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Developing a Costing Tool for Service Solutions in Digital Services

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Preface

When starting the Master's studies in 2015 I was not sure what I was getting into. Studying alongside with your day job and family activities with a less than 2 years old child was quite hard, but finishing all assignments really paid off.

First, finding a proper subject for my Master's thesis seemed to be impossible, but then I managed to find an excellent subject when the year was closing to an end. Samu Pylkkänen, who was also my supervisor, presented me an interesting case. I want to thank him for being supportive and enthusiastic throughout the study. I also want to thank my colleagues who contributed to the data gathering for this study. Getting started with the study was a bit troublesome, as in the company there were employee negotiations around New Year, followed by two revisions of the organization structure.

I would like to thank my instructor, Dr Juha Haimala, for his help pointing me to the right direction in case I got lost. I wish to thank Dr Satu Teerikangas, Zinaida Grabovskaia, PhL, and Sonja Holappa for inspiring feedback and positive attitudes to keep me going. All of the faculty members have made the lessons inspiring and memorable.

I was lucky to join this actual class, as the classmates have been amazing, there has been a lot of laughter and support during the year that really has helped to carry through the studies. A year ago, I would not have believed to make such good friends and memories during this year.

Finally, I would like to thank my family for being there for me. As mentioned earlier, it has not been easy to work a full day, then after spending the evening with your child study late in the night. I want to thank my wife, Sorella, for making my studies possible and coping with my surliness. Most of all I want to thank my daughter, Saaga, for being the joy of my life and making this tough year a little bit easier. Special thanks goes to my mother-in-law, Eija, who helped with childcare, giving me time to study.

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Espoo

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This study investigates a real business need introduced by a business unit of the case company. The business unit is responsible for providing service solutions for the customers of the case company. The issue introduced concerns the costing of IT services enabling the service solution deliveries. Previously there have been larger service solution deliveries that have been struggling with cost management concerning IT services. For these deliveries, the service solutions have been designed partly on the fly and there has not been a dedicated resource for managing the IT project. As the whole service offering has not been fully productized, the costing issues occur already in the proposition-making phase. The objective for this study is to propose a configuration tool for the IT infrastructure services, providing costs calculations streamlined with the service solutions.

To study the issue, action research was selected as the research method. With the business challenge identified, the current state of the service solution deliveries was analysed. The data for the analysis was collected from existing company documentation and interviews conducted with key stakeholders from both the business organization and the IT organization. The key pain points in the IT service delivery were identified. The study proposes a tool for creating modular IT service configurations, providing cost calculations for these service deliveries. The proposal for the tool was created using the information found from the current state analysis with the best practices found in the academic and business literature, enriched with workshops with the key stakeholders.

Due to organization and personnel changes, only the original business case owner validated and approved the proposed tool. The outcome of the thesis was a design for the Microsoft Excel based tool, as producing the actual tool was not possible due to the limited time. The tool is intended to be deployed in two different stages. In the first stage, a high-level tool is created to be used by the non-technical sales teams. In the second stage, a more detailed tool is designed and then created to be used in the detailed system design by the Digital Services unit.

The proposed tool will help the ones using to identify the key elements included in certain service deliveries. It will also provide information on restrictions and possible problem elements. Thus, it will also ease up the project planning as standardized solutions can be used.

Keywords	ITIL, Service Delivery, Cost Management

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Acronyms

CAPEX	Capital Expenditure
CSA	Current State Analysis
ERP	Enterprise Resource Planning
HA	High Availability
IoT	Internet of Things
ISP	Internet Service Provider
IT	Information Technology
ICT	Information and Communications Technology
ITIL	Information Technology Infrastructure Library
KPI	Key Performance Indicator
LAN	Local Area Network
OPEX	Operational Expenditure
RAS	Remote Access Service
R&D	Research and Development
SAN	Storage Area Network
SLA	Service Level Agreement
VPN	Virtual Private Network
WAN	Wide Area Network
WLAN	Wireless Local Area Network

1 Introduction

This study aims to improve the costing of IT service solutions provided by a large technology company. This can be achieved by identifying problem points in current pricing and delivery process and creating a modular costing model based on these findings.

The traditional manufacturing industry is going through a change. Selling products and support services are not sufficient anymore, and companies need to find new ways for growth. It has been noticed, that it is not necessary or even financially reasonable to do everything in-house, but some services can be purchased from an external service provider. Thus, companies are moving towards solution business, where the customers are provided with service solutions, instead of producing tangible goods. This enables the service providing company possibilities for growth and expanding to new areas of business.

In solution business, the companies are moving from production and supplemental services to providing whole service solutions. The case company works in an industry where providing only products is not sufficient in this economic state. The customers are not easily making large investments for new products. Thus, the customers want to make most out of the previous investments or outsource some functions so they can focus on their main business area. The customers are provided with different kind of services so they can focus on their main business.

1.1 Case Company Background

The case company of this study is a global technology company that is providing technology solutions and lifecycle services for its customers. The main operation areas are minerals processing and metals, energy, and water. The company headquarters is located in Finland.

The company has quite deep roots in the manufacturing industry, but the company is growing its share in the service business field. The company is providing service solutions in addition to the system solutions it provides from manufacturing machinery to complex

production systems. This study focuses on the functions of the Digital Services unit that started operating early in the year 2016. The Digital Services unit is combined with various units to provide automated service solutions for customers. These units have been previously working with similar systems and cases. Similar services solutions have been offered earlier, but the new organization focuses on providing the full solution from top to bottom IT-wise. Previously the Digital Services unit was operating on the business side, but now it is operating in the same organization with the case company's internal IT.

The next section introduces the business challenge for the case company handled in this thesis.

1.2 Business Challenge

The product portfolio for the case company consists of various physical manufacturing or refining systems from machines to factories. These products have included supplemental services in addition to the products. The product portfolio of the service organization includes pre-defined offerings for the customers. Usually, these service products are relying on IT systems.

The business challenge for this study was introduced by a member of the Digital Services unit. The challenge for the Digital Services unit has been previously that the IT cost breakdowns are not aligned with the predefined offerings as they are currently based on corporate IT cost structures tailored for internal financial control purposes. This complicates making quotes for the customer cases as every case must be defined separately on a very detailed level. This misalignment also causes inaccuracies in the cost projection. With help from more precise cost planning the Digital Services unit will be able to provide services with more affordable price and to win more customer cases.

The next section discusses the objective, the outcome and the scope for this study.

1.3 Objective, Outcome, and Scope

To answer the business challenge introduced in the previous section, the objective of this thesis is:

> to propose a configuration tool for the IT infrastructure services, providing costs calculations streamlined with the service solutions.

The outcome of the thesis is:

> a configuration tool for the IT infrastructucre services, providing costs calculations streamlined with service solutions.

The aim is to break the current IT cost structure down to small modular blocks. The study will discuss if different sized solutions can be built by using these blocks and the cost for each combination can be calculated. The costs are most likely separated to the technical costs and users costs.

As all customer cases are different and include different systems and requirements, the scope of this study is narrowed down to the infrastructure part of the IT-solution. This part is similar across most customer cases. By solving this element in one customer case, it is hoped that the thesis helps the case company deal with similar issues in other customer cases. The whole service system infrastructure provided is quite complex as it is combined from multiple different systems, which can be altered to meet customers' needs.

To approach the issue, the currently used processes for the service design, costing and service delivery need to be studied. Improvements and best practices to solve issues or to improve current processes are studied from existing academic and business literature based on the findings from the current situation.

This report is written in seven sections. Section 1 introduces the case company and the business case that is discussed in this report. It defines the objective and scope for the report. Section 2 introduces the research design used in this report and describes the data collection and analysis. Section 2 ends with the validity and reliability plan of the

report. The current state analysis (CSA) of the current system delivery processes is conducted before literature review as the current state is not clearly known, and the targets for development are pointed out by the findings of the CSA. Thus, Section 3 presents the findings of the current state analysis and shows the strengths and weaknesses of the current situation based on the insights from key stakeholders involved with current and previous system deliveries. In Section 4 the literature will be reviewed based on the findings of CSA to discuss the existing knowledge and best practices concerning this case. From these best practices, a conceptual framework for solving the current business need, is created. In Section 5 based on the findings from the current state analysis and the conceptual framework created, the initial proposal for the IT service configuration tool is created. In Section 6 the initial proposal is validated, and the final proposal is completed with the feedback from the validation process. This section also presents recommendations for next steps. Section 7 discusses the results and presents the summary of the research done concluding the study.

2 Method and Material

This section discusses the research approach and design for this report and why these were chosen. It describes how the data for this study was collected and analyzed, and the last part presents the validity and reliability plan.

2.1 Research Approach

This study uses action research as its research approach. Action research is chosen as the research approach as the author is working in the case company in the same organization with the Digital Services unit and is attending to developing of the IT infrastructure services of the service solutions provided to customers. Coughlan & Coghlan identify four main characteristics of action research. Firstly, it is more of "research in action, rather than research about action". It can also be described as being "participative" and "concurrent with action". Finally, it is "a sequence of events and an approach to problem solving". (Coughlan & Coghlan 2002: 222)

Coughlan and Coghlan (2002: 227) descbribe action research to involve an actual issue, which has "an uncertain outcome and which the group or organization is willing to subject to rigorous inquiry, particularly the analysis and implementation of the action". Action research can also be used to identify how an individual can change or improve some existing system by his or her actions. It also helps the person doing the change to learn from the change or improvement process. (Coughlan & Coghlan 2002)

Kaplan (1998: 91) remarks that "in both the physical and social sciences, most researchers aspire to describe, understand and predict, but not to change the underlying phenomena," as in action research being actively involved is crucial for the new knowledge creation. McKay & Marshall (2001: 47) characterize action research by "the active and deliberate self-involvement of the researcher in the context of his/her investigation", and Kaplan (1998: 91) suggests that "the scholars become active change agents, helping to create phenomena that did not exist before". Blichfeldt (2006) notes that researchers may emphasize in a different way the importance of the action and the research aspects. In action research, the primary status is in the action part instead of research.

Coughlan & Coghlan (2002) describe the six main steps for action research cycle. The first three steps are related to data collection and analysis and the rest to the action. The data steps are data gathering, feedback, and analysis. With the analyzed data needed actions are planned. After the planning phase the plan is implemented and after this step, the results are evaluated. They also include a meta-step for monitoring. The action research cycle introduced above has been modified for this study and the used action research cycle is illustrated in Figure 1 below.

