative and customized services and improving the overall service quality. Through the trends in IT, the 3rd PL companies can increase innovative service that rely on technology and IT solutions. A broader range of services can be offered to meet the customer demands. (Wagner & Sutter 2012)

For the logistic service providers to satisfy the demanding customer requirements, tailored IT systems for efficiently managing logistic processes are needed. The IT tools should support the company's vision and the development of new business products or services. (Holtkamp et al. 2010) Wang et al. (2012) propose that the logistic service companies should aim at centralizing the service management and integrate an intelligent scheduling to their IT systems. Cloud logistic (CL), is a new IT technology-based approach to offer scalability, intelligence, and reliability of logistic services. With building an effective cloud platform, the service providers can, for example support their resource management. More extensive services with a closer attention to customer needs to increase the amount of value-added services can be made possible. Furthermore, faster delivery with "one-stop service" mindset, where the services are centralized to one visit, is achievable. In addition, flexibility and efficient allocation of resources can be made available, while automatically adjusting the resources and company's capabilities to achieve an overall optimal performance.

2.2 Field services

Agnihotri et al. (2002) define that, field services differ from the traditional facility-based service description in the location part of the service. Field service by its name is performed at the customer's site. Commonly in the field service business, the service is about maintenance or other service work on the customer work site. (Hertz et al. 2012) Field services do not in all situation require on-site service. An example of a field service, which is not performed in the customer's location, is, for example, remote instructions through a web page or satellite repair, which is done from another location than where the satellite is. Field services can be divided into categories, for example to logistic services or garbage collection, and on the other hand, to services offered as after-sales support, for example, installation or repair. (Agnihothri et al. 2002)

In the field service industry, the use of vendors is common. Often vendors for field service companies are required to provide verification of general liability and insurance coverage information on possible errors. After the identification of a good vendor, the customer company provides the vendors with sufficient information about the policies or procedures of the services to be provided. The training and good communication between the service provider and the customer is important to minimize error and to ensure profitability. (Jaffa & Runyon 2012) In field service setting, it is important to identify the most important information in different service environments to ensure a good service. Generally, the most basic product information can be challenging to provide to the service personnel. (Lehtonen et al. 2012) The field service provider is in charge of how the meeting between the customer and the service personnel goes. The quality of the provided service is the only factor that effects on the customers opinion about the company. The customers who receive high quality services are often more likely to repeat their service order. Many organizations therefore, offer service guarantees, to improve the field service quality. The service guarantee is often a contracted response time for the service call. (Apte et al. 2007)

Lehtonen et al. (2012) have identified challenges in field services compared to the regular, more controlled service environment in a service facility. There can be numerous different service triggers from ad-hock service needs to scheduled maintenance or repair. As field services nearly always require travelling, the travel times and their frequency may create challenges in the capacity management. When transportation is needed, cross-training of the service workers can be beneficial, as risks of allocating an unqualified service worker to a

job can be high. Cross-trained service worker can perform multiple different service tasks. (Colen & Lambrecht 2012)

The travel time to the service site must be further taken into consideration in the capacity management. Secondly, the demand should be estimated. Nevertheless, the demand and the company capacity are linked, as the service provider determines the workload for each day. (Colen & Lambrecht 2012) To help in optimizing the time used on the service site, Peña-Rios et al. (2017) have researched the use of augmented reality (AR) in field service application. The possible use of AR in field service setting can help the service worker to reach the correct service site or provide the worker with information on how to perform the service task correctly. In the industrial setting, AR can be used to help the maintenance technician to identify the complex machinery structures. Moreover, AR can assist by giving repair instructions or guide the worker to perform tasks. Furthermore, AR could be used to point the worker's attention to the actual problem at hand. AR can offer benefits to field service tasks by reducing the risk of delays, as the service worker is familiar with the product at hand, and therefore also the risk of errors can be reduced.

An important measure for field service efficiency is the downtime, time measured in between the service request and the actual completion of the service. Downtime can be divided into time that is used for the response to the service request (response time) and the time used on the customer site. Response time measures the time from the customer order to the time when the service provider reaches the service location. The time used on the customer site (on-site time), is measured simply as the time needed for the service to be completed. (Agnihothri et al. 2002) Furthermore, Hertz et al. (2012) have discussed that in field services the focus needs to be put on meeting the customer needs. This requires emphasis to be laid on order fulfillment process and how the orders are handled. Lack of formal documentation, management support or unstructured service planning has a negative effect on the thorough service planning. Difficulties in forecasting the demand and the heterogeneous nature of the product/service portfolio offer challenges to the field service planning. Time constraints in field services are tight and customers require a fast response to service orders. In addition, the only way to measure the performance of a service can often be the customer satisfaction that is offered by an individual service worker.

Considering field services and the importance of good information flows, the on-site time of the service can stretch out to be longer with insufficient information. In cases where

information must be called for from the company's office or from the customer itself, the service on-site time ultimately increases. Therefore, important service information should be made easily accessible with proper software or tools. In maintenance services, the most important information given about the service is the equipment details, for the service worker to know what spare parts the service requires for example. (Agnihothri et al. 2002) Lehtonen et al. (2013) discussed reasons for field service failures. In maintenance services, the three main reasons for failure are the lack of spare parts, the lack of information and the missing of important tools. Furthermore, some issues can occur if the contact person in the customer facility is unreachable. Table 1. below clarify the differences between regular facility-based services and field services.

Table 1. Facility-based services versus field services

	Facility-based service	**Field service**
Where	At the service providers facility	At the customer's facility or work site
What	Hairdresser	Logistic services, maintenance, Garbage collection
Environment	Controlled environment	Information rich services, Uncontrolled environment, More challenges
Time	Only the time the actual service lasts	Response time, Transportation time, On-site time
Order handling	Easier to manage orders	Order handling can be difficult
Information management	Easy to manage information on the own service site	Good data flow and sufficient information important
Service failure	Easier to manage failure with all the equipment being on site	More often lack information or spare parts/tools, Need for sufficient training

2.3 Field service management

In every business, customer satisfaction is and should be the top priority. Customers should be happy with the products and services. Companies are waking up to the fact that the customer experience can be greatly better with quick, good quality services. Nowadays, the service industry is the one to be receiving the most customer complaints. The field service management market is evolving, and new software are coming to the market to allow efficient services. New technologies allow companies to monitor services better and enable

them to increase the level of customer satisfaction. (Puckett 2015; Shacklett 2017) Furthermore, as the competition in the field services is getting tougher, the customer satisfaction and loyalty are important factors for the service providers for the revenues to grow. (Tang et al. 2007)

With many field service providers, the problems circle around uneducated workers, tight scheduled resources, and dysfunctional communications. Often these problems occur due to lack of scalability and use of old-fashioned systems to manage the services. Field service management software have been developed to help companies in overcoming the most common obstacles in managing services. (Puckett 2015) Multiple companies continue using manual reporting on-site, even though technologies for management exist (Shacklett 2017). With efficient systems, the manual work can be eliminated, and processes streamlined to make the business more mobile and flexible (Puckett 2015). Furthermore, IT capabilities are important internal resources for 3rd PL companies to gain and sustain competitive advantage. With the use of IT systems, the service provider communicates with the customer effectively. A solid IT infrastructure aids the creation of collaborative relationships, by reducing risks and transaction costs. (Rahman et al. 2017)

Operation decisions needed for the field service management include the process management activities, such as coordination and controlling of the service orders, scheduling, controlling, and coordinating the service staff, as well as managing the material and spare part flows. The evaluation of the service performance is fundamental in field service management. (Visintin & Rapaccini 2009) Efficiently managing field services requires the company to map their service processes in a detailed way to understand the whole workflow of a service. The mapping should begin with how the order comes in, and who is the one responsible for moving the order along the service pipeline. Furthermore, all the triggers and transitions between different stages should be mapped. Identification of who are the people able to approve orders or changes and how the whole workflow is tracked are important steps in the service mapping. After mapping the bottlenecks, opportunities can be identified. Technology cannot fix processes that are themselves falsely planned. (Puckett 2015)

Technologies are not often used, due to the service field and the market being extremely scattered. Multiple companies are still lacking sophisticated enough systems to help in mapping the services from the customer order to the finished service. In many occasions,

with the lack of good technology, communication is often slow. The field service management technologies should be able to manage orders and invoicing, process customer payments and track different service levels. Furthermore, the service scheduling and route planning with the tight connection to knowledge management and resource optimization should be easily maintained. Efficient would be also to manage communication with the customer through the software and be able to attract reporting, among other features. (Shacklett 2017) Managing and sharing service knowledge can help the company to increase competitiveness. To be able to manage the value delivered to the clients is one of the main goals for service business. The business model should emphasize the accessibility of the customer and service knowledge to the firm and to the customer. Systems, such as Enterprise resource planning (ERP) or Customer Relationship Management (CRM) tools allow the planning of resources or customer contact management. Simultaneously, the use of IT systems allows the company to also optimize the production. (Mesjasz-Lech 2015)

In the long term, the service provider must be able to manage and modify the processes and resources needed for field services. Strategic decisions concerning the service portfolio, are an example of long-term field service management tasks. For example, the products and services that are offered to the customer, and the service levels should be addressed. (Visintin & Rapaccini 2009) To develop a service and solve management-related problems, such as resource optimization, the decision making requires an understanding of the service quality. Performance measures can for example concern the competitiveness, financials, quality, flexibility, utilization of resources or innovation in the service business. Some of the measures indicate the strategical success while the others are expressing the competitive success. (Tang et al. 2007)

The field service providers encounter uncertain environments. Uncertainties can be found in the company's resources, as well as in the operating conditions. Some routine activities, for example, installation or maintenance, can be scheduled in advance, nevertheless, in some cases, the forecasting of the demand may be difficult. Uncertainties are present on the service site, as the operational conditions change constantly. (Visintin & Rapaccini 2009) The problem in multiple field service operations is also the availability of information. In some service cases, the documentation can consist of multiple paper files that are not easy to manage at the service site. Furthermore, important documents may be lost if they are printed on paper. In the design phase of tools to help in information management, the important

thing to understand is the stages of the service process that are currently lacking crucial information. Based on the process steps, and as the impact of information to the service has been identified, the emphasis for information development must be laid on the stages with the largest magnitude of impact on the service completion. (Lehtonen et al. 2013)

With good field service management systems, the service provider should be aware of the service and all the needed equipment or material needed to carry out the service. Furthermore, it would be beneficial if the service worker would be able to send the customer a notification before arrival to the service site to enhance the service experience. For example, the systems could send out a text message indicating the customer that the service worker is about to arrive. This text message could also entail the name and the possible phone number of the service worker, so that the customer knows who is going to come and how they can be reached. (Shacklett 2017) This would be an enhancing factor to the good quality of the customer service, as based on research by Batarlienė and Jarašūnienė (2017), this is one of the most important service criteria in service development. In addition, reduction of costs as well as the service duration are important factors to consider in service improvement.

Flexibility of the workforce should be adapted according to the supply and demand of labor. Visintin & Rapaccini (2009) have identified three different types of flexibilities, including functional, financial, and numerical flexibility. Functional flexibility means the company's capability to quickly redeploy the employees across different tasks. The overall functional flexibility depends on the number of workers and the different skills they possess. At least two employees should be able to perform same service tasks, so that a backup worker is always available in case of absence. Furthermore, in field service management, the service planning and conceptualization plays a crucial role. Important aspects to consider include the field service network size and capacity, the scheduling policy, training policy and possible spare parts management policy. With planning the field service operations further ahead, an important part is a good service strategy and manageable service portfolio. (Hertz et al. 2012)

Planning of the manpower is an important responsibility in field service management. The planning is responsible for the workers being in the right place in the right time. Company should employ people with the right skills. The efficient management of field services requires skilled workers and personnel to handle off-site customer or field worker support.

Furthermore, the service workers and possibly needed tools or spare parts should be allocated to different service workers based on the service requests the customers make. It is important to schedule the service requests by adhering to the service level agreements (SLA) with the lowest possible costs. (Hertz et al. 2012) The numerical flexibility defines the capability of adding or decreasing the number of employees and their working hours according to the needed workforce. A sufficient numerical flexibility is gained with using overtime and temporary workers. (Visintin & Rapaccini 2009)

Financial flexibility is based on the workers' wages and defined by the company's ability to align the wages based on the employee**s** and company**'s** performance. Performance should be the basis upon which the salary is reflected. The salary should, therefore, depend on the skills the employee masters, their actual working hours and the personal work performance. Furthermore, the overall workforce flexibility is considered as the number of tasks that are possible to produce. Evidently, the more different skills the service workers obtain, the more options the company has to answer to the demand. A good mobility of the workers is needed, as this allows the company to adapt better to changing situations, such as high level of worker's absence, or a peak of demand. Furthermore, the uniformity of the service tasks is important, as it effects on the overall capability to maintain a good quality of services. (Visintin & Rapaccini 2009)

For managing resources, Wong & Karia (2010) have acknowledged certain strategies. A quick integration of new resources to the existing ones is important. For application integration to be successful, data integration is needed. Furthermore, for achieving integrated information, technical connectivity is necessary. However, data should always be consistent, for the users to properly interpret the information. Nevertheless, the integration of information by itself is not sufficient for business process integration, as the different stakeholders within the process have varying information needs and practices. (Berente 2009)

The lack of integrated resources can interfere with competitiveness. With the fast integration of resources, new business can be built quickly. Furthermore, the development of information systems to integrate resources to customers and suppliers easily is an advantage. (Wong & Karia 2010) A field service management information system should be flexible to use and flexible to change. The overall technical features, such as processing capacity, should be sufficient and different user-options possible. The service-related data should be

easily and in near real-time available to different stakeholders. (Visintin & Rapaccini 2009) When considering information systems literature, the information technology can help the integration between multiple different business units or functional groups with the integration of data or applications and systems. The integration of data connects the electronic data to different functional teams. This integration can be challenging because of the differentiation among the groups. Application integrations are about the application linkages, while systems integration affects the connection of diverse systems. (Berente 2009)

The designing of field service and the management of information and inputs are presented in figure 3. below. Hertz et al. (2012) describe the design of field services to have three distinct phases, that are the strategic network planning, tactical network planning, and operational network planning. These steps are integrated to each other. The steps include different sub-phases that guide the design work. The inputs that start the field service design are the strategic targets, the business model designed for the services, the existing service portfolio, the actual demand from the customers and the strategy of outsourcing. With these inputs, the field service design through different sub-phases can begin. The important to identify in the beginning, is the districting, meaning where the service will be offered. After this, the qualifications and facility and technical planning can begin. When designing the tactical network, the process of how the service is offered should be identified. Furthermore, the workers and the transportation must be considered. In the operative planning, the actual service scheduling and the order fulfillment needs to be planned for the services to be produced.

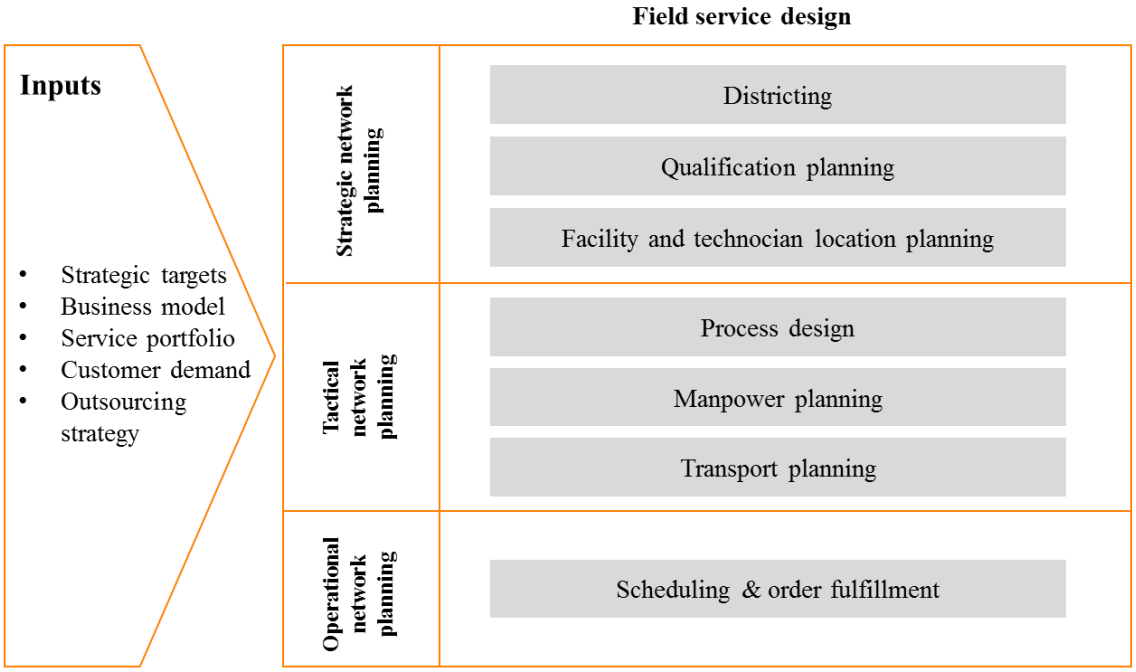


Figure 3. Field service network planning (after Hertz et al. 2012)

The company should be developing services that aim to create the highest possible customer value and fit in the company strategy. Customer needs should be in the center of the service design. (Hertz et al. 2012) This requires the company to have a wide range of distinctive service modules. If having a wide range of service modules, the compatibility of each module to other modules should be good. Through modular service concepts more complex and customized services can be efficiently managed. This method is standardizing sub-processes and products. Furthermore, modularization of services can offer flexibility in service customization. Service heterogeneity can more easily be managed, with modular parts of the service. A high level of different possible service combinations should be possible to serve the customer in the best possible way. Nevertheless, a risk exists that a too wide range of service modules can become confusing for the end customer. (Carlborg & Kindström 2014)

Organizations that offer field services, often operate on a highly dynamic market that is constantly changing. The operation locations and the overall demand can be scattered to a large geographical area. Multiple organizations outsource their operations in the field to different contractors. (Avraham et al. 2012) As the field service business is constantly developing, the management of tools, training or resources to effectively perform services becomes crucial (Jaffa & Runyon 2012).

