Aalto University
School of Science
Master's Programme in Computer, Communication and Information Sciences

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# Improving the Customer Support Process for a Software Product:

## A Holistic View

Master's Thesis
Espoo, 11th February, 2020

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Advisor: Aleksi Eskelinen, M.Sc. (Tech.)

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ABSTRACT OF MASTER'S THESIS

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A ship spends most of its life cycle during its service phase. This includes customer support for onboard software systems advising the crew on optimal vessel operation. To improve the relationships between the customers and the case company, this thesis investigates *how can the customer support process for a software product be improved at the case company*.

First in this study, a literature review was conducted on software customer support frameworks to understand the existing methodologies and their strengths and weaknesses. Then, an empirical study at the case company was conducted by interviewing both the support engineers and a customer organisation of the system.

The research found out that while the internal customer support process was well defined, some customers had problems with consistent communication from the case company. Also, issues with knowledge management were found which are tied to internal documentation and reporting practices. The supporting systems of the customer support, such as the ticketing and monitoring systems, had great usability and technical issues. Adopting process models from either CMMI, a maturity model for services, or ITIL, an IT service management framework, could improve the quality of the customer support. In addition, service design can help find future improvements for the service system.

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Laivat viettävät suurimman osan niiden elinkaarestaan palveluvaiheessa. Tämä sisältää asiakastuen laivan ohjelmistojärjestelmille, jotka ohjaavat miehistöä laivan operoinnissa. Jotta suhteita asiakkaan ja tapauksen yrityksen kanssa voitaisiin parantaa, tämä diplomityö tutkii *kuinka ohjelmistotuotteen asiakaspalveluprosesseja voisi parantaa tapauksen yrityksessä*.

Työssä tehtiin kirjallisuuskatsaus ohjelmiston asiakaspalvelun viitekehyksistä, jotta opittaisiin niiden menetelmistä, vahvuuksista ja heikkouksista. Tämän jälkeen tehtiin empiirinen haastattelututkimus tapauksen yrityksessä, jossa haastateltiin sekä asiakaspalvelijoita että yhtä asiakasorganisaatiota.

Tutkimus selvitti, että sisäinen asiakaspalveluprosessi oli hyvin määritelty ja onnistunut. Asiakkailla oli kuitenkin ongelmia yhdenmukaisen kommunikoinnin kanssa. Yritykseltä löydettiin sisäisiä tiedonhallintaongelmia, jotka liittyvät dokumentointi- ja raportointikäytäntöihin. Sen lisäksi asiakaspalvelun tukijärjestelmissä, kuten asiakaskontaktijärjestelmässä, oli runsaasti käytettävyyteen ja toimivuuteen liittyviä ongelmia. Asiakaspalvelun laatua voisi parantaa käyttämällä esimerkiksi CMMI- tai ITIL-viitekehysten prosessimalleja. Lisäksi palvelumuotoilu voi auttaa yritystä löytämään lisää parannuksia palvelujärjestelmään.

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| **Asiasanat:** | asiakaspalvelu, tuote-palvelujärjestelmä, IT-palvelunhallinta, ohjelmistoprosessikehitys, palvelumuotoilu |
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Espoo, 11th February, 2020

Neero Lius

# Contents

# Chapter 1

# Introduction

This chapter provides the context for this thesis and the purpose of the research. The research problem and questions are laid out and the scope of the study is outlined. Finally, the structure of the thesis is described in more detail.

## 1.1 Background and Motivation

Most vessels are in operation for decades. Before the vessels can be sailed, years of creating concepts, designs and then assembling is done. The vast majority of this time, however, is spent during servicing of the vessel. It can be over 30 years under regular service, when in most cases it takes less than 15 years to get into this point. There are plenty of different tasks when creating a new vessel which are visualised in Figure 1.1. Providing good service during this phase can vastly improve the user experience during daily operation (Goffin and New, 2001), and even increase the life time of the onboard systems (Aurich et al., 2010).

The case company provides operational advisory and analytics software for different sea-faring vessels. The software assists both onboard crew and office staff in making better immediate decisions and adjustments over time. However, both the crew and the staff require support with the software from time to time. Software customer support is a well-researched topic and different frameworks for service system manage-

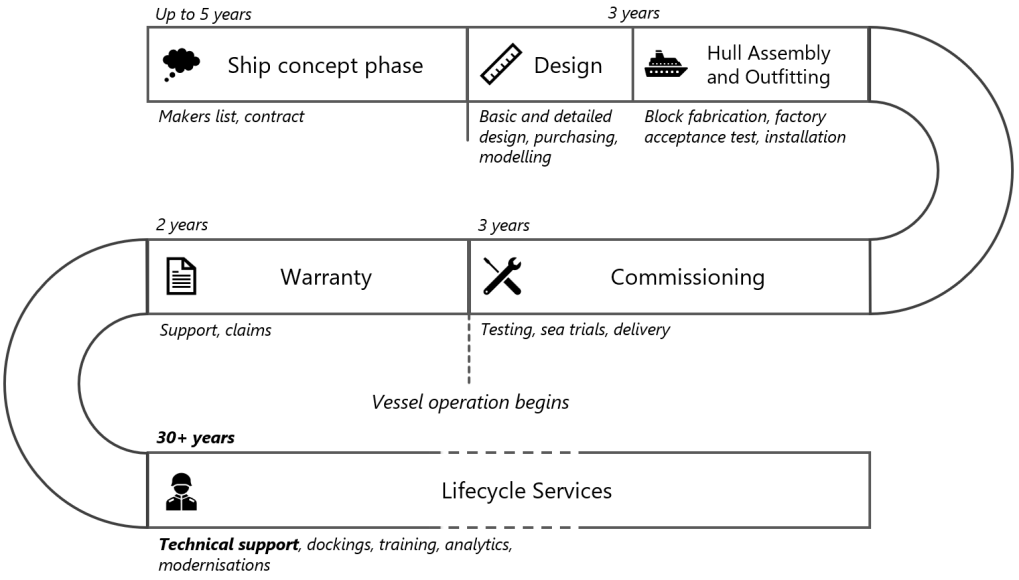


Figure 1.1: An overview of the vessel life cycle. The vessel spends most of its life in the service phase.

ment and service maturity modelling have emerged. The frameworks can be useful tools for providing better customer support. Better customer support, in turn, can provide many benefits, such as being a source of revenue, improving customer satisfaction, or creating a competitive advantage (Goffin, 1999). The advantage is even more important nowadays since the software is no longer unique for the case company. Now, services must be a part of the system to deliver more than the competitors (Aurich et al., 2010).

Since last year, the case company has been looking to improve the project delivery and support processes with the advisory software. There has been a increased interest in improving the level of documentation and how the work is done. The project delivery team has been looking at ways to streamline their actions, but the support team has been lacking in any official guidelines. The study is done in order to create documentation of the support process and to find ways to streamline the process for both support staff and customers.

## 1.2 Research Problem and Questions

The goal of the thesis is to find concrete actions to improve both the customer and employee experience of the customer support process, and to formalise and standardise the process for all employees performing customer support. With this goal in mind, we can define our research problem. The problem will be the backbone for the thesis.

> *How can the customer support process for a software product be improved at the case company?*

The research problem is supported by three different questions each of which address a part of the problem. The questions and their details are listed below.

> **RQ1:** *Which processes and methods can be used to improve software customer support processes?*

The first research question focuses on the existing process descriptions from literature. Its purpose is to reveal possible processes and methods which can be applied in the context of the study and how they are connected. Because the topic combines different frameworks of service management, understanding them well is crucial. Chapter 3 discusses the processes and methods of this research question in detail.

> **RQ2:** *How does the customer support process at the case company work currently?*

The second research question focuses on understanding the current customer support process model. A good understanding includes how the support work is performed, how do customers perceive the support, and which different parts does the support consist of. The parts also need to be evaluated in order to find the most crucial parts for improvement, as some factors are more difficult to change than others. Finally, documentation must be created for different process models and tools. Chapter 4 discusses the details of this research question.

**RQ3:** *How can the customer support process be improved at the case company?*

The final research question focuses on providing the case company with suggestions for improved processes. It combines the knowledge of the current support process with the knowledge of possible methods and uses service design methods and processes to develop new process models. The question also answers how to apply the new methods into daily work and what kind of changes might be required. Chapter 5 discusses the improvement methods to answer this research question.

## 1.3 Scope of the Thesis

The advisory software system consists of both an online component which can be accessed from anywhere, including offices, and an onboard component which is present on the monitored vessels. The end users are different for the online and onboard components but both belong under the scope of the same customer support. The primary scope of the thesis is to look for improvements with the processes and methods from product-service systems, information technology (IT) service management (ITSM), software process improvement models, and service design. They provide principles which are designed to create good customer experiences. Good customer experiences result in an increase in positive results of the service, such as satisfaction and likelihood of recommendation (Sivadas and Baker-Prewitt, 2000), and even customer loyalty (Bowen and Chen, 2001).

Before starting to develop an improved customer support process, it is crucial to gain an understanding of how the it currently works and which issues does it have, and which possibilities does literature offer. The understanding can be achieved interviewing the customer support employees and end users and creating process models for documentation. However, as the number of end users is small for the market and they can be difficult to reach, there are only few end user interviews creating challenges for generating processes which truly solve customer issues.

The scope is limited by the context surrounding the customer support. Within the case company, there are many decisions which affect the customer support process but are considered immutable for this study. These

include the service level agreement contents, development decisions and methods of the software, and business strategy regarding the software portfolio. These are all considered while conducting the study but the potential changes to them are not. This lets the study to focus properly at one problem at a time and not be affected by constant changes in the environment. The goal is, however, to form processes which are adaptable to different realistic contexts they might face.

## 1.4 Structure of the Thesis

Chapter 2 introduces the research methods used in this thesis. This includes how literature review and empirical study were completed. Chapter 2 also includes a more detailed case description and what information was used as the backbone of this study.

Chapter 3 describes the literature focused on creating and evaluating customer support processes. The first topics discussed are product-service systems, ITSM framework ITIL, and software process improvement model CMMI. They provide activities and artefacts required for the context. Finally, service design is discussed to bring the design thinking to complete the holistic view.

Chapter 4 is about the current customer support performed by the case company. It describes the process according to the interviews, what are the immediate challenges and which are the most potential improvement targets. Due to different business and social factors, some areas are easier to change than others and clear foci are sought.

Chapter 5 suggests the most reasonable but impactful improvements. This includes changes to the support process itself but also to its related tools and documentation practices.

In Chapter 6, how the thesis succeeded in answering the specific research questions is evaluated. They are all inspected individually and discussion on how suitable the methods used in the study is included. In addition, the primary limitations of this study are examined.

Finally, Chapter 7 concludes the thesis by discussing the research problem and how well it was answered.

# Chapter 2

# Research Methods

This chapter goes through the different methodologies used in this study. First, the literature review process is explained and what was its angle of approach. Then, the execution of the empirical evaluation is described. They are also evaluated on how they fit the context of the case company.

## 2.1 Literature Review

To gain a base understanding of the subject, the study began with a literature review. Its objective was to gain knowledge about the research and possibilities around the topic. The review offered the methods and processes used to answer the first research question.

The original objective of the literature review was to begin with the title keywords to understand service design, life cycle support, and user experience, better. However, as the thesis progressed and the focus of the thesis was refined further, the literature review followed service design with software customer support. This revealed keywords to search for software process improvement models, IT service management and product-service systems. Material about the subjects were searched from Google Scholar using various search terms. However, most of the literature was found by snowballing, loosely following the technique described by Wohlin (2014).

Some works found on Google Scholar were interesting based on the title and amount of citations but not available for reading. For these works, resources like Aalto-Finna search service was used which searches the collections of Aalto University Learning Centre and Archive.

After finding potential studies for reading, they were chosen for further examination based on their abstract and purpose. In the beginning, the articles chosen were more general about designing services whereas later they were more specified to discuss service design in the context at hand. In addition, newer material was preferred over old as the new take recent advances into account. However, for the foundations of the key principles, the older material was also examined to gain understanding of the history and to avoid possible mistakes made back then.

Finally, the reading material from different subjects was combined in order to pool their knowledge into one. Having first explored the high level topics by themselves, the literature was linked together to create a holistic view which serves the context of this study.

## 2.2 Empirical Study

An empirical study was conducted in order to understand the customer support at the case company. The customer support process depends on the individuals creating and receiving the support and it is crucial to take their perspectives into account. The empirical study followed the approach of design science with service design methods. The approach was complemented by the literature view.

For the empirical study, it was important to plan ahead how and when different stakeholders are included for which design science and service design methods provided good information. In addition, the context of the study was understood better after gathering data from semi-structured interviews and analysing the data.

### 2.2.1 Case Description

The case company is a global technology company. They provide many different products and systems for different business segments, including industrial automation. Industrial automation involves solutions for various industries, including advisory software solutions for marine vessels. The software has been active since almost the start of the 2010s and has evolved over time to become the system it is today. It provides performance management to reduce emissions and fuel consumption and increase the cost efficiency of the vessel. In addition, it provides assistance for safer operation for rough sea conditions.

The organisation has grown drastically and workload has increased with additional customers. However, with halted development and many new pursued prospects, this has left the current customer support engineers with more work than they have time for. The business strategy of the case company aims to increase the revenue of the unit which motivates the improvement of the customer support.

During 2019, two different advisory systems were combined into one. Previously, they had been handled by different teams with experts in their own respective software. The combined software also resulted in combining the two teams which now have had to learn each other's components. While internally the two components are usually still referred as two different pieces of the same system, to the customer they are only one. The software is split into different modules which the customer can acquire. When there is a need to differentiate, the two system components are referred as Component A and Component B in this thesis.

The customer support team is not the only team handling the software during its project life cycle; at first, the project team delivers and is responsible for the installation of the system. The project team then creates a handover of the system to the support team which increases the complexity of communication both internally but also to the customer. Historically, there has been problems in documenting and delivering information between each step but it has gradually improved over time.

The customer support engineers are responsible for assisting customers and end users with using the system and resolving issues which appear during use. These issues might be caused by bugs or faults in the software

itself, configuration errors on behalf of the customer, or third party sensor or signal errors which are used by the advisory software. In addition to the project team, the support team collaborates with the development team to handle bugs found in the software and sales personnel.

### 2.2.2 Research Process

This study aimed to reach concrete improvement suggestions but not to implement them. These suggestions are the artefacts of this thesis. They were formed with the support of existing literature and interviews with internal and external stakeholders. Based on work by Hevner et al. (2004), understanding both the knowledge base and environment is crucial for research related to information sciences. This is complemented by the stakeholder needs reasoned by the service design discipline (Stickdorn et al., 2018).

For the artefact creation process, design science was chosen as the research approach. Design science suits to be used in IS discipline and complies with the artefact focused objectives (Peffers et al., 2007; Hevner et al., 2004). Hevner et al. (2004) also add that design science addresses problems which are both flexible in terms of design and also social, which the problems addressed by this thesis are.

The design science approach followed is described by Peffers et al. (2007). This thesis does not extend far enough to implement the suggested solutions so some of the steps were not completed completely. Moreover, while the main objective is to produce artefacts, the approach is problem-centred. The perspective stems from the stance of the thesis where it was necessary to first define a problem before starting any research. This further emphasises the statement from Hevner et al. (2004) that the research should yield understanding to create solutions to important problems.

While not necessary (Peffers et al., 2007), the design science process is easier to proceed in a sequence as the approach is problem-centred. The entire sequence is visualised in Figure 2.1. The first step of the research was to identify the problem based on personal motivation and company interests. In practice, this meant choosing the topic of the thesis. Over time, the problem concept has been shaped into a more concrete form which is easier to split into understandable parts. After discussions with internal

stakeholders, the potential solutions were confirmed to bring value to the customer support problem.