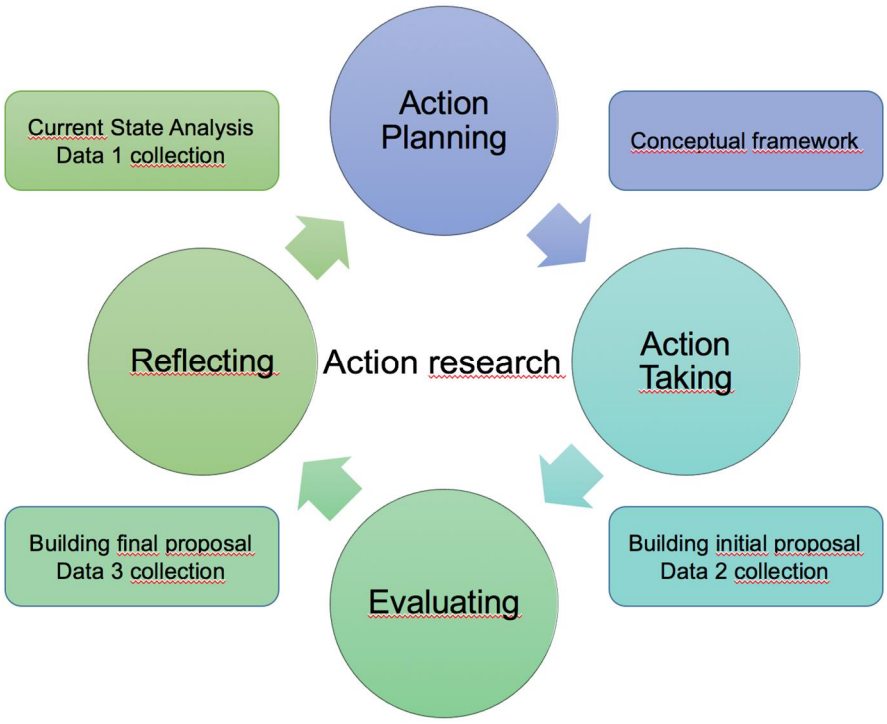


Figure 1. Action research cycle

Figure 1 above illustrates one cycle of action research. The cycle consists of action planning, action taking, evaluating and reflecting. Each cycle is a separate development process of which the outcome will be further developed in the next cycle. McKay & Marshall (2001: 52) point out that action research consisting of at least "two cycles makes it a lot easier for the action researcher, particularly the less experienced researcher, to ensure that they are doing research, and are not inadvertently trying to masquerade consultancy or problem solving as research". For this study, the identification of the business challenge and the current state analysis are inputs for the the planning phase. In the planning phase a conceptual framework is built based on the findings. Based on the data from the action planning phase the initial proposal is built in

the taking action phase. This proposal is validated with the business case owner in the evaluation phase. The final proposal for the first cycle will be presented in the reflecting phase. Due to the limited time for this study, only one cycle can be completed, but the following cycles will be implemented later on outside of this study.

"Once you have determined what your case will be, you will have to consider what Your case will NOT be" (Baxter and Jack 2008: 546). The case scope is limited only to the infrastructure part of the IT services provided to the customer and to the details that need to be taken into consideration in the quotation process. Hence, all application and system specific details are left out of the scope. The basic IT infrastructure builds up from similar components in each case, which in this case include the networking layer, server infrastructure, and user and workstation management. The IT infrastructure enables the use of the IT services, but it does not take the applications used within the system in consideration. The case scope may be altered in the following cycles to cover more of the different systems included with the service solutions.

The report uses qualitative research methods for data collection and analysis, as the data cannot easily be measured as in quantitative research, due to the nature of the data. As Myers (2009: 8) points out that "quantitative research methods were originally developed in the natural sciences to study natural phenomena". According to Myers (2009) data sources like, observation, interviews and questionnaires, and documents can be used in qualitative research. The impressions and reactions of the researcher can also be used as data sources (Myers 2009). For this study, the data for current state analysis is collected from existing documentation and personnel interviews. Most of this data is confidential and bound by a non-disclosure agreement.

The research design for this study is introduced in the next section.

2.2 Research Design

As described in the previous section this study uses the action research approach. The research design for this report is illustrated in Figure 2 below.

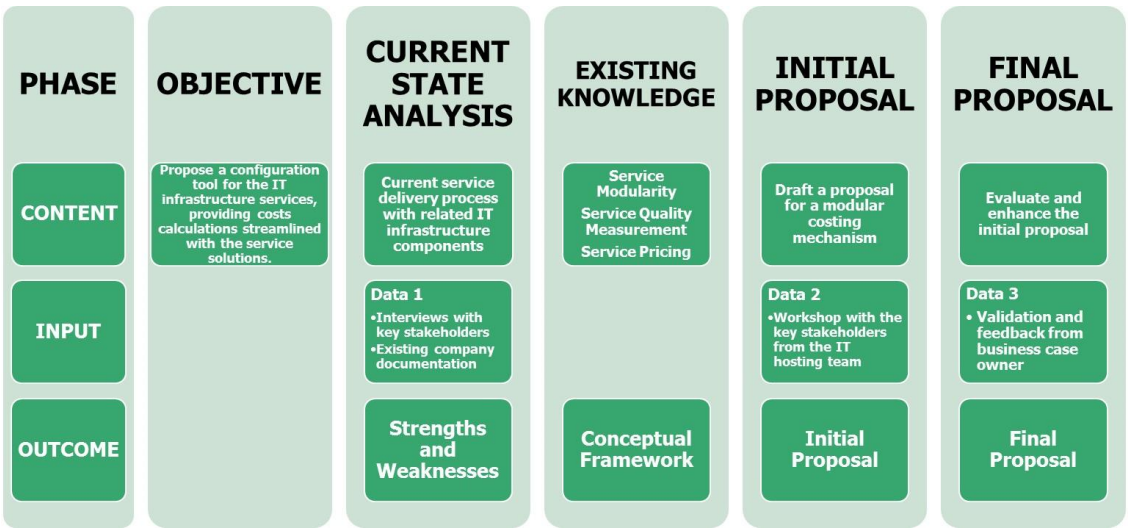


Figure 2. Research design of this study

Figure 2 shows the study's research design, and accordingly the different stages of the study. For each stage, the *content*, *input*, and *outcome* are described. The *content* describes main topics included in each phase. The *input* discribes the data inputs used for each stage. The o*utcome* describes the outcome of each phase. The first stage of the study is to identify the business challenge. The business challenge concerns the Digital Services unit, that has been struggling with the delivery and maintenance costs for the few previous years. The issues mainly focus to cost projection and cost estimation. The business challenge for this study was brought up by a member of the business unit at the end of the year 2015. He was looking for a costing model to suit their purposes as the internal costing models were designed to meet the internal purposes. This business unit was reorganized to the Digital Services unit at the beginning of the year 2016.

Once the business challenge is identified the study is scoped and a clear objective is presented. In this case, the current state of the existing processes defined for the service deliveries needs to be evaluated. The analysis is done by studying the existing documentation related to the business process, and key stakeholders involved in the

planning and delivery processes are interviewed. This stage provides the Data 1 of this study. As an outcome of the current state analysis, the strengths and weaknesses of this process are identified with an overview of the current situation. After the current state analysis, literature and existing knowledge in the company are reviewed to form a conceptual framework of the best practices.

In the initial proposal phase, a workshop held with the key stakeholders and interviews. In the workshop, the key stakeholders are introduced to the findings from the current state analysis and the literature review. Based on the feedback and suggestions from the workshop the initial proposal is built. This stage provides the Data 2 of this study. The initial proposal is validated in a workshop with the business case owner and with the feedback from the workshop, the final proposal will be prepared. This feedback from the validation is the Data 3 for this study. As this study uses action research, the final proposal will be as the input for the second research cycle. The second research cycle will start separately from this study.

As this section described the research design, the next section introduces the data collection points and the gathered data in more detail.

2.3 Data Collection and Analysis

The data for this study is collected in three stages. Data 1 consists of internal company documentation and interviews with key stakeholders. As the author works with the service delivery projects in the scope of this study, also the author's observations are affecting in Data 1. Data 1 shows the state of the current service planning and delivery processes and indicates their strengths and weaknesses. Based on these findings best practices is identified by reviewing both the academic and business literature and existing knowledge of the author. The best practices form the conceptual framework for this study. The initial draft is done in a workshop with the key stakeholders based on the findings from the CSA and the conceptual framework. The information gathered from the workshop is Data 2. The initial draft is introduced to the business case owner, whose feedback is used to produce the final proposal. The feedback is Data 3.

The details for the existing case company documentation in the current state analysis stage are presented in Table 1.

Table 1. Existing documentation

ID	Document Name	Main topic(s)	Type	Date
D1A	Proposal Matrix	The things required for a proposal	Excel Sheet	29.1.2016
D1B	Responsibility Matrix	Roles and responsibilities of provider and customer	Word Document	29.1.2016
D1C	Cost Breakdowns from Previous Cases	Cost calculations for different services	Word + Excel Document	10.2.2016
D1D	Legal Documents	Agreement legal documentation	Word Documents	29.1.2016

The existing documentation related to the service solutions offerings done previously in the case company are presented in Table 1. Alphanumeric ID marks each document. Document D1A is used to scope the project and document D1B is used to define the roles and responsibilities of the service provider and the customer. Document D1C includes a Word document and an Excel sheet describing cost breakdowns for a previous case concerning the basic IT infrastructure. Document D1D includes multiple documents that provide the legal information for the contract. To enrich the data, the key stakeholders are interviewed. The details for interviews concerning Data 1 are presented in Table 2.

Table 2. The interviews of key stakeholders

Person ID	Type of interview	Position	Date and Duration	Document
D11	Face-to-face	Project Manager	11.1.2016 - 30min	Field Notes + Audio recording
D12	Face-to-face	MES Manager	10.2.2016 - 1h	Field Notes + Audio recording
D13	Face-to-face	Head of Energy Services	10.2.2016 - 1h	Field Notes + Audio recording
D14	Face-to-face	IT Development Manager	10.2.2016 - 45min	Field Notes + Audio recording
D15	Face-to-face	Intergration Architect	11.2.2016 - 1h15min	Field Notes + Audio recording
D16	Face-to-face	Service Manager - Networking	17.2.2016 - 30min	Field Notes + Audio recording

To learn the current processes, a total of six stakeholders were interviewed. Interview information is available in Table 2. Alphanumeric ID marks each interviewee. As the same interviewees can be interviewed in Data 2 or Data 3 stages, the same ID is used for these persons. The interviews were conducted in face-to-face meetings and they lasted from 30 minutes to 95 minutes. The longest and most fruitful interview was with the Integration Architect, as he is the business case owner and has very good insight on the matter.

The interviewees' position in the organization is presented in the position column. For details, the date and length of the interview are collected. The documentation type of each interview is presented in the last column. The template used for collecting the field note can be found in Appendices as Appendix 1. The field notes are quoted in the text, but due to the sensitive nature of the data the whole interview transcripts are not included in this study. The list of key findings can be find in Appendix 2. The findings are categorized in to six main categories described in more detail in section 3.5.

The first interview was more of an open discussion with a project manager focusing on smaller scale service system deployments than this study focuses. The first interview was done to gather insights for this case, and to familiarize the author to the current processes. The five other interviews were semi-structured. Three of the interviewees have worked in the project delivery, and two of the interviewees have been attending to the project deliveries on the IT infrastructure part of the deliveries. The questions for the interviews were focusing on five different parts, and the interview template is included as Appendix 1. First part clarifies the background of the interviewee and his involvement in the case studied here. The second part focuses on identifying the strengths and weaknesses of the previous customer cases. It also tries to identify the key concerns of the interviewee. Third part analyzes what can be done to improve the situation. Fourth part sums up the best practices of the previous projects. The last part introduces possible development ideas for the customer case. Not all of the interviews did fully follow the structure, as the interviews were semi-structured but casual in nature.