2.4 Process management

The integration of processes is fundamental in any effort aiming to improve processes. Companies are under a constant pressure to increase efficiency and productivity of various business processes, and therefore also process integration should be a constant focus for many different businesses. Process integration is usually associated with utilizing and implementing new information technologies, such as applications integrations or exchange of data. (Berente 2009) New processes and process development stems from producing value for important customers. In many cases, business process requires the cooperation of multiple business units within the company and across organizational boundaries as partnerships. The number of multiple stakeholders in a process increases the complexity of process management. (Sun et al. 2006)

To successfully manage processes, the modeling of the workflow is important. With effective process workflow management, different aspects of the process can be identified. These include for example operational, informational, or organizational perspectives. The informational aspect identifies what kind of data is produced or used in the process in each of the process activities. The operational aspect presents the tools used or needed to execute activities or tasks. Furthermore, the basic relationships that are important to the performance of different tasks, are defined through the organizational perspective. (Sun et al. 2006) An integrated business process can be characterized as minimization of information flows between activities. The reasons and new practices for the integrations are explained through business process integration. Business activities are therefore changing towards more coordinated and human effort is often minimized. Furthermore, a majority of the business processes deal with informational inputs and outputs moving between different activities, the transparency and accessibility of information flow is important. (Berente 2009)

2.5 Data modeling

Data modeling is one of the most important aspects in database development (Pons et al. 2005). Data model is used to define the intended meaning and structure of data. Data models are needed to improve the quality of information in a company. (West 2011, p. 5) Data modeling can be used as a method to describe the information requirements. The data model can provide an understandable setting of the important data**,** based on the information needed, to all the organization's stakeholders. Furthermore, data modeling enables the

system developers to implement the database exactly as the information requirements state. Thus, the data model can act as a communication tool between the users. Therefore, the model services both the user and the developer. (Ponniah 2007, p. 50; Pons et al. 2005)

When designing a software, the process should start with the construction of a data model. The data model should be a representation of the user's needs. Data model therefore creates a conceptual basis for development. Modeling approach-based entity-relationships, has allowed the data designers to focus on the problem domain by identifying the entities of interest. (Fuller et al. 2010) The modeling of data to implement an information system is one of the most crucial activities. Data modeling entails the needed components for the representation of the real-world scenario. The components include entities and their attributes, as well as relationships between different entities. (Simsion et al. 2012)

Chmura & Heumann (2005) have expressed that entities represent the most important data stored in a system. The entity should be expressed in a singular form and it should be a noun. The entity can be a term that is important for the company in the data context. Furthermore, it should be unique within the data model. Data in simple data models can be organized into tables (Simsion & Witt 2004, p. 4), and the data instances, defining the actual data are created on the rows in the table. Data map can be created by defining the association between all the entities. (Chmura & Heumann 2005, p. 36-37) Thus, data models are built by linking attributes together. (West 2011, p. 15) Figure 4. below presents an example of data model entity, where student represents the entity and the rows below the data instances the entity contains.

Student
Name
Student number
Address
Phone number
Email address

Figure 4. Data model entity

Data modeling explores the structures of the data. The aim is to support the organization and model and record all the content and rules of the data elements required in the organization's business processes. (Ponniah 2007, p. 50) Data gathered in a database usually has specific value to the business over a longer period of time. If data is of poor quality and inaccurately

defined, the value of the data assets is lower. Moreover, data models are flexible, and they can be extended with information to accommodate new requirements with a small impact on the created data structure. (Simsion & Witt 2004, p. 10-12)

Conceptual models, put focus on the aspects of interest in the information systems development. The relationships between different entities are modeled graphically to represent how they are related to each other. (Fuller et al. 2010) Data modeling has been referred to help support the database development (Simsion et al. 2012). Fuller et al. (2010) further suggest that one important aspect of the data model is the graphical representation of it, as in some cases it can be used as a communication tool between the end users and database designers. If the data model should offer business understanding, the representation should be computationally efficient. Thus, the model should be organized in a columnar fashion helping the reader to understand the model more precisely.

Logical data model (LDM) represents the business concept by visually identifying their relationships. The modeling of data enables an effective storage of data and allows the company to identify how to access information and use it when needed. The LDM influences the entire data management of the company, while it affects the design of how data moves and transforms. (Srikant 2006) The research by Simsion et al. (2012) showed that data modeling consists of the initial concept of the business requirements before any performance development.

The development of logical data model usually begins with identifying the requirements from the enterprise data warehouse. (Srikant 2006) The LDM usually includes entities, attributes, and relationships between the entities. An LDM often starts to represent a structured data as it is implemented in the data store, and therefore, should be the start of the actual design. (Stiglich 2014) Furthermore, data model should include all the necessary data. The same data should be possible to save to the database multiple of times. (Simsion & Witt 2004, p.10)

Whenever data has a clear structure, a useful way to describe the data is the use of a data model. Whenever new data structures are designed, data modeling is made. (Stiglich 2014) The problems in data modeling are often about the uncertainty of the data objectives and priorities. Furthermore, the objective and priorities may change as the modeling process

develops. When establishing data model requirements, some stakeholders may have contradicting opinions about the requirements. (Simsion et al. 2012)

2.6 Data flow diagram

Process, by definition, describes the tasks, roles, people, functions, or departments that are needed to provide the needed product or service to the customer. Process contains activities that use an input to create more value to the process and in the end, produces an output to the internal or external customer. (Berente 2009) Turetken & Schuff (2007) discuss that processes include a set of tasks that are related to each other to accomplish a desired business outcome. Statements “input” and “output” are typically composed of information and serve as the flows between activities. An output of an activity acts as an input for the following activity. In a two-way communication, information content is being shared through an information channel that enables the receiver to view, read or edit the content. (Berente 2009; Durugbo et al. 2014)

Business processes are important building blocks for creating business systems. Once the processes have been identified and understood, these processes can be redesigned if improvements are needed. Modeling complex processes often results in complex models. In complex processes, multiple, interrelating diagrams are often used. In order to avoid too much information being modeled in one diagram, process models can be simplified to different levels. Nevertheless, switching between different levels can be different, while the viewer must be able to integrate the same context on multiple levels. (Turetken & Schuff 2007) Furthermore, the management of processes and information flows is extremely critical to preserve organizational competitiveness. Sharing of information is important in information flow management. (Durugbo et al. 2014)

Data flow diagram (DFD) is a tool to help support systems design and analysis. Graphical representation of the information system is needed for the logical understanding of the system. Data flow diagrams do not require the definition of any physical implementation. Therefore, the diagrams are simple and easily understandable. From the data modeling, the input and output data and their functions can be more clearly identified. Furthermore, visualization of data flows helps in understanding how the same data is processed in various functions. (Weck and Tichy 2016) The DFD offers understanding of the system and how it

communicates with the system users and external partners. Furthermore, the DFD has been identified to be an important tool to understand complex systems. (Sauter 2015).

The first step in information flow structure is the creation of a flow map. At the beginning of the mapping, the relevant flow of information for the specific use must be identified. Secondly, the context of the information should be set, to understand the information flow moving among the stakeholders in the company. On a more precise level, the first phases of modeling include the generation of an initial list of data needed to perform activities. (Durugbo et al. 2014) In addition, Schmalenberg and Vandenhouten (2016) have clarified the use of data flow diagrams in information modeling. DFD can be used to visualize the data flowing through different information systems. The DFD also models the functional process of the data flow. Furthermore, the DFD is used to clarify where data is coming from and where it is intended to go to use. Design flow diagram is a powerful tool that can be used to map systems and help in system analysis.

Data flow diagrams identify the different entities, processes, and the data storages to trace and portray how the information moves (Yih Chong et al. 2011). Transfer and usability of information flows between different activities is the key criteria for a business process. Transferring the information is associated with the transportation and communication of information. In addition, the usability is related to the understandability and ease of use of the information. Different groups connected with the process activities can have different perceptions about the goals, values or the best practices, and therefore the communication can often be difficult. (Berente 2009)

Only the system aspects are represented in data flow diagrams. Individual people or specified technologies do not play a role in the systems DFD design. (Sauter 2015) Data flow diagrams are therefore used to show the flow of information between places (Aguilar-Saven 2004). Nevertheless, the diagram can be broken down to sub-systems, that illustrate on a more precise level of the processes identified in the highest level of the diagram. The processes in the diagram are numbered and can be represented with a higher level of detail in separate diagrams. The highest level presented in the diagram is the Level 0 Diagram, that represents all the largest subsystems and the information flowing between them. (Sauter 2015)

Aguilar-Saven (2004) states, that the purpose of DFD is to describe how the processes are linked together through different data storages and how the different processes are related to

the external operators. The data flow diagram can be used as a method to organize raw data. Using the diagram, the output of each process and be identified. Practically any system could be represented in multiple levels of detail. (Zhao et al 2009) DFD offers the possibility to describe how the data flows through different business functions or processes. Furthermore, each process can be specified to a sub-process to show the steps in more detail. The diagram identifies the functional dependencies that different functions have of each other. Especially, the information of how the input and output data move between the processes and where it is stored is defined and to what organizational functions the activities belong. (Aguilar-Saven 2004)

Data flow diagrams are important tools in requirement analysis. The DFD offers an easily understandable system data flow that described the content of the systems and different systems functions. (Yang 2014) In DFD modeling, the process is representing the work the system does to the data. The process has a unique name. The data input or output is always shown as an arrow. The arrow goes to or leaves from the process edge. A direct data flow line should have at least one start-, or endpoint. The data storage represents the repository of data, that can be a database or a single file. (Zhao et al. 2009) Each storage has an identifying name (Yang 2014). External entities describe the destination or a source of data outside of the system under modeling. External entities represent for example people, who contribute data to the systems or receive data from it. (Zhao et al. 2009) Figure 5. below presents an example of a DFD.

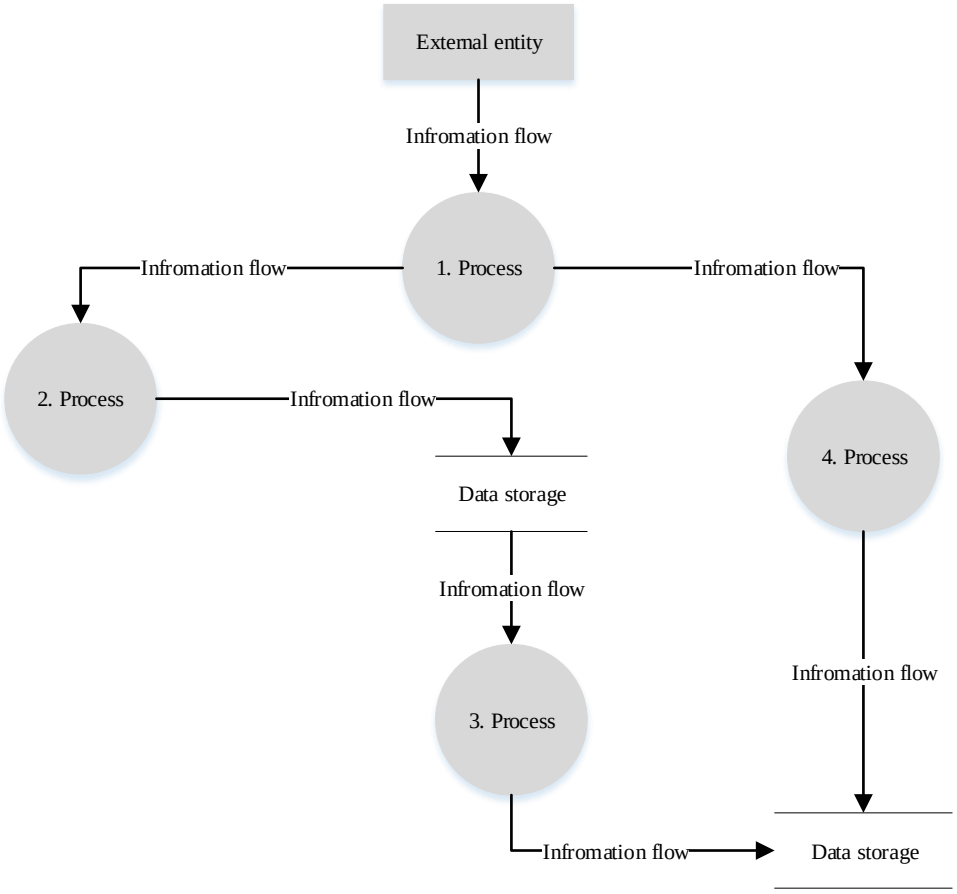
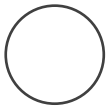
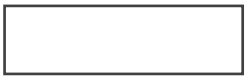
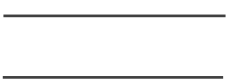


Figure 5. Example of a data flow diagram

Cuenca et al. (2006) have defined DFD notations similarly as Schmalenberg & Vanderhouten (2016) and Weck et al. (2016). Different symbols are used to represent the data flows, various processes, terminators, and data stores (table 2. below). The data flow is defined by an arrow, and it describes the information packets moving from one part of a system to another. The process is defined in the modeling with a circle. The process represents the tasks, operations or transactions that require the data in any way. External entities describe the origin or destination of the data. Furthermore, these entities describe, which outside objects the system communicates with. The symbol for this is a square. An external entity is often located at the boundary of the system. Finally, data stores are defined with two horizontal lines with a small gap in between. Data stores are used to determine, where the data is stored in between of different processes or transactions.

Table 2. Data flow diagram notations

Model element	Definition	Graphical representation
Flow	Illustrates the movement of information from one part of the system to another	
Process	Represents tasks or operations that utilize the data in some way	
External entity	Boundary of the system, is the origin or destination of data (input/output)	
Data storage	Data is stored in storages between different processes or transactions	

Data flow is a set of fixed data. The process describes what happens in the transformation of input data to output data. Each process in the data flow diagram has a unique name and number. Data storages temporarily store the data. Lastly, external entities represent the stakeholders outside of the software systems. The entity can be a person or an organization that needs data from the systems or provides the data. (Yang 2014) Through visualization of data, using data flow diagrams (DFD), the use cases of different processes can be understood better. (Weck and Tichy 2016) In addition, the identification of redundant channels and understanding of the ways they work, ease the coordination of information flows. Possible new paths for information flows could be identified as means to enhance competitiveness. The competitiveness can be enhanced with a better scalability and business expansion and therefore, more integrated information flows can be key players in the development. (Durugbo et al. 2014)

The company should have a clear understanding of coordination and communication within the organization. Each member of personnel must know their role and contribution to the information flow. After this, the company should internally be aware of the synchronization of the communication channels. The recognition of currently used channels and the realization of how the channels effect on the wanted flow of information is needed. (Durugbo et al. 2014) Furthermore, with the use of DFD, the system can be seen as a top view of all the possible functions. The method also divides the systems into smaller functions and presenting the data flow control from one function to another. (Jacob et al. 2016)

When managing the service information, the user of the information must be sure that the information is available when it is needed, and the accessibility of the information can be depended on. The data must also be easy to manipulate and the access method to the data convenient. The data should always contain the correct information. Different groups may understand or interpret information differently or they may need the information in a finer level of detail. (Berente 2009) When considering data flow diagrams, some problems may occur. The DFD does not address all the possible aspects of how the data is being processed. Moreover, the DFD determines the direction of the data motion flow with arrows. Nevertheless, the modeling does not reveal whether the data is pushed from a source or possibly requested by the destination. (Schmalenberg & Vandenhouten 2016)

3 METHODOLOGY

This chapter presents the methodological choices of the thesis. The methodology further explains the qualitative research and case study method. Furthermore, data collection methods, such as why specific persons were selected for the interviews is explained. Additionally, focus group as a data collection method is presented.

3.1 Research execution

The research method used for this Master's thesis is qualitative. The research is aiming to find a more specified solution to a problem, and there is a need for deeper analysis form different sources. Based on the nature of the thesis topic, a qualitative method is the most convenient as it allows the researcher to examine the topic from multiple angles and to create assumptions. The research is more of an exploratory research, as the aim is to discover what are the most important features considering the future development.