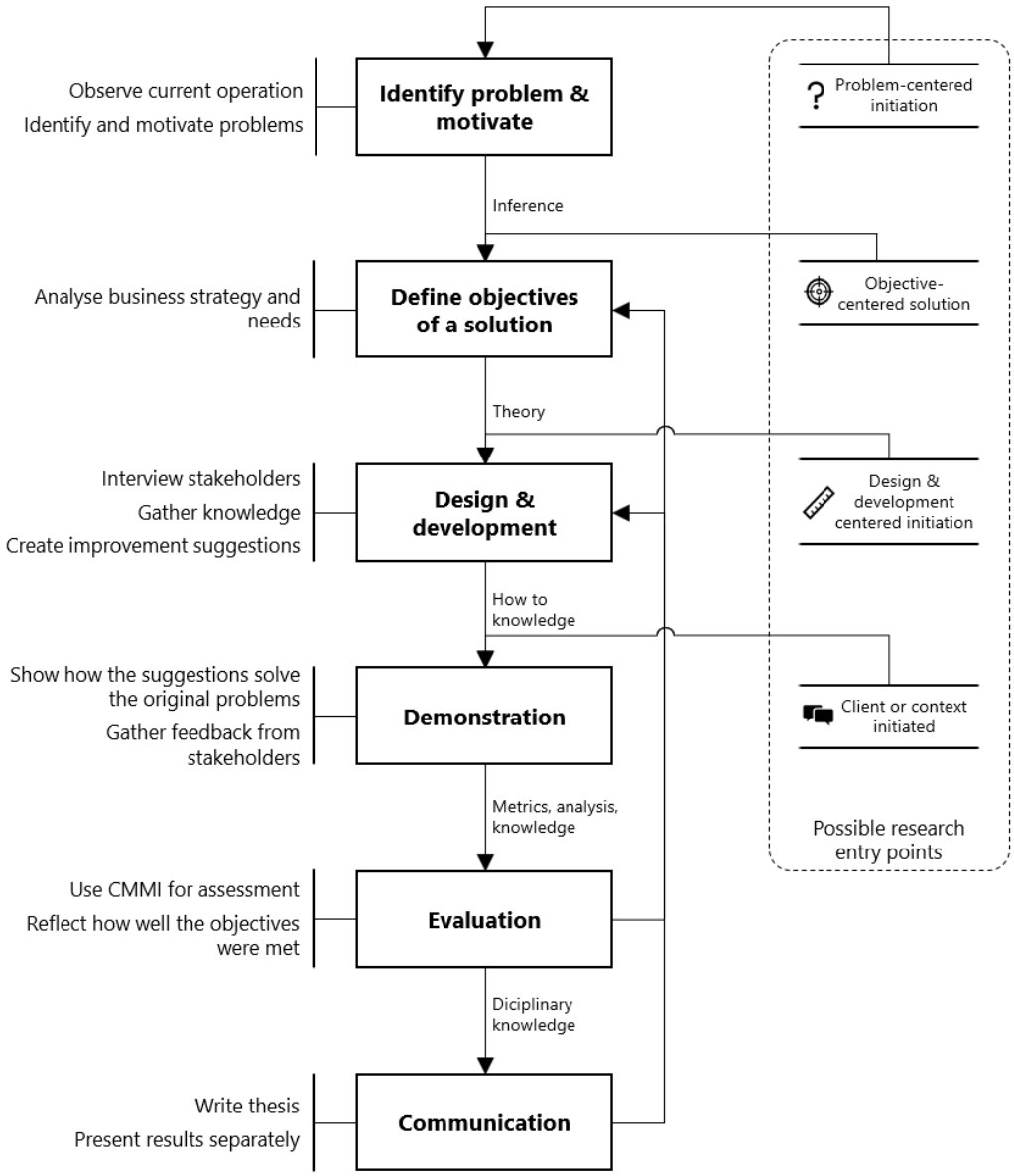


Figure 2.1: The design science research method process model. The activities on the left show the actual activities for this study for each step. Adapted from Peffers et al. (2007).

The potential solutions are also part of the second step in the research process: defining the objectives for the solution. It is necessary to understand which solution properties are feasible or possible. This was only partly

done as it relates to the business strategy which was considered as a static element in this study. A more pronounced understanding of the business and customer requirements could be researched here.

The third step is to design and create the actual artefacts. This, along with the second step, compose the vast majority of the work in this research. The aim is to provide the case company with new process models and methods of working in order to solve the challenges faced when providing customer support. Knowledge used for the development was gathered via literature review of well-known frameworks for a broad view and discussions and interviews for a context-specific view. Using this knowledge, the artefacts can be formed to fit the context and the best practices found in literature.

Then, the fourth step included in this study is demonstrating the use of the produced artefacts. The process would account for implementing the developed processes if it was possible. However, due to time constraints, the demonstration was done quite similarly to evaluation. The demonstration step, however, focused more on finding the concrete achievements of the suggestions.

During evaluation, the improvement suggestions were reflected against the CMMI evaluation framework. Was the new processes implemented, this step would also include iterating the created designs. Finally, the last step is about communicating the results which in this case means writing the thesis and presenting the results.

### 2.2.3 Data Collection and Analysis

The data for the empirical analysis was collected through interviews with both the customer support staff and customers themselves. The interviews were semi-structured and lasted from 30 to 90 minutes. These interviews were conducted in a manner which enabled a natural conversational flow instead of questions which were asked in order. The questions used as the base for the interviews can be found in Appendix A and Appendix B. The internal interviews were done via Skype as due to practical reasons, in-person interviews were not possible. The interviews were recorded for analysis.

The internal interviews included three internal customer support engineers. Two of them, engineers A and B, were performing the first line of support for Systems A and B, respectively. Engineer A was also the second line support for Component A. The third engineer does strictly second line support for Component B. The interviewees are summarised in Table 2.1.

Table 2.1: Overview of the support engineers interviewed

| **Support Engineer** | **Role** | **Expertise** | **Experience** |
|---|---|---|---|
| A | 1st and 2nd line support | Component A | 4 years |
| B | 1st line support | Component B | 1,5 years |
| C | 2nd line support | Component B | 15 years |

Two external interviews were conducted face-to-face during a visit to both a vessel and the customer office. On board, the chief officer was interviewed whereas the superintendent was the interviewee at the office. The interviews focused on understanding how the end users approach the system and what are their main concerns at work. It was found out that this particular customer had not had many issues with the system and both interviewees were overall happy with the system performance. Their needs were focused on a narrow set of features and were mostly concerned with cost and fuel efficiencies during their daily work.

The customer interview, however, felt lacking in transparency. The interviewees seemed to avoid certain topics. This may mean some issues with the interviews themselves or the operation of the case company. Nevertheless, the answers given in these interviews are considered true.

The interviews were analysed by writing out the answers to the questions or other important comments given throughout the interviews. The interview recordings were listened to again in order to find additional findings missed originally. The answers and comments were then grouped by categories and combined from all interviews. Finally, the categories were evaluated to get the collective opinion of the discussed topics. The analysis loosely followed the instructions laid out by Taylor-Powell and Renner (2003).

The analysis of the internal interviews can be found in Figure 2.2. The statements on sticky notes were grouped by categories which had their summaries written out next to them. The first iteration of understanding the process model can be found on the left and the pain points next to them.


Figure 2.2: The categorised internal interview analysis. The sticky notes were individual statements made by the interviewees. Some case identifying information has been blurred.

After the analysis of the internal interviews, further discussions with some of the interviewees were held where they could elaborate on their pain points. This was done due to the process model showing little troubles and the issues were mostly with elements supporting the process. These discussions were open ended and served to provide additional information of the problems they face during the daily work.

# Chapter 3

# Literature Review

This chapter discusses the different service management frameworks and service design which are the focus of this study. These are described independently at first and then their relationships are discussed. The interrelations summarise the findings of the literature review and give the ground work for the empirical evaluation.

## 3.1 Effective Customer Support

After commissioning an industrial product, customer support is required for maintenance and efficient use of the product. The support is provided as a service which assists customers in effective and easy use and extends the life of the product.

Effective product customer support is essential for good customer satisfaction and long-term customer relationships. It can provide a competitive advantage over other products (Goffin and New, 2001) as differentiation can be difficult with some markets.

Goffin (1999) identifies customer support by its seven key elements: installation, user training, documentation, maintenance and repair, on-line support, warranty, and upgrades. These elements lay the groundwork for splitting processes into parts and help at investigating whether the entire customer support chain is holistic.

In order to provide meaningful customer support, the support has to work with the business needs of the organisation as a service. For ensuring their alignment, practices from product-service systems (PSS), IT service management, like ITIL, and software process improvement models, like CMMI, can be used. These practices are used to create guidelines which frame the sought after improvements for the customer support at case company. The guidelines are then used to help with the service design process. Sections 3.1.1 to 3.1.3 discuss these practices and the key activities for designing effective customer support. In Table 3.1, the different focus areas of the guidelines are shown.

Table 3.1: The focus of the different frameworks used for this study.

| **Framework** | **Focus** |
|---|---|
| Product-service systems | Provides product and service design guidelines for the full system life cycle. Focuses on artefacts, process systematisation, and information exchange. |
| ITIL | Provides detail on implementation and what changes have to be made within an organisation for a successful IT service. |
| CMMI | Provides a model to evaluate the maturity of both the current service process and the proposed new process. |

### 3.1.1 Product-Service Systems

Product-service systems (PSS) is a broad topic under which customer support can be placed. PSS can be defined as ”a marketable set of products and services capable of jointly fulfilling a user’s needs” (Goedkoop et al., 1999). In essence, products which are supported by services, or vice versa, can be categorised under PSS. However, PSS must first be further divided since it can cover a plethora of other service systems than customer support. PSS is first split into three main categories: product-oriented, use-oriented, and result-oriented (Tukker, 2004). The main categories can be distributed to be either centred around the product or centred around the

service. The categories differ in how much the system values the product content compared to the service content. Product-oriented PSSs gain value mostly from the product whereas result-oriented PSSs gain it from the service more as is visualised in Figure 3.1.

In the context of the case company, the customer support offered is product dependent so the product-service system is product-oriented in itself. The orientation can be further split into either product-related services, and advice and consultancy (Tukker, 2004). While the case company offers both types of services, the main focus of the study is in product related services which cover customer support for the software product portfolio. All main categories and subcategories can be found in Figure 3.1

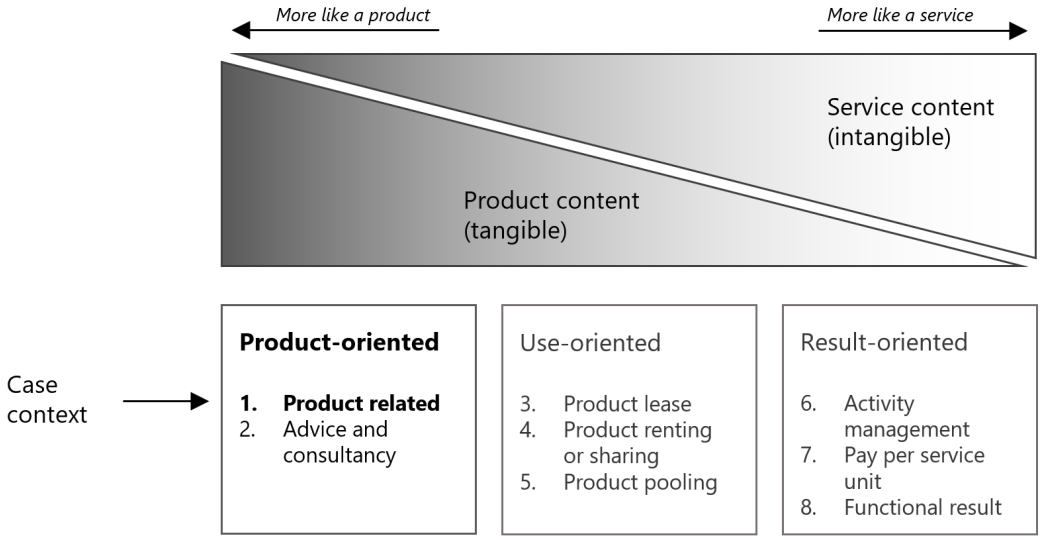


Figure 3.1: The different categories and subcategories of PSS and how their focus is oriented more in either products or services. Some product service systems can be very similar to pure products while some to pure services. The case context deals with product related product-service systems. Adapted from Tukker (2004).

While PSS is often discussed with physical products, its definition does not rule out software systems. Many software products can be categorised by PSS to be more about the product or more about the service, respectively. In addition, some PSS research explicitly state to include software products as well (Mikusz, 2014; Isaksson et al., 2009). Furthermore, Lindström et al. (2012) include software in their work and state that the ”service sup-

port system is needed to keep the ... software operable" when discussing functional products which can be equated to product-service systems.

Creating an effective PSS requires attention to the entire system from the beginning of the system life cycle. A successful implementation provides an increase in functional and resource productivity for system operation. For a single organisation providing both the product and service, it also allows the an increase in value attached to the system and improve the customer relations alongside other benefits. (Mont, 2002) The value can also be seen in enhanced life cycle performance which reduces required resources for both the manufacturer and customer (Mont, 2002), and can extend the time taken until system end of life (Aurich et al., 2010).

Furthermore, a well-designed PSS can be used as means to differentiate from competitors which offer similar services by, as an example, higher product uptime or reduced investment costs (Aurich et al., 2006). Finally, the co-operation of service and development teams allow for greater information flow which in turn creates a more responsive system (Mont, 2002).

With a product-oriented perspective on PSS, the responsibility of creating and delivering value is on the provider opposed to the customer (Reim et al., 2015). The provider should keep the customer as the primary focus when offering technical services. The services should be offered with the customer's point of view to the product life cycle but also to be tailored for the customer's use (Aurich et al., 2006). This means the design of a PSS can vary from customer to customer and the phases of product purchase, usage and disposal should all be considered (Aurich et al., 2006). During the design of the PSS, the product characteristics should also be aligned with the service characteristics, and vice versa (Reim et al., 2015).

Providing a service alongside a product differs from traditional product design. It applies the user-centred, co-creative, and holistic natures of service design and extends the role of providers to the entire life cycle of the product. Considering the customer preferences during design also increases the role of the marketing department to keep in touch and transfer more information both ways. Also, having both product and service design to be considered, different stakeholders must participate in the system design which can prove to be problematic. (Mont, 2002)

To aid further with designing a good PSS, Aurich et al. (2006) describe characteristics of technical services. In the context of customer support in

business-to-business relations, technical services are services which focus in the product core and provide additional value with services. These services can affect the availability, performance, and life time of the product. However, the product must also support the services and so be designed to be compatible with the planned service portion of the system.

The characteristics of technical services can also be extended into key activities of their design phase. To provide the focus during the design of the technical services, Aurich et al. (2006) identify three main processes of the services: customer order taking, service realisation, and information exchange. Creating models for these processes should be the main goal of the service design. The models should be sufficiently described and have enough detail for the actual service provider. The processes are important for proper service delivery but information exchange has a special importance in improving the PSS. In order to keep sufficient service quality, understanding customer requirements and their needs is crucial. Strong interaction with customers enables targeted designs. Information flow during the interaction must be established through communication channels. (Aurich et al., 2006)

When creating the process models for a technical service in PSS, four components can be identified which are necessary to implement for a complete model. The product is described by the *reference* which is the description of the product, its components, and the users of the service. It also includes the effects of the service on the users as well, such as training. While reference covers the product, it covers it with the perspective to the technical service and should verify whether the product is suitable for service integration. (Aurich et al., 2006) Figure 3.2 visualises the components of technical services.

Aurich et al. (2006) also describe the three last components, *description*, *function*, and *resources*. *Description* is an explanation of the service. It covers what service is going to be provided, how it will be implemented, and what are its goals. All different entities and stakeholders are involved and how they interact with each other. *Function* is dedicated for describing the concrete measures of the service operations, i.e. the measurable quantities answering how does the current service perform. Finally, the *resources* component describes the physical resources require for the service alongside any non-physical ones, such as process instructions, knowledge levels, and organisational responsibilities. (Aurich et al., 2006)

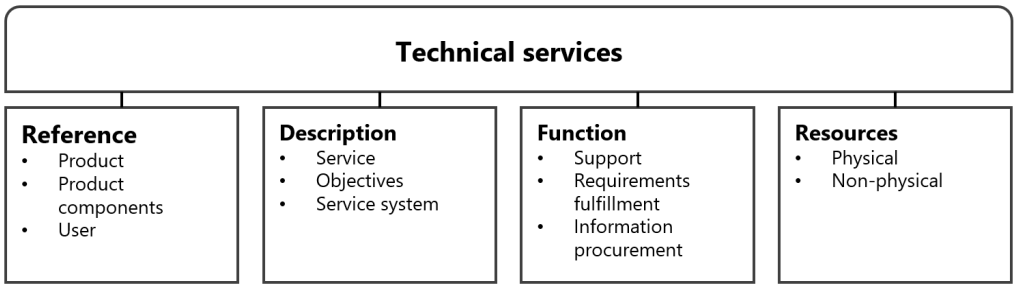


Figure 3.2: A summary of the components of the technical service of PSS and their scopes. (Aurich et al., 2006)

These components should be used with a systematic process when designing PSSs. This process, however, is not explicitly defined and can be created by organisations themselves. Aurich et al. (2006) suggest a systematisation process for the PSS design which can be seen in Figure 3.3. It first analyses the product design processes and information exchange processes of the organisation, alongside technical services in general. This analysis is validated with the design process concept creation. In this systematisation, identifying and analysing available resources and current practices are emphasised.

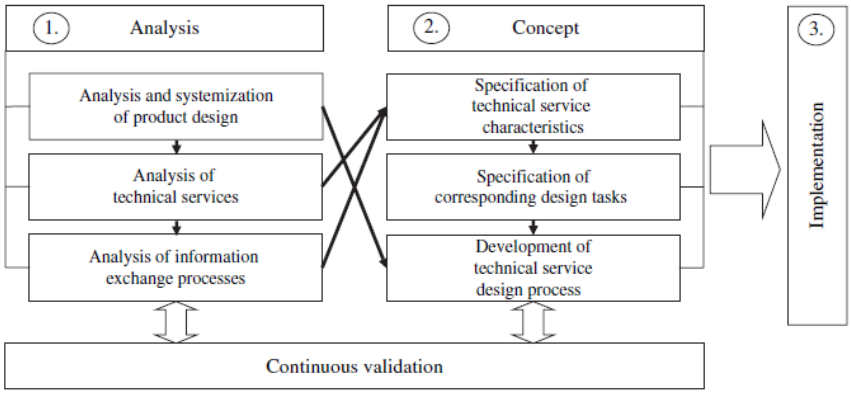


Figure 3.3: The systematisation process for designing technical services. The current processes and resources should be analysed before specifying the service characteristics and design tasks. Reused from (Aurich et al., 2006).

The primary take-away from PSS for the case company is to consider the system as a whole, applying general service design principles already dur-

ing the design of the product. This means informing the software developers of the entire life cycle and designing the PSS with them and other departments. This also means that the scope of services should be explicitly defined. In addition, customer opinions should be heard, especially with such a focused market and few end users. To bring these aspects properly into daily work, the design work should be done with a systematic process which should be clear for all departments.