The data from the interview was categorized as there were some major topics that came up in all of the interviews. These topics are described in more detail in section 3.5 Strengths and Weaknesses of Current Service Deliveries.

After the literature is reviewed, the author makes a presentation with all the findings from current state analysis and the literature review. The presented material was discussed and evaluated in a workshop with key stakeholders from the IT hosting team. Table 3 describes the workshop for Data 2 in more detail.

Table 3. The workshop with IT hosting team

Data ID	Person ID	Position	Date and Duration	Document
Data 2	D14	IT Development Manager	11.4.2016 – 30min	Workshop Notes
Data 2	D16	Service Manager - Networking	11.4.2016 – 30min	Workshop Notes

The stakeholders introduced in Table 3 also attended the interviews for Data 1. The proposal was built based on the findings from the current state analysis, with improvements and best practices from literature and the workshop with the key stakeholders. This proposal was validated with the business case owner, and the feedback was collected as Data 3, which is described in more detail in Table 4.

Table 4. Data 3 collection

Data ID	Person ID	Type of Meeting	Position	Date and Duration	Document
Data 3	D15	Face-to-face	Integration Architect	14.4.2016 – 1h	Field Notes

The collection for Data 3 was done in a face-to-face meeting as shown in Table 4. The data received was used to revise the initial proposal, to create the final proposal.

The next section discusses how the validity and reliability of this study are evaluated.

2.4 Validity and Reliability Plan

For an academic study to be rigorous and trustworthy, its validity and reliability need to be evaluated. Jha (2008) describes that the ones who read the study must be able to rely on that the research outcomes presented are valid, and they lead to truthful outcomes.

Concerning validity Quinton and Smallbone (2006) discuss on different ways to test the validity of the research. Internal validity tests, if data measured was what was intended to be measured in original research design phase. Then external validity tests if the outcome of the test can be used for different situations, and to what degree it can be used. (Quinton and Smallbone 2006)

Reliability of an academic study must be proofed. For example, if only a few informants can be used for collecting the research data, it may decline the reliability of the study. Hence, it is important to show the credibility of the sources, especially when the amount of them is little. In some cases, these few informants can be the only and best sources available. (Quinton and Smallbone 2006)

Reliability of the study can be enhanced using different *data sources*, *data collection tools*, and *collection points in time*. The reliability can be improved by applying formerly established theory from a different area to the research area. To strengthen the reliability of the research triangulation can used, as illustrated in Figure 3. (Quinton and Smallbone 2006)

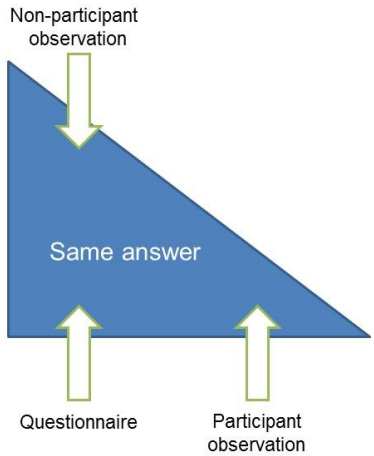


Figure 3. Triangulation (Quinton and Smallbone 2006: 132)

In triangulation (Figure 3) the research question is answered using different methods to gather data. When data from various sources provides the same answer, for example, it eliminates the effect of personal bias of an interviewee. It is also possible to achieve the same answers if a different person conducts the research. For this study, the data was collected from different type of target groups, which consist of personnel from service business unit's, the Digital Services unit and internal IT's personnel. The data is enriched with the observations of the author of the daily operations of the organizational units involved in this study.

The interviews for this study are semi-structured, following the main topics set by the researcher. Hence, there are different types of bias to be considered. The interviewer may create bias by commenting, using certain tone or non-verbal behavior, which may have an effect on the interviewee's answers. On the other hand, there may be interviewee or response bias, where bias is created, for example by perceptions about the interviewer. It is also important to notice if the interview requirements are time-consuming, it may reduce the willingness of key stakeholders to participate. (Saunders et al. 2007)

The next section discusses briefly the case company and its area of the industry it operates. After the company overview, the current way of building the IT infrastructure for the service deliveries is introduced, followed by the findings from the interviews.

3 Current State Analysis of Service Solution Delivery

This section discusses the current state of the service solution deliveries. Firstly, the case company and the area of the industry it operates are introduced. Secondly, the different components in IT infrastructure affecting the service solution deliveries are introduced in detail, and the effect of each component is described. This information is reflected in the knowledge of the author and the findings from the interviews. The CSA section is concluded with the findings from the current state analysis, which identifies the strengths and weaknesses in the current way of planning and delivering the service solutions.

3.1 Overview of the Case Company

The case company aims to provide leading technologies and services for using natural resources. The case company has a long history in minerals and metals processing technology business. In addition to these, the case company provides solutions for example for chemical industry. The company's operating model is illustrated in Figure 4 below. This revised operating model has been operational since February 2016.

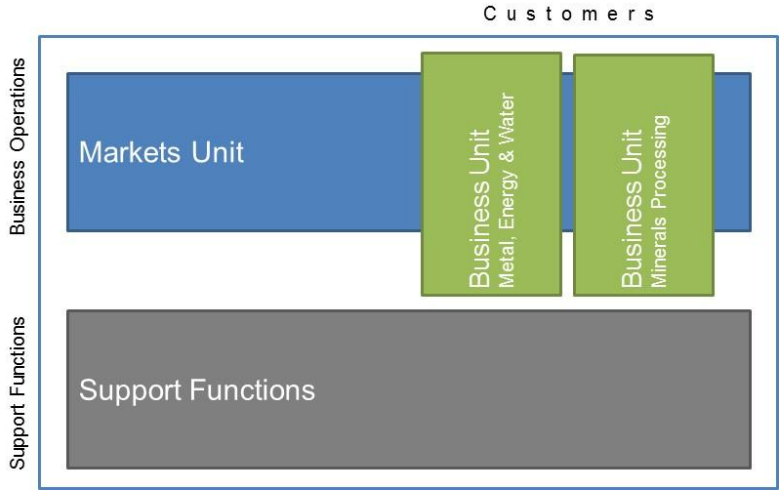


Figure 4. The operating model of the case company

In Figure 4 can be seen the two main business units: Minerals processing and metals, energy, and water. The business units are supported by support functions. The support functions provide also the IT services related for this study.

The case company operates in eight market areas, which operate under Markets Unit. The Markets Unit provides for the case company's customers project implementation, deliveries, and service. In total, the case company is running different functions in 30 different countries on six continents. The case company sales were in 2015 approximately 1.2 billion euros, and it employs approximately 4800 people worldwide. The case company's shares are listed on NASDAQ Helsinki.

The case company is operating in the area of renewable energy industry and industrial water treatment, in addition to the traditional minerals and metals processing. It intends to set more effort on providing sustainable life cycle solutions, with an aim to provide the best returns for customers' investments with minimized ecological impact. The author is working alongside with the study with service business cases in the field of the energy industry.

The next section introduces the service operations that the case company provides to its customers.

3.2 Introduction to the Case Company's Service Solution Business

The service solutions sold by the case company, are mainly built on the different solutions and components designed and produced by the case company. In addition to these, there are also some services provided to customers with technologies in use other than provided by the case company. Currently, the selection of services varies from monitoring services to full operation and maintenance services. These services are often based on IT-systems, where the service providing company defines the infrastructure and systems. The used systems may vary between different cases, but usually, the basic infrastructure builds from the same blocks in most of the cases. To be able to productize the services, standardization of the systems and processes is important. A framework with certain boundaries is needed, for the case company to be able to provide working solutions from the available components.

For the case company, there is a selection of different product and service solutions for different business areas. The solutions are being built from a long history of traditional manufacturing industry, but now they are adapted to better fit the service business. The

product solutions are still available, but the service solutions are adding more value to these product solutions. The service solutions are also provided apart from the product solutions, for example, to provide supporting services for the customer's existing solutions. Currently, there is a three-step model available in the service solutions. The different options are *advisory services*, *support services*, and *full operation and maintenance*. The research done in this study covers all different service options.

The next section introduces the different components, which are needed for building the IT infrastructure to enable the service solutions.

3.3 Building the IT Infrastructure

The IT infrastructure builds up from various components. Everything is based on a working data network, which consists of a local area, automation, and other data networks, supplemented with secured connections between the customer and case company networks. On top of the network is built a server infrastructure providing a baseline for the server systems needed to run the infrastructure systems together with the automation and data gathering systems. The servers hosting these systems are running in a virtual environment, which is hosted on one or more physical servers. Virtualization is used to achieve a more versatile, agile and cost efficient solution.

In addition to purchasing all components required to build the IT infrastructure, the components can be purchased as a service, which enables the element of cost predictability and the maintenance with certain SLAs can be included in the service. On smaller scale deployments, where for example a data collector is collecting data from the automation system, it may be more feasible to procure the required hardware. Depending on the agreed service level, the monitoring and maintenance may need to be purchased as a service. Often in such cases, it is not critical for the data collector be connected to the central system all the time. The main function of the collector is to collect tag information and cache it locally. Data transferred to the central system is never on-line data, as there is at least some minor delay all the time. The collected data is used to analyze the status of the facility, and based on this data plan maintenance and performance improvement tasks. Based on these actions the uptime and productivity of the facility can be increased.

The Internet of things (IoT) can be described as connecting a different kind of equipment and devices to a network, allowing collection of the data from the connected equipment or devices (Goldman-Sachs 2016). In the service business, IoT and especially industrial Internet can be used to collect data from the different parts of the automation system and other production devices. This data is collected to one location and processed in a central data center. This information can be used for multiple purposes. Usually, the *operate and maintain* type contracts have certain key performance indicators (KPI) to measure the performance of the provided service. In case the outcome is better than specified in the agreement, the customer may pay performance bonus for the service providing company.

In many cases, there will be case company's personnel working as engineers in the customer premises. To operate properly, they need to have regular office services, like printing and email, available. These services need to be provided either locally or if possible from a remote location. The engineers can be located in a separate office area with case company specific LAN or WLAN connection with network printing and file share availability. Another option is that the engineers are provided a network connection from the customer's premises, and they work over a VPN connection with only remote services available. The IT infrastructure needed by the staff is also included in the scope of this study.

The current state analysis shows further how these different components are currently designed. As a baseline, all required components are identified and described for the internal use in the IT organization. To make them suit the needs of the Digital Services unit, they need to be modified to some extent.

The next section discusses the planning of the services that are provided for the customers and the certain minimum requirements that must be met to be able to provide the services.

3.3.1 Detailed Planning and Pre-requisites

Certain pre-requisites must be met before different stages of the project can proceed to delivery phase. The requirement for the pre-requisites can be understood from one of the interviewees note concerning a particular customer case.

> *We had promised to the customer that infra is up at the certain time and we were forced it to make it in time. Then we got there (to the customer site), and there were even no walls on the building. It did not make sense at all. This points again towards the project management issue, as the IT project should be defined to be reasonable. There were no walls, but there was a server room without a door. Every time the air conditioning started, all of the workers were cooling inside the server room. (Data 1: D15)*

To avoid similar cases in the future, clear pre-requisites must be set. As in this case, the case company would have been forced to pay penalties to the customer for missing the deadline of the system delivery.