3.1.1 Qualitative research

Qualitative research methods are understood as an analysis of a simple, non-numerical material. Qualitative research material is often in a text form. (Patton 1990, p. 4; Eskola & Suoranta 2014, p. 13-16) Findings from the qualitative data stem from interviews, direct observations, or written documents. The main goal of the research is to discover and identify something new from the existing theory. (Flick 2014, p. 16) Qualitative research at its best changes during the conduction of the research. An open research plan emphasizes the different steps of the research, that become intertwined together. These steps include the data collection, analysis, interpretation, and reporting. Qualitative research is not easy to divide into clear phases, as the interpretation is distributed throughout the entire research process. The research plan and the research problem may have to be revisited during the research process. (Eskola & Suoranta 2014, p. 13-16)

Qualitative research often focuses on a smaller amount of research cases to maintain the analysis as precise as possible. The scientific criteria for the data is not the quantity, but rather the quality of the data. With discretely choosing the research sample, the researcher must have the skills to build a solid theoretical foundation for the research. The theoretical background helps the researcher to choose the right ways to obtain data. (Eskola & Suoranta 2014, p. 18) Therefore, the central criteria in qualitative research depend on how well the

findings are extracted from the empirical material and how well the different methods are used. The basis is to develop already existing grounded theories. (Flick 2014, p. 16)

Qualitative research in theory, is about data related analysis that at its most simplified nature means building up a theory from the gathered empirical data. Nevertheless, problems can arise from the never-ending nature of qualitative data. Material based analysis is necessary especially when basic information is needed about a specific phenomenon. (Eskola & Suoranta 2014, p. 19) Qualitative research methods involve the members in the field to participate to the research. Furthermore, the actions and impressions, feelings, and observations of the researcher about the research topic form the interpretation of the research. (Flick 2014, p. 17)

Qualitative research does not necessarily require a research hypothesis. In qualitative research this means that the researcher does not have any specific presumptions about the research or the research results. This guides the research to the directions that the researcher can be surprised about the results or learn in the research process. Nevertheless, it is always possible, and also desirable to create work hypotheses, that act as "guesses" of what the analysis could offer. (Eskola & Suoranta 2014, p. 19-20)

Qualitative data often includes observations or quotations. The quotations are derived from the interviews and the observations yield detailed descriptions of activities or interpersonal interactions. Furthermore, operational activities can be observed based on the experience. (Patton 1990, p. 4, 47) The data gathered for the qualitative analysis, must be scientific, generalizable, or representative. Qualitative research is often about discrete, theoretical, and meaningful data collection. Therefore, the research can focus on a rather small sample. This is, because the qualitative research does not aim for statistical generalization, but rather to describe and understand certain behavior or to propose a theoretically plausible interpretation of a phenomena. (Eskola & Suoranta 2014, p. 60-61)

3.1.2 Case study

Case study can be chosen as a method for the study when the research phenomenon is not easily distinguishable. A case study investigates a current phenomenon in its real-life context. For example, the research can be for a project or program that is under evaluation. A case study can be used as a method for both, qualitative and quantitative research. (Yin 1993, p. 4, 31, 59) Once the literature reference has been developed, the number of case units

should be chosen. After this, the methods for the data collection are identified. (Dresch et al. 2015) A case can be for an individual group of people or for an organization or an event. Regardless of the case, the researcher must aim at analyzing the case as a full entity. In other words, the researcher must not oversee any data, but to keep the case intact as a whole. (Roller & Lavrakas 2015, p. 290)

Case study is an acceptable research method, when the researcher is aiming to identify relationships, and not only to explore a specific situation. The major objective for using case study as a research method is to identify the phenomenon and the context it is presented in, because the context contains important information to the phenomenon, or the boundaries between the two are not clearly defined. (Yin 1993, p. 4, 31, 59) In case study research, the researcher should always pay attention, that the results refer to the presented theory. The results and evidence of the research should therefore always be associated with the theory. (Dresch et al.2015) A single-case design case study utilizes only one unit for the analysis. Single case studies are more unique in nature. Furthermore, using the case study method, the researcher can gain access to information that has possibly been inaccessible before. In some situations, the research may be executed during a longer period, offering a more longitudinal study. (Roller & Lavrakas 2015, p. 295)

According to Dresch et al. (2015) the phases of case study research include the definition of the research structure and the creation of the research plan. In the beginning, the theoretical background should be defined and the restriction to be research identified. The case plan includes the methods of data collection and data analysis. After the case plan the data collection begins. The identified contacts are approached, and data is recorded for analysis. After the data collection the analysis phase begins, where the data is reduced to include only what is needed. Furthermore, causality of the collected data should be identified. In the end, the report of the case study research is created. Theoretical research should be implicated to the case findings. Figure 6. presents the structure of a case study.

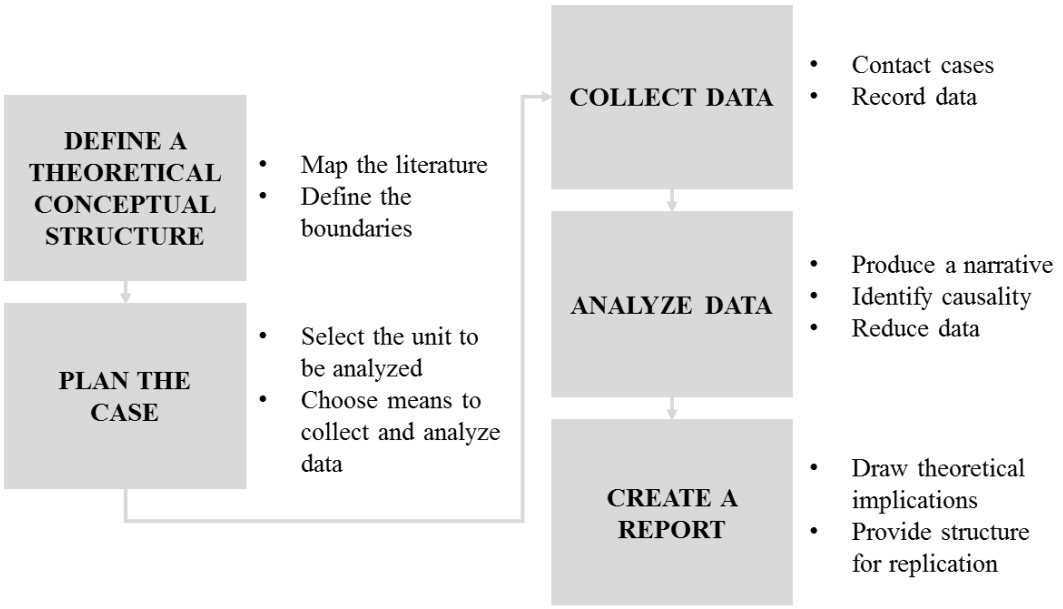


Figure 6. Structure of the case study (after Dresch et al. 2015)

This thesis research can be perceived as a case study, as one project in the company is used as a start point in the research work. Furthermore, as the research is created as an assignment from a company, a case study is a relevant definition for the research. The case study approach utilizes interviews and the observational (focus group) activities as data collection method, aiming to identify the development points in the concept under advisement. The company related information is important in the case study, and therefore, as a research method, it suits the thesis research well. This case study has been executed in a shorter period of time, but the research context is extending far into the future, to aim for the best possible operation model.

3.1.3 Design science research

Design science research is often used as a paradigm in multiple information system research. The methodology offers modeling tools and possible methods for information systems evaluation. (Gregor & Hevner 2013) Design science research combines the knowledge of why and how something is created. The design science research aims to identify and produce an artifact that combines the theory and research conducted about the most important principles. The artifact resulting from the design phase utilizes the desired properties. Design, in that case, uses knowledge to create a new concept, while science in particular aims to study the world and concept at hand to create new knowledge. (Baskerville et al. 2015)

With the connections of the theory and practice, design science creates the research paradigm that utilizes both a meaningful design of a concept and creates new knowledge and scientific contributions. The design science is used to create knowledge of a problem through a thorough analysis. The analysis is then the basis for the evolution of the solution. (Baskerville et al. 2015) Dresch et al. (2015) have further discussed, that design science research is a responsible method, as the aim of it is to design an artifact or prescribe a new solution. This research approach can be used both in an academic context as well an in the organization and has therefore been proved to reduce the gap between practice and theory. Design science research is not restricted to specific fields, but rather it can be used in different industries.

With the design science paradigm in mind, the main goal of this thesis is to identify the most important information flows based on information systems and business development. A data model based on the service development and important information needed to flow through the entire organization is created. When the main information for the business operations and business development have been identified, in other words when the research analysis has been conducted, the data model is created. This means the research data is used to design an artifact as an output of the research. When considering the scope and result of the thesis, design science as a choice of research paradigm is relevant.

3.2 Data collection

Collection of data for the Master's thesis is done through interviews and a focus group based workshop. The interviews are conducted with people from different backgrounds to create a higher variety of data. Semi-structured interviews with people of different position in the organization give a wider understanding of the important information needed in different business units inside the organization. For example, interviews with the production personnel offer insight of the information needed for the execution of the services and the resource planning. Interviews in different business units offer an understanding of the existing customer needs and information flows between the company and the customer.

3.2.1 Interviews

One of the most common ways to gather qualitative data is through interviews. The objective of the interviews is to identify what the interviewee thinks about the research subject. Interviews are organized and stated by the researcher. Furthermore, interviews are about the

interaction between the interviewee and the researcher. In addition, typical for the interview is that the researcher motivates the interviewee and upholds the conversation. (Eskola & Suoranta 2014, p. 86) The interviewee must trust the researcher that all the information is handled with confidentiality. The interview in total consists of an interviewer who initiates a conversation with the interviewee to discover personal opinions about the topic of interest. (Roller & Lavrakas 2015, p. 51)

Steps for interview planning are presented by Roller & Lavrakas (2015). The determination of the research questions and the identification of the possible interviewees is important on the beginning. The interviewee method is to be chosen after this, and the possible preliminary pilot interviews should be conducted. In addition, the location for the interviews should be selected and good interviewing techniques should be used during the interviews.

Eskola & Suoranta (2014, p. 87) and Roller & Lavrakas (2015, p. 50) describe that commonly three types of interviews are identified. These types are a structured interview, semi-structured interview, and the unstructured interview. The semi-structured interviews offer similarly themed questions to all interviewees of the similar topic. Semi-structured interviews offer the interviewees the possibility to express their viewpoints more likely, as the interview situation is more openly designed. In this interview method, the structure of the interview is created before the interview, but the way the questions are framed in the situation can vary based on the knowledge the interviewee has. The questions of the interview can be represented in the actual interviewing situation, by applying the questions together with the interviewee's statements. (Flick 2014, p. 217) The semi-structured interviews can be described as a shared experience among the interviewer and the interviewee. The interview should encourage two-sided dialogue, while the interviewer can react to the comments of the interviewee by changing the wording of the questions or offering clarification to the interviewee. (Roller & Lavrakas 2015, p. 53)

Seven (7) interviews were conducted for the data collection in total. The interviews can roughly be categorized into two parts. The first part of total 5 interviews concerned the company’s internal operations from the production and from the business perspectives. The focus was on field service development capabilities and the information flows needed to enhance and develop the management of the services. The second part of the interviews was conducted with different stakeholders or extra-organizational people. These interviews focused mainly on the service business in general, the customer need and point of view about

the company and the operations and main insight of the new technologies or the information flow management aspects.

The interviewees were selected based on their tasks in the organization as well as their knowledge about the service production in general. The extra-organizational interviewees were selected due to exceptional knowledge or expertise about the research concept or the status of important customers in the field at the current state of the project. Customer insight was gained through interviews. In this occasion, the important information from the customer point of view was assessed. The structure of the interview questions can be seen in appendix 1.

The first interview was organized with the head of new service development in operations. This interview offered insight from the higher level of the service development team in the field of the actual operations. Responses from the interview offered important knowledge of the actual information need in the production and of the development goals of field service in the organization for the future. The first respondent has a crucial role in the new service development and she offers important knowledge for the future service needs.

The second interview took place with a production manager, who is mostly managing a terminal where most of the metropolitan area field services are produced. Insight about the actual production information needs and the operational perspectives were collected with this interview. The production manager could shed light on the important factors to consider in the whole information flow and information needs from the operational side.

The third interview was organized with a product manager from the business unit. The aim of this interview was to identify the needs and challenges of the business side of service development. Furthermore, the interview offered insight of the internal business information flows and the information needs from the business perspective. This interview is important because different stakeholders take part in the service process from the business point of view and the customer interactions are managed through the business units.

The fourth internal interview was conducted with the company's joint venture organization's head of ICT. Through this interview, data and insight were gathered mainly of how the resource optimization can be handled, but also about the service operations development and information flow aspects of another company. The interviewee was selected due to the knowledge of resource planning and the information content of the knowledge management.

The interview, in the end, focused, mainly on the resource optimization and the utilization of an enterprise resource planning software.

Finally, the last internal interview took place with the head of logistics performance and analytics from the production operations. Through this interview information about the service quality and first mile operations was gained. Therefore, the beginning of the service process and the information flows can be identified. The final and external interview for the master thesis was conducted with a researcher of service development. This interview offered insight of the service business and service market in general.

One customer interview was conducted to enhance the understanding of what the customer expects from the company and the services. Furthermore, with the customer interview, the importance was also to identify the most important value offered to the customer as well as the information needs of the offered and produced services. The customer insight is extremely important as at the moment the company is creating new digital channels and the customer feedback is important already in the early phase of a new user interface development. Table 3. below presents the interviews conducted for the research data collection.

Table 3. Conduction of the interviews

Date	Interview type	Interviewee position	Relevant experience	Purpose of the interview
28.2.	External (customer)	Operational Service Manager	2 years	- Understanding service needs - Need for digital transparency - User testing
2.3.	Internal	Head of Operations New Service Development	Overall over 10 years	- The insight of service development operations - Actual information need in the production
14.3.	Internal	Production Manager, Field Service Operations	Over 5 years	- The actual production information and data needs - The operational perspective of service development
21.3.	Internal	Product manager, Business Unit	4 years	- Needs and challenges in new service development - Information flow from the business point of view
28.3.	Internal	Head of ICT	Overall over 20 years	- Resource planning - Worker knowledge management
6.4.	Internal	Head of Logistics Performance and Analytics	6 years	- Quality management - First mile operations
6.4	External	Researcher, Service Development	10 years	- Overall service market - Service development drivers

3.2.2 Focus group

Focus group discussion, or group interviews, has similar features to interviews, but still differs from it in multiple ways. Focus groups provide the researcher more perspective, as multiple people are focusing on a single discussion about the research topic. The researcher has an important role in the success of the group discussion. (Roller & Lavrakas 2015, p. 104-105) Focus groups are similar to interviews and they should focus on topics that have a fairly narrow focus or seeks reactions to a product for example, rather than analyzing complex issues in detail. (Patton 1990, p. 385-388)

Roller & Lavrakas (2015, p. 106-107) have explained that focus group discussion offers the researcher different understanding of the topic than through individual interviews. When people are gathered together, the participants should be encouraged to talk and even debate about their thoughts and ideas. The variations of a focus group revolve around the size of the group, the type of participants and the mode of how the discussion is conducted.

Furthermore, focus groups are cost-effective, while the researcher can gain insight from multiple different people at once, rather than interviewing only one person. (Patton 1990, p. 386)

The researcher must identify the best possible group of people, given the research topic. Furthermore, the size of the group should be identified to fit the focus group agenda. Most commonly used types of focus groups are the so-called “full groups” where the number of participants ranges from eight to 12. Nevertheless, the topic determines the amount people that would be optimal to participate. Furthermore, the researcher must consider, how the focus group is composed. Thus, the degree of homogeneity or heterogeneity that the group represents should be determined. This way, the similarity of participants characteristics and their experiences can be considered. Researchers have identified, that some homogeneity in the focus group participants is considered essential for the dynamics of the group. (Roller & Lavrakas 2015, p. 109-110)

The moderator, in other words the researcher, should be able to adapt to the unique situation the focus group offers. Furthermore, the moderator should manage the group dynamics and keep the focus of the group in the actual topic. Creation of a supportive atmosphere and encouragement towards spontaneous can help in maximizing the usefulness of the focus group outcomes. (Roller & Lavrakas 2015, p. 110-111) Patton (1990, p. 386-387) has identified an important role for the moderator. The researcher should act as a facilitator and have good group process skills, so that one or two participants do not dominate the conversation. The moderator should take all the participants into consideration, while not all people are willing to speak up possible contradictory opinions.

Focus group method was used to help in the latter phase of data collection and research for the thesis. After the initial data collection through interviews, two workshops with a designated group was organized to develop the information flow modeling. The workshops offered important insight about how the participants perceived the created information flow model and how it should be further developed. During the workshops, the research gained more insight on how the model should look like in the end. The first workshop had six participants, Head of Operations New Service Development, two Senior Development Managers, Product Manager, Head of Services, and Head of New Services. The second workshop had only five participants, with one of the Senior Development Managers being unable to attend.

The 1st workshop applied the nominal group technique (NGT). The aim was to get the participants comfortable with the topic and start the development and thinking process by themselves. The NGT is a method developed for facilitating group decision-making. The method is found to be excellent in clarifying ideas and participating all the people involved in the decision making. With the used of NGT problems can be identified or solutions for development created. After the participants are aware of the topic and a brief introduction is made, the silent generation of ideas can begin. As a first task, the participants write down their thoughts with the help of predefined questions. The participants should not consult one another. The next phase is to get the participants to share their ideas with the group. The group discussion is initiated, and all the participants should be encouraged to take part in the conversation. The final step in the NGT method is to vote and rank the ideas. (Harvey & Holmes 2012) Nevertheless, the last part was left out in the first workshop, as the first data flow diagram was presented after the discussion of important topics. The participant's thoughts and ideas generated in the first phase were considered throughout the presentation of the data modeling.

The 2nd workshop did not utilize a facilitation method, while the goal was to generate as much discussion in the short time available as possible. The goal of the second workshop was to utilize brainstorming to generate ideas for the future operating model. The data flow diagram gained much more valuable feedback during the second focus group. Table 4. presents the workshop details of the two consecutive focus group sessions.

Table 4. Workshop schedule and participants

	Date	**Workshop attendees**	**Workshop focus**
1.	8.5.	Head of Operations New Service Development, two Senior Development Managers, Product Manager, Head of Services, and Head of New Services	- Identification of B2C service data flows - First ideas for future operational model
2.	22.5.	Head of Operations New Service Development, Senior Development Manager, Product Manager, Head of Services, and Head of New Services	- Focus on data flows of billing B2C services - Time-booking possibility and resource master data management

4 FIELD SERVICE DEVELOPMENT AND DATA CONTENT

The development of new services within the organization must be considered from different viewpoints. The operations development team works together with the business unit and the production is organized to report to both aforementioned party's. Based on the data collected within the company, most of the respondents saw great potential in field service development and perceive it as an important aspect to develop throughout the company.

The company field services include B2B and B2C services. The definition of B2B or B2C field service can be misleading, while all the field services are initially sold to an organization (B2B customer). In this case study, the B2B and B2C services are named by the end-customer, the person or company occupying the service site. The two services differ from one another, as the B2B services are often more structured and are repeated on a regular basis. The B2B field services can, for example, be shelving service or filling, cleaning, and maintaining coffee or snack machines. These field services are produced based on an agreement with the customer and often take place in organizations, while the end customers are companies. On the other hand, the B2C field services are produced for consumers, individual people. In these field services, the service site is the customer's home. The field service is often produced only once at one location. B2C field service can include for example installations of home appliances or furniture. The B2C field services can also be referred to as transportation-related additional services, as the consumer field service is often connected to a parcel or a freight delivery.

4.1 Company service potential

The unique competitive advantage compared to the competition was one of the main features identified from the interviews considering the company's service potential. The company can easily offer cost-effective services, even with less time-consuming tasks, as long as the wanted services use the existing synergies in their production. Furthermore, as the competition in the market for a nationwide field service provider is now nearly nonexistent, the market can be stated to be growing. In both service fields business-to-business (B2B) and business-to-customer (B2C), new customer needs are constantly arising. Currently, the company has taken only small steps towards a possibly great service potential. The world is changing towards the situation where consumers and companies are constantly more willing to buy services to help in everyday life or activities.