### 3.1.2 Incident Management with ITIL

When improving the IT service functions, such as customer support, ITSM provides perspective and frameworks to guide the process. It approaches IT operations through the services, customers, and service level agreements, and their activities and processes. (Iden and Eikebrokk, 2013) However, ITSM does not have a single definition (Iden and Eikebrokk, 2013) and is usually practised by frameworks which define practices to achieve it. (McNaughton et al., 2010)

While not the only one, the most popular framework has been ITIL with an increasing popularity over the years (McNaughton et al., 2010). ITIL is a large library which considers offering services from different perspectives. In the third version, it contains five publications: ITIL Service Strategy, ITIL Service Design, ITIL Service Transition, ITIL Service Operation, and ITIL Continual Service Improvement.

The publications are tied together by the first publication of the fourth version: ITIL Foundation (AXELOS, 2019). It provides a set of guiding principles for the service value system. These principles are designed to fit any organisation and their context when improving IT service management processes. These principles range from focusing on value to keeping it simple and practical. These principles share the perspective with other frameworks, methods, standards, and others, such as agile and service design. The primary perspective is to focus on value. It ensures that all actions benefit either the organisation or the customer.

By applying the ITIL framework, organisations can deliver better IT services to meet business goals (Iden and Eikebrokk, 2013; Peak et al., 2005), improve the quality of IT services, and reduce long term resource costs for providing services (McNaughton et al., 2010). ITIL provides a way to use

other design activities and methods, and context for the existing service structure. (Barafort et al., 2002) It also helps in gaining a better view of the goals and processes for an IT service which makes systematisation easier.

However, some writers like McNaughton et al. (2010) and Hochstein et al. (2005) have argued that the benefits of ITIL lack any quantifiable data to support them and many users simply assume but not verify that the adoption of the ITSM framework has helped them. Nevertheless, ITIL provides strong guidelines and assists with which topics need to be considered when designing customer support activities which is why it is suitable for this study.

ITIL is not a framework which must be either followed entirely or not at all. Organisations applying ITIL generally do not follow all publications or even all individual processes within a single publication. In the surveys compiled by Marrone et al. (2014), the organisations using ITIL followed half of the ITIL processes on average. This allows organisations to choose the most important areas for improvement and keep the scope sufficiently narrow.

While all five publications contribute towards a successful service, this thesis will mostly consider only the Service Operation publication. This restriction is made in order to keep the focus of the study in the actual service instead of business models and similar factors. Service strategy, design and transition offer little for the guidelines of what customer support should be which is why ITIL is used in this study in the first place. The ITIL Service Operation describes in detail which factors need to be considered for successful service activities. (AXELOS, 2019)

In this study, ITIL will be considered when creating guidelines for the customer support process models, choosing technologies, and managing people. In addition, ITIL discusses different perspectives on balance which must be maintained in order to provide valuable services. An example of one of the perspectives is the balance between external and internal focus of the organisation. These provide some possible artefacts of ITIL and are described in more detail in Table 3.2. The incident management process is the primary focus of ITIL in this study. It is also the most adopted individual process of ITIL (Marrone et al., 2014) which means that it is also better established in businesses than the other processes.

Table 3.2: Example artefacts which can be acquired from applying ITIL. (OGC, 2011)

| **Artefact** | **Description** |
|---|---|
| Incident management process model | A step-by-step flow chart to describe the incident management process. Used to document the task and provide instructions to the support personnel. |
| Stakeholder map | A map of all people involved in the customer support processes. Involves customers, support personnel, and managerial positions and separates them by type. |
| Communication models | A model to visualise the communication and interaction between stakeholders. Includes the possible forms of communication and situations where communication is required. |
| Required technologies | The software and hardware required for the customer support processes. |
| List of relevant conflicts | A list of conflicts for future consideration and continuous improvement. |

### Creating Process Models

Out of the five different service operation processes explored by ITIL, only incident management is discussed in detail in this study. While the other processes would complete investigation of the service operation at the case company, they involve stakeholders and tasks which are not within the scope of this thesis.

In ITIL, an incident is ”an unplanned interruption to an IT service or reduction in the quality of an IT service or a failure of a CI [configuration item] that has not yet impacted an IT service” (OGC, 2011). Thus, incident management aims to restore the service operation to the agreed quality level. Any disruption, present or future, is involved in the scope and should be resolved. Incidents are triggered either independently via e.g. an email, or by the event management system. Event management is one

of the other ITIL processes where events which are exceptions trigger incident, problem or change management processes depending on the exact classification. The exact characteristics of an incident is up to the organisation to decide. (OGC, 2011)

It is important to note that incidents are not problems in ITIL. Problems are the root causes of incidents and resolving an incident does not necessarily solve the problem. Problem management has its own process which has different objectives and tasks. (OGC, 2011)

Formalising incident management ensures proper care of the service disrupting event and provides many different benefits. First, the standardised operation processes are able to provide efficient and timely resolution, documentation, and reporting of the incident. In addition, the processes increase the perception of IT services with the better communication and visibility to both management and customers. Providing efficient care with incidents also maintains the quality and, thus, the user satisfaction of the services. Finally, the value extends to the business as well with less time spent with individual items, lower downtime, and identifying future needs within the organisation. (OGC, 2011)

ITIL suggests an incident model which describes a regular operation when a new incident occurs. It defines steps which the support engineer can follow in a sequential order. It should include all steps required for handling, their dependencies, responsibilities, and timescales and thresholds for completion. Some of the steps are for dealing with the incident directly whereas others might be precautionary or escalation to higher level of support. For major incidents, there must be a separate model due to the urgency of the situation. The process model for standard incidents proposed by ITIL can be found in Figure 3.4. The components of Figure 3.4 are described further in Table 3.3. (OGC, 2011)

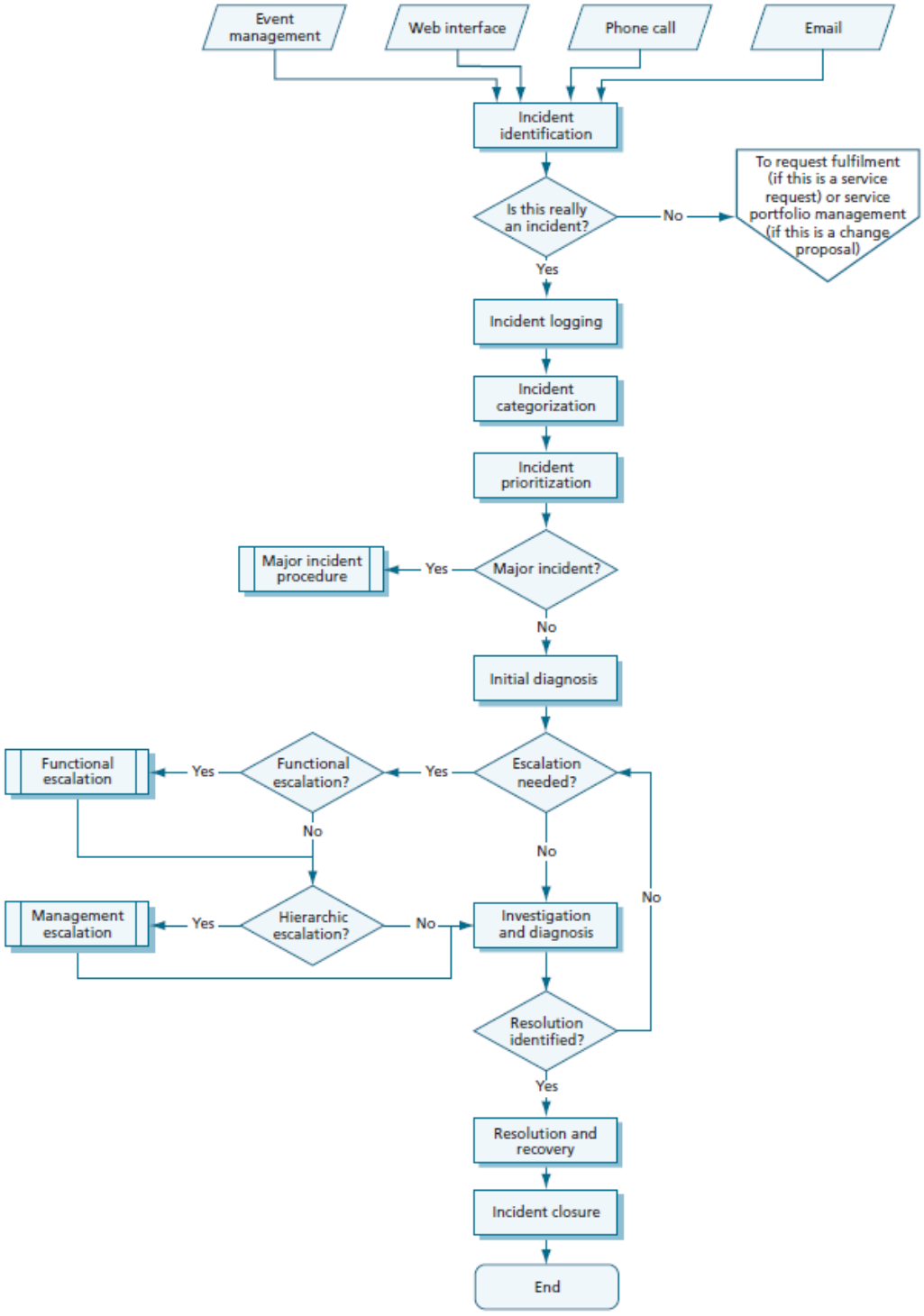


Figure 3.4: The ITIL incident management workflow. Reused from (OGC, 2011)

Table 3.3: The components of the incident management process model. (OGC, 2011)

| **Component** | **Description** |
|---|---|
| Identification | The event must be identified as an incident. Events and incidents should be monitored proactively. |
| Logging | All incidents require the logging of detailed information regardless of their urgency. This information includes names, dates, categories, related items, symptoms, and others. |
| Categorisation | The incidents must be categorised for later analysis on frequent issues. The category may change throughout the incident life cycle. The used categories should be predefined by the support team together. |
| Prioritisation | The incidents need to be evaluated by their impact to business and urgency. They can be combined to a 2D-matrix with low, medium, and high statuses for both variables and combining them into a 5-step scale. The scale can then be used to define the proper response to the incident. |
| Initial diagnosis | The symptoms of the incident should be investigated in order to understand the cause and resolution to the incident. Incidents should be matched to previous known cases found in the knowledge database. |
| Escalation | If the service desk is unable to resolve the incident, it must be escalated to the next line of support. This is called functional escalation. However, the escalation must sometimes also involve managers for communication which is then hierarchic escalation. |

Table 3.3: (continued)

| Component | Description |
|---|---|
| Investigation and diagnosis | Most incidents require deeper examination to understand and resolve. This step, however, should not be done after the others but should be considered to be done parallel with other tasks. |
| Resolution and recovery | Applying the solution to the incident must be applied and then tested for successful implementation. This might involve the end user that the problem is also resolved on their end. |
| Closure | The incident should be closed after the end users or customers agree that the solution works. The service desk should also verify the category of the incident, complete a user satisfaction survey if necessary, manage documentation for the issue and determine whether the incident also resolved the root cause or not. The incident can then be closed. |

The challenge for implementing the incident management is having adequate detection systems in place. As one of the goals is to improve the perception of the IT services, solving the incidents before they reach end users is crucial. This requires proper event management tools and incident reporting. Resources can also prove to be inadequate as the process can be heavy; providing enough both service engineers and information about the problems can be too challenging at first. (OGC, 2011)

Implemented ITIL processes can be evaluated by following different critical success factors. They are defined for each management process separately and include the key performance indicators (KPI) which can be used to measure the factors themselves. As an example, one of the critical success factors for incident management is ”maintaining quality of IT services” which is a high level factor in itself. It is, however, complemented by its KPIs which define it more explicitly; total number of incidents, size of current incident backlog, and number and percentage of major incidents provide the metrics for evaluating the factor.

### Managing People

It is important to understand that customer support services often involve people at both ends. People are what enable the systems, support, and care for customers. This involves many different parties and mapping the customer support stakeholders is important in providing clear and effective services. This enables understanding which roles are fulfilled and what everyone is doing. This further helps creating the processes models as it clarifies who completes which steps. (OGC, 2011)

There are plenty of stakeholders involved in service management, such as the customers, users, service providers and partners. Many of them are, however, mostly involved in planning the service strategy which is out of the scope of this study. The stakeholders most important for service operation are the teams within the providing organisation, i.e. the management, service desk, and technical management. Their roles and primary tasks should be stated explicitly in order to provide successful service. (OGC, 2011)

Changing the roles and ways of working in an organisation can be difficult, however. As the organisation personnel are the backbone of the service, their personal values also show in the effectiveness and operation of the service. Implementing new processes will affect the culture as well and it is important to prepare people to the changes with effective communication. The staff members need to be convinced to follow the processes as having some incidents not logged in can mean to others that they do not exist at all. (OGC, 2011)

For service operation, proper communication between the different teams, users, and customers is required. Sharing information is crucial not to be stuck with poor knowledge about a simple issue. Still, information should be shared with a purpose and to a clear audience. The form of communication is not defined strictly by ITIL. Rather, the organisations should choose the methods themselves, be it face-to-face meetings or email. ITIL does, however, describe the most important forms of communication, their purpose, frequency, audience, content, and sources. These should be explicitly stated. (OGC, 2011)

#### Managing Technologies

The service desk has to be provided with appropriate tools for them to be able to provide support. Most of the technological requirements stem from the necessary processes; a ticket managing system like ConSol helps considerably in managing the information saved with each incident. Ticket managing systems usually also provide functionalities for measurement and reporting which are useful in analysing the incident management and improving the process. There also needs to be tools for proactive monitoring for event detection and alerts for exceptions. (OGC, 2011)

The most substantial need is building a knowledge database which provides information on common incidents and how to solve them. ITIL suggests maintaining a service knowledge management system which includes all the tools for IT services, including enabling all actions necessary for transforming data into knowledge and maintaining it. It consists of 4 layers: data, information integration, knowledge processing, and presentation layers. These layers can have multiple tools, or have tools which span over different layers. As an example, a ticketing system can be a part of the presentation, knowledge processing, and data layers. (OGC, 2011)

It is not necessary for an organisation to immediately work on creating a service knowledge management system (OGC, 2011). The data layer, however, should be present for any organisation which is aiming for managed processes of CMMI (CMMI Product Team, 2010). This layer is the first step on creating a knowledge database.

### 3.1.3 Process Evaluation with CMMI

In general, it is not enough to design and implement a system once but its quality must also be assessed. For evaluating current and future software processes, software process improvement models can be used. These models, such as the CMMI (CMMI Product Team, 2010) and ISO/IEC 15504 (ISO/IEC, 2003), provide methods to assess and improve the processes systematically to increase the process efficiency which in turn can improve the quality of software, productivity of employees, and return on investment (Raninen et al., 2015). The models focus on any kind of software processes, from development to managing life cycles, but include

areas which can be used for customer support evaluation. Specifically CMMI includes a publication for services (CMMI Product Team, 2010) which describes the goals and practices in improving service processes. It also enables maturity evaluation of individual services and organisations through capability and maturity levels, respectively.

The levels are tied to the approach of CMMI which is to provide either a continuous or a staged representation of the system or a service. These representations provide the improving organisation a way to evaluate their current level of operation and the target they wish to achieve. They have different perspectives to improvement they differ by their scope: continuous representation selects a process area of a service and a target capability level which is desired, whereas the staged representation improves multiple process areas at once within a maturity level. The different levels are complementary and have similar definitions but vary slightly. (CMMI Product Team, 2010)

Inspecting the service processes from the perspective of staged representation enables a more broader improvement work. The organisation can focus their efforts on improving the processes as a whole and gain greater benefits than with smaller changes. If the organisation has less commitment, however, continuous representation might provide better results with its more focused changes. It enables evaluation of one task at a time and gives directions on how to improve upon it. The continuous representation capability levels provide goals for the organisation to meet one at a time. All existing processes are at least level 1, performed, with only level 0, incomplete, being below it. The second capability level, managed, is for processes which have adequate competence and resources, and is done according to policy and is monitored, controlled and reviewed. A managed process is a good target level for organisations looking to improve. The final capability level, defined, has no new elements from level 2 but has a vastly more specific and tailored standards, process descriptions, and standards. (CMMI Product Team, 2010)

For the purposes of this study, the continuous representation of capability is used. This supports the scope of the thesis as it is limited to mostly service delivery. While other areas of operation are important in the big picture, it is necessary to narrow the scope. Alongside service delivery, the topics of causal analysis and resolution, and incident resolution and prevention are considered.

The different capability and maturity levels can be achieved by meeting certain goals within the process area. These goals are explicitly defined in the CMMI for each process area, and provide guidelines which can be followed when creating an improvement plan. All goals are supplemented by practices which define the behaviour to enable meeting the goals. The practices can be generic or specified for the process area in question. The goals can be split into generic goals and specific goals. The generic goals define how to institutionalise the work done in the different areas while the specific goals aim at providing guidelines for a specific process area. (CMMI Product Team, 2010)

The generic goals provide the organisation with ways to work and affect the work culture. The three goals can be set as a path to increasing capability levels. To achieve the next goal you must before achieve the previous. Out of the three goals, the second provides the most details on how to work in practice. It comes with ten practices which should be followed to be able to say that the process is a managed process. (CMMI Product Team, 2010) These practices are listed in Table 3.4 along a short description. The generic goals are elaborated in CMMI based on the process areas. As service delivery is the most relevant process area in the study, the descriptions in Table 3.4 are based on its elaboration.