The issues introduced above was a result of poor requirement setting for each building phase, and neglecting the fact that possible delays in certain functions will prevent certain following steps from starting. In the proposal phase in addition to setting the required components, there is clearly a need for more detailed requirements to be set for building up each customer case.

For the initial project setting, it is important to analyze the risk level, as it aligns the whole contract with the customer and sets the baseline for costs and everything like noted by an interviewee.

> *The risk assignment aligns everything. It aligns the contract that you sign with the customer because then you know how you can support the system, what the availability is going to be, and all of this stuff. Then you can say to the customer that the system may not be available all the time, are you OK with this? If the answer is no, then the price goes up four times. But the thing is that we shouldn't go in with the four times price as the customer goes "wow-ho" and select another. We have to go in low, and "here's the risk, are you accepting the risk?" If yes, we give the low-cost option. (Data 1: D12)*

The initial price setting will affect the customers' interest towards the offered services, especially if it is too high. In such cases, the possible customer will try to find a cheaper service provider unless it is not familiar with the service providers service quality.

The pre-requisites for different each component are described in more detail in following sections. To start from the bottom, the network infrastructure is the base for working IT infrastructure and it is described in the next section.

3.3.2 Network Infrastructure

The most important pre-requisite for running successful remote operations to a customer facility is to have a working network connection between the case company's data center site and customer site. If the operation task is to monitor a customer facility or to operate and maintain a plant, connectivity between the facility and the remote operations center is important. Remote operations are agile and cost-efficient ways to operate different functions, compared to running everything locally on-site with dedicated staff. There are some limitations to the possibility to use these remote services. For example, the facility maintained may have its closed data network without access to the outside world. There may also be some limitations for the customer to want to provide access to the restricted network.

Depending on the service level agreement (SLA), the network connection can play an important part in the success of the operations. For a higher service level, the cost is higher, as the connection may need to be doubled, in case a break in the service occurs. In high service level cases, all network hardware needs to be doubled, which easily multiplies the capital expenditure (CAPEX) cost on the network hardware and licenses for required features. The cost for the connection will also increase as two different connections are needed. The cost of the Internet connection does not necessarily double as the backup line can be of lower bandwidth.

For the customer to provide the connections is the preferred way, a the customer facilities are often located in sparsely populated areas, due to the nature of the industry. In these locations, it is impossible to get low-cost connections from the Internet service providers. In many cases, the connections may be built on satellite or wireless

technologies, which provide quite an unreliable performance. The cost of these solutions is usually high and depends highly on the location, which makes it hard to estimate the price in advance if the case company needs to provide the connection. Compared to the other components that are needed to build the IT infrastructure, the network connectivity is the most uncertain cost-wise as the prices alter highly between different geographic locations. This has been emphasized byt the service manager for networking (Data 1: D16), “there are no estimates for the network connection pricing as in Kuwait the cost is quite a lot more than in Espoo”. There may also be restrictions for the connections set by the government or other parties, which need to be identified in advance.

> *Then we shouldn’t have sites in China where the government can close the firewall to prevent IPSec connections. For example things like this. They need to be tested before. (Data 1: D16)*

If there are personnel working for the case company on the customer site, there is also a requirement for local area network and possible Internet connectivity. In the local area network is usually located authentication services provided by Active Directory, file and print services, and computer management services.

There are some pre-requisites that have to be met before systems deployment can begin. The facility needs to be complete to the certain extent that the network cabling and facilities for the IT infrastructure can be built once the hardware is delivered to the site. The network cabling, including copper and fiber cables, are installed and documented by the constructor. This connectivity needs to be available all the way to the automation system network. There must be a possibility to access the automation network to extract required data for monitoring and analysis.

On top of the network infrastructure builds the server infrastructure, which is discusses in more detail in the next section.

3.3.3 Server Infrastructure

The server infrastructure consists of multiple elements and the need for certain elements depends on the service level agreed with the customer. With low service level systems, there is no need for high-availability (HA) services, as the recovery from error situations is not very critical. Then for systems requiring attention 24 hours a day for seven days a week, will need to be secured using high-availability components for network connectivity, server platform, and management access. The setting of the service level to a correct level has been a problem in the first service delivery cases, as was pointed out in one of the interviews.

> *We have to be sure, if the operations are dependent on the system, then it has to be 24/7. None of the systems we have deployed require nothing close 24/7. (Data 1: D12)*

The effect of service level compared to the price has not been clear for the business units as described by the service manager for networking.

> *In the second case, they wouldn't lower the SLA, and that's why it was so expensive. If they've had dropped the SLA, they prices would have been much lower. You would need to have a taxi price type catalog for SLA as well, where you can see the effect of different SLAs for the pricing. (Data 1: D16)*

High-availability can be achieved by duplicating the services, which usually means that there is two of every device and connection. For the server infrastructure, this means that the servers hosting the virtual environment are clustered from two or more servers. To enable them to host the virtual guest servers, they need to have a common storage for these virtual guest servers. This common storage is provided from a storage system. In most cases only one storage system is sufficient, as the device has doubled power sources, controllers, and a redundant disk configuration to endure breaking of single components. Depending on the storage technology, a storage area network (SAN) may be needed. For interconnecting the storage devices and servers, SAN switches are needed. But as the MES Manager (Data 1: D12) brought up the issue, "You know, while we have the nice infrastructure, it is way over the top what was needed". For the previous deliveries this has been the case as the real need for the service level of systems was lower than what was initially intended.

In most critical cases the whole server infrastructure can be mirrored to another location, which ensures the systems to be running even if the main data center, for example, burns down. Mirroring a data center is expensive and requires fast connections between the data centers. This option is out of scope in most of the cases, and this has an issue has been approached by assessing the risk, like pointed out by one of the interviewees.

> *It would be nice to have the 24/7. But if they go down, the question is what I'm doing for one of the customers at the moment, I have created a risk assessment on the system, and therefore for each risk you have to have a mitigation action. And if you can successfully identify the mitigation actions, you reduce the risk to the priority of the system. (Data 1: D12)*

Even if the systems are highly automated, there is usually always a need for personnel working with the projects. The personnel requirements are discussed in the next section.

3.3.4 Personnel Requirements

For personnel working on the site have a certain IT-related cost per person. This cost is combined with the services used by the person. These services include following: authentication services, remote access service (RAS), Internet and Intranet connectivity, Office 365 tools (Outlook email, Skype for Business, etc.), antivirus service, mobile phone, IT support services and others. Different types of roles require a different kind of tools, for example, a manager needs to have full Office 365 toolkit, as a factory worker may only need access to his or her email.

Not all of the personnel necessarily work on the customer site, but they can work remotely from an operations center located in a different country than the customer is located.

The personnel costs are already internally priced for all users in the case company and are based on a monthly cost of each service item. Usually, contractors use a limited amount of services provided by the case company, but in some cases also contractors may use the whole service offering provided for the personnel.

One of the biggest effects on the costs for a service delivery is set by the roles and responsibilities. Defining the roles and responsibilities also define cost responsibilities, which is described in the following section.

3.4 Roles and Responsibilities

Roles and responsibilities of the customer and the provider, which in here is the case company, are mapped to a matrix. The setting of roles and responsibilities has a high impact on the costs, hence to the pricing of the service. If the customer, for example, provides Internet connection on site, the cost can be removed from the operational expenditure (OPEX) of the case company providing the service. The roles and responsibilities can be reported in different ways. Previously there has been used a matrix (Data 1: D1B) defining the responsibilities for actions and costs. An example of the matrix is illustrated in Figure 5.

Task	Responsibility for Action				Comments	Responsibility for Costs			
	Case company	Customer	Constructor	Sub-contractor		Case company	Customer	Constructor	Sub-contractor
Participation to the site design review meetings	x	x	x	x		x		x	
Provide heating, ventilation, air conditioning, water, electricity	x		x	x		x			

Figure 5. An example of action and cost responsibility matrix (Data 1: D1B)

The matrix in Figure 5 defines the responsibilities for actions and costs between the solution provider (here the case company), the customer, the constructor and other key stakeholders.

Another way us using a RACI matrix. In RACI matrix, the responsibilities are separated into four different categories: *responsible, accountable, consulted* and *informed*. A simple RACI matrix is introduced below in Table 5.

Table 5. Example of a RACI matrix

Function	Case Company	Customer	Constructor
Network cabling	I	I	A/R
Internet connectivity	I	A/R	
Firewall control	A/R	C/I	
Automation network build up	C/I	I	A/R
Automation network maintenance and monitoring	C/I	A/R	
Monitoring service system	A/R	I	

In Table 5 above can be seen the roles and responsibilities set for the case company, the customer, and the constructor. For each function, there can be multiple roles for each stakeholder, but there should be only one accountable set for each role.

Using an action and cost responsible matrix is more feasible to be used in the proposal phase, as it can be used to calculate the costs. Using RACI model it is not clear who is responsible for the costs, but it gives important information when planning the service levels.

The findings from the current state analysis of current service deliveries were separated to strengths and weaknesses, which are introduced in the following section.

3.5 Strengths and Weaknesses of Current Service Delivery Processes

Based on the findings from the interviews introduced in Table 2 are presented the strengths and weaknesses found in the current processes. In the interviews it was quite clear that the concerns that all interviewees expressed were quite similar. Depending on from which unit they were from there was some variation. Cost control was brought up in all interviews, but it was approached from a different angle depending on the interviewee's position and expertise area.

There were clearly six main categories, which came up in the interviews. The main categories found are cost control, hardware, requirements, resources, roles and responsibilities, and service level. The findings in each category are color coded to reflect the

state of each finding. Green icon identifies those findings that are already taken as strengths in the current service delivery process. The yellow icon identifies the findings that are acknowledging an area of improvement, but these are not yet implemented. The red icon is used for findings that are unidentified as weaknesses. The key findings from the system deliveries, based on previous cases are listed in Appendix 1, but the ones relevant to the study are shown in Table 6. Some categories have both strengths and weaknesses.