The company should be able to define what kind of field services it is going to produce and to what kind of industries. The field service business is not as is, the core competence and business for the company. Therefore, the field service business that is under development should entail services that correspond to the existing service base the company has. Furthermore, the field service portfolio should support the core business. It is always better to get the customer more committed to continuing as a client through a wider range of products and services offered. It is important to commit the customer and make them stay as customers by keeping up the good quality of service.

4.2 Service development and scaling of services

Interviews with the head of new operations development and the production manager revealed, that the development of new field services requires the company to have enough capable and motivated workers. Good service employees are the key to the effective field services because good customer interaction skills and problem-solving skills are highly needed. Starting up with a new field service in a designated area does not require great changes to the production processes. The new customer needs must be defined and sufficient training for the personnel must be taken care of. Furthermore, the starting requires producing the work instructions and reporting.

The development of new services starts with understanding the volume and the geographical areas the field service has demand in. The location of the customers and the physical location of the service workers must be taken into consideration early in the field service development. Furthermore, the need for equipment, such as transportation vehicles and other possible tools or safety gear needed, must be identified. Concerning the service volumes, sufficient demand is needed. Nevertheless, the number of service workers must be estimated, in order to identify, whether the service work would overall be profitable.

Before the service can be started in the production, careful planning of how the execution will be done, and where the field services can be offered, is needed. Moreover, evaluation of the possible investments to make the service production feasible needs to be determined. When developing a new service to the be produced alongside with the existing field services, one must remember that the existing jobs must be executed as well. Therefore, planning of how the new service can be ensured to be profitable and high-class while fulfilling the existing service needs must be thought through.

When considering expanding the services to new areas, the information management becomes more important and the information process must be well defined. The information flow should be as transparent and as easily manageable as possible. The follow up of the service information is also crucial. The efficiency, quality, time consumption and the actual follow up of the executed service must be easily identified. After the service has been produced, the necessary information must be delivered to the financial services for billing and necessary reporting.

From the resource optimization point of view, if the development of a new service or the expansion of existing field services requires recruitment of new workers, the skills and number of workers needed must be defined. An efficient staffing of new employees is needed to make the service offering possible. Nevertheless, the volume estimates for the service should be rather high and the quality of the service should be guaranteed with sufficient knowledge and competencies. Furthermore, the customer needs should be forecasted to proactively plan the service production. In addition, based on the service type and where the field service is executed, the end customer may have specific requests on who the service worker should be. This can be a problem for example in health-care services.

The most important information needed for enabling field service development include the service requirements that have been agreed with the customer. The basic idea is to understand what is expected of the service and how long the service task should last. The next important thing is to identify how the service can be done and how it was meant to be done. It is impossible to measure quality if the operations have not been well defined and planned.

From the business point of view, the most important factor that is already needed is better process management tools to produce and control the field services in the best possible way. Currently, the scaling of field services is not possible, while there are no systems to support the managerial or operational tasks. Furthermore, the workers need sufficient tools to be able to digitally manage the service knowledge, so that manual reporting work can be limited. Table 5. presents the most important aspects to consider in new service development, as identified from the interviews.

Table 5. New service development

Service development aspect	Specification
Service volume	Sufficient volume is needed for ensuring profitable business
Location of the demand	Where is the demand for the service? The skilled workers must be brought together with the demand
Production planning	Service execution, evaluation of investments, making sure the synergies are used in the production
Efficient information management	Information should be transparent Data should be easy to manage Follow up of the data important (reporting, transferring information to financials and billing)
Production management	Sufficient ERP Managerial and operational control of the field service tasks Managing service information
Resource optimization	Predictive service planning Identification of service competencies important

4.3 Problems in field service development

The biggest problems in the service development and the service area expansion can be seen in the whole order-delivery process of the services. All the data collection and information delivery channels should be transparent and suitable for the service execution. Another problem can be seen in the change of mindset that is necessary when moving towards more differentiated field service tasks. Therefore, also the finding of new employees and offering them the proper training can be a challenge. In some places, employees may be reluctant to advance their job description or change to do different tasks. It is important for the service quality and employee motivation that the workers are willing to do the job they are offered.

Employees for the service task are nowadays mostly collected from the existing base of workers. In multiple cases, the worker may not be totally satisfied with the current job description, but when the opportunity is given to expanding the job description, the answer is often no. Furthermore, when the company supervisors have considered someone to be a good match for the new service task, the employee him/herself does not want to participate. Often the problems may lie in the compensation, and the employees consider that the new service tasks are not worth the slight increase in the paycheck.

New field services have been in the company service portfolio for a few years, and the company is constantly finding better employees to complete the service tasks with a good quality. The worker's reluctance to change work tasks has constantly grown smaller. As the new service development may require a change in the professional identity, efficient change management is necessary. On the larger scale when field services should be managed in a wider area, good communications and management can rise to be the biggest issues. In the beginning and pilot phases, the tasks of new services are often added to be a part of the regular job, not as a part of creating something from scratch.

From the business point of view, the biggest challenge is to produce good quality services cost-effectively. The quality is crucially important, as there may be smaller competitors in the business that offer much more personalized service to the customers. Furthermore, some clients may perceive a good quality superior to a low price. The company has an ability to do basically anything with a large field organization, but cost-effective services require a sensible business case. Good planning and initial calculations should guide the planning towards effectively utilizing the existing operations and creating synergies. The company as a larger corporation should be able to produce equally good quality service as the rest in the market to have a realistic chance against the competition.

Problems exist in the forecasting of field services. The demand information arrives to the service operations planning too late. Furthermore, problems exist in knowing where the possible service required products are on their way. The lack of transparency is affecting the quality and speed of the service production. In the best-case scenario, the service production would be informed about the coming service order at the earliest stage possible. These cases vary from B2B standard orders and possible ad-hoc service needs to B2C product-related services that require the service order information as soon as the product has been ordered or bought by the consumer. Furthermore, the forecasted demand about the service should be precise and contain a large amount of information to be effective. All the field service related information that is needed by the service worker for a successful service to be produced, should be provided in the early stages to deliver a good customer experience

4.4 Important stakeholders in field services

In field service development, both production and the business unit have important roles. The production has the basic information and knowledge of the operational capabilities, and

thus projects are often lead by the production. An effective field service development requires information of the total production capacities and knowledge, so that actions to utilize the existing base of workers in the best possible way can be planned. The biggest role in the productizing phase is still in the business unit and the business should be tightly involved in the process. The job of the business unit is to determine how the service is created to be a generic offering to the customer. The development work in the business units should get more emphasis and the services should be constantly monitored based on their profitability and quality. Currently the business units are responsible for the creation of specs for the service, as well as the pricing and profitability of the service. The business units should plan and discuss tightly together with the production about the possible deviations in the service or managing of the resources. Furthermore, the customer should be involved in the service development so that best possible offering could be created. The new field service concept should also be easy to understand and easily modifiable to different use. Currently the company is focusing on better ways to productize services, and control and monitor the field service production through digital channels. Figure 7. illustrates the most important stakeholders in service development.

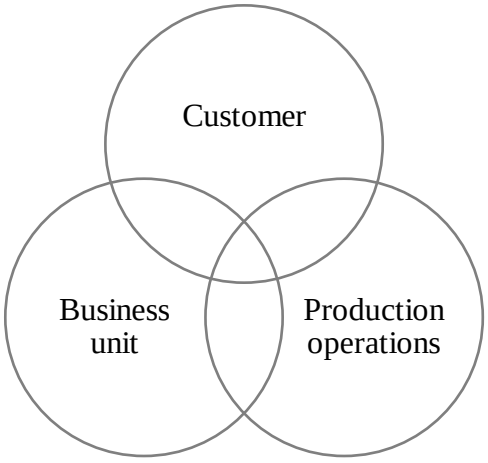


Figure 7. Important stakeholders in field service development and operations

The most important drivers for producing field services are the designated and well-educated workers. If the workers fail in their performance, the service is directly ruined. The foremen and supervisors also have an important role in the operative work, as they are the ones to drive the occupational shift towards a more service-oriented job description. Efficient service planning is also important, and changes are happening also in the planning section of the field service management.

The production is often in connection to the business unit and the product managers discuss possible problems in the service execution. It would be important that also the previous part of the process would be tightly connected to the service production so that all the necessary information would reach the service operations team as soon as possible. Currently, forecasting and preparation for demand and service volumes are low, because of the low level of information to predict data concerning the field services.

4.5 The important information for field service execution

The service instructions and descriptions should be created well in advance before the production planning. The production operations should be thoroughly documented and monitored for efficiency. Furthermore, the service execution must be reported and acknowledged. The working time that was measured should be referred to the planned lead time and the quality should be monitored with this information. From the service actualization data, the billing and cost information can be derived. The precise service detailing can be made when all the necessary competencies needed for the service are identified. Naturally, the setting of the service price, estimated service frequency and the service level agreement (SLA) are all factors to consider early in the service development. The SLA level entails the reaction time that is promised to the customer, about whether the task can be completed within the next 24 hours or can the service be executed after 2 weeks of the service order.

In the operative side, the important information includes the place where the field service should be produced in. Furthermore, the total volume estimates are important to know well in advance, for the operative team to be prepared for the upcoming orders. From the resource and capabilities point of view, all the production tasks should entail knowledge and skill requirements. This information is needed for ensuring good quality and effectiveness. Nevertheless, the basis of all planning is, that the company cannot be entirely aware of what are the specific competencies and skills needed from the service worker beforehand.

When it comes to planning the work schedule, the essential information is of course, whether the worker is available or not. For example, there can be workers willing to do extra hours after their initial shifts, and the resource planners should be aware of when the workers are willing to take on extra tasks. The employee can by themselves announce the times they are available for extra tasks. This staffing of the employees should be an online activity, while

the customer needs may change or come at a fast pace. Practically, someone must be organizing the field service work and service tasks at all times. When a worker is sought out for a specific task, the service area (geographical) and the competencies needed for the job are identified. The worker for the job can be chosen from a pool of primary (“first choice”) employees or if a suitable candidate is not found, from the rest of the employees in the group.

The most important internal information of field services is the customer need and time used in services or the number of times the service was provided in a certain period of time. This data is used for customer billing and is naturally extremely important for the company to gain revenue. Moreover, the possible deviations in the service execution or problems in the customer's service site are information that should be provided in near real time. The broader extent of data offered to the customer offers more added value. Internally this information is also important from the development point of view. Nowadays internal reporting is not effective, and in many cases apart from billing information, nonexistent. Some reports are handled on paper, which is not effective. At least the quality information based on how well the scheduled service time was achieved is important to be measured. Furthermore, if the service is being produced on a regular basis, the quality can be measured by how often the set service frequency is achieved. Many smaller competing companies can produce good reporting to their customers; therefore, the similar abilities should be built to remain competitive. Table 6. simplifies the most important information needed for efficiently managing field services.

Table 6. Important information for field service management

Information context	Specification
Service concept	Customer needs When, where and how often the services are needed Instruction and specifications
Quality monitoring	Service time vs. planned time Service frequency against whether the service was executed as planned Service level agreement
Operative data	Where the service site is How well in advance the service task is known What skills/competencies are needed from the service worker
Competence modeling	Should be easy to manage competencies Competence pooling by geographical area Creation of worker groups based on skills
Shift planning	When the employee is available Providing information to the worker about the service task or shift
Service execution	How many time the service has been executed in a certain period of time How long the service task has lasted Gathering of service related information Billing information Data on deviations and problems

4.6 Managing service information

Mainly the information that is currently handled in field services in the organization is transferred and manipulated with different spreadsheets. The spreadsheets are often shared with different operators in the production planning phase. This method has been accepted at this point in the field service operations as the number of service tasks is rather low. However, as the volumes grow, a need for more effective and automated information management channels and planning tools are needed. Some areas may have different approaches or tools to handle production service information, but no internal and broad software yet exists.

Basically, the service information can be collected in four ways. There are multiple different information collection methods varying from the company's own mobile applications and bought service software platforms to manual writing or customer's own interfaces. Mostly the company is moving towards handling information with own internal applications, but multiple B2B customers require a use of their own software during field service production.

The customers may need quality information for example of who has been producing the service at the service site and when. Using the company's own systems should help in the business monitoring of the services. For example, the deviations can be more easily solved when the information is saved directly to the company's own systems. Furthermore, with effective channels the resourcing can be monitored, to ensure the company does not have too many useless resources. In addition, the systems offer visibility and capabilities for fast reaction in cases of workers absence, when the substituting worker should be found rapidly.

Multiple interviewees agreed that a more streamlined and centralized order management software would be necessary for effectively managing large amounts of service orders and deliveries. New development steps have been taken towards a thorough field service management systems, but a lot is yet to be done. The information about the service orders should be transferred to the field service operators, for example concerning the tools that are helping the worker to identify what services should be performed. Furthermore, the service time can be monitored through the field application, and this information can automatically drift into reporting, billing, and quality control software.

Currently, there are problems in some parts of the field service production, as multiple different software for service management exists. Furthermore, the field service workers will be needing their own application to digitalize the information of the actual service execution. The exceptions in the service operations can be informed through the field service application. In addition, the workers can constantly find all the necessary information or instructions through the digital channel. No paper documentation should be utilized in the field after this. When it comes to optimizing and planning resources, specific enterprise resource planning (ERP) systems should be used. With an ERP, all the workers and all the needed competencies can be mapped to help in planning, which worker is suitable to perform which field service task.

4.7 Ensuring effective field service operations

In addition to the previously mentioned needed information, the expected volume information and capacity planning should be synchronized. Multiple interviewees emphasized the meaning of accurate and predictable volume information to ensure effective services. The volume and capacity should be constantly linked, and the production operations should constantly be aware of how much time is available for the new service

orders and when. Furthermore, an important factor for the service execution is the geographical area, where the service should be performed.

The efficiency for service ordering and service time verification to the customer stems from a good definition of knowledge and educational needs for the specific services. When the worker's empty shifts can be identified, the empty timeslots can be filled with service orders from customers, adding together the company's knowledgeable worker and the customer service need. This way the shifts can be easily managed and new service orders can be taken in on a controlled basis.

An effective field service production requires a good predictive data of service demand. The information should be more accurate than the estimate from the previous year or the estimated growth rate during the past months. Furthermore, the more information the production receives about the service order in the beginning, the better. Therefore, getting more information in the early stages of the service order process would be crucial. Based on this, the effectiveness of the B2C service production could be better, when the product information is constantly known.

After the interview with the head of performance quality and analytics, the understanding of the first-mile service operation became clearer. The delivery of sufficient predicted delivery arrival data can be difficult, as for the moment if the field service requires an item to be received before the service task, the process for the delivery of the information enough in advance has not been established. This is because the shipment is identified the first time as it arrives at the first sorting. Based on the first sorting scan, estimations could be made. This would nevertheless require knowledge of the service areas as a master data. Therefore, the master data based on an additional service ID and the service area register is necessary.

Automation could be used to further enhance the estimation and assumptions of the service process and execution. Automation and data analysis can help to identify specific time slots to inform the customer about the when the time the service should be provided. Furthermore, the processes can be better monitored based on successful outcomes to minimize the customer complaints. In addition, if the process encounters something out of ordinary, the automated data analysis can identify delays and inform the customers about possible delays in real time, possibly using artificial intelligence (AI).

It is important to identify the business potential of new service early in the service development phase. The company should be able to create an effective information process to offer the best possible service experience to the customer. The structure of the information that is received from customers is not clear enough and in many cases, the data is received in multiple different ways. It would be important to be able to model different service in the simplest way possible. The data modeling for different kind of services is currently not comparable. B2B services should require similar information regardless of the differences in the service offering. Furthermore, the service should be developed in the best possible way in the early stages, while seldom there is time and resources to increase the effectiveness of the processes or change it later. The service information should be easy to manage to make quick scaling up of services possible. Once the service has been established and is working in one area, new areas are more easily started. Competitors exist, who can offer more flexible services at a faster pace. Nevertheless, multiple large national companies search for a service provider with a wider service area coverage.

When the wanted service has a good business volume, it has been analyzed to be profitable, a suitable production process has been created and the skilled and customer service oriented workers have been identified, the service is ready to start. Nevertheless, when discussing service profitability, the company should be more proactive in the service development and identify the service profitability. The sales should not be the biggest measure in the service production. Furthermore, after the service has been established and piloting has been mastered successfully, it is important to keep monitoring the service profitability and start necessary changes

The most central observation from the service production point of view is the differences in how long the service operations last and how often the service should be performed. To be able to execute the services in the production, the operational work requires similar processes to each service, but the actual service production time and frequency are determined in a similar manner. By standardizing the service modeling from the information content onwards, the service business becomes easier to manage, monitor, and sell. Table 7. presents the tasks and information needed for effective service operations.

Table 7. Ensuring effective operations

Task	What is needed?
Starting new services	Good business volume Profitable business Established service process Skilled workers
Planning	Volume and capacity need of the service (linked to production planning operations) Forecasting delivery arrival (difficult to produce at the moment)
Management of the services	Currently managed by spreadsheets System should be created Should be easy to manage different kind of services
Worker capacity identification	Planning of empty timeslots How each service task lasts

4.8 Resource planning

The skills and the capabilities of the workers should be maintained in one system. The purpose of handling all the skills in one system is to be able to centralize all information to one place. This makes the use of search possibilities effective when all the people with specific skills can be listed with one search. Every worker in the systems can be defined with similar skills. Furthermore, the planning of different training, or changing or expiring courses and competencies can be easily managed from the system as well. Often the workers are pooled based on their skills. A worker is always connected to an organization. The staffing and selecting of workers to different service tasks are prioritized based on the type of contract the worker has. For example, the monthly paid workers are a priority against hourly paid workers.

Different personnel groups could be established. Grouping of the service workers can make the efficient resource planning possible. The employee competencies are a substantial factor in resource planning, as with the competencies needed for the service, the worker with sufficient skills and capabilities can be connected to the service. The term competence is used as a concept to define the specific knowledge or skills the worker needs to perform specific tasks. Competencies can be trained by the customer, as specific courses, or training from the customer's side before the service can be executed. The competence can be a worksite-specific training or a basic training offered by the company about the code of conduct for example. The top competence categories can be created by a different scale.