In CMMI, the common terminology uses initialisms for the goals and practices. Generic goal and generic practice are commonly referred to as GG and GP. Likewise, specific goal and specific practice are abbreviated to SG and SP, respectively. They are also numbered for convenience, so GG 1.2 is the second generic practice of the first generic goal. Each process area have their own numbering.

CMMI has many different process areas. With continuous representation, these can be examined individually and their specific goals and processes followed. The most important process area for evaluating an IT help desk is service delivery. While incident resolution and prevention lines up well with ITIL incident management, it has fewer concrete actions which organisations can follow. Other related process areas are also similar to some ITIL processes, such as how causal analysis and resolution is closely tied to ITIL problem management.

For the purpose of the study, the specific goals and practices of service delivery provides with guidelines on how to initiate customer support pro-

Table 3.4: The practices under Generic Goal 2 in CMMI specified for the service delivery process area. (CMMI Product Team, 2010)

| **Practice** | **Description** |
|---|---|
| Establish and organisational policy | Establish the expectations for the service delivery goals. |
| Plan the process | Plan how the service delivery process is performed. |
| Provide resources | Ensure the infrastructure, tools, processes, consumables are up to date and upgraded or changed when necessary. Provide retraining, advanced training or possible rotations for service staff. |
| Assign responsibilities | Define people responsible for establishing service agreements, accepting service requests, operating the service system, maintaining the service system, processing service requests, and resolving incidents. |
| Train people | Train people performing and supporting the service. |
| Control work products | Service agreements, service delivery and request reports, and other work products should be controlled (e.g. version control) where appropriate. |
| Identify and involve relevant stakeholders | Identify the relevant stakeholders who take part in service delivery. |
| Monitor and control the process | Ensure daily the process is performed according to plan and improve where necessary. |
| Objectively evaluate adherence | Evaluate the process and work products and intervene in case of noncompliance. |
| Review status with higher management | Provide visibility of the service delivery process to higher level management. |

cesses and manage service requests. This includes creating service agreements, setting up tools and practices for support work, and receiving and managing incoming service requests. The specific practices under service delivery taken into account are SP 2.1, SP 2.2, SP 2.3, and SP 3.1. They address how to establish the service delivery approach, i.e. the primary actions to prepare before doing the actual service, and how to receive and process service requests, i.e. which actions should be taken after a request arrives, respectively.

CMMI can provide many benefits for organisations by increasing cost efficiency and quality among other measurable quantities (Gibson et al., 2006). However, it has also been criticised not to suit the needs of the fast-paced software market of today. It can be too complex for companies to adopt and not suit agile organisations. There is a conflict between the agile manifesto (Beck et al., 2001) and the perspective of CMMI. CMMI is focused on following processes and evaluates the organisation based on their ways of work whereas the results are what matter in agile contexts. (Patel and Ramachandran, 2009) These concerns are discussed in ITIL which proposes actions to meet changing requirements but to also not change too much.

## 3.2 Service Design

Service design provides tools and methods to understand the customer perspective with service creation successfully. It does not, however, have a singular definition and has a plethora of possible methods. This study limits the discussion about service design to only its values, key principles, and the most potential methods to learn more about the specific research context of the study.

### 3.2.1 Definition

Service design is a discipline which guides the growth of the service industry seen around the world. It is multidisciplinary, combining the knowledge of different marketing, human resources, operations, organisational structure, and technology disciplines. (Ostrom et al., 2010) It is partly ser-

vice strategy, innovation, and implementation and aims to affect the customer experience more than with just the service offering itself. (Stickdorn et al., 2018) To understand service design, a service must also be defined.

Services are the core of service design. As many disciplines aim to improve a service or another, there are many definitions for services as well. OGC (2011) offers a definition that a service is "a means of delivering value to customers by facilitating outcomes customers want to achieve without the ownership of specific costs and risks." While, according to Aurich et al. (2010), there is no single accepted definition, services can be characterised by intangibility, heterogeneity, simultaneity of production and consumption, and perishability. These characteristics fit the description by OGC (2011). In this study, a service is a sequence of activities to deliver value for customers and is subjective to the experience of the end user. The service provided by the case company is bought by a customer who often is not the end user.

The definition for service design is more difficult than for just a service. There are many different similar definitions all of which focus on creating services from the perspective of users. (Stickdorn and Schneider, 2011) In addition, there are many different names used for activities similar to service design. These are difficult to differentiate between each other due to the broad definitions. (Stickdorn et al., 2018) This study, however, aims to apply service as a way of thinking and a toolset instead of a singular definition. This enables a more objective-oriented outlook for using the service design methodology in practice and helps with combining service design knowledge with the frameworks discussed in this thesis.

Stickdorn et al. (2018) have defined six key principles which can be used to help understand of the core values and perspective of service design. In addition, it helps to keep the focus in place during the design process. These principles are similar to those who are familiar with principles of the agile manifesto.

The first of the six principles is how service design thinking is *human-centred*. All services affect people and their experience defines whether the service is successful or not. In other words, the people generate the value of the service through their subjective experience. These people can be the users, service providers or even others who are within the influence of the service. Understanding the needs of these people is a key part

in designing services. (Stickdorn et al., 2018) ISO (2010) defines the standard for general human-centred systems design. It provides an overview of the design process which can be applied to services as well. A diagram of the process can be seen in Figure 3.5. The design process does not include methods for producing any artefacts but highlights the user needs and requirements and how the design should be affected by the context.

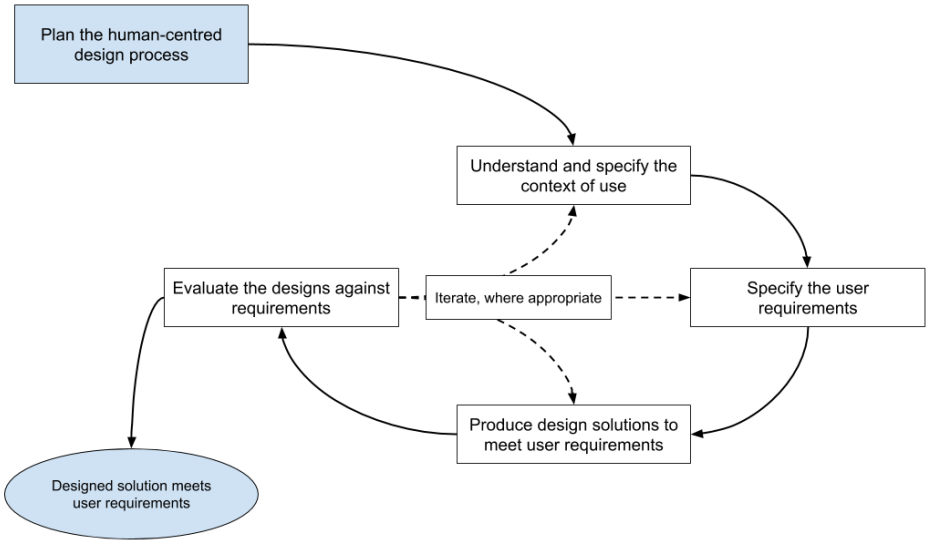


Figure 3.5: The iterative process for human-centred design. Adapted from ISO (2010).

Second, service design is *collaborative*. It involves the different stakeholders, especially the users, in the design process. During the entire design process from creation to testing, different stakeholder perspectives should be examined and understood in their own language. (Stickdorn et al., 2018) This helps in producing solutions which meet user requirements (ISO, 2010) but also in increasing customer loyalty and long-term engagement (Stickdorn and Schneider, 2011).

Then, service design is *iterative*. A major part of the service design process is how it produces different artefacts constantly. These artefacts can be ideas, different solutions, or prototypes but are purposefully light on their required effort. These are meant to be generated in large amounts where all but the best are later discarded. These iterations are small and cheap in the beginning and allow the design team to experiment and learn from the failures of the iterations. The process has to be flexible enough to allow

adaptation of the things learned during the iterative process. (Stickdorn et al., 2018)

Fourth, in order to be able to change the service in a controlled fashion, service design is *sequential*. Services consist of a sequence of touchpoints which should be used for visualising the entire experience. These touchpoints are individual interactions which form the entire service, e.g. sending a ticket is one touchpoint of the customer in a support case. The interactions all individually affect the user and can change their mood for the better or worse. It is often useful to visualise the change with a customer journey map, like shown in Figure 3.6. (Stickdorn et al., 2018) A customer journey displays the subsequent touchpoints of the activities and events of the service for the customer. (Patrício et al., 2011)

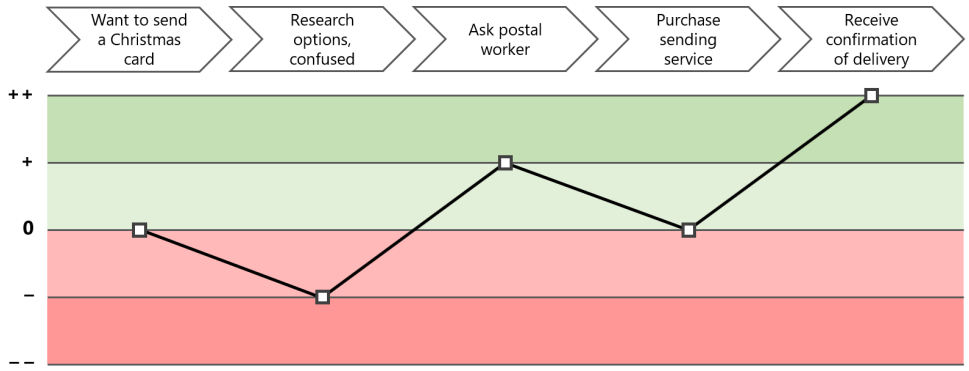


Figure 3.6: An example of a simple customer journey map for a service experience of a person sending a Christmas card. The emotional experiences are shown below with a scale from very negative experiences (– –) and very positive experiences (+ +). A customer journey map can have other elements included as well, such as listing the involved stakeholders at each touchpoint.

Next, service design is *real*. The basis of creating anything with service design is grounded on research done on real people who are or will be affected by the service. The design should produce physical or digital artefacts to visualise the service and its created value, and make them tangible. (Stickdorn et al., 2018) For a service to be effective, it should be clear to users when they are using it. This matches the customer expectations better by giving them an understanding of the process itself and prepares the user to be a part of the sequence. (Stickdorn and Schneider, 2011)

Finally, service design thinking takes the entire journey into account and is *holistic*. This means taking the surroundings of the service into account, such as the environment, tools, and different types of stakeholders. Often, business needs can be forgotten with service design but they should also be taken into account. All stakeholders should be involved during all stages of the service. (Stickdorn et al., 2018)

### 3.2.2 Service Design Process

Likewise to the definition of service design, there is no single process for carrying it out either. Other sources focus on the attitude and ways of thinking (Stickdorn and Schneider, 2011; Polaine et al., 2013; Design Council, 2015; Stickdorn et al., 2018), whereas some introduce detailed methods for service design (Patrício et al., 2011; Teixeira et al., 2012).

From the former sources, Stickdorn and Schneider (2011) and Polaine et al. (2013) focus on keeping the perspective on the customer, cocreation and the holistic experience. Design Council (2015) takes another approach, however, illustrating the design process as two back-to-back diamonds, starting from a single point, dispersing into many ideas, and converging at a single point again. The model is shown in Figure 3.7 The design process begins by learning about potential problems and generating ideas to solve them. After ending up with a solution idea, potential implementations are then generated and then finally after many iterations ending up with a single one. Due to the iterative nature of design work, the double diamond could be extended into a chain of diamonds with the latter ones representing the support and future development work of the service.

Stickdorn et al. (2018) also use the double diamond when describing the service design process. They focus on the service design thinking instead of explicit steps for performing the design process. Diverging and converging with ideas is advocated for and iterations are necessary for success. The process learns from failure, be it the failure of the prototype or the process itself, and adapts what was learned. At its simplest, the process can be condensed into three steps, explore, create, and evaluate, but the process explained below has four. The following process is first described by Stickdorn et al. (2018).

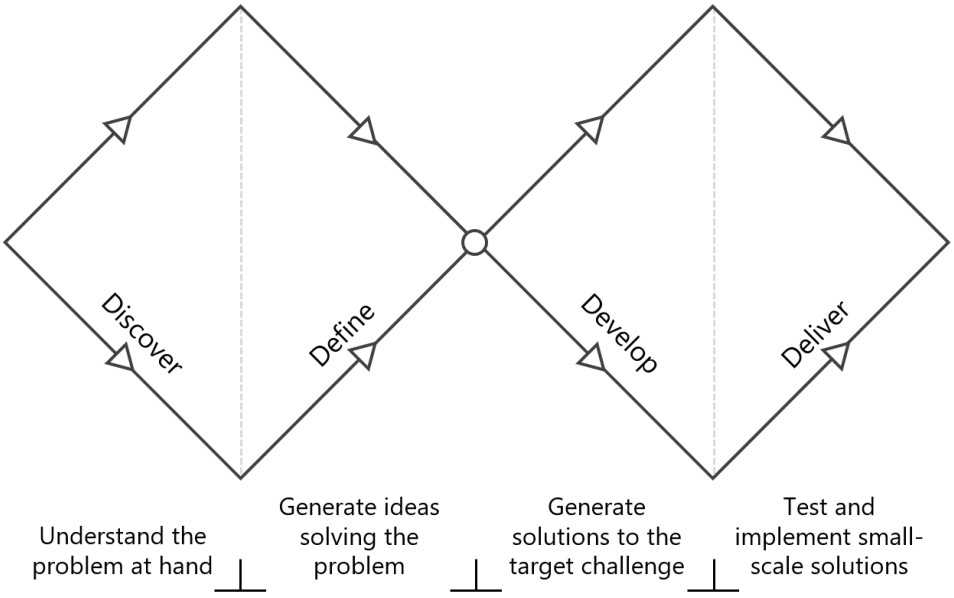


Figure 3.7: The double diamond model first presented by Design Council (2015). The alternatives and opportunities diverge as the diamonds spread meeting at a single point: the defined problem to solve.

First, the design team must understand what do they need to know to solve their problem. Defining a research question and knowing how to answer it are the first steps for learning about the case context. The objective is to learn as much as possible about the users and their environment which provides better data about the initial assumptions. The design team should interview, observe, and even try the service themselves to understand what actually happens instead of what they think would happen. During this step, the data must be transformed still into knowledge. Gathering data is the diverging phase whereas then different methods and tools should organise and visualise the information. During the analysis, the data converges into insights which are the input for the second step. (Stickdorn et al., 2018)

Ideation on a wrong topic can lead to solutions which do not solve the original problem. By having the research insights as the input for ideation, the design will solve the research question at least partly. The diverging part of this step is to generate as many ideas as possible to solve the design problem. The generated ideas should not be limited by feasibility.

Methods like brainstorming and 10 plus 10 sketching support generating ideas together. Ideation works better when people with different skills and experiences are cooperating. Only when the ideation step converges, the ideas are ranked based on their impact on customer experience and their feasibility and then chosen for future concepts. (Stickdorn et al., 2018)

Moving to the third step, prototyping, with the concept ideas means making these ideas into reality. The ideas were ranked based on their feasibility but this was not verified. By iterating over prototypes for the concepts and testing them with real stakeholders and environments, the design team can gain valuable insights on the most important aspects of the service or validating the core value propositions. The prototypes can be different for different ideas, like a walkthrough, a service theatre, or even digital or cardboard prototypes. (Stickdorn et al., 2018) An example of a service prototype can be seen in Figure 3.8.

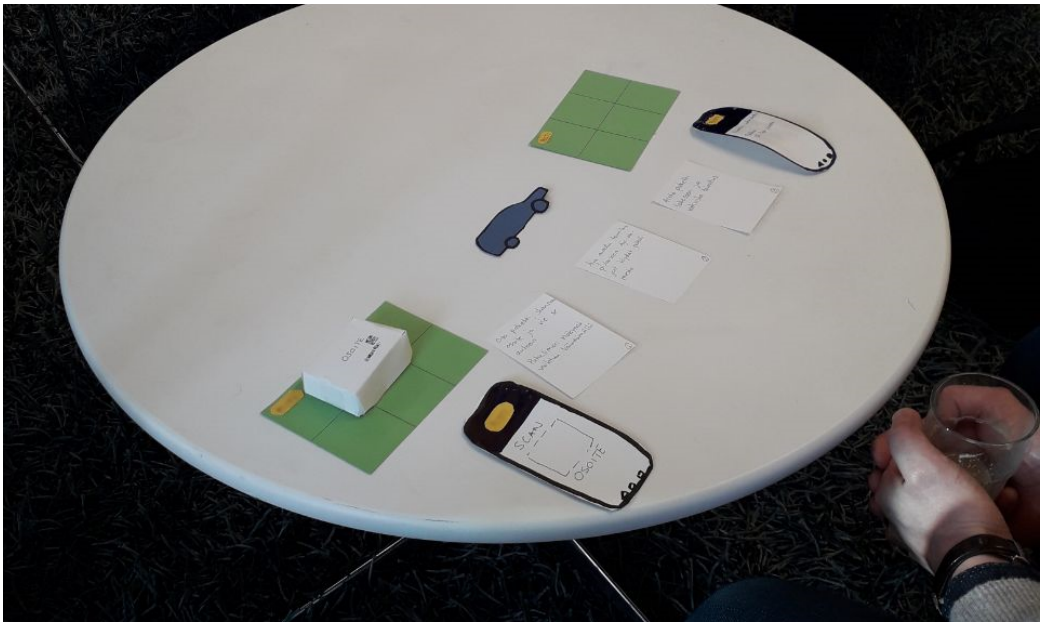

Figure 3.8: A cardboard prototype for a parcel delivery system. Different touchpoints and service encounters are laid out in the prototype to gain better understanding on how such a system would work. Prototyping services can be also intangible, like with service theatre as an example.