Table 6. Strengths and weaknesses of current system deliveries

Findings from the Interviews of Current State Analysis	Current State
Hardware solution not standardized and productized well enough.	🔴
Many times non-technical people negotiate the contract and technical information is lost in translation.	🔴
Customer needs to understand what is required from the customer.	🔴
Modular solution needed. If a module breaks, it can be changed easily, but production is not affected.	🟡
Using customer resources as much as possible is easier than providing hardware and connections to their secured system.	🟡
Everything needs to ready and validated on-site before anything is delivered.	🟢
Well operated and maintained solution.	🟢
Good documentation and solution security, which has been evaluated by a third party security company.	🟢
Able to access remote sites from own desk.	🟢
Service level can be agreed with customer and some risk assessment can be done.	🔴
These types of systems have been running for previous 20 years, and they will do so now, even if the connection is down.	🟢
Service provided by current business partner is compared to the agreed service level good.	🟢
For most cases high SLA is not required, as data loss is not critical.	🟢
Impossible to deliver a solution to the expected price	🔴
The cost effect of the SLA is not clear	🔴
OPEX costs for IT infrastructure are too high.	🔴
Cost projection not done correctly	🔴
Oversized hardware deliveries, the same solutions does not cover all customer cases.	🔴
Two different cost categories: User and facility costs	🟡
Too tight schedules as planning, delivery and building takes time.	🔴
Currently no specified resource for certain to maintain responsibilities.	🔴
No implementation manager who understands and speaks the same language with IT.	🔴
No dedicated IT resources available directly in certain business cases.	🔴
There may be some government set restrictions, e.g. China Internet connectivity.	🔴
Business partner can deliver HW almost any corner of the world.	🟢
Good internal IT knowledge and expertise	🟢

Legend			
Service Modularity	Service Quality Management	Service Pricing	Other Topics
🟢	An already existing strength		
🟡	Acknowledged area of improvement, not yet implemented		
🔴	An acknowledged weakness		

Table 6 indicates some of the key strengths and weaknesses related to current service deliveries. There are also some acknowledged changes to improve the current status, but these changes are not implanted yet. The findings are color-coded here to match

them later on to the best practices introduced with the conceptual framework in section 0. The first three categories are included to the scope of the literature review and conceptual framework. However, the author sees that there will be improvement for the other topics listed from using the tool proposed in this thesis. Improving the topics listed for the three main categories, these other topics will be improved to some extent as they all are somehow related.

In the following two sections, the strengths and weaknesses, shown in Table 6, are analyzed in more detail.

3.5.1 Strengths of Current Service Delivery Processes

When discussing strengths with the interviewees, the first thing that was brought up was, that there is skilled and efficient in-house IT department in the case company. The integration architect comments the adaptability of the in-house IT department.

> *When he started he was purely from a large data center environment, but he quickly realized what was going on, and a bit different laws apply when going to distant locations and different systems. (Data 1: D15)*

The IT department can deliver what has been promised for the customer, even in hard situations and under tight schedules.

For the current concept of remote management, the manageability and connectivity remotely are important according to the MES Manager.

> *I think that the fact that we access to the systems, as they would be our internal systems is very valuable to us from the development perspective. Just log on to a PC, get into the servers and do your configurations and all that. You know, it is almost as working on the site, which is very positive. (Data 1: D12)*

Concerning the hardware solution, it was found to be standardized high quality solution, but not designed to suit especially the needs of the service deliveries of the Digital Services unit. The hardware solutions was described to be too data center centric solution

to fit the purpose, thus being too expensive. However, the processes with the hardware/IT service provider are very well designed and efficient. In addition, for the hardware provider being a large global company was found as big strength, as the business partner can deliver and maintain hardware in most of the locations the case company operates.

One of the most important strengths brought in the interviews is ability for the internal IT to understand the business needs even the specifications are unclear.

> *On IT side, there has been understanding what is needed, even the specifications have not been too clear. Even in these cases, the need has been understood what is needed to get things working. (Data 1: D14)*

As the operations of the internal IT have been found to be quite effective, the next section discusses on the weaknesses found in the current service planning and delivery processes.

3.5.2 Weaknesses of Current Service Delivery Processes

In the interviews, the biggest weakness turned out to be the control and estimation of costs. During the deployment projects, the costs are often assigned to a single cost center, which makes it very difficult afterward track the different costs later on. Correct cost projection is very important. It helps in planning the future cases if the cost structure is clear from previous cases.

There has been in the past some high OPEX costs due to service level agreement. These extra costs could have been avoided with more thorough planning and requirement setting.

One source for problematic cost estimation is the provided server infrastructure. There has not been a clear understanding what is the impact of higher service level, and the highest SLA has been selected, but the cost of this choice is not realized by sales. If previous solution sold has been a low SLA solution, the IT pricing cannot be used for a high SLA system. It was brought up in some of the interviews, that the IT solutions were developed on-the-fly in the previous customer cases. The development on-the-fly has

excessive cost effect as the solution costs cannot be estimated on beforehand. In this kind of cases the troubleshooting process is time consuming, as pointed out by the integration architect (Data 1: D15).

> *Many times there is also the problem that things don't work out for the first time. Is it that we don't know how to specify them or is our infrastructure too complex? If we have understanding and documentation on needed level, we could solve these issues immediately; now the troubleshooting can take weeks. I understand that some single cases may take time, but simple, basic things should go through easily. (Data 1: D15)*

Another topic brought up in the interviews is the issues in project management and resourcing. On the project management, the issue has been previously that there has not been a dedicated IT project manager to lead the customer cases. This has caused issues with the planning and requirement settings. Someone from the IT hosting team has then taken care of the project manager tasks in the delivery phase. As there has not been an IT project manager for the Digital Services earlier, the issue has been for the business unit to understand the IT department and vice versa. This problem was also identified in the case company and some organizational reconfiguration was done to resolve this issue. The interviews were conducted right after the new organization was announced, so the change had no meaningful effects to on the responses from the interviewees.

The preliminary service offering presented to the customer is done by a salesperson, who does not necessarily have the full technical knowledge to understand all things required to deliver the service. There may also be other issues as stated by one the interviewees (Data 1: D15).

> *Many of these new sales cases are based on complex data network connections, and I understand that the salesperson goes to meet the customer, where is not either a very technical person. I can imagine the salesperson sells some service and tells briefly, what is needed and some price for that, and after the deal is closed, the customer is starting to figure out what was bought. When they involve technical personnel questions start going through the salesperson and customers presenter between the technical personnel. The questions are modified to be not as technical and maybe translated to Spanish and then we get lost in translation. Diagrams and IT-language can be understood globally. (Data 1: D15)*

There are also some other positions that do not have proper resourcing and understanding. This was noted in some of the interviews.

> *If you think automation and standard office infrastructure, they are similar, but totally different worlds. If you would have someone who would understand them both, he would have a lot of work. We should put the effort in training people to semi-automation experts, to combine these two domains. I would not train the automation people to Infra, but the other way round. We need to somehow securely combine the automation world to the regular office IT world. It is both pro and con, and we can turn that to our strength by training people. (Data 1: D15)*

One important issue has been previously that the pre-requirements are not set correctly, as there have been cases where there are some required elements, like proper facilities, missing to be able to provide the systems required by the service solution.

As a summary, the initial problem is the technical understanding of the salesperson selling the service solutions. This may already introduce some mismatch in the IT costs for the project. Then the IT planning is done without a proper IT project manager involved, and there may be multiple people involved in the planning without anyone coordinating the whole planning process. This may cause some important factors not be considered in the early stages of the project, which may cause cost pressure. Then the IT costs are lost to the general cost center of the project and are not clearly noted. For the system deliveries there needs to be reasonable pre-requirements set so the systems can be delivered. In addition, there needs to be a feasible and cost effective hardware solution available for the system deliveries. When considering the hardware solution, the effect of CAPEX and OPEX costs need to be balanced.

The study will focus on resolving the issues concerning cost management, the hardware solutions, roles and responsibilities, and service level setting. The proposal for the configuration tool will also help with the project management and resourcing issues, as it provides all required information that need to be considered in the service delivery cases.

The next section focuses on finding best practices from both academic and business literature to solve the issues found in the current state analysis of the current service deliveries.

4 Existing Knowledge and Best Practices

This section discusses the best practices that are suitable for this field of this study. First, the basic idea and requirements for service opertaions are discussed. The best practices are introduced here and are used to develop a conceptual framework for the IT service design used for service solution deliveries. This section ends introducing the conceptual framework, which will be used to build the proposal for the case company.

4.1 Service Solution Business

First, to understand the concepts handled in this section of the study following definitions are in place. Storbacka and Pennanen (2014: 1) express that “a solution-based firm focuses on the customers’ processes and supports customers as they create “use-value” based on the solution the firm (provider) offers”. Storbacka and Pennanen (2014) also point out that for the solution business to be trustworthy it is a necessity for the solution match what has been promised to the customer.

Storbacka and Pennanen (2014) discuss three reasons for companies to enter solution business or improve their existing business. Firstly, to gain top-line growth the companies need to progress in the value chain and their offerings need to be complete and integrated. Secondly, larger shares of profit can be achieved by focusing on more how the offerings are used by the customers, which enables the bottom-line growth for the company. Thirdly, this kind of markets are more stable than traditional product or equipment markets, so forth the cash flow may be more stable. (Storbacka and Pennanen 2014)

Davies et al. (2006: 39) emphasize the same matters when describing that “services are attractive because they provide continuous revenue streams, have higher profit margins and require fewer assets than manufacturing”. This study focuses more on designing the services for the solutions than whole solutions. To define a service, Steinberg’s (2011: 13) definition as it is used in ITIL: “A means of delivering value to customers by facilitating outcomes customers want to achieve without the ownership of specific costs and risks.”

Mathieu (2001) observes the differences between services supporting the product or the client's actions related to the product, illustrated in Figure 6.

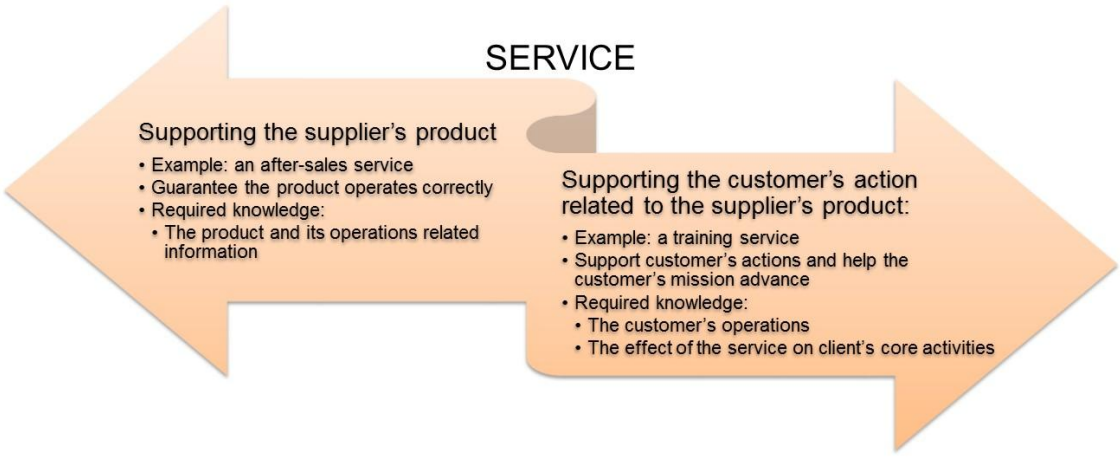


Figure 6. Differences between service types (Mathieu 2001)

In the industry where the case company operates, the provided services traditionally are to support the provided products throughout their lifetime as shown in Figure 6. The services are developed only with the supplier's view in mind. For services, which support the client's action, the development is driven by customer needs and require customer-specific knowledge as shown in Figure 6. (Mathieu 2001)

To describe IT services in more detail, Steinberg (2011: 13) defines IT services as being "made up of a combination of information technology, people, and processes". It is separated to "a customer-facing IT service" and to "supporting services". First one of these supports the customer's business processes and works under a service level agreement made with the customer and the latter provides support for the customer-facing services. (Steinberg 2011)

To be successful in solution business a company must meet its customers' needs when providing solutions. As the differences are shown in Figure 6, designing solutions cannot only be technology or product-driven, but it needs to be customer insight-driven value innovation. The company needs to combine both outside-in and inside-out approaches to enable value creation for itself and its customers. The research and development (R&D) process need to be focused more on the customers. For new technologies and processes, there may be well-defined development process, but no proper process for

developing services and solutions necessarily exists. In some cases, the development of services and solutions may be done in a similar way as for products, which is not necessarily suitable. (Storbacka and Pennanen 2014)

Mathieu (2001: 40) also discusses on the advanced services, indicating that “the supplier's work concerning the service offer never really ends: the mission is not just to make the product work, but to help the client maximize all the different processes, actions and strategies that are associated with the supplier's product”.