These categories can be about the language skills, licenses or permits, industry-based skills, warehouse work, software and systems skills or some government mandated skills such as the hygiene proficiency certificate. In addition, company or customer related courses or training can be set as one category. Table 8. below presents an example of competence categorization.

Table 8. Competence categorization

Category	Type	Information	Industry / Service
Language	Finnish	Native language	
Licenses, permits	Driver's license B	Expiration year 2064	Logistic industry
System knowledge	MS Office		
Company specific training	Code of Conduct	course completed 2.1.2018	
Law regulated permits	Hygiene proficiency certificate	course completed 6.5.2015	Food industry

4.9 Quality and predictive delivery planning

Nowadays the company's quality management is basically reflective of how the SLA's were achieved. The actual problem has already occurred, and the main goal is to make sure the same mistakes are not made again. When considering the prediction data of services, the possibility of an error will increase. As the delivery product is identified to arrive in the logistic operator's process for the first time in the first sorting, the calculations for a delivery estimate to the service terminal can begin. Nevertheless, even though the items had reached the sorting in time, lack of capacity or the sick leaves of workers can cause delays to the process.

Measuring and evaluating the possible demand based on the electronic data interchange (EDI) message that is provided as the delivery order, is currently not accurate enough. In the future, with utilizing AI technology, a more efficient analysis and production of the predictive data of service needs may be possible. The data of the EDI message that is received from the customer and the actual information of when the shipment has first arrived in sorting can be analyzed. Based on the average interval with which the customer delivers the shipment in relation to the EDI message, some predictions can be made. Nevertheless, this means that all the data and estimations provided are based on history data, and may still not be entirely accurate.

The customer-based delivery data could be more accurate if data was delivered to the service provider from the customer warehouse. This data would help in identifying if large batches of products are about to leave the warehouse. The customer must be able to identify all deliveries from one day, to stay aware what shipments have arrived and when. Currently, there is a possibility to deliver more specific data of what items have been delivered to the destination terminal. Nevertheless, this does not speed up the process as such, and no accurate pre-information about the deliveries or the demand can be offered.

4.10 Future goals for service development

The head of operations development and the product manager offered similar insights, that the ultimate reason for field service development lies in the increased revenue. The revenue may come directly from the services, or be indirectly bringing the company more revenue, as in some cases value-added transportation-related B2C services may be the important feature to make the business possible. A good enough quality should be ensured, with low enough expenses. The service should always be an answer to the customer needs. The different service modules the company offers should be flexible. Still, the generic service descriptions should be well defined, so that with every new client there is not a need to create a new service from scratch.

Good follow-up of the field service operations is important. This monitoring enables the company to stay aware of what are the profitable services. Unprofitable services should be eliminated from the service portfolio. The financial business unit oversees the monitoring of the profitability, but the business unit defines the actions that should be taken to tackle issues in the field service lifecycle.

After the development of new field service operating systems, new information of providing the services can be gathered. Therefore, new information is created. In the ideal world, the customer can define what kind of information they need and in what form. It is possible for the company’s applications and software to save this needed information and transfer it through an application interface to the customer’s system. This way the customer can transfer and modify the provided data to their own needs. The better the company can offer data to their customers, the better the customers can provide information to their end customers. Value is added to all the stakeholders.

4.11 Customer's service cooperation and information needs

One customer interview was organized with the Operative Service Manager from a large and important field service customer. The customer is a large national company, that offers services to their customer on the side of the product they are offering. Nowadays with a tough competition, the companies are forced to offer service to support their core business to gain customers in the first place. In other words, in many cases, the product might be left unsold without effective value-adding services. This customer interview offered value to the research work, from the customer needs perspective.

The case company is creating tremendous value to the customer by offering field services on large geographical, nationwide, area. In the past, the customer has had a varied number of service suppliers, who are often smaller companies, and not that willing to integrate to external systems or make investments on software. This results in a weak integration between the small service providers and the customer company. Currently, the customer is satisfied with having only one field service provider. All the information about the services can be delivered to one destination. Furthermore, all the information is provided to the customer with a one link. This easy information management is necessary to effectively sell the services. In addition, the customer company has been able to expand their service area to new cities, even to a destination where services were not offered before the partnership. Nowadays, services can be offered to almost everywhere in Finland, which grows the customer's sales to a new level and the end customer can be offered a more comprehensive service experience.

The information needs of the customers are simple. The field service operations should report the deviations and the quality back to the customer. Data of possible changes is also important, and can nowadays be offered with a simple phone call. The customer can see all the other information concerning the field services from their own systems, as the service workers utilize the customers ERP interface application in the service work. Nevertheless, there is a need to standardize the information moving between the service provider and the customer. For example, simple text fields where the necessary information is filled are good tools to transfer data.

4.12 Service business and development

A service development researcher was interviewed for the thesis project as a specialist in the service industry. This interview explained some distinctive trends, that can be identified in service development. Growth, digitalization, the rise of the service design as well as ecosystem way of thinking are changing the service market.

Companies are often driven forward in the service industry by the increasing urge to produce more value to the customer. Often the discussion has circled around customer need but nowadays the focus is put more towards customer understanding. The better understanding of the customer often stems from service design. Not only the process is defined, but also the customer journey and touchpoints are identified. Multiple different methods can be identified to pursue a better customer understanding. Furthermore, digitalization has changed the processes. Currently, all services somehow related to data, are a trend.

Triggers for service development often come from multiple directions. In the industrial setting, companies are often lagging on the development, but as new services are created, technology is often the driver. The companies are wondering, how the services can be developed to create more value. It is important to understand the customer and their business in B2B services. Furthermore, customers are taking part in the development of the services and they are more connected to the whole process. Multiple open innovation platforms exist, to participate the customer better in the development. Nevertheless, the customer participation could still be more common. In many cases, the company thinks they know what the customer wants, but in reality, the customer expectations may be different than suspected. Through service design, the company can also learn to communicate the process more effectively internally.

New trends are making it possible for new companies to enter the service market. Nevertheless, multiple existing companies are adding services to their portfolios. Moreover, when discussing technologies, new services may be needed or existing services may need updating. For example, the maintenance services need to require more knowledge on for example electric vehicles, while electric and hybrid cars are constantly more popular. The evolution of technologies enables the emergence of new service providers.

It is difficult to define boundaries for service development, as nearly all industries offer services. The physical elements, such as a product, is often connected to the service. In

addition to the digitalization trend, AI can be a driver to increase the value for traditional services. Artificial intelligence can be beneficial for example in the healthcare industry as self-diagnostics, or in the public services. Technology is making many new services possible. Furthermore, the purchasing of the service should be made as easy as possible. In addition, personalization is becoming increasingly important in services as well. In multiple occasions, when services are developed together with the customer, the cooperation relationships also last longer.

The most important reasons for the outsourcing of services can be hard to identify. Every now and then the trend is to focus on the key competencies, while on the other hand sometimes companies aim to decentralize their offering. The customers may have specific requirements when concerning their service needs. When collaborating with the service provider, the customer usually has specific requirements concerning the service. These kind of services are comprehensive. The service provider offers the entire package for the customer. Furthermore, the customer value and benefits should be measurable. The comprehensive services often also require some personalization, while the customers are not afraid to ask for exactly what they need.

The thorough well-being and customer value have also been drivers for the growth of new services. As free time is valuable for people, they often have a need to optimize their use of time. This has led to, for example, the growth of cleaning services or other services to help in daily tasks. There is potential for multiple more services, and for example, aging of people can as a “trend” strengthen special service changes. In general, different generations require and need different kind of services. For example, the modern youth appreciate the environmental aspects more and may even be used to have better services, faster. The latest Z-generation, of people born after 1995 or at the beginning of 2000, have grown with mobile devices in their hands. This creates a certain aspect of the service development, as different age groups require different kind of services, offered in different ways. The technology adaptation is high among the Z-generation.

The companies developing their services need to identify the needs for development and bring in the customer understanding. The steps for developing services can start from expanding the business and scaling the services to new areas. The service provider needs to understand how their services are being controlled and what systems or methods they need to execute the services. The scalability can become a problem for some companies, as the

systems for it are not available. When it comes to field services, the service portfolio is not that extensively known. In many occasions the services circle around maintenance or installations.

5 DATA FLOW VISUALIZATION

Based on data gathered from the interviews, data modeling was started. The aim of the modeling was to identify all the information needed for allocating new services, as well as for identifying the information flow through different processes within the organization. The data model and data flow diagram were both created to support each other in the overall end-to-end information modeling of the field services.

5.1 Data model

The information flow modeling started initially with the data model creation. The overall entities identified in the first phase are listed in table 9. below. The data model is an important part of the overall service modeling, as all the information can be mapped with the data model. With the help of the data model, new services can be drafted based on a general information need. The company can establish more structured field services as well as identify the process needed for the service, only by getting familiar with the service information provided.

Table 9. Data model entities

Entity	Explanation
Customer	Information of the billing customer
Destination	The postal address of where the service is needed
Service site	A more specific service location inside the destination (in the destination address)
Order	The service order the customer delivers of the service
Product	Internal additional service product name and code
Service template	The general definition of the type of field service the company provides
Service	Service produced to the customer, including the pricing – linked to the service
Business unit	Financially responsible for the service, responsibility of the sales
Production	Requires the information of what services should be produced and where
Operations planning	Creates the timetables of the field services, requires more specified information of the service destination and the overall service
Service task	Defines how long the service should last, saves the actual service start and end times, offers additional information gathered from the service site/service
Deviation	Defines whether there was something preventing the service from being executed, or if something was wrong with the service task
Service worker	Information of the service workers, their skills and education and their service tasks capabilities and training

The data model includes all the possible information needed for the new service development and service execution. All the data entities include attributes that describe the data content of the attribute at hand. When creating new services, or transferring existing services to match the data model, all the attributes should be included in all cases. The data model should be followed and updated whenever new features arise. Furthermore, the data model should be at the center of all service or software development to ensure that all the necessary information is gathered or transferred to different processes. The data model created is connected to the data flow diagram presented in the next chapter. The entire data model can be seen in appendix 2. The data model illustrates the information the company has already modeled with light orange color. The dark orange colored entities should be defined in the company's systems in the near future.

5.2 Data flow diagram

After the creation of the first data model, the data flow diagrams were created. In total three diagrams were formed to identify the development steps in the field service management. The data flow diagram and the processes include all the information defined in the data model in the earlier chapter. The first diagram identifies the starting point of the situation in managing field services. The second stage presents the current situation after a project took place to develop a service worker application and a user interface for the management of field service information. The current situation offers a more dynamic environment to manage services and to identify and correct problems in the service execution. Finally, the last diagram represents the desired state for the future development. The final diagram has been developed together with a team using the focus group method. The participants for the workshops were gathered from different business units and production to ensure there was a lot of knowledge to create the best possible desired state. The final data flow diagram developed during the workshops offers the new development projects a direction for process improvements.

The data flow diagrams present only the first initial level of all the processes in the data modeling. The individual processes have not been modeled on a finer level, as the research focus is on the total modeling the end-to-end data flow. Thus, the research does not include any detailed explanation of what the individual processes entail, or what other systems inside the processes are possibly needed for the full operation model to be functional. The processes are numbered to aid in the understanding of the diagram. The numbering is started from the customer order and ending roughly to the billing of the service.

The data flow diagrams include only one external entity: the customer. Other notations used in the data flow diagrams include the different processes that use and create different information. The information flows and their directions are illustrated with the arrows. Many different data storages exist, where the data is being stored. These include for example the enterprise resource planning system or the new service content management database. The different stakeholders in the data flow diagram are color coded. The green is customer related entity or process, the orange represents the business unit, the light blue is used to identify production operations in the diagram. The dark blue color is used to separate the billing related processes.

The interviewees emphasized the lack of digital channels and transparency in the starting situation of field service management. Most of the work is currently done manually and visibility to the service-related tasks or information gathered on the service site is minimal. The service information is stored in excel format and sorted out manually. Updating the service information or instructions is not automated and everything must be manually saved. Furthermore, data gathered from the field is not stored in an easily available location for further examination. In addition, all the deviations or problems encountered in the field during the service tasks are only manually recorded. Therefore, development project was needed to enhance the field service efficiency.

As figure 8. illustrates, the data is stored in the excel sheets or in the end in the billing database. Service order, service execution data, and billing information are the only data that moves through the processes. No information is automatically transferred between the different processes. The problems in the field are usually written on a paper and left on the customer site for information. Additionally, the deviation information is delivered to the supervisor who is responsible for the service tasks in the company. Nevertheless, no real-time data is stored or transferred in any way. This means that the customer does not get any information automatically, or they do not have access to see when the services were performed or if any problems occurred.

The field service process starts with the customer service order that is delivered to the company usually by a phone call or an email. The business unit goes through the service order and sends data to the field service operations to plan the service execution. The work schedule for the field services is planned and the service workers perform the services. If any problems occur, the deviations are informed to the manager, but no database stores information of problems in service situations. After the service tasks have been performed, the service time and duration are transferred to the billing system for the creating of the customer invoice. The last process in the diagram represents the sending of the customer invoice, thus ending the service process.

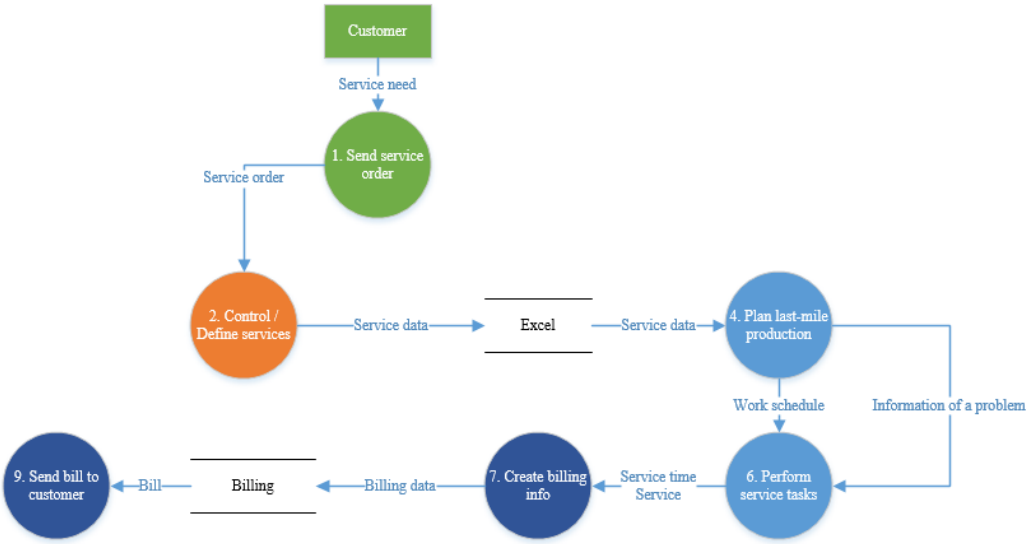


Figure 8. Starting point – Data flow diagram

The second diagram representing the current state was created based on the interview data and information from the software development project. The project focused on field service management from the customer and the service worker point of view and took place at the same time as the thesis research. The project offered an abundance of insight into the management of services produced in the field, as knowledge of the service needs was gathered. The objective of the developed software is to ease the management of field services and to eliminate the use of spreadsheets and manual reporting. The software project created a field service application as well as a user interface to help in the follow-up and controlling of the field services. The created application helps the daily production worker but does not offer a solution to the production planning of the service.

The second and modified version of the data flow diagram can be seen in appendix 3. Automation and new software have been added to the diagram, as the development project created a new software as an outcome. In addition, two more data storages have been added, and naturally more processes as well. The beginning of the information flow is the customer order that is received through the customer user interface. The entire diagram, as the previous one as well, presents the service process from the customer order to the sending of the service bill to the customer. Furthermore, as the model was developed from the beginning stage onwards, the data flows can be seen to travel to and from different processes, as the data can be utilized better due to the software development.

The current state offers the business unit a platform to configure and maintain the services through a content management system, which allows easy management of the offered field services. Furthermore, through the content management system, all the service related data, such as service destination or service sites are maintained. Changes or additional information in relation to the services can be received through the customer interface. The user interface offers structured service input to the system. This is a significant step forward, as the company can optimize its operations, by eliminating the service order calls or transferring service data through emails or spreadsheets. Moreover, as data received from the customer to the system is structured in the way needed, the operations and business unit do not have to configure the data to the right form. The automation creates great efficiency to the processes.

The user interface can also be used as a channel to monitor the service tasks. The customer can, for example, see the service history or possible deviations from the user interface. In addition, the customer can see and extract the service report from the system, to check or identify different service tasks and recognize the task prices. The company, therefore, can use the same system to create manual service tasks or add possible deviations afterward, for example, due to a worker's absence or misfunctioning field service application. All this information is stored in the service systems database and can be extracted by the company or the customer.

The processes identified in the current situation diagram in addition to the earlier phase, include the creating and managing customers and services in the content management system, publishing the data for production, as well as checking the relevant information based on the executed service tasks. The information moves automatically through the system interfaces and the content management system creates a service order to the production planning to streamline the service management. The billing information is transferred automatically to the billing system and all the service related information can be seen from the user interface. Even though new processes are added, the automation is creating possibilities to scale the businesses to new areas and to manage the existing services more efficiently. The field service application enables information transparency and with it, a better customer experience. The current operation model presented is not used at the moment, as the system has not been published yet. Changes may occur later during the testing.

Information flows are naturally also increasing, due to new data storages. The new information flows include the possibility of the customer to check the service data, similarly as the production operations or business unit can follow the produced services. Instructions or other relevant information concerning the services can be managed and delivered to the reach of the service worker, no matter where the worker is performing the service task. The future desired state of the operation model focuses more on identifying the best data model for these, transportation-related field services.

6 DEVELOPMENT OF THE DESIRED STATE OF DATA FLOWS

The final data flow diagram is created for the future development. The last model was developed in two consecutive workshops that consisted of people from the operations as well as from the business units. The future needs for field service operations were identified for the model development. An initial model was created for the first workshop. The current operation model presented in the previous chapter was enriched with B2C services for the workshops.