Finally, the process includes implementing the improvements. The prototypes have shown the places which require the most attention to and the implementation depends on the specific service itself. This step can in-

clude activities such as software development, product management, and change management which are suitable for different types of services. Often, the largest change in this step compared to the previous steps is the involvement of all real stakeholders. Naturally, the depth of the solutions is much greater in the final step than previously. (Stickdorn et al., 2018)

In addition to planning and initiating the task, the four steps can be also seen in Figure 3.9. This figure shows the different steps and possible methods used during the entire journey to an implemented process. While the steps are depicted as equal size, they can have varying levels of effort put into them. As an example, some designs can have an intensive research phase with easier ideation.

While Stickdorn et al. (2018) define the steps in detail, they focus mostly on the way of thinking, working, and the methods separately. Another approach to service design would be to follow a more rigorous model. Multilevel service design (MSD) by Patrício et al. (2011) divides the service context into three levels. These levels are used to understand the customer experience and then design the service offering itself. They use the levels of service concept, service system and service encounter to describe from higher to more detailed levels of action. While the steps of the MSD process are iterative, the iterative nature is not emphasised like by Stickdorn et al. (2018). The steps of MSD are visualised in Figure 3.10 and explained further below.

The broadest view in MSD is the service concept. It describes the service providers position in the value constellation experience. The service provider might be the provider for only one of the largest identifiable activities for a service. As a whole, a value constellation represents the interrelation of stakeholders. A value constellation experience extends this definition into the actual experience of navigating through the relation network during a service. This decomposition to activities assists in discovering the most important factors contributing to the experience. It also highlights the different service organisations and their roles as a part of the service chain. For buying a house, an example of some of the activities in the value constellation experience could be searching for a house, obtaining a mortgage, and purchasing a house. (Patrício et al., 2011)

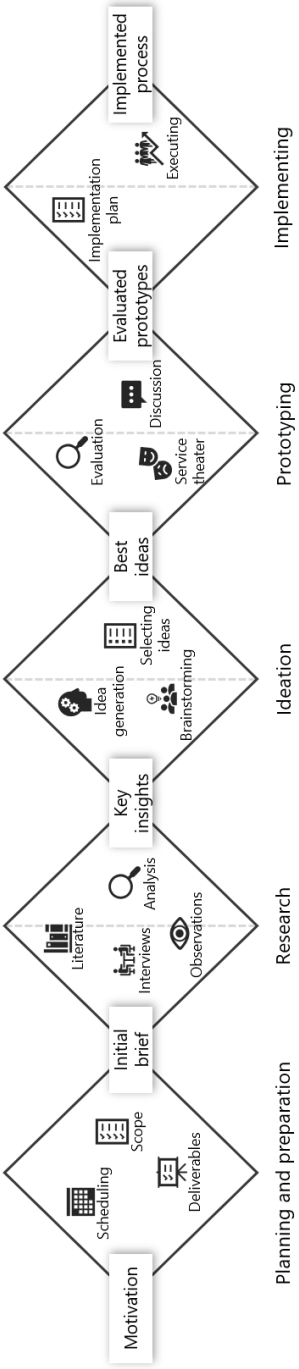


Figure 3.9: A view of the entire service design process. Some example methods are presented in the diamonds. The first half of the diamonds represents the divergence and the latter half the convergence. The first diamond is usually thought as before the design process and does not add up to five phases.

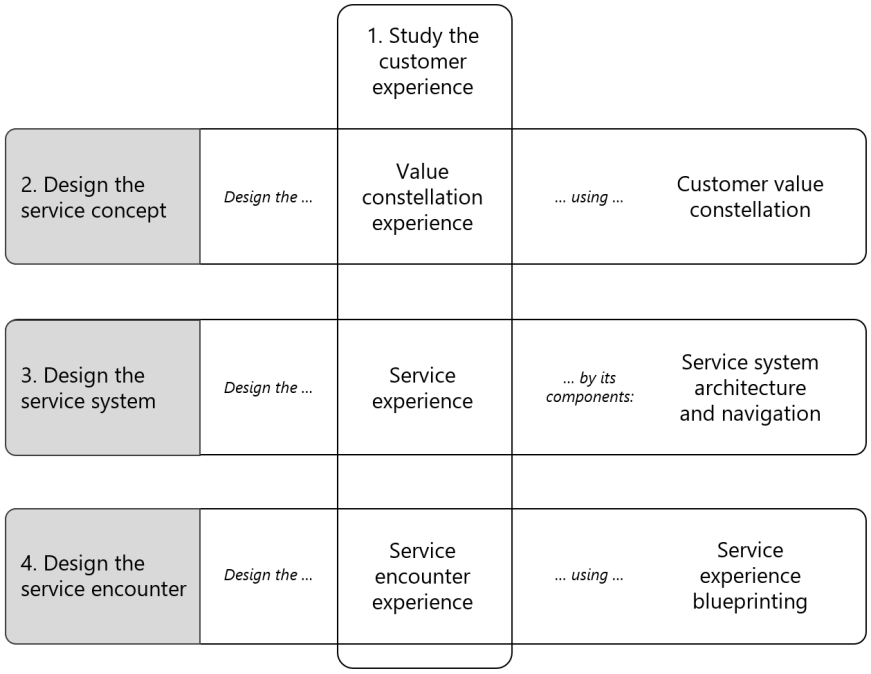


Figure 3.10: A visualisation of multilevel service design. First, the customer experience is studied and then in steps next three steps the levels are analysed and designed using different methods and components.

The second level in MSD is the service system. After identifying their own position in the constellation, the service provider can design their own service system in order to better the customer service experience. This is the set of interactions between the service provider and the customer whose goal is to complete the next activity of the constellation. (Patrício et al., 2011)

Finally, the last level is the service encounter. By looking at the individual moments of interaction between the customer and the service provider, the service encounter experience can be improved. (Patrício et al., 2011) These are equivalent to touchpoints which is the preferred term in some works of literature, like (Zomerdijk and Voss, 2010; Stickdorn et al., 2018).

Multilevel service design has four steps, first of which studies the customer experience through the concepts of service concept, service system, and service encounter. This enables the design team to understand the current level of the customer experience and offers the basis on building the new solutions. Qualitative methods, such as observations and interviews,

can be complemented with quantitative methods, like surveys. (Patrício et al., 2011) Using different methods improves the quality of the research by triangulation (Wilson, 2006).

The other steps are dedicated to designing the different levels of service context. In the second step, the value constellation can be redesigned to better serve the customer. Then, the service system architecture and navigation have to be designed. Finally, the individual service encounters is designed by using service experience blueprints as described by Patrício et al. (2008). The blueprints enable better identification of suitable interfaces for the service encounter. The practical design activities are not described in MSD but should be iterative. (Patrício et al., 2011) Using another process for the design tasks could be useful due to this lack of description.

MSD has influenced future models as well. The three customer experience levels are also used by Teixeira et al. (2012) who also combined human activity modelling (Constantine, 2009) and customer experience modelling (Patrício et al., 2009) with MSD to form another model for service design.

### 3.2.3 Service Design Methods

Many processes created for service design only describe the general steps of how to arrive at a good service. They have steps, such as ”Design the service concept” (Patrício et al., 2011) without enough details on how to proceed in practice. For individual steps and actions, plenty of methods have been developed for the different design phases of research, generating ideas, and prototyping. Stickdorn et al. (2018) suggest over 50 different practical methods which combined cover all three design phases and different situations. These methods can originally be from other sources, like personas (Pruitt and Grudin, 2003) and cultural probes (Gaver et al., 1999), but it acts as a compilation and has been updated the methods to suit modern use.

The following methods are adapted from Stickdorn et al. (2018). While other methods exist, these are the most promising in understanding the needs and requirements of the target group in the case context, and can be used together for a more complete view of the customer environment. They are all different but share their starting point: define the research problem and answer how the method supports in answering it. Then, the

participants must be selected so that selection biases can be avoided and comprehensive data collected.

### Mobile ethnography

Research methods which do not require face-to-face communication work well when researching people who are difficult to reach. Mobile ethnography has the participants documenting their experiences during their daily tasks. It works like a diary which then the researchers can review and analyse its data. The length of the data collection can vary depending on the pace of the service. For slow paced work, the data should be gathered over many days or even weeks. (Stickdorn et al., 2018)

Before starting gathering data, the researchers should define the platform for submitting the data, the questions asked from the participants, and instructions on what the study requires from the participants. The questions should be thought to both be clear and easy to answer and the instructions need to cover what is the aim of the study, how to document their experiences, and what to do in different scenarios. It is easier to create good material for the participants if the researchers have time beforehand to interview them or use some other ways to get to know them better. (Stickdorn et al., 2018)

Having the participants gather the data themselves can be drastically easier for the researchers as travelling can be expensive and time-consuming. The participants can then perform their tasks normally and document the experiences when they are not busy. This method does, however, leave the participants doing the work which can make it difficult to recruit them. This can also reduce their motivation to report and does not take more subtle clues, like body language, into account. Adequate compensation should be offered, though the type can be decided on a customer basis. (Stickdorn et al., 2018)

### Contextual interviews

It can be better to be able to ask questions from the participants instead of letting them solely do the reporting. Conducting contextual interviews is similar to regular interviews but it happens in the context of the research

problem. (Stickdorn et al., 2018) In the case of software customer support, it could be during a problem is handled as the process is usually handled by email and does not require constant attention from the customer.

The preparation guidelines should be semi-structured which allows the interviewer to not forget important topics but to let the conversation flow in other directions as well if need be. The primary motivation is to learn the underlying motivations and let the interviewees to demonstrate their actions or show possible artefacts. The five whys -technique is an useful tool when trying to learn the root causes of specific emotions or actions. It asks successive ”whys” with the details increasing every time until the root cause is reached. (Stickdorn et al., 2018)

These interviews can be done either on-location or remotely. Face-to-face interviews can yield more data as body language is important in communication and would not be as strongly present with a remote interview. In addition, many artefacts can be gathered on location, be it photos or physical items on location. These can aid in understanding the tools used and the environment even better. (Stickdorn et al., 2018)

#### Co-creating journey maps

One desired artefact from the research can be customer journey maps. Creating these with customers themselves helps the research by providing instant feedback on the accuracy of the map. The participants must, however, be people with the actual experience of the customer journey. Otherwise there is a risk that the participants think they know the journey but do not, leading the entire research astray. (Stickdorn et al., 2018)

For creating the maps, the objectives must be clearly defined. Some customer journey maps have more details than others, belong in a different context, or be only a subsection of the entire process. Especially when the participants are not trained in creating customer journey maps, sufficient instructions are essential. (Stickdorn et al., 2018)

The co-creation is fit for a workshop type of collaboration. If there are a lot of attendees, they can be split into smaller groups which can discuss between themselves about their experiences and add those together during the mapping. Tools, such as sticky notes, pens, and earlier research

artefacts, should be provided to the participants to work with. When creating the journey itself, its stages need to be iterated over before finally combining the works of the groups into one. (Stickdorn et al., 2018)

This method gives a concrete artefact which can be used later in the ideation, prototyping, and implementation steps of service design. Given the participants are screened well, it is based on real data and incorporates their real experiences into the design. Organising such a workshop can be difficult, though. It requires a creative environment and possible warm-up exercises. It also must be done in the same space; a remote workshop is not a possibility. (Stickdorn et al., 2018)

## 3.3 Summary

Customer support is performed as a service and belongs under many disciplines. Improvements to customer support can happen in two areas: improving the design process of the service system, and improving the customer support process. With better service design processes, more flexible and creative solutions can be obtained. When looking at the customer support process directly, fixing shortcomings and improving the current service is simpler. The knowledge from different frameworks and perspectives helps the design to be holistic and forces the design process to be multidisciplinary.

#### Product-service Systems

PSS focuses on topics which support improving both design and service processes. It advocates holistic and collaborative principles by examining the entire system life from the angles of both product and service design. Additionally, technical PSS can be divided into component descriptions which serve as the artefacts of the design phase. Identifying customer support as a technical service lets PSS to differentiate the components which are then easier to focus development on. PSS also offers guidance on systematising the design phase of technical services.

However, PSS offers no practical principles to apply or which steps should an organisation take to create the described artefacts. PSS can be seen as

the middle ground between more solution-centric frameworks, like ITIL and CMMI, and service design. It also requires taking product design into account from the start of the system life and thus covers a broader context.

### ITIL and CMMI

Some practical steps for improving customer support processes can be obtained from ITIL. It provides multiple publications on service management, from service strategy to continual service improvement. This thesis considers the service operation publication which provides details on implementation for the daily operation of organisations and which are the common exceptions. Services are divided into processes, such as incident management. ITIL describes these processes by their models and details to provide a starting point for organisations.

ITIL also covers how can technology be used to support the operation with processes like event monitoring and managing a knowledge database. It considers people by approaching the problem on how to help the work culture to adjust and involve stakeholders in the improvement process. The other publications can also expand the scope of improvements.

For evaluating the current service level and for setting up targets, CMMI provides an evaluation framework. It uses similar processes to ITIL but instead of models, CMMI defines specific practices to perform in order to achieve levels for the service operation. The maturity of a service can be evaluated by using the specific goals of different process areas.

ITIL and CMMI are focused on the internal organisational activities and affecting the customer support process directly, although the latest ITIL publication has started adopting more of a design mindset. They describe how organisation should work and their targets clearly. Tools to evaluate the work are also provided. Their differences come with the scope of their work and initial perspectives. ITIL focuses more on details of the process, such as technological suggestions and how to manage the social aspect in the work place. CMMI, on the other hand, provides also general process management guidelines which can be applied to different organisational processes to evaluate them.

Both ITIL and CMMI provide a few practical examples of activities but they rather focus on the properties of the artefacts. Both publications, however, explicitly state that their processes are not to exactly be followed but rather can be adapted to organisational operation (OGC, 2011; CMMI Product Team, 2010). This enables using them with a customer-centric and agile way of working which represents the values of service design.

**Service Design**

All frameworks discussed in Section 3.1 are compatible with either service design thinking or its methods. Authors like Mont (2002) speak directly for service design. Aurich et al. (2006) and AXELOS (2019) suggest approaching the design from a similar perspective service design uses but do not mention service design itself. That said, PSS, ITIL, and CMMI give few suggestions on how service design should be applied. Service design itself is able to provide with the methods to come up with new solutions to service problems which adhere to the guidelines set by the frameworks.

The frameworks suit improving customer support, but their different perspectives can be differentiated with their scope, given advice, and flexibility. PSS is the only one which does not provide with clear advice on how to perform its suggestions. ITIL focuses on only IT services while CMMI also discusses internal process management. Service design is the broadest and encourages more for a way of thinking instead of certain actions but provides with a plethora of explicitly defined methods to use.

Service design fills in the gaps left by the frameworks and helps with the implementation of the process improvement. As an example, none of the frameworks address how to decide on the new processes. Service design has plenty of methods which focus on understanding the context and choosing next steps. Even though the frameworks focus on customer value, service design provides the practical means to understand and fulfil customer needs. The frameworks emphasise measuring only during operation which can be difficult to execute properly and provide knowledge too late (Symons, 2010).

Finally, Figure 3.11 visualises and summarises the frameworks and practices introduced in Sections 3.1 and 3.2. While these elements provide a holistic view of customer support processes, they do not include all pos-

sible topics. As an example, ITIL could provide a broader scope with its other publications, such as the Service Strategy publication.

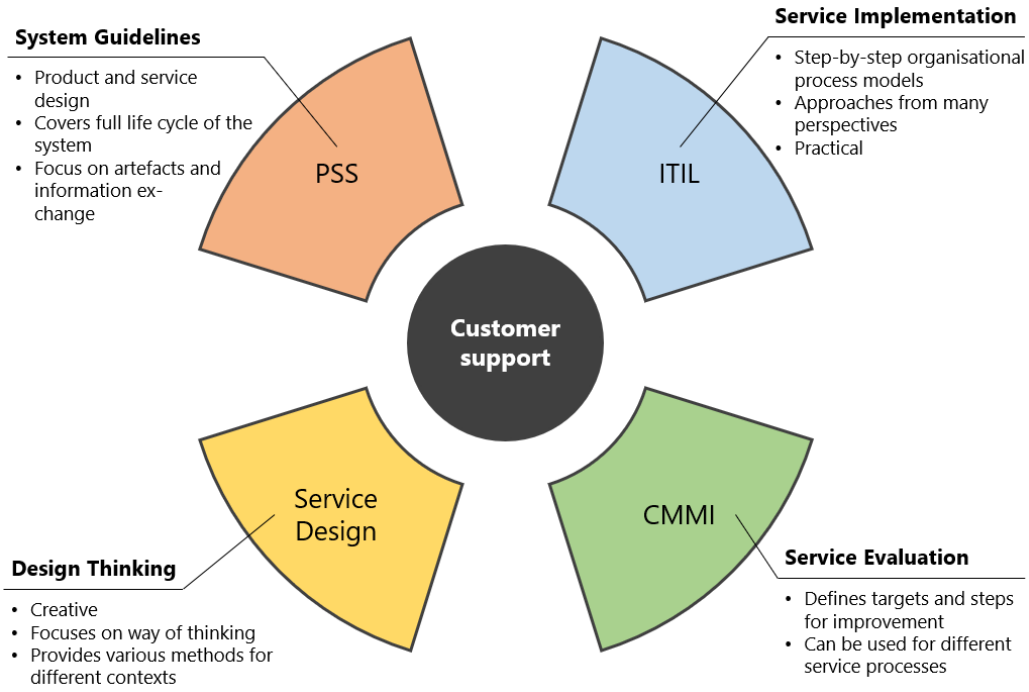


Figure 3.11: A visualisation of the frameworks and methodologies surrounding customer support in this thesis. The frameworks give a holistic view to improving customer support and cover topics which the other frameworks do not.