The next section discusses how the organization and the operational model are affected by the changes of moving to service operations. it is important for the service providing company to have trustworthy and capable business partners, so the company itself can focus on its main business.

4.1.1 Supplier Network

Davies et al. (2006) discuss how companies have started moving from manufacturing to also providing services since the early 1990s. These companies were not only providing services of their own but also services from other providers with a rising trend. It is not always reasonable to use in-house resources performing all tasks or processes, and some tasks and processes can be outsourced to a business partner, for example in IT-environments different vendors or business partners can be used to host IT-systems or network connections.

Many manufacturing companies have outsourced some part of their manufacturing activities and started to focus on systems integration service activities, which are more profitable. These integrated solutions interest also service based companies, who work strongly together with product suppliers and improve their capabilities in system integration. Nevertheless, a company originates from manufacturing or has its roots in the service business, needs to offer a larger variety of individual and bundled offerings than earlier. Davies (2006: 41) emphasizes, the systems integration is crucial as it works as a tool for “the customers to create value and transform their businesses” as illustrated in Figure 7. (Davies et al. 2006)

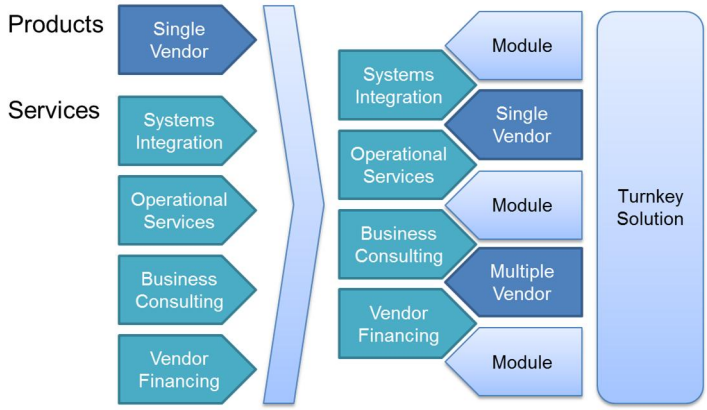


Figure 7. The migration to integrated solutions (Davies et al. 2006)

As shown in Figure 7, there are discrete products and services from both single and multiple vendors. In addition to the vendors, there are modules that can be re-used and entire turnkey offerings. Davies et al. (2006) point out that the companies planning to implement integrated solutions need to be clear, which are their key competencies are, and which need developing. From these capabilities, they need to choose, which are the ones the company provides and which partners can provide. Davies et al. (2006: 41) also note that these companies, "must be able to demonstrate four key capabilities: systems integration, operational services, business consultancy and financial services". (Davies et al. 2006)

To enable the capabilities required for the transforming to a service provider, some changes may be required in the organization. These are discussed in the next section.

4.1.2 Organization Reconfiguration

When companies start to transform to solution business, it is not sufficient to only create services and solutions to provide for the customers, but the companies also need to transform their organization to be more customer-centric (Storbacka and Pennanen 2014). Davies et al. (2006: 43) suggest, "companies must build their organizations around their customers' current and future needs." To succeed in these Davies et al. (2006) discuss on moving to new, reconfigurable organizations, which can adapt to their customers' needs as illustrated in Figure 8, and offer customized mix of products and services for customers' peculiar needs. The back-end units need to have the capability to back up the customer-facing units with modular products and services.

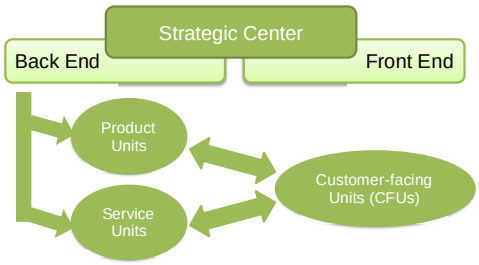


Figure 8. A three-part organizational structure (Davies et al. 2006: 43)

The organizational structure illustrated in Figure 8 consists of separate customer-facing units, which are supported by strategic centers and the back-end units, which can include external providers as well. It is important for the company to have control of the customer channel to prevent other companies from interfering with the customer connection. (Davies et al. 2006)

Davies et al. (2006) point out that companies with a background in manufacturing compared to a company with a background in services will be facing a set of challenges when starting to replicate service and product components. One reason for this is caused by the different organizational structure, as usually their product units start the building of new services. These services may turn out to be insufficient and useless. It is also vital to deploy the knowledge assets and resources throughout the company. In the organizational structure introduced earlier, the customer-facing units will not only operate as internal customers but also as a distribution channel to the external customers. To get these back-end and front-end units working, there need to be compromises done between the two units to have all bargains realized. Eventually, the control of key customer accounts is transferred to the customer-facing units. The strategic center in the middle needs to manage the operations between the front-end and back-end units. Davies et al. (2006: 47) point out that the in-house back-end units "may be reluctant to cede control of their accounts, and they may be downright resistant to the idea that the CFUs will propose solutions that incorporate a competitor's technology or products". Without proper management, these units may end up with separate strategies, and put the blame on each other if plans do not work correctly. (Davies et al. 2006)

Storbacka and Pennanen are approaching this subject from a bit different angle, as shown in Figure 9.

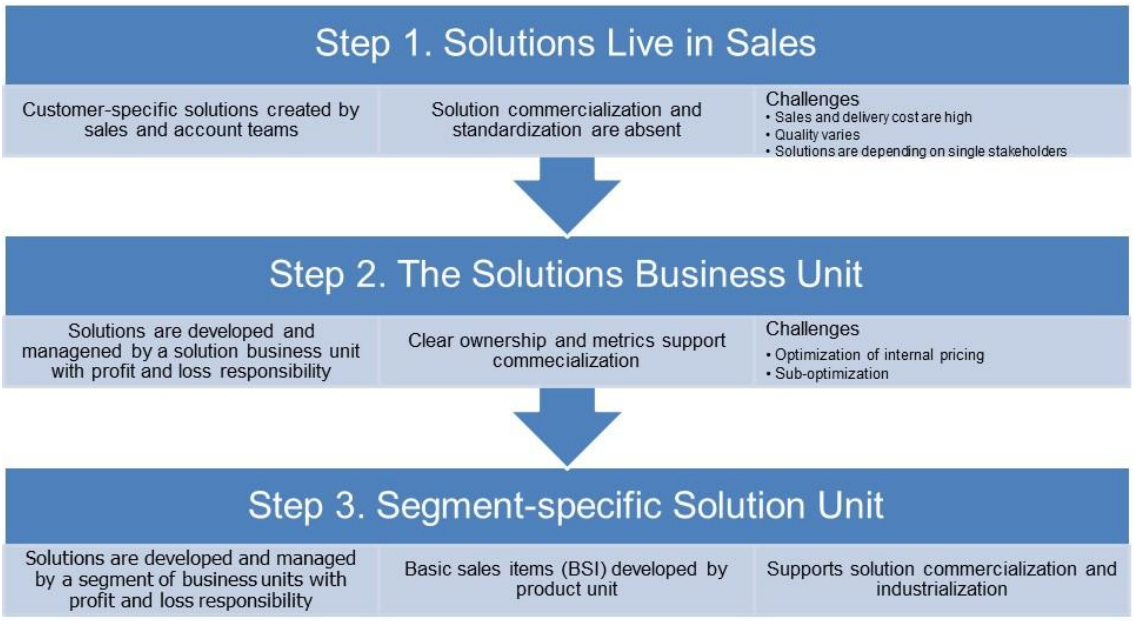


Figure 9. Typical evolutionary steps towards a solution-centric organization (Storbacka and Pennanen 2014: 97)

As suggested by Storbacka and Pennanen (2014) in Figure 9, moving towards a solution-centric organization starts commonly from sales. Sales build the solutions per customer, which is not very efficient as there is not necessarily any productized solutions available. The next step is to create a unit to manage the solutions. In the final step, the company is fully organized for providing solutions from standardized basic sales items. (Storbacka and Pennanen (2014)

Storbacka and Pennanen (2014) emphasize that it is not sufficient to only develop a new organizational structure, but there need to be new employee roles, like “solution portfolio owner”, “solution manager”, “solution architect”, and owners for all solution components, just to name few. It is important to define correct skill profiles for each task, so a person with certain skill-set can perform in the certain role. Their personnel needs to be systematically trained to improve their knowledge about the different business areas, such as “customer-value quantification”, “compelling customer-oriented value propositions”, and “industrialization of solutions”. (Storbacka and Pennanen 2014: 98-108)

Steinberg (2011) points out the importance of the personnel providing the service know that they are providing a service to a customer or customers. Even if the personnel are skilled and capable providing the service, but do not provide as it should be provided,

the customer may be dissatisfied. On the contrary, being polite and nice does not save badly provided service. (Steinberg 2011)

To enable the full potential of the service providing company, the customer needs to commit to the provided services as well. This is discussed in the next section.

4.1.3 Customer Focus

This section discusses on committing the customers to the company providing services, and what can be done to enable this commitment.

Different types of customers have different types of needs and expectations. It may be important for customers with less experience, to be able to select pre-configured solutions from the portfolio. These customers may not be sure what are their needs and capabilities. On the other hand, for the more experienced customers, these pre-configured standard solutions may not be sufficient for their needs due to the characteristics of their business issues. These customers may have internal capabilities to use the solution, and need help only in the beginning to be familiarized with the provided solution. (Davies et al. 2006)

Storbacka and Pennanen (2014: 6) emphasize that the focus is on “how the firm can support the customers’ business process”, and call it “client supporting” instead of “product supporting.”

This section discussed the changes needed in the organization and operational models to be able to transform to a service solution provider. The next section will discuss the different components to build a service solution.

4.2 Service Modularity

As the previous sections focused on changing the organization and operational model of the company providing services, this section focuses on how the services are designed and build. Baldwin and Clark (1997) describe a modular system to be “composed of units (or modules) that are designed independently but still function as an integrated whole”.