The initial modeling created for the first workshop contained both, the B2B and B2C field services offered by the company. As these field services are slightly different in nature, the data process for the field services is therefore also different. In the B2B field service management, the service information can be stored in a database, while the service site and service information are stable. With B2C services the service site is different with every new service order, as the field service is by its nature produced only once to one consumer. Therefore, new service order and service site information are always needed on the B2C service case. The initial model presented in the first workshop can be seen in appendix 4. This model was created based on the current state, that was developed and modeled alongside the system development project.

The data flow diagram should be examined from top to bottom. The numbered processes explain the order of the data flowing through the organization. As both B2B and B2C service have been modeled in the same data flow diagram, the diagram has two starting points. One on the right and one on the left, depending on the nature of the field service.

The first workshop offered insight to the important information in field service management, focusing on the additional and transportation-related, B2C services. The most critical process phases and some of the system requirements were identified. The first phase ideation results of the NGT process can be seen in appendix 5. During the workshop, the first model of the data flows was presented to the focus group. The group discussed the model after a thorough presentation of what the model contained. The focus group identified problems in the model concerning the pairing of the service to the transportation order. For example, in this case, after the consumer has purchased the product and reserved the time for the additional service, the two information should be linked. The transportation order is received after the customer has handled the product in their warehouse. When the product arrives at the logistic service

provider the delivery preparations are made and the product and the service are delivered to the consumer. Figure 9. illustrates how the order and delivery process of the transportation-related installation service should look like.

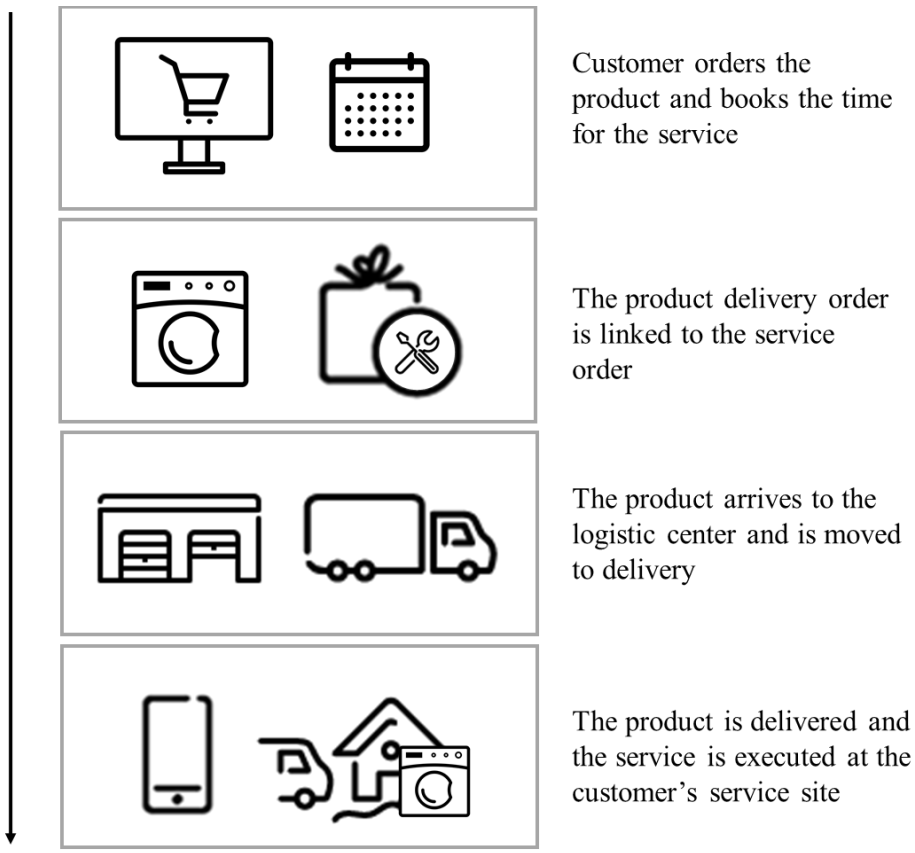


Figure 9. Additional service process illustration (icons from the company icon library)

The process of transportation-related additional services should include the acknowledgment, that the actual transportation product, parcel or freight order, has arrived in the logistic operator's process. This way, if delays occur and the service has been ordered in advance, the production planning could react to the problem and schedule a new service time. Therefore, if the product is not arriving at the logistics operator in time in relation to the scheduled service time, a trigger must be created for scheduling a new service time. As the field service order arrives at the company systems, the transportation order should be connected to it. Both order related information should be linked together, to make sure the product is available when the service should be executed. This ensures also the service data being enriched with the delivery information if necessary. If the service order was successfully connected to the delivery order, the data reported to the customer would be more comprehensive.

The need for pre-delivery data of the service requirements is getting more important in the future. With large service volumes, the management of field service orders can be difficult, if the worker's shifts cannot be planned well in advance. Furthermore, if the prediction of the delivery arrival can be brought into the system, the need, in the end, is to link the estimate information to the service order and the product arriving at the process. This way, through constantly gathering more data, the forecasting of the product arrival can be more accurate. Automation could then be used for accurately aiming to predict a parcel arrival to the process based on history data, for example.

Changes to the initial data flow model were made after the first workshop results were received. The most noticeable changes include the elimination of some EDI information data flows, as the EDI message within the company is not seen as the most reliable source of information. This is because the customer sends out the EDI information at different times and it cannot be guaranteed that all the necessary information is sent in the EDI. The EDI information should nevertheless, be used as prediction data when sufficient patterns for the delivery time estimations from history data can be made.

Emphasis in the first workshop was put on the new need for the creation of time booking and the service order information delivered from that source. The modeling suggests a time booking possibility, where the consumer can order the service while purchasing a delivery product. The ordering must be made possible in the actual store by the cashier and in the webshop by the customer them self. The time booking system requires the company to identify all the resources in different areas by postal code to dedicate service times. The time booking should rely on the field service type, for example furniture or home appliance installation, the time available for the field service, and the amount of field service workers available each day of the week. As the customer is ordering the service, the input should include the product in need of a service, and the postal code the field service should be produced in. The system would then return the available times on a calendar display. The customer can choose the suitable time from the available slots and book the service. The company will then receive the data and reach out to the customer to specify the service time if needed. The time-booking principle is illustrated in figure 10. The time-booking system and data flows in the end-to-end modeling were developed further in the second workshop.

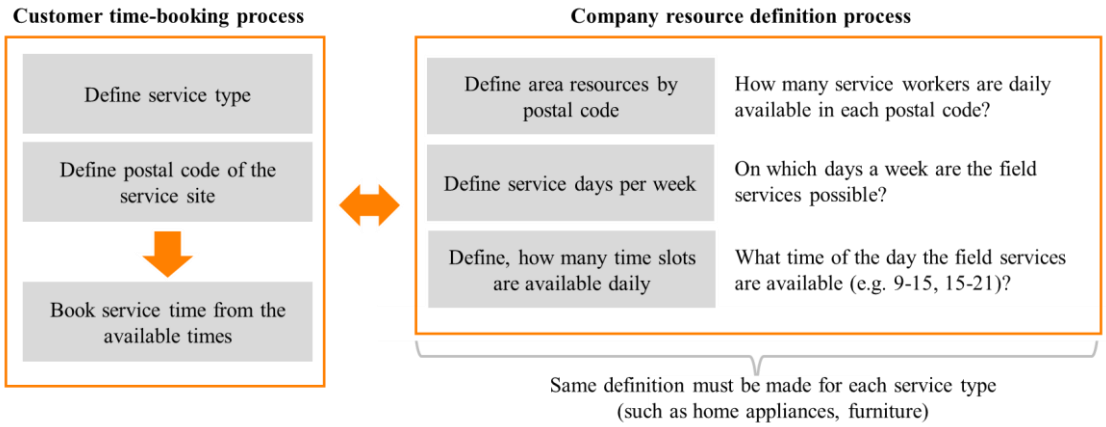


Figure 10. Time-booking process

As identified in the data flow diagram, the EDI information arrives to the Transportation Management System (TMS). The idea is to designate the service to the delivery order right after the delivery order has reached the company. The delivery order and the service order have the similar customer information and the same product codes. This way the both orders can be connected, and more importantly, the parcel or shipment ID can be connected to the service. The two data to be connected are coming from the TMS and the resource master data. After the data is connected, the total data of the B2C service, including the service and delivery information can be stored in the content management system. The development suggestions from the first workshop were modeled to enrich the initial data flow diagram. The diagram after the first workshop can be seen in appendix 6.

The second workshop was organized after the first workshop results had been modeled. At the beginning of the second workshop, the model modified after the first workshop was presented (appendix 6). The second workshop further discussed the management of billing and reporting data, and the time-booking systems to allow the customer to reserve service times in advance.

The second workshop suggested modifications to the reporting data management. The company operates a system (datapick), that currently handles the field service duration and creates the data for billing. This system entails all the necessary integrations to invoicing and to the Postal Events Tracking System (PETS). PETS is a system where all the transportation-related tasks are saved for the customer to see. These include for example the time when the delivery has arrived at the sorting center or when the delivery has been handed over to the customer.

With integrating the field service application and service task data with PETS, the customer experience would be excellent and the reporting extremely sufficient. The reporting is more comprehensive when the entire product and service operations are saved in one database. If the field service application would use the integration path of the PETS system, the company could possibly eliminate the current, and rather inflexible, datapick time management system. PETS receives the EDI data that is used for delivery billing. With the PETS integration, the service and delivery billing could be easily connected. Therefore, the PETS system database was added to the final data flow diagram. The integration of this system would be beneficial due to the increasing transparency considering the delivery and service data. The PETS database was considered to be more beneficial for reporting rather than the TMS.

The time-booking system was further discussed, and the need for a customer process of managing the booked service was identified. Moreover, the service time is now planned to be delivered straight from the resource database to be connected to the delivery order. Therefore, some of the data flows were discarded to simplify the diagram. After the booking of the service time, the customer systems configure and accept the booked delivery time. Additionally, when the service time is booked, the company resource master data is updated to identify the chosen timeslot as reserved. The information of the reserved service time is transmitted forward to be connected to the delivery order. In all cases, the delivery related field service order information is arriving before the delivery order reaches the company. The final data flow diagram developed after the second workshop can be seen in appendix 7.

The information content generated for the delivery and field service order would increase and the efficiency of the whole process could get better. The development project of spring 2018 would get much more attention and could offer great benefits. The change of system integration will nevertheless, require money for the development and a sufficient research to plan the best possible solution. Table 10. below concludes the most important development points for the B2C field services, identified in the workshops. The final data flow diagram was developed according to the suggestions from workshops.

Table 10. Final data model development - insights

Development need	Specification
The link between delivery order and service order	The customer service order and the delivery order information must be linked together for effectively managing the delivery information and to reach the SLA levels
Forecasting	The forecasted data of delivery arrival should reach the company early enough for better resource planning
More comprehensive data integration	Utilization of the existing datapick application integration (PETS database) interfaces to enhance the amount of data being transferred to different systems. Enhancing the transparency of data even more
Time booking	The service time booking calendar created for offering a good customer experience and creating efficiency to the delivery planning process
Process phase impulses	There is a need to identify whether the delivery is arriving late to the service provider. Parcel/shipment arriving late must send an impulse to the production planning for scheduling of a new service time

7 DISCUSSION AND CONCLUSIONS

This chapter presents the results derived from the previous chapters and analyses the research results. The research aimed to identify the most important information for field service development and develop a visual representation of the future desired state of data flows. The data modeling and information needs are at the core of the analysis, as these themes are the most crucial to resolving the research questions. In addition, the research reliability and validity are addressed.

7.1 Information content and field service development

One of the research objectives was to identify the most important information to effectively manage and produce field services. This chapter discusses the results of the first research question of the important data content for field service management.

The company's service operations handle and produce an abundance of data. Even though the most important information is hard to designate, from the service execution point of view, the actual customer need was listed multiple times in the interview as the most valuable piece of information. The field service planning and production require sufficient information from the customer about the service needs in order to execute the services effectively. For the development of services, the location data, competency data and service execution details are needed. Therefore, the data model created should be used in the future service development and identification of system requirements. The data model acts as a basis for the field service work and all the information needed for efficient service execution. The service planning should always be made with the help of the data model. The efficiency of the services is dependent on the quantity and quality of data available.

The working time spent at the service site is a crucial piece of information, as the time spent is in some cases the basis for billing. In addition, measuring the service time is important for the internal planning and efficiency evaluation, while the service tasks are often scheduled based on their duration. Nevertheless, the company is aiming for task-based pricing, which requires a clear understanding of the cost structure of the service. Service related information can be communicated through the service platform that was created in the software development project during the spring of 2018. The customer interface offers a channel for precise and structured information to be delivered from the customer to the content management system, in order to efficiently control the service orders and customer needs.

The user-friendly and dynamic system allows the company to gain competitive advantage by offering more data to the customer and answering rapidly to customer needs.

As the literature review identifies, sufficient systems for service information in field service management are crucial. Wagner & Sutter (2012) emphasize how IT solutions can help increase productivity and service quality. The similar conclusion can be drawn from the company's field service operations, as the work before has not been as efficient as possible without digital channels. In addition, the interviewees explained how important the good service process management tools and IT solutions are for service development. Most of the information and instructions has until now been handled manually and with several different spreadsheets. The manual work should be limited to a minimum to ensure the efficiency. New possibilities, such as AI or machine learning can also in the future aid in enhancing processes as the systems are constantly learning from the data. The development work done during the spring of 2018 and the current state of the data process includes a sufficient system to manage the service information and field service work. The system is being developed using agile methods. The goal is to launch the first version as soon as possible and develop the system based on user feedback. With the use of effective digital systems, the productivity and service quality can be predicted to increase.

Services should be easily managed and all the service information defined using a similar data model to enhance consistency and better management of field services. The service market is highly dynamic and constantly developing. Furthermore, as Wang et al. (2012) explain, centralized service management and intelligent scheduling are crucial in efficient service management. Data gathered from the interview suggest that the service business is becoming increasingly important for the company. The potential for new field services is high and all the service information should be uniform and simple. In addition, all the field service related information in the company, whether it is concerning the workers and the service schedule, or the product needed to be delivered, the information must be available in real time. Modern cloud services make it possible. This makes the service management easier and enables the development of new field services to the service portfolio.

The important information for developing new services or scaling up existing services was identified in the interviews. Sufficient service volume is needed in the beginning to guarantee a good business case and ensure a profitable business. In addition, the geographical area of where the services are to be produced must be defined. All the necessary

investments, such as vehicles or tools and equipment must be identified and managed before the field services can be started. The interview data is in good correlation with the service design process phases by Herzt et al. (2012) The interviewees identified the location planning and the identification of worker skills as an important part of field service development. Furthermore, the processes should be sufficiently planned and all the order and scheduling practices determined. In addition, the new services developed should offer a high value to the customer and they should fit the company's existing product portfolio and business area. With good planning, the service quality can be ensured for a better customer experience.

Colen and Lambrecth (2012) identify the cross-training of service workers important for field service management. The risk exists, that an unqualified worker is sent to the service site to perform the service. Furthermore, as identified in the literature review, the employee training and good communication in cooperation with the customer can increase service success. In relation to the literature review, the interview results indicated that the capable workers are fundamental to the field service development and production. The research identified the importance of service worker competencies to the service production. The competencies and knowledge requirement should be clearly defined and planned. Overall, the company service worker is the only person the customer is in contact with on a regular basis. Therefore, emphasis should be laid on finding and training the good employees, even though finding good workers can be problematic. The service culture and good employee experience are important for the case company. The new system created to aid the employees in daily operations must be easy to use, and build up the positive working experience.

The measurement of transition times to the service site, as well as the on-site time, were identified as crucial information in the interviews. The total service duration can be split into a more specific level, such as the transportation time or the time spent in the destination, with the help of the new field service system. Based on the accurate time measurement, the services can be developed and performance increased. Agnihothri et al. (2002) had identified that the on-site service time can stretch to be longer without sufficient service information. If the service worker arrives at the service site unprepared for the upcoming service task, the time spent at the site grows longer. Furthermore, the field service time lengthens if the worker does not know where the service site is located or cannot find it easily. All this information should be sufficiently modeled and stored in a field service

management system to ensure smooth production. The service worker should be able to inform about possible deviations or other relevant information from the field. In addition, the service worker should be aware of all the equipment needed for the service, while lack of spare parts, tools or information can fail the service execution.

The transparency of process flows and the information is crucial (Berente 2009). With the help of systems that are suitable and created for the field service management purpose, the service data should be collected and saved for further use. The customer interview identified that information, such as reporting the possible deviations and service quality back to the customer, is crucial. The quality can be measured for example by whether the scheduled service was time achieved. The data should be available to all the stakeholders in real time to ensure good overall service experience and quality. Field service management system relies on an ecosystem, an efficient platform to ensure flexible and transparent sharing of data between the stakeholders.

A few of the interviewees discussed the importance of pre-delivery data and the prediction of the delivery arrival, and similar requirements were presented in the workshop as well. The pre-delivery data is important to ensure efficient service planning. In addition, with sufficient predictive data, the field service workers shifts can be planned accordingly. The interviews also suggested that automation should be used for efficient forecasting in the future. Artificial intelligence could be used to map the possible time the product takes to arrive after the delivery order has been received.

7.2 Process development and increased competitiveness

The latter part of the research focused more on the development of the data flows and realizing the best possible future operation model, thus answering the second research question. The model was created and presented in chapter 6. This chapter presents the most important features derived from the data flow modeling for the company to reach the future operational goals.

In the end, the focus of the company's field service modeling moved towards the consumer field services, the installations or repair services for example. When it comes to additional services on the side of a product delivery, the development work is in its beginning stages. The value-adding services should be enhanced with efficient digital channels. The efficiency stems from platform thinking, and the data being easily available and offering value to all

stakeholders. Nevertheless, issues revolve around the confidential data management, such as customer's personal data. Customer contact information must be well preserved and managed. Therefore, the tools to manage this data safely and effectively must be identified.

As the new field service management application and user interface have been created, also new services could be configured to the field service application. With the creation of the delivery related B2C services to the system, the user interface can gain more features. One possible future development is the resource optimization. This feature was also identified in the workshop for the future model development. A field service task calendar could be created to the user interface or system application interface so that when a customer would like to order and book a specific time for the field service execution, it would be possible from the user interface with a simple calendar choice. There should be a chance for the consumer to order the field service, such as installation, from the online store or book the service time from the physical shop. The booking of the service time in advance allows the company to plan operations predictively, which fastens the process and creates superior customer value and competitive advantage. Some competitors are offering time booking possibility for their customers already. With a dynamic time booking possibility, competitiveness can be improved.