The primary topics of customer support covered by the discussed frameworks are listed in Table 3.5. The table is ordered so that the topics which received more attention are listed first. This indicates that the topics are more important and should be paid more attention to. However, the topics with fewer mentions are not necessarily unimportant but are not supported by multiple methods.

Table 3.5: Topics covered by the different frameworks and practices. The cell is marked if it is covered in literature. The level of detail a topic is covered varies but some guidelines are required for it being counted.

| **Topic** | **PSS** | **ITIL** | **CMMI** | **Service Design** |
|---|---|---|---|---|
| Continuous improvement | X | X | X | X |
| Service realisation | X | X | X | X |
| Focus on customer value | X | X | X | X |
| Documentation | X | X | X | |
| Physical resources | X | X | X | |
| Non-physical resources | X | X | X | |
| Creates processes | X | X | X | |
| Customer order taking | X | X | X | |
| Responsibilities | X | X | X | |
| Stakeholder map | X | X | | X |
| Collaborative | X | X | | X |
| Stakeholder requirements | X | X | | X |
| Information exchange | X | X | | |
| Service life cycle | X | X | | |
| Iterative | | X | | X |
| Managing people | | X | | X |
| Technological considerations | | X | | |
| General process management | | | X | |

# Chapter 4

# Current Customer Support

For some years now, there had not been any clear processes on how to manage incidents at the case company. Many tickets and customer requests had come as emails directly to a single person and there was not any consistent way of handling the incidents. However, the case company had started improving their processes during the spring of 2019. These new processes have been evolving over time and the employees have started getting used to them. This was during the same time as when the different teams of Component A and Component B combined into one. These processes are now shared between different support engineers and is more consistent.

## 4.1 Current Support Process

Based on the customer interviews, the interviewees had not contacted customer support lately and so had no experience with the customer support process. This can be explained by the nature of the software and its complexity; the faults they had seen were often due to an issue with a system which was not the responsibility of the case company. However, during informal conversations with other customer, they revealed that the process was good apart from desiring more communication. The largest issues were on the quality of the delivered software and timely solutions which partly fall out of scope of the support.

The customer journey found out is presented in Figure 4.1. Due to the customer interviews providing no experience of entering this journey, it is presented at a high level only. It shows how the case company can affect the journey in two ways: by proactive monitoring, which removes the first two steps of the customer journey, or by improving the communication to the customer during the support process. In the current case, however, the proactive monitoring is seldom performed. This is explained in more detail in Section 4.2. Figure 4.1 does not include specific touchpoints or their emotional impact as this data was not obtained from the interviews.

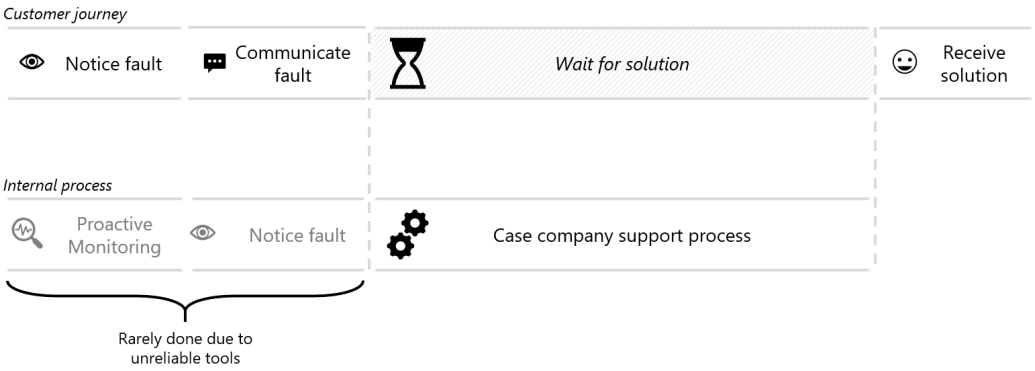


Figure 4.1: The timeline of the customer journey and how it acts alongside the customer support process of the case company.

Since the spring of 2019, the customer support team had started to improve their ways of working. This meant changes, such as clearer processes and updated service agreements with customers. These changes were implemented slowly over time and at the time of the internal interviews, the support engineers settled quite well in the defined processes. While there exists a ticket management process model, the study focuses on the performed process instead of the ideal one. The model does not show tasks outside of the ticket management system which misses documentation tasks. It also does not involve escalating to the second level of support nor assigning tickets.

The common support process identified from the documented process model and the interviews with the support team can be split into eight steps. The steps are compared against the simplified incident management process from ITIL which can be seen in Figure 4.2. Naturally, as no formal guidelines have been followed, the current process differs from

the process flow suggested by ITIL. In addition, different processes were highlighted in the interviews than the processes suggested by ITIL, such as solution verification.

While the process model used by the case company contained actions for customer communication, this was not mentioned by the support engineers in the interviews. It was left unclear whether they performed the communication consistently according to agreements during the support process.

However, Figure 4.2 highlights how well the applied customer support matched the topics of ITIL incident management. For common incidents, all tasks could be matched to an ITIL activity, while not in the same order. No support engineers mentioned about problems in the flow of the process, even though the process is relatively new to all. The most problems mentioned was with documenting information.

Current documentation activities are limited and can vary case-by-case. The received tickets are not categorised and prioritisation is done by gut feeling, i.e. either by experience or by first come, first served basis. ITIL suggests heavier logging procedures which might not suit the case at hand. Component A often faces incidents which are difficult but there are not many of them, whereas Component B receives plenty of incidents which can be solved quite quickly. Generating statistical information on a few incidents is not too beneficial and might play against the wish for light documentation by support engineers. The logging would most likely be beneficial for the engineers working with Component B but then following different procedures within the team is inadvisable. Suggestions for the level of detail with documenting incidents are discussed later in Section 5.3.

Figure 4.2 shows the process for common incidents where no escalation is needed. In ITIL, there are separate procedures for functional and hierarchic escalation. The case company has a procedure for functional escalation but not to hierarchic. This is not to say that hierarchic escalation does not happen but rather that it is not organised. In case of major incidents or if the issue is closely related to managerial topics, the escalation is performed as the support engineers see fit.

Functional escalation by the support engineers is done based on their understanding of the limits of their knowledge. Normally, the incidents are

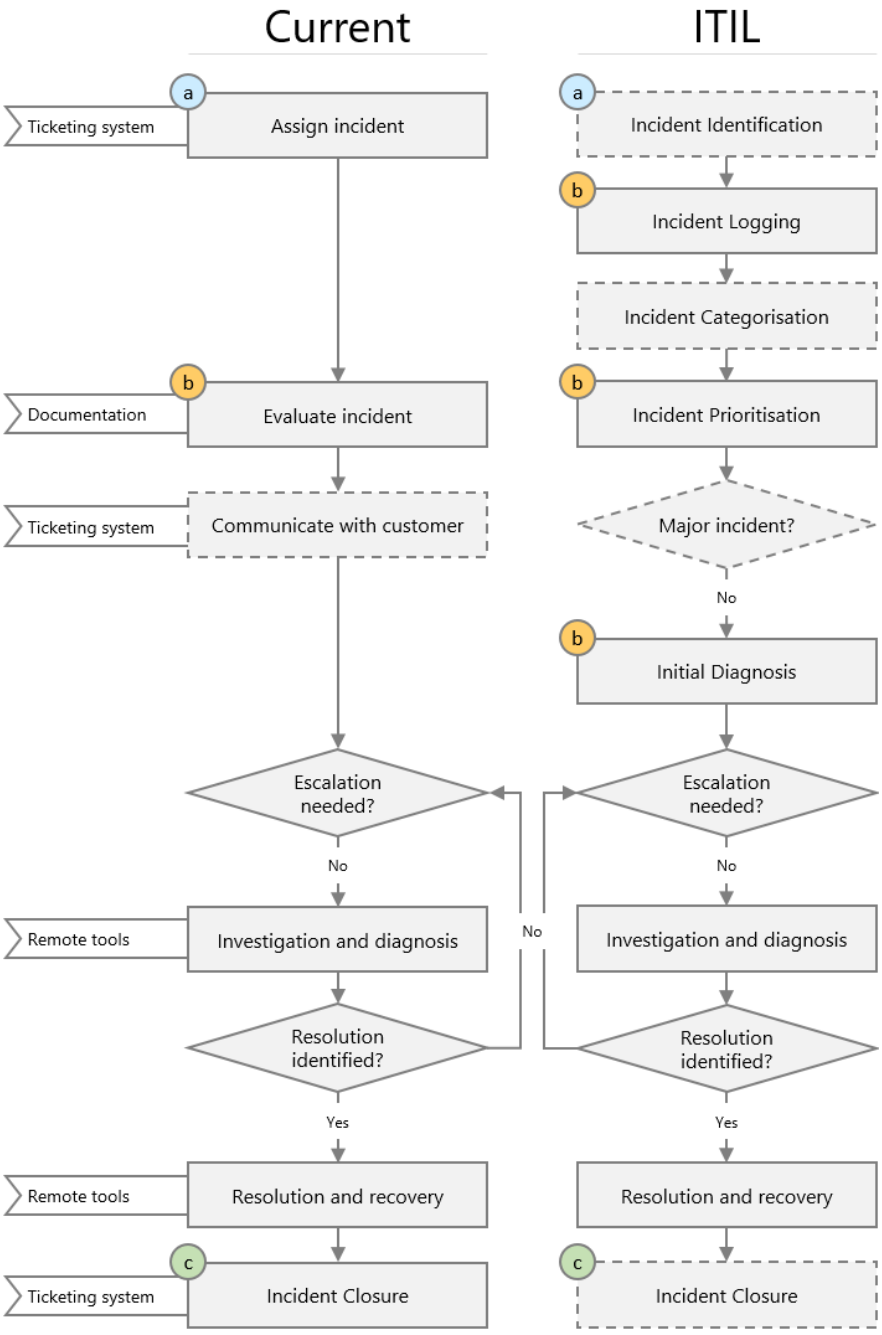


Figure 4.2: A comparison of the applied customer support process (on the left) and a simplified ITIL incident management process. The process steps are grouped $a$-$c$ where each group are comparable in their individual actions. The dashed outline indicates either a no match or a poor match within the groups. The flags on the left show the most important tools or systems in use for the steps.

handled by the first line of support but might be escalated to the second line during either evaluation or investigation phases. This, however, does not really happen with Engineer A since they are both the first and second line for parts of the software. If the issue is too difficult to either first or second lines, it is escalated further to the development team which will look into the issue. Some of the issues are of nature where it can be seen immediately that it has to be escalated to development but some take more time. The support engineers are guided to spend 50 minutes on an incident before escalating but in some cases it has turned out to be too short of a time for practical use. In reality, this time can be up several hours.

The communication channels for escalation are often email or instant messengers. The support team is split into two locations which prohibits effective face-to-face communication. Some support engineers felt that this is an issue but overall, the communication has been good lately. The development team is separate from the support team and has been difficult to reach. Lately, however, there has been a dedicated contact person which has eased the communication.

## 4.2 Challenges

The challenged found during this study were mostly internal but some customer problems were also found. The internal challenges were mostly related to the **process supporting tools**, and the **level of documentation**. In addition, the lack of resources and poor organisational clarity was also expressed by the support engineers but they are not considered further. The customer challenges, however, were found out based on earlier customer support projects instead of the interviews conducted. The customers faced issues with **inconsistent communication** and poor perceived quality. The latter customer issue was also not considered further.

The tools received a lot of attention during the internal interviews and at times the discussion about them was heated. The most feedback was given to the ticketing and proactive monitoring systems. The former had large usability problems which impacts proper documentation, communication, and reporting. The latter, however, had mostly technical problems which lead to unreliable information and difficulties in regular use. These problems took a large share of the support engineers' time which is espe-

cially troublesome with the lack of resources they face. It also impacted their mood and how eager they were to use the systems.

Problematic tools do not only affect the support engineers but also the customers. One of the issues with the ticketing system prevented customers from receiving outgoing communication from the customer support completely. This was ultimately due to the IT policies of the customer organisation but no indication of messages being blocked was sent and better ticketing system configuration could have prevented this. The issues with the tools have led to poorer user experience and issues with communication, along with other smaller complications.

Internal documentation also suffered because of the ticketing system. The system lacks the possibility to view easily relevant tickets to gain a good understanding of the case. In addition, the usability issues discourage using the system any more than the engineers have to, so additional documenting has to be done elsewhere. This raises the bar to document properly as it would require work which could be solved by a software system automatically.

In the internal interviews, there were mixed results on how much documentation are the support engineers ready to do but all interviewees agreed that the level of documentation needs to be better. Creating better documentation but not increasing the effort involved is a major challenge. Other documenting systems work somewhat better but suffer heavily from having inconsistent updates in information and types of information. As an example, information of the installation base should be stored all in a specific location but cannot be easily accessed by all, it is uncertain whether the information is up to date, and sometimes is completely missing for some projects.

While the support process works mostly well internally, some challenges were found. The customer interviewees had not used the customer support yet but based on the experience of the case company, there are repeating issues. Consistent customer communication is something which has proven problematic and the customer support process is a black box to the customers with first a singular input and then finally output. Improving the transparency could assist in creating value to the customers and help support engineers to focus their help to the problem a person has instead of a problem the system has.

As can be seen in Figure 4.3, the customers of the case company only see the communication and the system end state during the entire customer support process. The process is a black box. The ways to improve on the process is to either reduce the number of times the customers are required to contact customer support, reduce the time taken to solve the issue, create more pleasant touchpoints, or improve the quality of the solution.

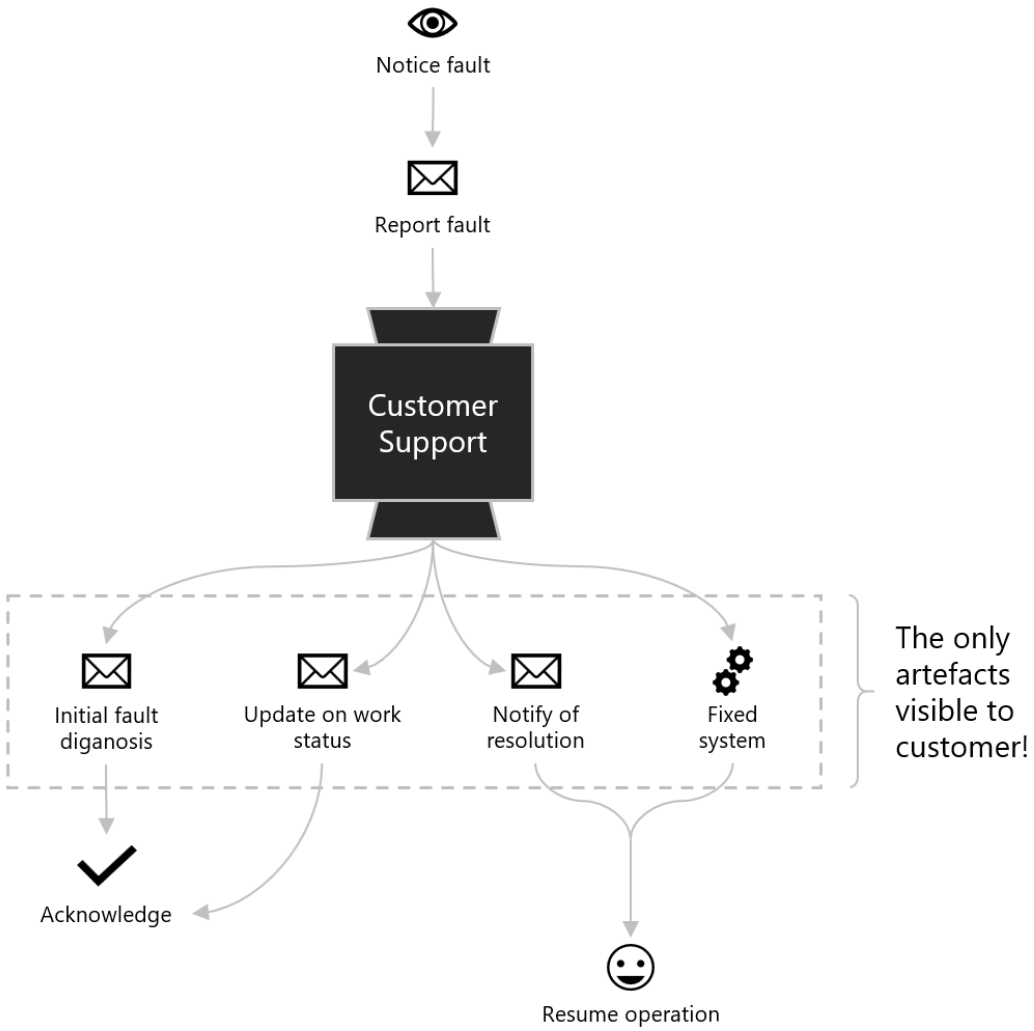


Figure 4.3: The customer point of view of the customer support operation at the case company. The process itself is a black box which only produces communication back and a fixed system.

## 4.3 Process Evaluation and Targets

It is important to understand the starting point which is being improved upon. The current process can be evaluated using its adherence to CMMI, ITIL, and PSS practices. Furthermore, the most relevant practices can be extended to provide targets for what the process should approach as it is bettered. Due to the scale of the sets of practices by themselves, they are not considered in their whole but the most relevant and valuable insights are picked for this case. This lets the process improvement focus on the aspects which have the most potential of improvement and bring the most value-per-effort.