4.2.1 Standardized Service Components

A company needs to create solution structures, which are solutions assembled from standardized components or “basic sales items” (BSIs). The use of information and communications technology (ICT) is a requirement for larger companies providing service solutions. The company then needs to be able to digitalize their basic components and solutions so that they can be entered into the company’s enterprise resource planning (ERP) or product data management system (PDM). Digitalization of these structures and components empowers standardization and repeatability of the solutions, and can create noteworthy cost savings. Storbacka and Pennanen (2014: 106) emphasize, “digitalizing BSIs and solutions is the foundation for scalability in solution business.” The solution structures need to flexible so customer-specific offerings can be created from standardized BSIs and their options as illustrated in Figure 10. These standardized solutions can then be offered in the same way in all of the market areas the company operates. It is more cost-efficient to deliver case-by-case customer-specific solutions using standardized components. (Storbacka and Pennanen 2014)

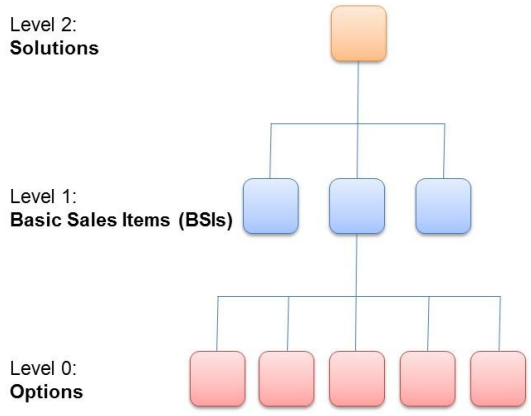


Figure 10. Hierarchical solutions structure built around basic sales items (Storbacka and Pennanen 2014: 30)

By developing a hierarchical solution structure, like shown in Figure 10, enables the company to combine flexible and standardized solutions for the customers. The solutions can be built from basic sales items and their options. For example, one can purchase a completely customized car, which is still built from the standard components and their options available from the manufacturer. When the components are granular enough and have available options, they can be used to build wide selection different solution configurations. (Storbacka and Pennanen 2014)

The next section discusses the service design that is used to build services from the standardized service components discussed in this section.

4.2.2 Service Design

Baldwin and Clark's view of modularity have similar aspects as Storacka and Pennanen's view of building solutions from standardized items or units. They suggest modularity can be accomplished by breaking the solution design down into "visible design rules" and "hidden design parameters" as illustrated in Figure 11. (Baldwin and Clark 1997: 86)

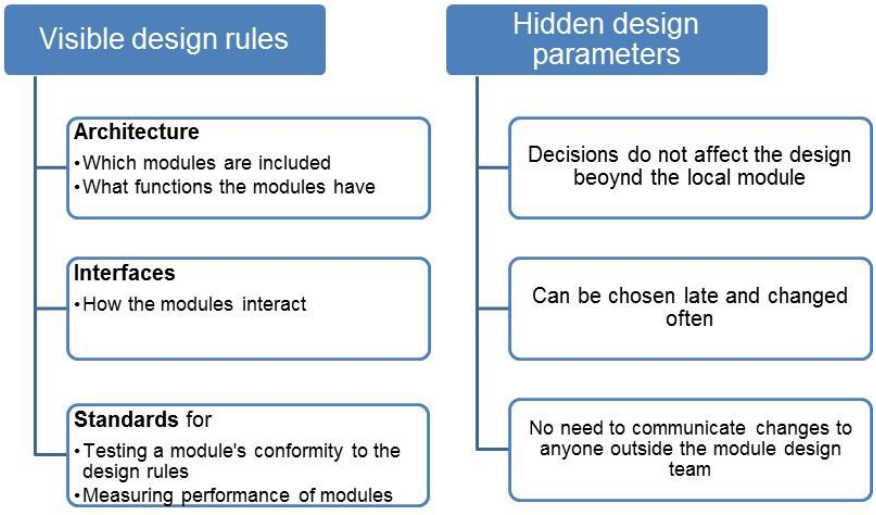


Figure 11. Design rules and parameters for a modular system (Baldwin and Clark 1997)

The three visible design rules in Figure 11 are described Baldwin and Clark (1997: 86) as "decisions that affect subsequent design decisions". Newcomb et al. (1996) also dis-

cuss how in the design process, the structure is combined by choosing which components and options are included and how they connect to each other, similar to the visible design rules. Storbacka and Pennanen (2014) suggest a configurator tool for creating customer-specific solutions specified with the design rules introduced above. An example of the configuration tool and its connections is illustrated in Figure 12.

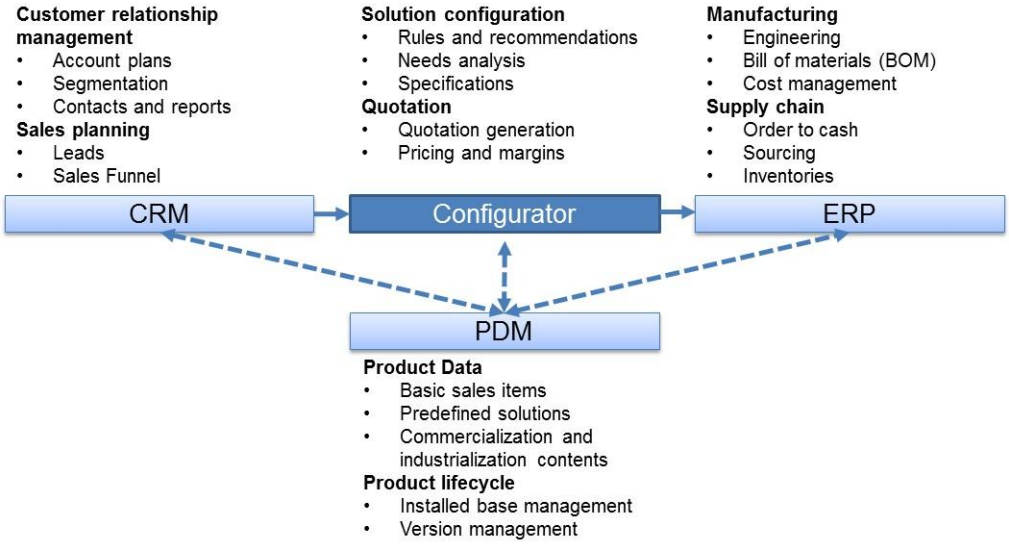


Figure 12. Interface between configuration tools and other systems (Storbacka and Pennanen 2014: 63)

As shown in Figure 12, the configuration tool can collect the digitized data the product data management system (PDM) and the customer data from client relationship management (CRM). Then use the configurator to combine the data into a solution and take company data from enterprise resource planning (ERP) system. Using such tools can help the service providing company to accelerate the sales processes and shorten the sales cycles. Sales do not need to have much technical expertise, but the quotations will be more precise from a technical point of view. The profits and customer satisfaction will increase. (Storbacka and Pennanen 2014)

The classic thinking that providing a large variety of products to the markets would increase economic growth is not necessarily working. Fulfilling of customer hopes is important in today's markets as stated by da Cunha et al. (2010).

> *The transformation from the "demand-driven economy" to the "offer-driven economy" has increased corporate competitiveness. To support the "offer-driven economy", companies tend to enlarge their product portfolios in pursuit of increased market shares. The challenge*

> *is then to determine a trade-off between the cost of offering a wide range of products and the gains that such portfolio provides. (da Cunha et al. 2010: 1439)*

Some pre-defined solutions can be saved to the product data management system, as these can be offered for different customers. It may be easier for the customer to understand the possibilities with the pre-defined solutions and their options. The customers do not necessarily know in all cases what they want. Therefore, it is not easy for the customer to understand what kind of solutions can be built from the different components and options. These solutions need to be based on results from previous deliveries. By commercializing some of the pre-defined solutions, the company can reach the customers more easily. The pre-defined solutions may ease to communication between the sales and the customers. Some configuration to the solutions may be needed to make them suit the customers' needs. (Storbacka and Pennanen 2014)

For the company to be able to manage all of its services, it is important to have a service catalog management tool available. The next section focuses on the service catalog management.

4.2.3 Service Catalogue Management

For a company a service catalogue is an important tool for provisioning services and helps the company to ensure it employs all possibilities of the service catalogue effectively. The main idea of the service management process is to collect and uphold have the up-to-date data of all running services and the ones going live. Some of the key objectives of the service management process are introduced in Table 7. (Hunnebeck 2011)

Table 7. Key objectives of service catalog management process (Hunnebeck 2011: 97)

Key objectives of service management process
Manage the information contained within the service catalogue
Ensure the service catalogue is accurate and reflects the current details, status, interfaces and dependencies of all services that are being run, or being prepare to run, in the live environment, according to the defined policies
Ensure that the service catalogue is made available to those approved to access it in a manner that support heir effective and efficient use of the service catalogue information.
Ensure that the service catalogue supports the evolving needs of all other service management processes for service catalogue information, including all interface and dependency information

**Text in the table taken directly from ITIL literature sources.*

As described in Table 7, the key objectives for a service catalog management process are to keep the company's service information up-to-date and available for the authorized stakeholders. It can also be used for creating new or updating old services. The process itself covers multiple things, like defining and maintaining the descriptions of services and service packages. The process also creates the service catalog, keeping it updated, including all the interfaces and dependencies between the services and other related information. (Hunnebeck 2011)

The service catalog can be used for developing service solutions, as Cannon (2011) suggests:

> *The catalogue is useful in developing solutions for customer from one or more services. Items in the catalogue can be configured and suitably priced to fulfill a particular need. A service catalogue is an important tool for service strategy because it represents the service provider's actual and present capabilities. In addition, the service catalogue serves as a service order and demand channeling mechanism. It defines and communicates the policies, guidelines and accountability required for the service provider to deliver and support services to its customers. (Cannon 2011: 174)*

To be able to better manage all services in the service catalog, a company needs to introduce a service portfolio management. The service portfolio management is discussed in the next section.

4.2.4 Service Portfolio Management

A service providing company needs to have a service portfolio, which is a document or a database with information about the company's available services in different states, detailed in Table 8 (Steinberg 2011: 24). The company can use service portfolio management to identify the beneficial services and focus on deploying them. To achieve this, the service portfolio management makes it possible to compare the expected customer income of the service to the costs to provide the service. (Cannon 2011)

The service portfolio consists of three different parts, which are service pipeline, service catalog (introduced in the previous section), and retired services, which are introduced in more detail in Table 8.

Table 8. Parts of service portfolio (Steinberg 2011: 24)

Parts of Service Portfolio	Description
Service Pipeline	• All services to be considered or to be developed • Not visible to customers
Service Catalogue	• All IT services that can be for deployed • Only part of the portfolio available to the customers
Retired Services	• All services that are phased out or retired. • Available to new customers only in a special business case

**Text in the table taken directly from ITIL literature sources.*

The service catalog is the information of all, available IT services, which can be deployed to customers, and so on the most interesting part of the service portfolio shown in Table 8. Services in the service pipeline are still in idea or development phase, but the customer can have an impact on the services that will be developed. The retired services may be replaced with newer services. More information about the service catalog management in part 4.2.3. The services in the service portfolio can be separated into two categories: "customer-facing services" and "supporting services". The customer-facing services are the IT services available for the customer. Supporting services are supporting the customer-facing services. (Steinberg 2011: 24)

The key objectives set for a service portfolio management in companies are introduced in Table 9.

Table 9. Key objectives of service portfolio management (Cannon 2011: 170)

Key objectives of service portfolio management
Provide a process and mechanisms to enable an organization to investigate and decide on which services to provide, based on an analysis of potential return and acceptable level of risk
Maintain the definitive portfolio of services provided, articulating the business needs each service meets and the business outcomes it supports
Provide a mechanism for the organization to evaluate how services enable it to achieve its strategy, and to respond to changes in its internal or external environments
Control which services are offered, under what conditions and at what level of investments
Track the investment in services throughout their lifecycle, thus enabling the organization to evaluate its strategy as well as its ability to execute against that strategy
Analyze which services are no longer viable and when they should be retired.