The service orders received from the customer should be extremely well structured, regardless of whether they are for B2B or B2C field service. The necessary order information must be defined in the service contract and monetary sanctions established in case of inconsistencies in data. This enhances the data quality that is the core of efficient field service production. Furthermore, the management of the service orders is as easy and as automatic as possible. A structured service order is to be sent to the production for final order planning and scheduling. All the crucial field service information, such as quality control or error handling, is delivered to the customer and all the internal stakeholders through the user interface. The timeliness of the produced service should be measured afterwards to identify, whether the service was executed as planned or as the customer had booked while buying the product or service.

The next step in the service development concerning the transportation-related field services is to configure and plan the processes to support the data flow. Nevertheless, in the beginning, all the customer related information must be well planned due to the tightened data security regulations. When further evaluating the reporting needs, the service data

should be linked to the transportation information, such as a delivery number or freight document number. This feature was seen extremely important in the workshop, as the service quality depends also on achieving the agreed service times. Furthermore, naturally, the service cannot be produced if the product cannot be delivered at the same time. This creates a new dimension to the operations planning and optimization, while the producing of additional service is dependent on the delivery. As an example, the customer naturally requires the product to arrive at the same time the installation or repair service is offered.

With the creation of new field service management system, the company can offer a full supply chain transparency and data-driven services to their customers. This way the customer experience is getting better and the company service image is improving. In the beginning, with the help of one digital channel specifically designed for enhancing the efficiency of field services, the company can start expanding their operations. The new billing integration with PETS system should be considered to further enhance the transparency with linking the field service to the delivery order data. New areas can be conquered now as the systems can support business growth, and similar service level and information can be offered throughout the country.

The company's competitiveness is improving as the digitalization of field services is developing. The systems developed for field service management should be utilized to the highest extent. The company should aim at streamlining all the processes to be similar, to ensure smooth field service production. With efficient data management and coherent field service management, the company can considerably increase customer satisfaction. The uniform data modeling of service information and the sufficiently planned data flows help the company to standardize operations and therefore to increase the growth of field services. The manual labor can be minimized and thus the operations become much more efficient.

Multiple new operating areas can be reached out to with the help of good planning, good employee training and persistent use of digital channels. After the field services have been planned to fit the designed service model, the use of the software is possible. Expanding the service to new areas is possible also from the customer service point of view. When a sufficient user interface to deliver the field service information in real-time to the customer exists, the customer service contacts are estimated to decrease. Therefore, more resources can be used to gain more customers, than to tend the existing customer relations.

The literature review pointed out that better service monitoring can increase the customer satisfaction. Furthermore, Rahman et al. (2017) described how IT capabilities are important internal resources. The case company has identified the importance of efficient systems for field service management, but a lot is still to be done. The future desired state of the data flow diagram presents the important development needs for increasing efficiency in B2C field services. The customers are to higher extent demanding more specific service time ordering possibilities that the case company does not currently offer. Therefore, resource optimization and field service competence planning are crucial during the next steps of field service development.

Currently, the company is also battling with multiple different applications being in use in the service field. The interviews identified that many of the B2B companies require their own application to be used during the field service production. The case company's new cloud-based field service application may offer a solution to this problem. The new technologies enable customers and partners to easily integrate their own systems to the cloud database. The scope is to be able to gather all the necessary data in the application and simultaneously produce accurate data to customer application through a simple application programming interface (API). This would even further increase the field service performance when only one application is used. The customers can follow the field service production better and combine the service data to their own business database. The end-to-end service process would be easily managed and the customer would be better committed to the company. The controlling of the information is easy, with the integration being light, flexible and creating the important data accurately and in the right form.

7.3 Suggestions for future development to create efficiency

As presented in earlier chapters, the research offers insight of the data content for efficiently managing field services and identifies the model for future operations data flows. The final suggestions to aid the company to identify what to focus on in the future, are presented in this chapter.

Concerning the future operation model created in the workshop, the company should focus on efficiently managing the B2C services. The information of both, delivery order and the service order must be efficiently managed and the data combined. Only with the full customer order data can the best possible value be delivered. The end customer should

constantly be aware of the order status and have full transparency to the process and possible problems. The company could examine the possibility of utilizing the existing field service data management channels on the side of the newly created system. This way the already existing delivery data could be connected to the field service production data. The combination of information of these two areas can offer more transparency and value to the customer.

The booking of the service time in advance by the consumer must be a top priority in the company. Some of the competitors are already offering the possibility to book the time for the field service at the same time the product is purchased. The integration of a time-booking system to the data flow diagram is crucial for maintaining competitiveness. The development of the time-booking should be started immediately. In addition, the company must be able to efficiently forecast the demand. Only with efficient planning, can the booked service times be filled with competent workers. Without good planning and resource optimization, the service quality and achievement of the SLA's cannot be ensured.

The future development of the field services should focus on the created future model for the data flows. The diagram modeled as the result of the research entails the important development points identified from the interviews and the workshop. The case company should focus on good cooperation with the customer to create and offer best possible service. Now, as the digital channel development has started, the better operational model should be constantly pursued for more efficient processes and superior customer satisfaction.

7.4 Research reliability and validity

The thesis aims to describe the research process thoroughly to ensure the reliability of the research execution. The reliability of the data for the research has been ensured by gathering interviews mostly from within the organization. In the current situation, the data can be utilized for the case analysis, as the aim is to find the best solution for the company. The customer interviews offered important information about the customer needs but, due to the small sample, further customer research would be advisable to ensure the reliability.

When utilizing interviews as a research method, the reliability can vary based on how the researcher has understood the interviewee's answers. Furthermore, how the interviewee has understood the research questions may have an influence on the answers and therefore also on the research reliability. In some interview cases, the interviewees may have understood

the questions differently, or the interviewee has understood the answers wrong, changing the meaning of the answer to something else that was meant by the interviewee. Nevertheless, the use of focus group method further increases the reliability, as another research method has been used. Therefore, it is possible if the research was conducted again in similar circumstances, the results would yield similar results.

When it comes to research validity, as the research is a case study, the overall results can be perceived valid. Similar answers from multiple interviewees were collected, increasing the validity of the research. Nevertheless, as the logistics service market is extremely dynamic and under constant development, both process and system wise, the company data needs or processes may change rapidly. The answers received from the interviewees today may not be similar, for example after one year, if systems have been developed further or if the process or service needs have changed. Therefore, even though the research results are valid, the situation may change rapidly. Moreover, the research results can be applied to similar field service organizations but are not generalizable to the whole service industry.

7.5 Limitations and areas for future research

Development is a never-ending progress. This research offers insight on the state of digitalization of field services at the case company. Nevertheless, a lot must be done to achieve the best possible operation model. The thesis gathers mostly internal company data and does emphasize the customer side of the service development. Next step in the future research concerning field services would be to identify the customer needs, and how the customer satisfaction and customer experience is linked to field service development. Based on the one customer interview, substantial conclusions cannot be drawn.

The field service business, in general, has existed for decades but is constantly evolving and moving towards different directions. Companies with large field organizations can produce different services in large geographical areas. Furthermore, when considering the logistics business, where the key activity is transporting shipments across countries, the service personnel is always on the move. This allows for the companies producing field services to create new possible service offerings to the market. What the different services can be should be researched. Sufficient overview of the field service market and all the possibilities it can offer should be assessed. The thesis research offers a light overview of the service business in general but does not address field services specifically. The drivers and market pull for

field service development should be identified and researched for the creation of superior services and customer value.

In addition, the competitive market of field services should be researched. The thesis does not identify all the possible competition precisely. It would be interesting to identify where the business is going and what kind of new competition is entering the market. Large international retailers can offer supply chain operations also to smaller retailers and can pose a threat to traditional logistics and supply chain operators.

8 SUMMARY

Field services in the logistics business are becoming important for company's competitiveness. Many companies and retailers are outsourcing their logistics operations and pursue to offer their end customers more value. Field services in the logistics operations can offer substantial competitive advantage also for the customer. Offering field services and managing them effectively is the key to fulfilling high customer demands and delivering good value. The field services offer possibilities for growth especially in B2B services and in e-commerce of larger B2B products.

8.1 Theoretical implications

The literature review presents process steps for planning new field services. The steps include districting and facility location planning, alongside with the process design and manpower planning. The research part of the thesis offers insights to field service development process by identifying the information content needed to pursue the development steps. The data was collected mainly through internal interviews from different units within the case organization. The thesis research implicates that all the service related information content such as volume, geographical service areas or worker competencies must be identified before the planning can be finalized. Therefore, the research contributes to the existing literature of field service development by identifying the important data to be collected before the production can begin.

The service specific data is also identified important in the literature review. A few scholars emphasize the importance of service instructions or equipment information needed for successful field service production. The research interviews identify the same importance and define how the information should be handled. The interviewees emphasize the need for a field service application to digitalize the service related data and instructions. The data needed for field service production must be well structured for efficient digital data management.

8.2 Managerial implications

The research identifies an abundance of information needed in field service production. The field service operations should produce data of the service execution, the service duration and problems occurring in the field. The field service worker should always be able to check

the service instructions for a seamless workflow. Moreover, digital systems should help in performing the service tasks more efficiently, without manual reporting. The services the company offers should be uniform and similarly defined to enhance field service management. For this purpose, the data model was created to improve the service integrity by modeling data for all the field services on a fundamental level.

Identifying the important process steps and information flows are essential in increasing the field service efficiency. The research shows multiple important development points that are needed for increasing competitiveness and allowing the areal expansion of field services. The company should focus on developing new digital channels as well as altering the existing technical integrations to create smooth information flows to enhance operations efficiency. B2C field services require sufficient information of the delivery order to be able to guarantee a successful service production. By operating service and delivery data through same systems, the consumer and the customer, can both benefit from an increased amount of data and transparency in the supply chain. In addition, the B2B services require exquisite customer reporting for error control and quality management, without forgetting the increased operational transparency.

The research included the development of a data flow diagram to create a visual modeling of the important field service processes and information flows. The company's digital channel integrations should be flexible and guarantee easy service management. With focusing on time booking development and predictive operations planning, the company can operate at a faster speed and create superior service to their customers. Competitive advantage can be gained. The company must stay focused to enhance digital service management and continue the work to reach the goals of effective field service operations.

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APPENDICES

Appendix 1. Interview structures

(available in English upon request)

Basic information of each interviewee

Perustiedot haastateltavasta

1. Nimi ja titteli
2. Työtehtävät ja vastuut
3. Kuinka pitkään olet toiminut tässä tehtävässä

PART 1

Service development and internal information content

Palvelukehitys ja sisäinen tietomallinnus

1. Mitä uusien kenttä palveluiden / prosessien kehitys ja laajentaminen tuotannon osalta vaatii?
    - Nykyisten palveluiden rinnalle optimoituna muuhun liiketoimintaan
2. Minkä koet olevan suurimmat ongelmat palveluiden kehityksessä ja palveluiden laajentamisessa?
3. Ketkä on kenttäpalveluiden tuottamisessa tärkeimmät osapuolet?
4. Mitä on tärkein tietosisältö palveluiden / palveluprosessien toteutuksen mahdollistamiseksi?
5. Millä tavalla palvelutietoja / prosessidataa nyt hallitaan?
6. Miten tuotannon palvelutietoa / prosessitietoa voitaisiin parhaiten hallita? Mikä on best case scenario?
7. Millaista tietoa tehokkaan tuotannon varmistaminen edellyttää?
    - Ottaen huomioon uusien järjestelmien kehityksen
8. Mikä on tavoitetila tuotannon kenttäpalveluiden / palveluprosessien ohjaamiseen?
    - Miten kuvailisit kenttäpalveluiden tuotantoprosessin
        - Nykytilassa
        - Tavoite tilassa

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9. Mitkä ovat tällä hetkellä merkittävimmät ongelmat kenttäpalveluiden kehityksessä tai tuotannossa?
10. Mitkä ovat organisaation palvelukehityksen tavoitteet teidän näkökulmastanne?
11. Miten tietosisältö muuttuu järjestelmäkehityksen myötä? Vai pysyykö se muuttumattomana?

PART 2

Customer interviews – field service need and development

Asiakaskohtainen palvelukehityksen tarpeiden selvitys

1. Miten tärkeänä koette palveluiden tuotannon omassa liiketoiminnassanne?
    - Miten tärkeitä kenttäpalvelut ovat liiketoiminnassanne?
2. Mitä lisäarvoa valtakunnallinen kenttäpalveluiden yhteistyökumppani voisi teille tuoda?
    - Mitä arvoa tarjoatte asiakkaillenne Postin suorittaessa kenttäpalveluita?
3. Millaista tietoa tarvitsette palvelutuotannon tilanteesta?
    - Palveluiden sujuvuudesta, aikataulutuksesta, laadusta?
4. Millaista tietoa teidän on tärkeä välittää omille asiakkaillenne palveluiden suorituksesta?
    - Millaista raportointia välitätte omille asiakkaillenne?
    - Mitä kautta asiakkaat saavat tietoja teiltä? Muukin kuin laskutus?
5. Mikä on mielestänne helpoin tapa jakaa tietoa?
    - asiakkaan oma näkymä, integraatiot omiin tai asiakkaan järjestelmiin
6. Mitkä ovat tärkeimmät syyt omien sovellustenne käytölle kenttäpalveluiden tuotannossa?
    - Yrityksen oman sovelluksen tarve
    - Monella tarve käyttää omaa sovellusta, mutta uusi tekniikka palvelussa mahdollistaa, että käytetään yhtä sovellusta ja jaetaan tieto helposti API rajapinnan kautta

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PART 3

Service market development - drivers and trends

Palveluliiketoiminnan markkinoiden kehitys – Trendit ja ajurit

1. Mitä ovat yleisimmät trendit kenttäpalveluissa ja niiden tuottamisessa
    - Maailmalla ja Euroopassa?
    - Suomessa?
1. Miten eri toimialoilla palveluliiketoiminta on kehittynyt?
    - Asiakaslähtöisesti? B2B / B2C
2. Onko palvelutuottajien määrä lisääntynyt merkittävästi?
    - Muovautuuko ennemminkin olemassa olevien yritysten tarjoama?
3. Onko palveluliiketoiminta kasvamassa jossain?
    - Jollain toimialalla erityisesti?
4. Mitkä syyt johtavat mahdolliseen lisääntyneeseen palveluiden tuotantoon?
    - Mitkä ovat johtavia kehityksen eteenpäin viejiä (digitalisaatio?)
    - Miten palvelua tuottavien yritysten tulisi reagoida muutoksiin kuluttajien/yritysten palvelutarpeiden osalta?
        - Muutoksia organisaation toimintaan? Mindset?
5. Tekevätkö yritykset itse vai ulkoistavatko useammin?
    - Mitkä ovat tähän merkittävimmät syyt?

Appendix 2. Data model

Entire and closer views represented.

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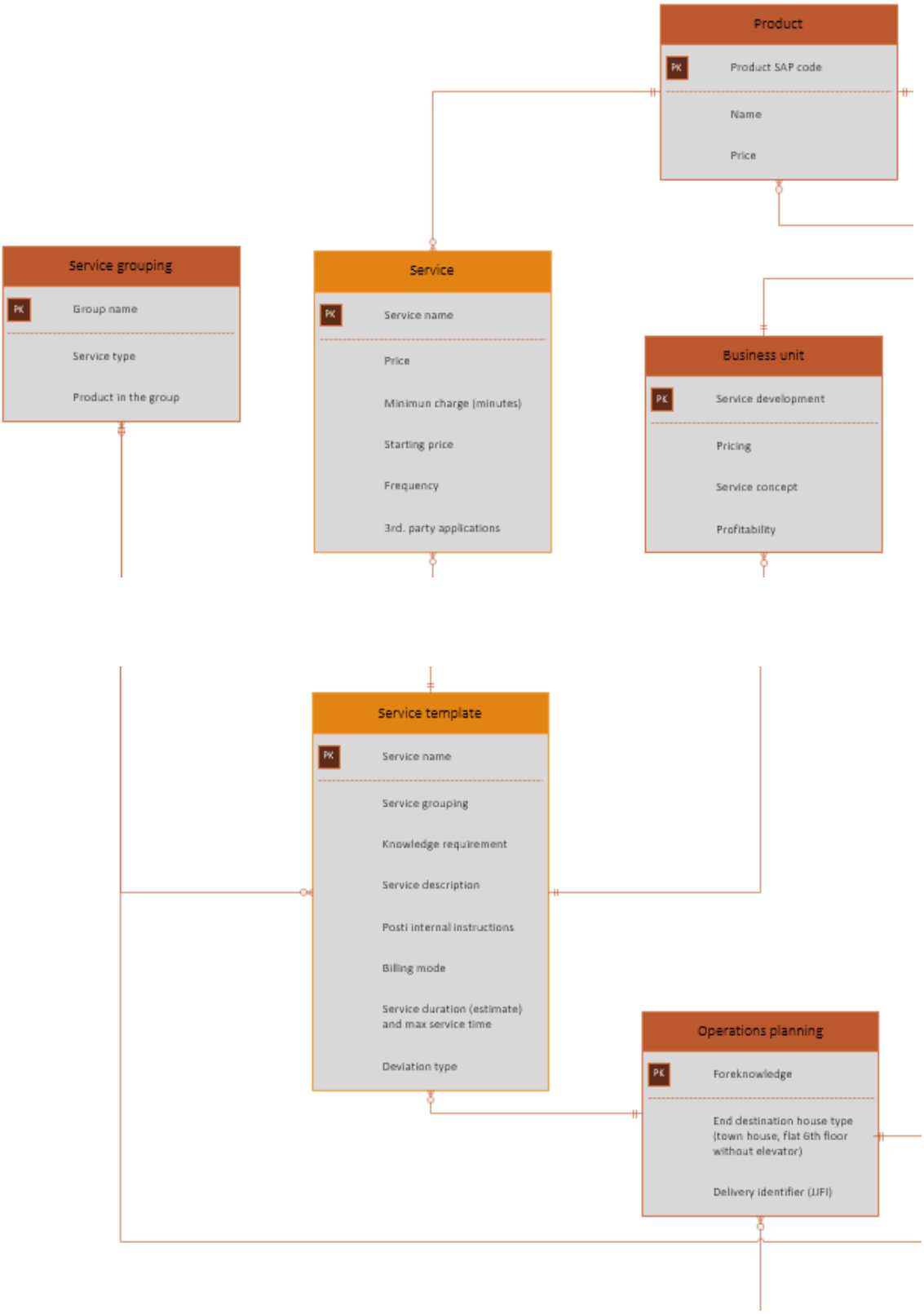