Looking at the primary objectives of the suggested improvements, ensuring the creation of value is the most important. While there are plenty of stakeholders, there are three most important in the service cycle: the support engineers, the customers, and the end users. Naturally, for a business it is imperative to focus on the customer relationship but providing value to both the customer and end user ensures the entire customer organisation is satisfied with the service. Value to them is transferred via the support engineers, so improving their ways of working also increases the value to customers by extension.

Ideally, during the improvements to the customer support process, the case company could also improve their practices on process development. Full adoption of CMMI offers many benefits (Gibson et al., 2006) and provides generic goals to achieve better a service offering. This includes how to institutionalise a managed process. These provide excellent resources to look into improving the processes further but are not included in the process targets. Some of the practices are implicit from other improvement suggestions but also looking to incorporate the process improvement practices at the same time might be too heavy for the case company.

### 4.3.1 Evaluation

For evaluating the current processes of the case company, the general goals and process area of Service Delivery from CMMI are used. The generic goals provide a spotlight for the overall tasks which should be done internally to improve on the service work being done. These have little direct

impact on the customer value and thus are discussed mostly for possible future improvements.

Service delivery describes the practical tasks which an organisation should complete in order to be mature in the area. CMMI associates a maturity level of 2 for Service Delivery which to is the first level where organisations can improve to. Level 1 is where all organisations start. Service Delivery suits the context as it discusses the first steps of creating a managed service process and requires the least effort with its low maturity level.

The most applicable specific practices of Service Delivery SG 2 and SG 3 are evaluated against the current process using the capability levels as simple evaluation levels. The levels are not exact as the case company does not follow CMMI. Thus, more accurate levels could be ”mostly managed” as an example but the practices would not be treated differently due to the distinction so it was left out. The evaluation is presented in Table 4.1.

There are many other ways to evaluate the current service offering. Using different process areas, such as Incident Resolution and Prevention, from CMMI, or focusing on ITIL are some such alternatives. Service Delivery process area, however, combines the key insights from different sources and provides a basis for building a better process. On the contrary, Incident Resolution and Prevention is a more detailed description of incident management compared to Service Delivery SG 3. It offers little more in the context where problems are less in the actions and instead more in the planning and tools of the support engineers.

Table 4.1: The evaluation of the current process against the most applicable specific processes of CMMI Service Design. Establishing service agreements or correct operation of the service system are not considered as they either relate to business decisions and are difficult to measure.

| Specific Practices | Level | Evaluation |
|---|---|---|
| **SP 2.1** Establish the Service Delivery Approach | Performed | The approach is missing some of the most important subpractices. Resource requirements are not determined almost at all, and there is little to no documentation on approach. |
| **SP 2.2** Prepare for Service System Operations | Incomplete | Given how many problems were expressed in the internal interviews about the service system, this practice is not done. Many tools are not functional, and work orientation for new employees has been poor. |
| **SP 2.3** Establish a Request Management System | Performed | The RMS is closely related to the issues with the tools, and while fills the minimum requirements, it misses out on reporting completely and has trouble with engineers retrieving information. |
| **SP 3.1** Receive and Process Service Requests | Managed | Service requests are handled well. The largest shortcoming is the lack of categorising requests which is not done whatsoever. Some inconsistencies are also present in other subpractices but they are minor. |

### 4.3.2 Targets

To get the most benefit out of the limited efforts, the improvement focus should be on bettering the work efficiency and work quality for the support engineers. Like stated earlier, no major problems were stated by the customers whereas plenty were found by the support engineers. Thus,

the improvement will revolve mostly around the challenges described in Section 4.2 and the issues found in the evaluation.

The areas found the most lacking and easing the process improvement in the future should be focused first. Addressing the problems with the practices described in Table 4.1 provides some targets already, although some of the problems are more major than others. First focus should be on setting the service system up which would address the issues present with many different tools. Fixing the other problems on the list will improve the process as well, albeit less than the service system.

Both CMMI and ITIL emphasise on categorising the received service requests and other tickets. ITIL goes as far to provide a detailed list for all the information which should be documented for each ticket. These practices, however, are not taken as is but should be fitted into the case company context. As some parts of the software system receive tickets infrequently and solving them takes often multiple days, the benefit of extensively documenting them might go to waste as there are not as many duplicate cases, especially with every installation having differences.

Another way to improve the process is to make the system clearer to all stakeholders with service components (Aurich et al., 2006). Out of the components, the description and reference stand out from the others because the function and resources are already described if following either CMMI or ITIL. A good target for the case company is to provide a description of the technical service which serves to remind about its objectives and which other systems it relates to. This eases the future development when there is a common, documented starting point.

Described by Aurich et al. (2006), the reference of the service helps in solving the issue of poor technical and functional descriptions of the software itself. This is an important part of the entire service and will help both end users and customers solve their problems by themselves but also the support engineers find solutions more quickly. It also provides descriptions of users' profiles which is similar to the service design method, personas. Having a well-documented reference will also have the service system accomplish SP 2.1 from Table 4.1 better.

## 4.4 Holistic Service Improvement Process

Overall, the combination of the frameworks and service design can be put to work together. Combining all of the frameworks and methodologies is very intensive, however, and requires a motivated team to learn the holistic view and to incorporate it into daily work. An illustration of this process is shown in Figure 4.4. It describes how the different methodologies can be used in tandem for different phases of the design process. Phase 0 is highlighted as the motivation to act but no processes are included.

Phases 1 and 2 are about understanding the context and best practices. These correspond to the research questions 1 and 2 of this thesis, respectively, and focus on providing the reason to improve and how the improvement is achieved. The frameworks provide the knowledge of the best practices whereas service design is about learning the people perspective of the context and current situation. From PSS, the core concepts should be understood and the design process systematised. CMMI offers the targets which the organisation should agree on.

Phase 3 is about coming up with ideas which meet the set goals and chosen guidelines from the frameworks and communicating them. ITIL and CMMI provide valuable information here and even example processes but ultimately organisations have to create the solutions which suit them the best. PSS finalises its definitions of the system components. Service design offers communication methods via prototypes.

During phase 4, the created artefacts from phase 3 are implemented. Demonstrating the upcoming processes can be helpful to communicate the decisions and to evaluate the process prototypes. Here, last minute changes are still possible but majority of the changes are made into daily work. Systems should be put into use and maintained.

The operation is evaluated in phase 5 in detail. The frameworks provide checklists for performance evaluation and highlight different parts of the system. After evaluating the operation, changes can still be made, looping back to either phase 2 or 3. While phase 5 emphasises evaluation, it must be done in every other phase in a smaller scale as well. This is part of the continuous validation. Service design thinking advocates for maintaining flexibility during the design process and learning from mistakes.

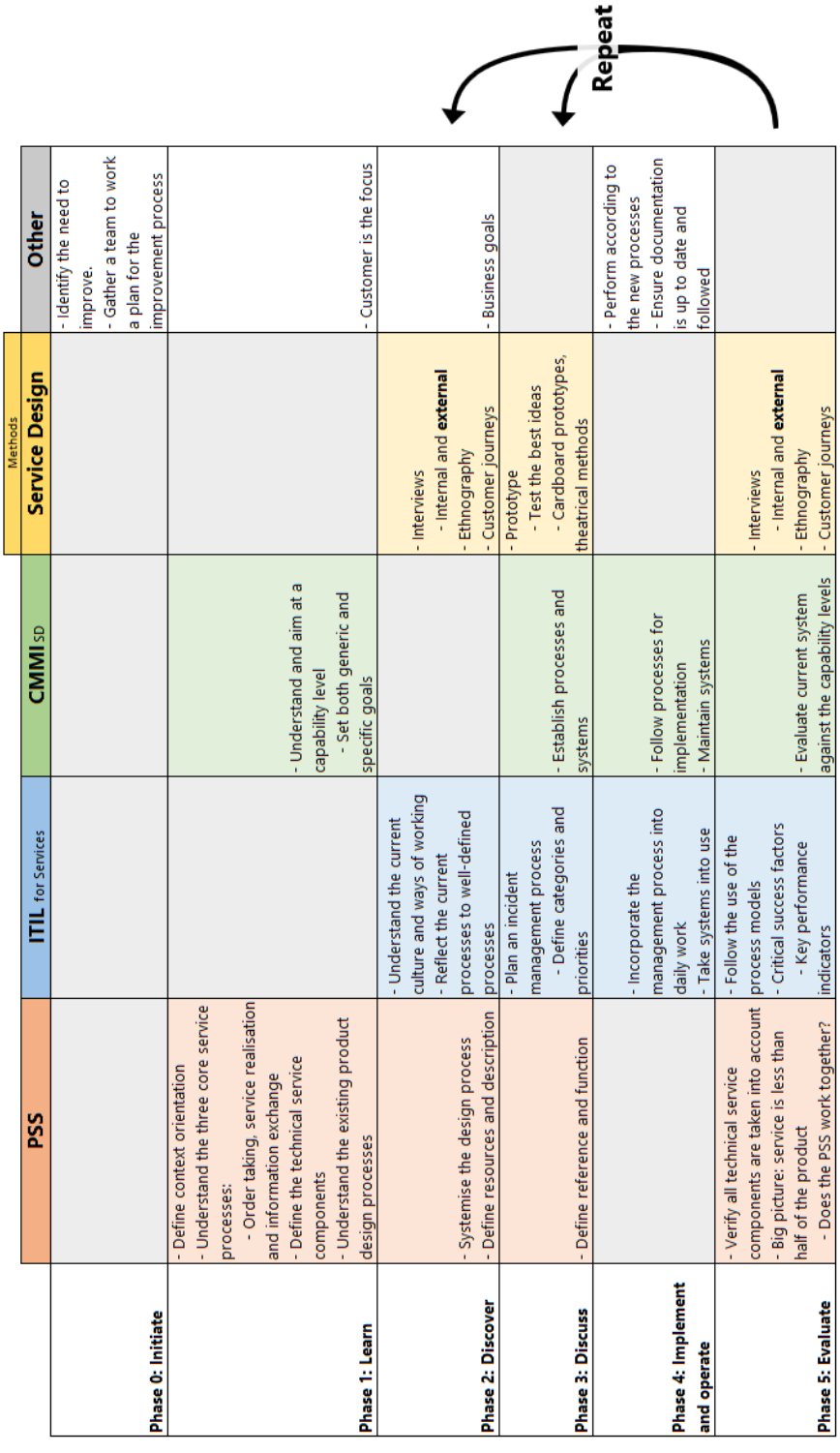


Figure 4.4: The overview of the process of improving customer support using the described frameworks.

# Chapter 5

# Suggestions for Improvements

While the primary goal of this study, the process, was found to be relatively successful, there still were many opportunities for improvements. The results look at the challenges uncovered by the interviews and reflects them with the literature. The topics discussed are used to validate the improvement suggestions. First, PSS provides with general guidelines which should be met by the system. Next, ITIL gives practical actions which can be used to check whether the necessary tasks are done. Finally, CMMI evaluates the maturity of the system against a pre-set level.

These suggestions are not able to evaluate how they fit the business strategy or organisational restrictions of the case company. It would require another layer of complexity and information out of scope for this study. They do, however, attempt to fit into the company culture and provide the next steps which are the most potential improvement locations with the product-service system. Lastly, they are designed to suit the needs of the support engineers. After all, they are the people performing the service and their poor performance could be perceived as poor quality or as some other tangible problem by the customers and end users.

## 5.1 Support Process

The support process was the primary focus of the study but was found out to work the best in the customer support overall. Because the support

engineers have recently taken up the new process, it will not be changed further significantly. Not involving them in the design could be detrimental to the success of the new process and forcing yet a new process for them is redundant. Using as much existing processes as possible follows the ITIL guiding principles the best and allows incremental progress.

The primary improvement to the process model is emphasis on the documentation. Splitting the documentation tasks into filling the general information, categorisation, and then prioritisation emphasises their relative importance. Having the process split into more detailed elements also assists possible new team members learning the support process. The suggested process model is shown in Figure 5.1.

Before starting the use of the new process, categories should be thought out carefully by the support team together. They should be meaningful and useful for metrics and further analysis. The categories are important additions but if not thought carefully, should not be included in the process initially. Similarly, the prioritisation should be done after agreeing on a system what all support engineers follow. This can be the combination of urgency and importance factors of incidents suggested by ITIL or some other way. If no method is agreed upon, prioritisation can be done by the personal judgement of the support engineer.

Because originally the process itself already conformed mostly to the ITIL Incident Management and CMMI Service Delivery suggestions, this will still be the case after suggestions.

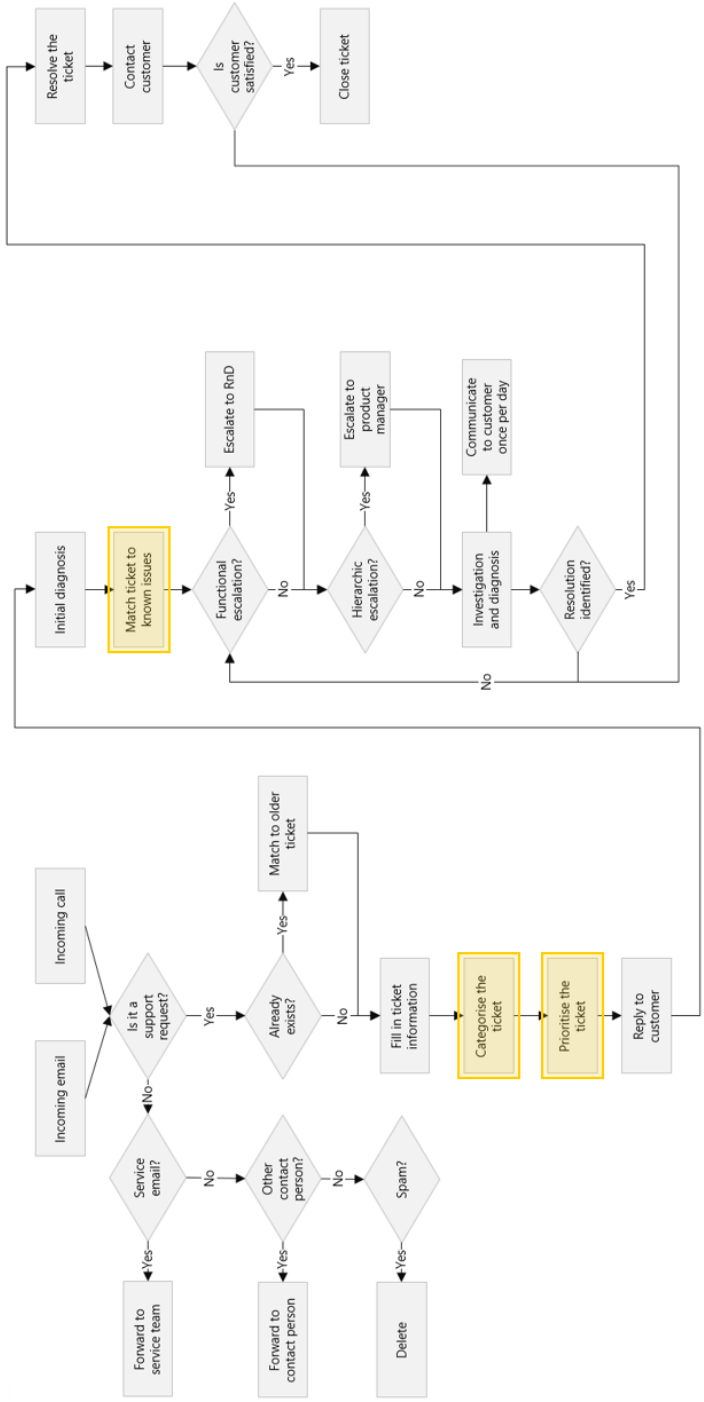


Figure 5.1: The suggested new customer support process model. The main difference from the current process model is the consistent customer communication and documentation. The changes to the original process are highlighted in yellow.

## 5.2 Tools

The most significant changes can be done to the tools in use. A significant amount of time sinks into operating the service system, especially the ticketing software. The current ticketing software is an adaptation of ConSol by the case company. While it is an established software, there are key problems in its implementation. The solvable problems can be sorted into four categories: user experience, reporting, ticket management, and technical implementation. The changes presented below can be either implemented with the same software, or another software can be looked for which fulfils the case company criteria and the solves the issues below.

The support engineers reported many problems with the user experience which should be solved, the primary concern being with writing messages to customers. Right now, the message formatting is set to a default which is not in line with the email formatting set by the case company. The formatting has to be changed each time if consistency is wanted. The system should have customisable and saveable text formatting, including message signatures. In addition, attached files currently have to be confirmed to be attached which must not be the case. They must be able to be added with a single confirmation. Finally, the user experience suffers from occasional crashes or online page reloads which delete the text fields. The message fields should remember the text even in these events.

For continuous improvement of customer support, data needs to be gathered to base decisions on. The ticket management system is the perfect place to receive information on how long it takes to solve tickets and which are the most common issues. The ConSol system in use does not support either of these properly but even states itself that reports are the last priority. This should be revaluated and proper reporting tools added. This is supported by ITIL which suggests building service processes so that they can be monitored and improved upon.

Ticket management also has proved to be too difficult. The system should provide adequate views which give information on all tickets which are relevant to the end user. Currently the system shows all open tickets for an entire vessel which can span many different systems not relevant to the support engineers. Filtering the irrelevant tickets from the view enables the support engineers to understand what issues have been with the spe-

cific project lately and how they might affect the support right now. The filtering can be done if the tickets could be linked directly to a knowledge database and the categories given can act as the filters.

The ticketing system is not the only tool which requires changes. For certain service agreement levels, the case company agrees to do proactive monitoring for the vessels. This includes monitoring the status of different signals, whether they are providing erroneous values or not, and informing the customer of the found issues. As was discovered in the interviews, the support engineers have neither the time nor the proper tools to handle the proactive monitoring. The tools which support it exist but are riddled with bugs resulting in unreliable information and are extremely slow to use. Solving these issues should be the first actions in making them usable.

The software for proactive monitoring is also lacking in configurability. A feature suggestion was given in the internal interviews where the support engineers could set conditions for custom warnings. This would work with simple conditional logic, e.g. ”if the speed of the vessel is over 3 knots and its propulsion power is less than 1 megawatt, send a warning.” The warnings would automate much of the proactive work and would help document the possible logical signal failures which can happen. This feature, however, is not useful before the system provides reliable data and has its unresponsiveness solved.

The goal of these improvements is to bring the tools more in line with ITIL technology considerations. The ticketing system better provides reporting and dashboards after the changes. It also conforms better to the incident management technology functionalities, most importantly the logging capabilities and automated relationships between incidents. These changes do not cover all of the considerations but are the most reasonable for the case company.

## 5.3 Documentation

Many of the issues solved by support engineers are common. They are, however, affected by the differences in the installation specific configuration and hardware used on the vessels. The differences can drastically

change the diagnosis of an issue so the information must be readily available to the support engineers. This can be achieved with a managed knowledge database which hosts the information of all deliveries and their configurations. This database must be accessible by all teams involved with the installations which includes at least the project and support teams. The database must be maintained and any changes to the systems must be documented. The changes can be done during incident management so proper support from the ticketing software is also expected. In addition to the changes, the database should support the incidents themselves and provide a known error database which the support engineers can use as reference when completing support.

Documentation is important not only to the current employees but also are crucial for new recruits. New hires have no experience with the systems and must be able to have written instructions on how the advisory software works and how to solve common incidents. A proper user manual should be provided which explains the operation of the system but also the causal relationships between different parts. This helps both the end user with the system but also the support engineers in troubleshooting.

To abide by the PSS suggestions, the software and service should also have documentation of PSS components: description, reference, function, and resources. These would align and document the business strategy, architecture, components, user role, and other important details of the operation. This documentation should be created by different experts in each area, i.e. the product owner should be the responsible for the description and resources components whereas the development should focus on the function component.

Having good information available helps in exchanging knowledge between stakeholders. It makes analysis of the current situation easier and helps other organisational functions understand the needs of the product and service teams. Having consistent documentation to communicate enables also the analysis of the information exchange. This analysis affects the continuous validation and improvement and helps align the value with the service.

Creating the knowledge database, however, requires a systematic process of entering data. The customer support team must have a common way of documenting processed incidents and changes to the system. The tick-

eting system could provide the descriptions but the steps for resolving the incident must be created manually. Creating the knowledge database is a large investment and is up to the team itself to decide their own approach and how much information should be written (OGC, 2011).

## 5.4 Learning for Improvement

Service design provides a plethora of methods which can be used when looking to improve the service. However, not all methods suit every situation and they must be chosen on a case-by-case basis to make sure that their end results are valid for the scenario. (Stickdorn et al., 2018) The case context has difficult requirements for the methods. Just reaching the end users is a major challenge as they are sailing for a large portion of their time. Especially with a global customer base and only relatively few customers, generalising their needs and wants might not work with any method of choice.

Many common research methods are not suitable for the case context. As an example, self-ethnographic research may not work due to the detailed knowledge required from the researcher for vessel operation. The same problem can easily pose a barrier with simple observations; researchers must have sufficiently deep knowledge about the operation for the observation to be effective. Cultural probes, on the other hand, do not gather enough surface data as it focuses on diverse experiences and perspectives (Stickdorn et al., 2018).

Perhaps the easiest method for understanding the customer requirements is conducting online surveys. OGC (2011) suggests sending surveys after some incidents to evaluate the performance and learn about the customer's experience. These could be done by the case company as well occasionally to gain simple information. Still, the surveys should be short enough so the respondents do not feel overwhelmed. Online surveys are not intrusive to customers but lack predictability in the type of responses OGC (2011).

The three most promising in-depth service design methods for understanding both customers and end users alike are mobile ethnography, contextual interviews, and co-creative journey mapping. These methods are

introduced in detail in Section 3.2.3. Learning from the customers more deeply would enable the creation of better suited services and better customer retention (Mont, 2002).

These methods should be completed so that the participating individuals have understood the situation clearly and are relaxed. They should have enough time during their responsibilities on board to participate on the research and not feel pressured. Otherwise they might not report anything, or even report falsehoods unintentionally at worst.

For designing further improvements, service design can also be used for prototyping. For a customer support service, theatrical prototypes could work as it is about designing the experience rather than the user interface. These prototypes are like plays where a human can be the digital interface or a small play about the customer context. These can also be done by the design team themselves but require real data and preferably includes real customers. (Stickdorn et al., 2018)

Out of the service design methods, ideation is difficult to use in the case context. The requirements for a successful customer support service are detailed and limit creativity. ITIL and CMMI provide many different aspects that the service system should include and diverging with ideas is challenging. The ideation methods are not suggested to be used in this context but can be rather replaced with following ITIL and CMMI guidelines.

# Chapter 6

# Discussion

In this Chapter, the research questions are answered directly. They provide the basis to the thesis and are the contain the essence of the topic. After the research questions, the limitations will also be discussed. The topics which were left out of the study are discussed and introduces some related concepts which can influence future work.

## 6.1 RQ1: Processes and Methods for Improving Customer Support

First in this study, the question researched was *which processes and methods can be used to improve software customer support processes?* The literature review revealed three major research areas which provided either guidelines or practical actions for customer support improvements: product-service systems, IT service management, and software process improvement models. In addition to these three, service design has methodologies which are suitable for software customer support improvement.

PSS research highlights the importance of focus on both the product and service cores from the start of the system design. Different systems can be categorised as different types of PSSs but the case customer support can be considered to be technical services. PSS describes the components of the technical services and the systematisation of their design process to aid in creating value for customers.

To get practical considerations, ITIL discusses process, technology, and people management in one of its publications. By introducing process models, it gives organisations the opportunity to get a baseline understanding on good practices and reflect upon it. Use of different supporting tools and systems is also discussed by ITIL, as well as how to manage the organisation culture. The other publications can expand the ITIL scope but it is not necessary.

CMMI helps organisations with further evaluation of their customer support processes. By including clear maturity levels for process areas, it enables targets for improvement. The process areas are accompanied by specific practices which include detailed activities on how to perform the part of the service.

Service design can be thought as a way of thinking instead of strict methods and processes. The main focus is on gathering as much accurate information as possible and then iterating over solutions before converging for implementation. It is a creative process by nature and does not include any case specific details but rather encourages choosing the methods on a case-by-case basis.

All four provide a different perspective and not all are applicable in every situation. Service design is the most versatile of them and is not limited to either just software or just customer support. While not all, some of its methods work well for this context. The research methods provide the customer perspective well which supports understanding the starting position for improvements. Understanding the initial state is advocated by all three frameworks discussed in this thesis.

The research areas provided the study with opportunities to evaluate the case context. Process models were created based on ITIL structures, and challenges identified by using the goals of CMMI. PSS offered guidance on creating necessary artefacts, and finally service design introduced methods which would be useful in the future research but particularly when understanding the user perspective of the service.

Service design faced challenges with the requirements of the service system. The service design perspective has roots in creativity which is limited heavily by the customer support system specifications. Having to adhere to effective ticket management, documentation, data gathering, and other properties, ideation with service design is difficult. However, the other

research areas provide good requirements for the characteristics which guides the processes similar to service design ideation.

ITIL and CMMI were easier to use and proved to be effective in improving the support. They have descriptions on how the final service system should work and what aspects to take into account internally. PSS would have been more useful if the context would have been about designing the software and customer support for it. While its topics were relevant still when working with an existing system, the lack of practical advice proved challenging to incorporate for the case company context.

The processes and methods from the research areas provide the basis for improving customer support processes for software systems. The processes from CMMI provide a detailed list of requirements for what should the processes be able to accomplish, how to evaluate the current system, and how to set targets for improvement. ITIL is focused on the internal customer support process and describes the required supporting systems and approaches to accomplishing the improved process. PSS suggests artefacts which assist in guiding the design of the entire product-service system and is not limited to just customer support.

## 6.2 RQ2: The Current Customer Support Process

The second objective of the study was to investigate *how does the customer support process at the case company work currently?* This includes understanding the process from both internal and customer perspectives.

From the customer perspective, few issues were found. The customer interviews did not succeed in gathering the targeted data as the interviewees had not contacted the customer support at the time of the interviews. Instead, general customer knowledge acquired from the case company was used to form the timeline of the customer journey. Individual customer journey touchpoints and their effect on customer mood were not identified due to the lack of data.

The primary identified challenge of the customers was the inconsistent communication of different actions regarding the entire system. The case company customer support process is somewhat of a black box which pro-

duces few and infrequent visible artefacts for the customer. The problems in communication were not limited to the customer support process and includes changes, upgrades and new purchases as well. While the customers had not mentioned this during the interview, other customers had mentioned this in cases unrelated to this study.

The internal interviews revealed that the current process is working quite closely following the ITIL Incident Management process model. The support engineers had a clear view of the activities during the process and how they continue to another. The main differences between the performed and ITIL processes were that the case company had dedicated steps for customer communication but less documentation. The lack documentation, however, impacts also the possibility for continuous improvement which requires accurate data from operation to succeed.

The challenges from the internal perspective were the difficult and unreliable tools and lack of documentation. The ticketing and proactive monitoring systems in use faced major usability and technical problems which could slow down the work or even prevent the activities at worst. The ticketing system was unable to record information of the incidents like suggested by OGC (2011) and CMMI Product Team (2010) which has made documentation cumbersome. Documentation was perceived as troublesome by the support engineers and preferred to keep its level to minimum. This conflict with the best practices of proper documentation and preference of documenting as little as possible is a cultural challenge to solve and is not attempted by this thesis.

From the perspective of CMMI, the internal service system followed some of the specific practices of the Service Delivery process area. The levels of the practices ranged from incomplete to managed and 3 out of the 4 examined practices require further attention. If the issues with the tools and documentation were solved, two of the levels could be considered to be managed. The final specific practice, SP 2.1, would require more attention to the resource requirements and documentation of the service approach to reach the managed-level.

## 6.3 RQ3: Improvement Suggestions for the Customer Support Process

The final research question investigated was *how can the customer support process be improved at the case company?* This question was aimed to provide the study with the practical actions when improving the customer support process. The actions should solve the challenges with the most potential for improvement, i.e. the value-per-effort ratio should be as large as possible.

An update to the customer support process model was created to include documentation more clearly. Categorising and prioritising tickets during the process helps later when looking to match the tickets to known issues. It also enables tracking which issues are frequent. The details of individual activities, such as which categories or priorities to use when documenting, was not specified in this thesis as this should be done by the team to match what works the best for them.

The internal activities could be improved by introducing a more complete ticketing system. The system used by the case company does not support reporting on the level which would allow continuous improvement. In addition, the support engineers must do hour logging manually which would be easier and more accurate to be automated with the ticketing system. Finally, as the usability of the ticketing system was found lacking, changing to another system could be possible. The change would require experience from other systems or a test use to confirm its applicability.

Understanding the other changes or installations made on the vessels was also found important. The other teams, like the project team, can make changes which affect the system. Finding this information related to the vessel or another ticket was also difficult for the support engineers. A majority of this information is stored in the ticketing system so either the support team require more training to use the system better or improvements to the system itself to enable searching for the information.

The improvements for documenting tickets, reporting, and other information should be contained in a knowledge database. It could additionally hold the most common errors which would help troubleshooting during daily work but also when the team structure changes. In daily work, the

database could be accessed to verify a solution to an error which the engineer is not certain about. It would be especially useful when a new recruit joins the team or a team member starts working on a new part of the advisory software. The database could also be attached to a user manual which then can be used by the customers as a self-service tool.

The final major improvement would be fixing the proactive monitoring systems. The support engineers are obligated to offer proactive monitoring with certain service agreement levels but lack the time and tools to do it properly. As was discovered in the internal interviews, the systems are frustrating to use and their information is unreliable. The system's basic usability should be ensured alongside the reliability of the information available.

For future research, service design has potential to create better understanding of customer needs. Mobile ethnography, contextual interviews, and journey map co-creation were proposed as the methods to serve as the first methods in the challenging marine context. Different methods were picked to ensure triangulation for gathering data and considered how difficult reaching the customers, and end users especially, physically can be.

## 6.4 Limitations of the Study

The primary limitation of this study was the empirical data used. The empirical study conducted of the internal actions was limited. There was little collaboration with the support engineers after the internal interviews. Only a confirmation of the problem areas was received afterwards. Using other methods, such as observations, to learn more about their work could have provided the study with more reliable data. Involving the other internal stakeholders more could have also verified the improvement suggestions. These stakeholders, such as the product owner, could have had valuable input on whether a suggestion is valid if a more comprehensive analysis would have been made.

As stated previously, the customer interviews did not succeed in being comfortable for the interviewees. They seemed to prefer not to discuss some topics but there are no evidence of this, only a suspicion. This could mean that the interviewees were not comfortable telling something, that

they did not know about the topic, or simply spoke in a way which left this impression. This might have left the study without some data which could have been useful.

The problems with the customer interviews might have been due to the strong connection of the researcher and the case company. The researcher has worked for the case company for years which in itself can introduce a bias to the study. The bias is affected by the researcher's notions about the company. In addition, the previous work has likely introduced knowledge from before the study which has been inadvertently used.

This study was done strictly within the context of the advisory system. This limitation threatens the applicability of the results when comparing to other software customer support activities. No research has been made to verify whether the solution suggestions are suitable for other case company support processes. In addition, the case company has other related functions which were not considered.

The support team is the second team to work on the advisory software for each project. The project team has its own processes and documentation of what has been done and what has been the acceptable level of quality. These teams are separate and the work of the previous team affects the work of the latter. The communication and documentation between these teams is not considered which could affect the results. Many of the improvement suggestions, such as the knowledge database, could also be shared between the teams and affect the organisation larger. This effect, however, is not studied.

Finally, while the study attempts to be realistic in the improvement suggestions, there has been no discussion about the service or business strategies of the case company. These affect the most potential areas of improvement and how resource intensive changes are viable.

# Chapter 7

# Conclusions

The objective of this thesis was to answer *how can the customer support process for a software product be improved at the case company?* This questions was investigated with different frameworks and their methodologies. The starting point was understood and the objectives for improvement defined.

The holistic literature review suggests that **adopting ITIL or CMMI process models can improve the quality of software customer support**. Their process models describe potential solutions to many of the problems faced by the customer support team. As an example, ITIL describes a detailed knowledge management system which can be used as the basis for improving the system of the case company. ITIL and CMMI can be used in tandem along with other methods but having a rigorous model to base improvements upon helps in designing effective and scalable services. Not all of their methods have to be used but the case company can select the most interesting or potential parts which can be incorporated.

Both the literature and empirical evaluations imply that **providing proper tools for the customer support team lessens their workload and eases their daily tasks.** The understaffed team could benefit greatly from tools which support their ways of working and the needs of the company. This could ease the hurry experienced by the team and improve the service the customers receive. The improved tools could support the full function of the team and provide data of the performance to support continuous improvement of the service process.

Finally, the study found out that **improving the documentation systems and practices can improve information exchange between stakeholders.** The support engineers could create and use a knowledge database to store information about the installed systems and common incidents. The database could help engineers to work on problems they have not experienced before. It would also help new recruits on understanding common problems and learning the system more quickly. The internal stakeholders could learn about the recurring problems of the system and external stakeholders can receive faster incident resolution times. However, for a complete knowledge database, the customer support team must also create systematic processes on entering information to the database.

To further expand the research on this topic, more work could be done to implement and evaluate the changes to the service system. More detailed user research studies could be done in order to understand the needs of different stakeholders better. These studies could involve topics, such as what kind of information do they need or how can the customer support team communicate to the customers effectively. Finally, the user groups could be extended to involve also other than cruise vessel operators, such as cargo or ice breaker vessel operators.

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# Appendix A

# In-house Interviews

1. Could you tell me about your average day at the office?
2. How do you know which tasks to work on next?
3. What kind of tools do you use?
4. How do you manage proactive maintenance vs reactive support?
5. How do you communicate with your colleagues?
6. Where do you find information when you don't know something?
7. Could you walk me through the customer support process you follow regarding incidents?
   (a) How does the process work out for you?
   (b) Is this process strict? Do others follow it like so as well?
   (c) What parts work the best in the process? What could use some improvement?
   (d) Do you have any ideas on how to improve the process?
   (e) Do you feel like there is enough resources and personnel?
8. How has the process changed over the last year? If so, how? Has the change been either for the better or worse?
9. What kind of feedback do you receive from customers? How about your colleagues?

# Appendix B

# Customer Interviews

1. What kind of technologies do you use on a weekly basis at home?
2. What are your daily tasks at work?
3. What are the most important parts of operation on the vessel you work on?
4. How do you use the advisory software at work? What do you use its information for?
5. How do you collaborate using the advisory software with your colleagues?
6. Are you happy with how the advisory software works for you? How would you like it to be better?
7. Have you encountered an issue with the advisory software so far? What did you do after?
8. If you could have anything for your work, what would that be?
9. What would you like to see more or differently from the case company?