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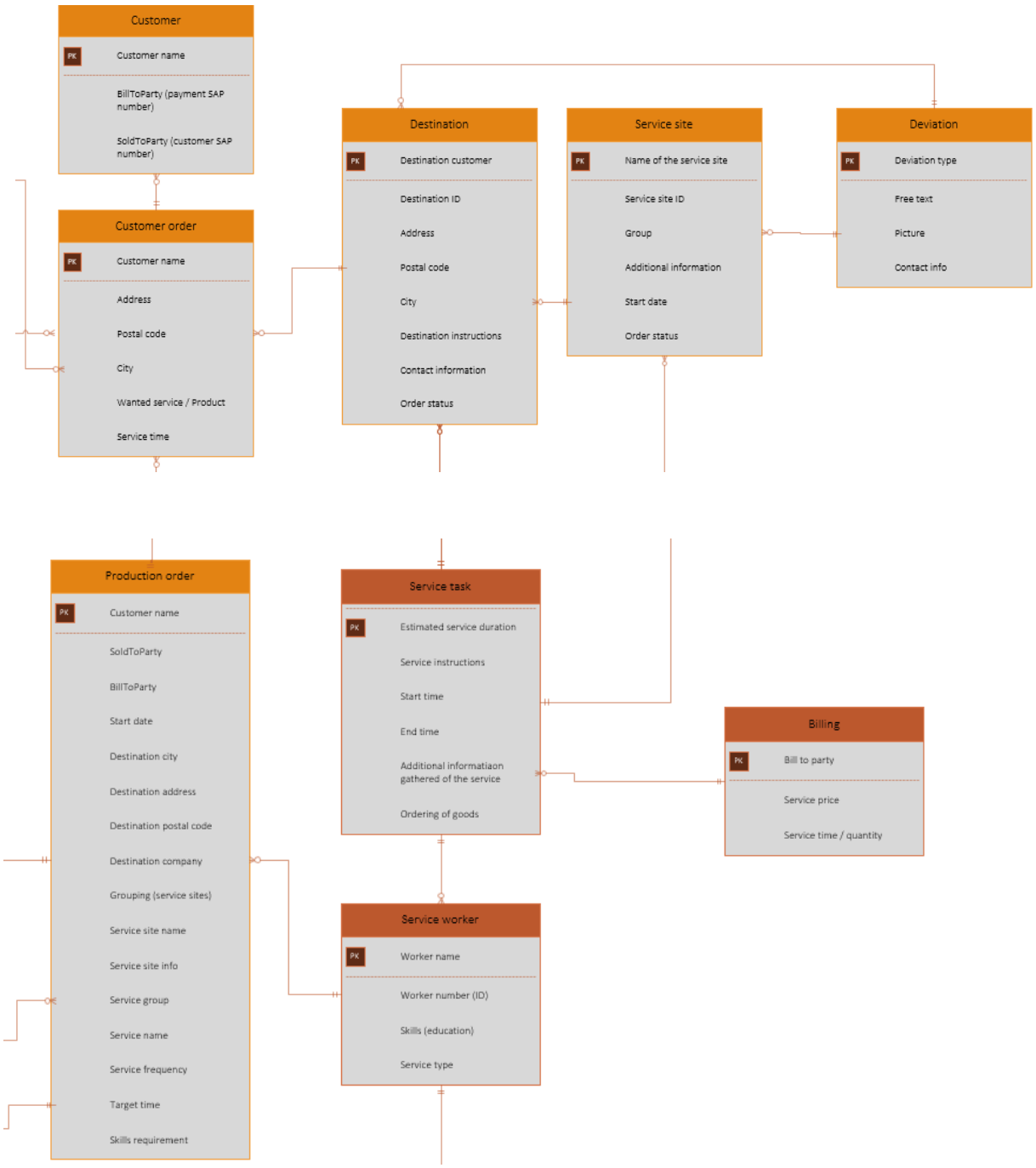
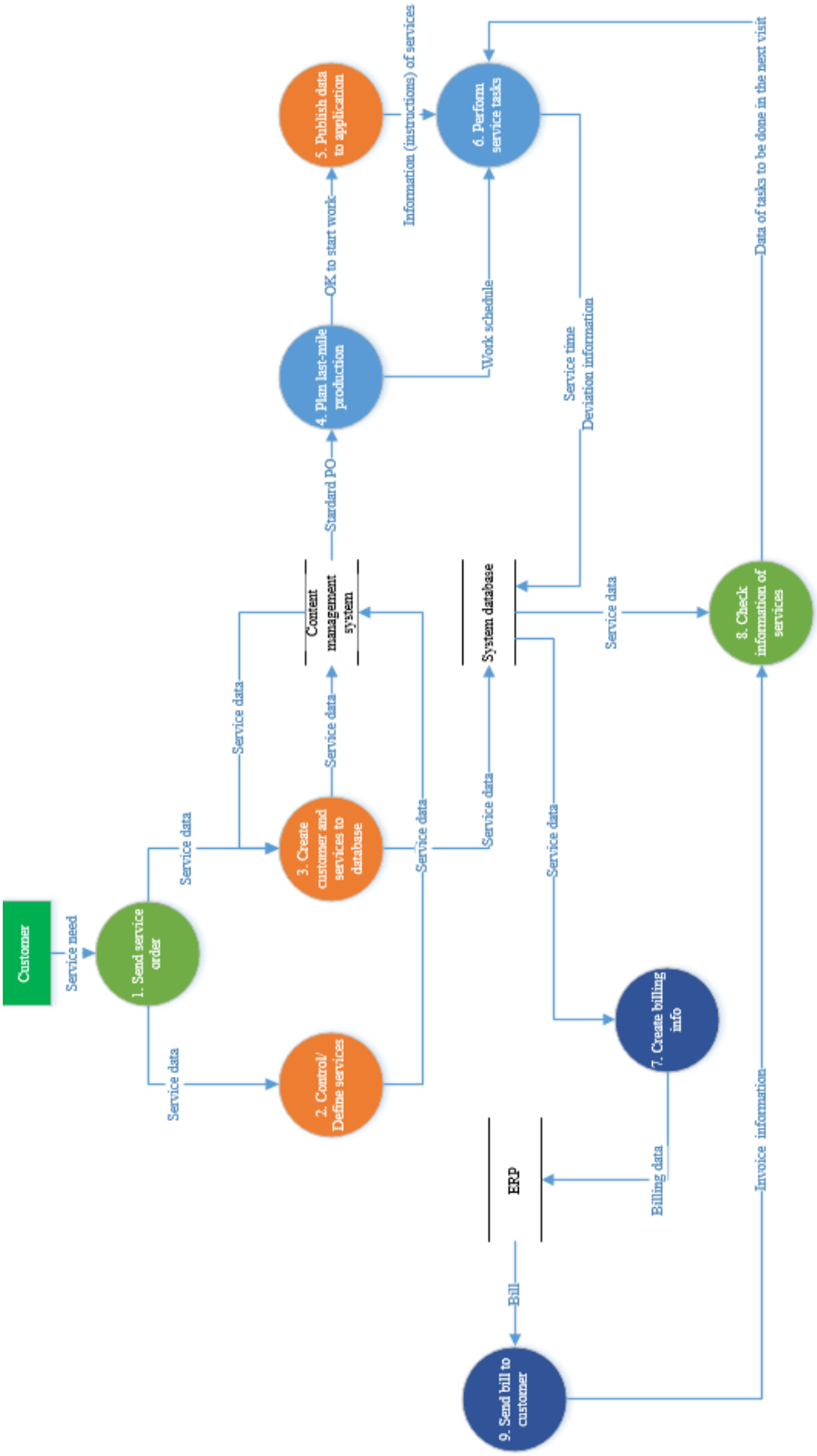
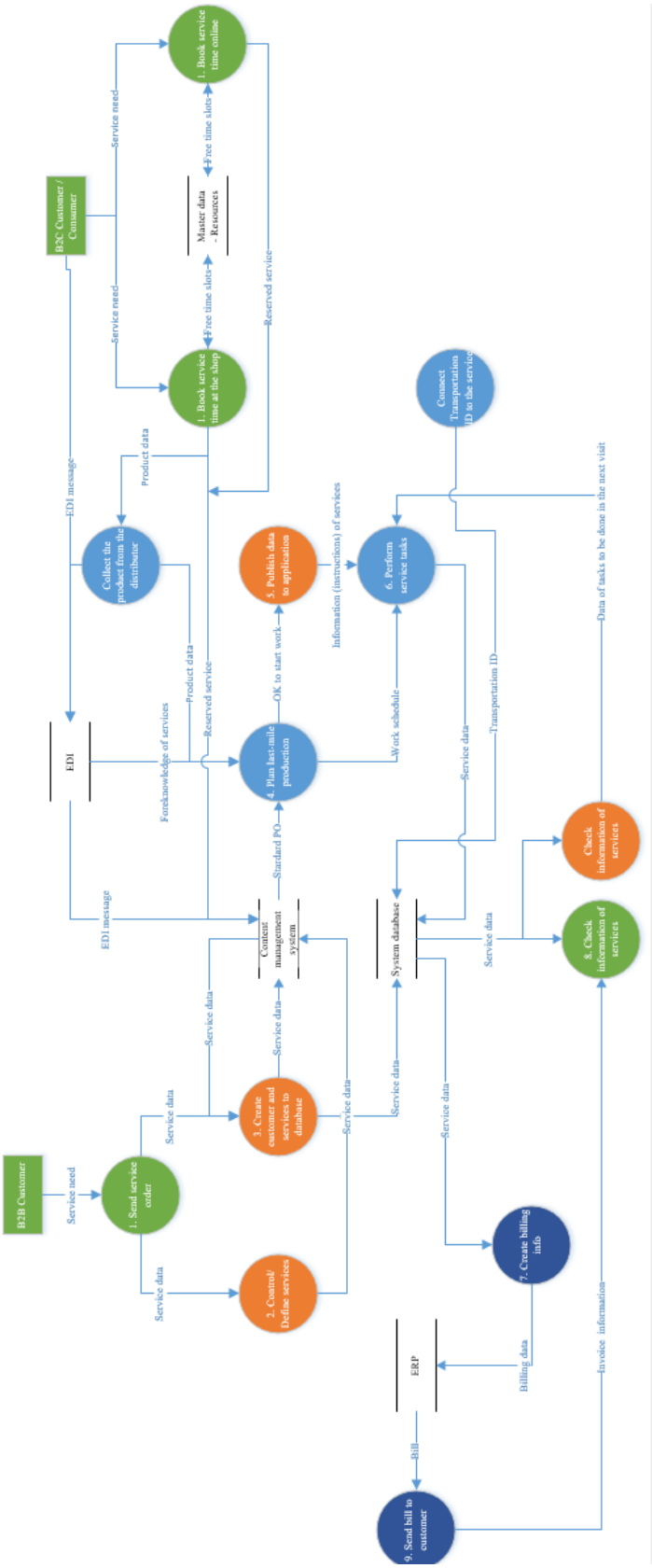

Customer
PK
Customer name
BillToParty (payment SAP number)
SoldToParty (customer SAP number)
Customer order
PK
Customer name
Address
Postal code
City
Wanted service / Product
Service time
Destination
PK
Destination customer
Destination ID
Address
Postal code
City
Destination instructions
Contact information
Order status
Service site
PK
Name of the service site
Service site ID
Group
Additional information
Start date
Order status
Deviation
PK
Deviation type
Free text
Picture
Contact info
Production order
PK
Customer name
SoldToParty
BillToParty
Start date
Destination city
Destination address
Destination postal code
Destination company
Grouping (service sites)
Service site name
Service site info
Service group
Service name
Service frequency
Target time
Skills requirement
Service task
PK
Estimated service duration
Service instructions
Start time
End time
Additional informatiaon gathered of the service
Ordering of goods
Billing
PK
Bill to party
Service price
Service time / quantity
Service worker
PK
Worker name
Worker number (ID)
Skills (education)
Service type

Appendix 3. Current state data flow diagram



Appendix 4. Initial data flow diagram for the 1st workshop

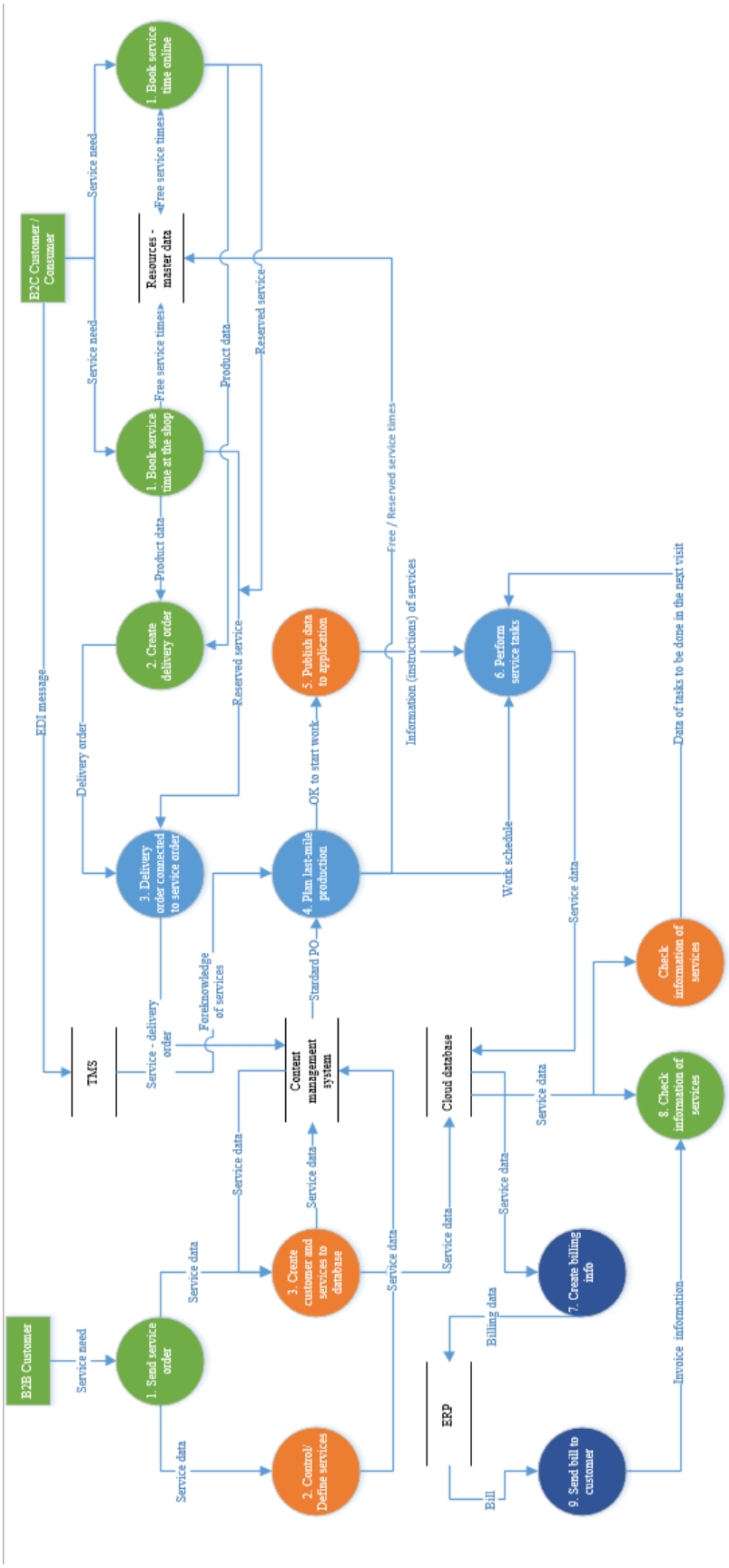


Appendix 5. 1st workshop, silent generation of ideas

Mitä on tärkein tietosisältö? / What is the most important information content?
Mitkä ovat tärkeimmät prosessin vaiheet? / What are the most critical process steps
Mitä ovat tärkeimmät järjestelmävaatimukset? / What are the most important system requirements?

Important factor	Specification
Capacity planning	Allocation and planning of resources
Work scheduling	Predicted duration, agreed service time, actual time of the service execution
Linking the service to the transportation / distribution	The service order and service details should be linked to the transportation or distribution ID early in the process
New time for service	If a new time needs to be booked for the service execution, the customer experience should be maintained good
In real time	All the information related to the service or the transportation should be offered to the customer and the business management in real time
Deviation information delivered to the customer without delay	All possible problems in the production should be communicated to the customer at once
Additional information	The service situation may require some additional information to be filled out and the systems should be able to add data to the service tasks (other than deviation)
Quality control	Efficient reporting to ensure the good quality. Training of employees and effective management of service orders
Service definitions	The service that is configured to the system needs to be well defined (what the service includes, duration, skills needed, equipment needed) for ordering, planning, and execution of the services to be effective
Skills requirements	The worker competencies must be well defined
Pre-delivery data received early enough	The transportation orders need to produce sufficient prediction of the delivery arrival for efficient planning
Service availability	The service availability should be defined so that the as the customer (service time and service area)
Transparency	The whole process should be from end-to-end digitally transparent so that all the steps and phases of the process can be managed and reported later
Time machine	The customer should be able to order service times rather accurately from a service calendar
Uniform operations at the customer site	All the service workers operate similar ways and have gone through similar training. The operations process is well defined
Completed service linked to the transportation confirmation	The knowledge of the completed service should inform the customer that the order has been fulfilled successfully

Appendix 6. Desired state data flow diagram – after 1st workshop



Appendix 7. Final desired state data flow diagram – after 2nd workshop