**Text in the table taken directly from ITIL literature sources.*

The key objectives of service portfolio management shown in Table 9, point out the importance of this tool for a company. The main issue for service portfolio management is to show if the company can make value from the services, and estimates the value during the lifetime of the services. Service portfolio management is needed to show, how the current services are performing compared to the ones they have replaced. With the help from service portfolio management, the company can make trustworthy decisions concerning investments. (Cannon 2011)

To learn how the services are operating according to expected results, there need to be certain key performance indicators set to be able to measure the performance.

4.3 Service Quality Measurement

The use IT services can nowadays be related to the use of commodity items like mobile phones or television. Thus, the IT services can be described to be tool of business. The IT services are taken for granted ,but still the best technologies do not necessarily not enable utility-like reliability. Steinberg (2011: 15) emphasizes that, “professional, responsive, value-driven service management is what brings this quality of service to the business”. (Steinberg 2011)

To understand how the customers receive the quality of services, Grönroos (1984) developed a model to measure the service quality perceived by the customers. The model is visualized in Figure 13.

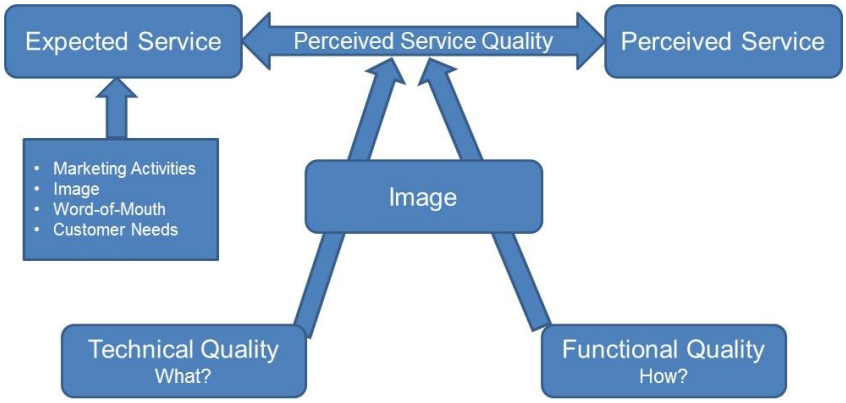


Figure 13. The service quality model (Grönroos 1984: 40)

Figure 13 of the service quality model by Grönroos, shows the different elements affecting the customer's way of perceiving service quality. Technical quality is the outcome the customer receives out of the service that "corresponds to the instrumental performance of the service", as described by Grönroos (1984: 36-40). The functional quality describes the way, how the customer receives this technical outcome. The image represents the corporate image of the service providing company. This is not necessarily the brand of the company, but the image created for the customer by the service providing organizational unit interacting directly with the customer. From the combination of these elements, the service perceived by the customer will be formed. The customer perceived service quality will be compared to the service expectations of the customer. These expectations are affected by marketing activities, like advertising, the image of the company, word-of-mouth, possible previous experiences of the services, etc. (Grönroos 1984)

Storbacka and Pennanen (2014: 83) emphasize the importance of service quality measurement by stating, "customer's perception of bad service can change when the customer can be provided a statistic of the real uptime records, compared to the hearsay from own employees. Some of the challenges in service management noticed by Steinberg are listed in Table 10.

Table 10. Challenges of service management (Steinberg 2011: 15)

Challenges of Service Management	Description
Intangible nature of the output and intermediate products of service processes	Difficult to measure, control and validate (or prove)
Demand tightly coupled with the customer's assets	Users and other customer assets (processes, applications, documents and transactions) come with demand triggering service production
High level of contact for producers and consumers of service	Minimal or no buffer between the service creation and the service consumption
The perishable nature of service output and service capacity	Customer receives value from assurance on the continued supply of consistent quality. Provider needs to secure a steady supply of demand from customers.

**Text in the table taken directly from ITIL literature sources.*

As described in Table 10 the common challenges with service management concern the intangibility of the services, which are not present in traditional product management. Storbacka and Pennanen (2014) emphasize that for product manufacturing companies only re-designing their organization and adding services to their offerings, also need to change their metrics to measure the services.

To measure the quality and performance of the service providing company and a customer, the service level targets are set in a service level agreement. The service level agreement describes the responsibilities between the company and the customer. One agreement can be used for numerous services or customers. (Steinberg 2011)

A service provides value to the business in all phases of its lifecycle. To achieve this, the service operation cannot only focus on daily operations and delivery of service as challenges may occur. The service needs to be tested that it works as designed within the financial targets set in the design phase, but it is not easy to evaluate what the service cost will be after some years of operation. Altering or fixing the service in operational mode is difficult, as extra funding is needed for fixing the issue. Technology evolves rapidly, newer, more effective and cheaper technology becomes available after a solution has been deployed. This technology cannot necessarily be implemented later on as there may not be funding for it. (Steinberg 2011)

Showing the effect of the provided solution's financial effect to the customer is called value quantification. Value can be quantified in different ways, either "product-oriented" or "customer-oriented". As "product-oriented approach" focuses the product's features and their benefits, the product features are not adequate for the "customer-oriented approach". In the customer-oriented approach, it is not only sufficient to focus on the profit and loss of the customer but in more details, which are illustrated in Figure 14. (Storbacka and Pennanen 2014: 55-56)

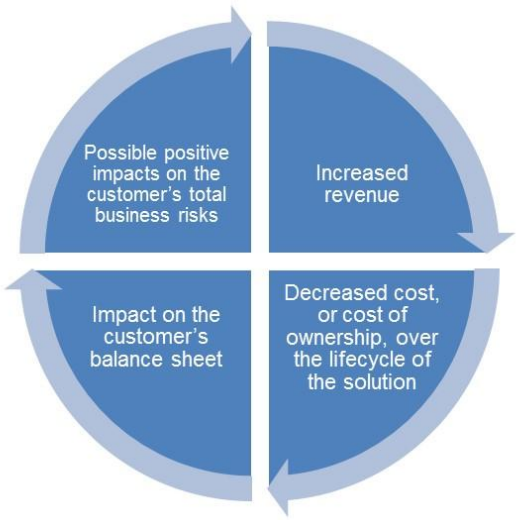


Figure 14. Solution's impact on a customer's situation (Storbacka and Pennanen 2014: 56)

Figure 14 displays the four dimensions that need to be considered when quantifying the value to show the solution's impact on the customer (Storbacka and Pennanen 2014). In addition to the financial effects on the customer, it is important for the service providing company to have a balance between stability and responsiveness as illustrated in Figure 15.

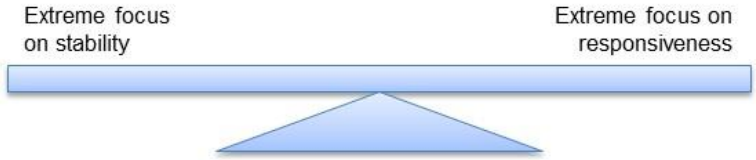


Figure 15. Achieving a balance between focus on stability and responsiveness (Steinberg 2011: 41)

Figure 15 displays the effect of focusing too much either on stability or responsiveness of IT services. If the service provider is on far left, it is not considering the changing

business requirements. If the service provider is on far right, it may be using too many changes. (Steinberg 2011)

When the company has reconfigured its organization, developed a service catalog and a service portfolio, and is measuring the services it provides, it needs to set its pricing on the correct level to be able to be successful in the service business. The service pricing is discussed in the next section.

4.4 Service Pricing

Storbacka and Pennanen (2014: 58) discuss how “pricing is the most powerful lever for improving profitability”, and it “has far greater impact than any other operation measure such as cost reduction”. Companies “develop contract models for selected pre-defined solutions that effectively support solution selling and even value-based pricing” (Storbacka and Pennanen 2014: 62).

Storbacka and Pennanen suggest that using solution configuration tool, introduced in section 4.2.2, can be used to create customer-specific solution designs and proposals. A configuration tool can help to speed up the sales process, as proposals need fewer revisions and re-configurations. Storbacka and Pennanen also emphasize that “clear understanding of the customer’s needs enables the sales teams to identify a suitable solution from the firm’s available solution offering and to configure that solution in the shortest time possible.” (Storbacka and Pennanen 2014: 62)

Davies et al. (2006) discuss how the complexity of offered solutions require the service providing companies to include new technologies and possibly other vendors, to be able to implement the solutions to customers. If a company can provide suitable and lower cost solutions, it can significantly increase the value received by the customers. (Davies et al. 2006)

For the service providing company, finding the best ratio between the cost and the quality of service is not an easy task as illustrated in Figure 16.

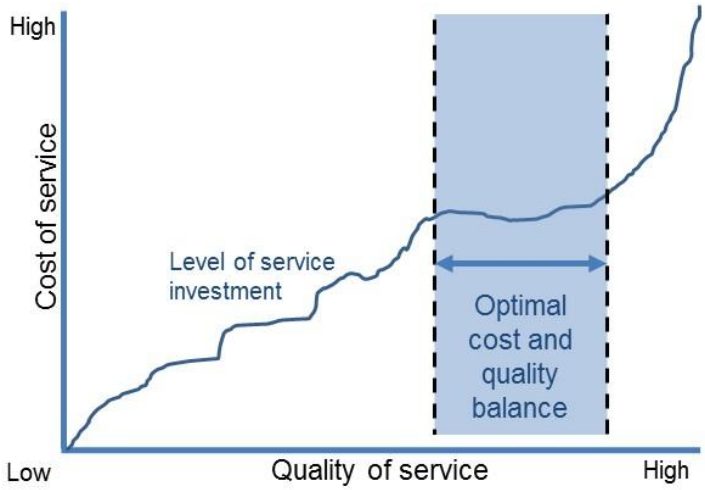


Figure 16. Balancing service quality and cost (Steinberg 2011: 43)

According to Steinberg (2011) there are better chances to increase the service quality with smaller investments, as the input needed for example increasing notably service availability may be relatively small. However, later on improving the quality will become more expensive as can be seen in Figure 16. For example, increasing the same service's availability from 96% closer to 99.9% usually requires bigger investments in technology and personnel than moving for example from 50% to 75%. (Steinberg 2011)

Steinberg (2011) emphasizes the balance between reactive and proactive behavior. For example, in capacity planning, it is important to find correct metrics to show the need for expanding the capacity. This can either lead to spending money on extra capacity that may never be needed, on the other hand, it is not either good to wait until the capacity runs out before adding new capacity. (Steinberg 2011)

The previous sections have created a view of the things affecting a company that is entering or already is in the service business. Next section will conclude the best practices found to be used in this study, and are combined into a conceptual framework.

4.5 Conceptual Framework for IT Service Design for Service Solutions

From the reviewed literature the main logic is refined from the solution business models introduced by Storbacka and Pennanen. This logic was enriched with insight from ITIL and other authors. These three main topics selected create the conceptual framework for this study. The conceptual framework is introduced in Figure 17.

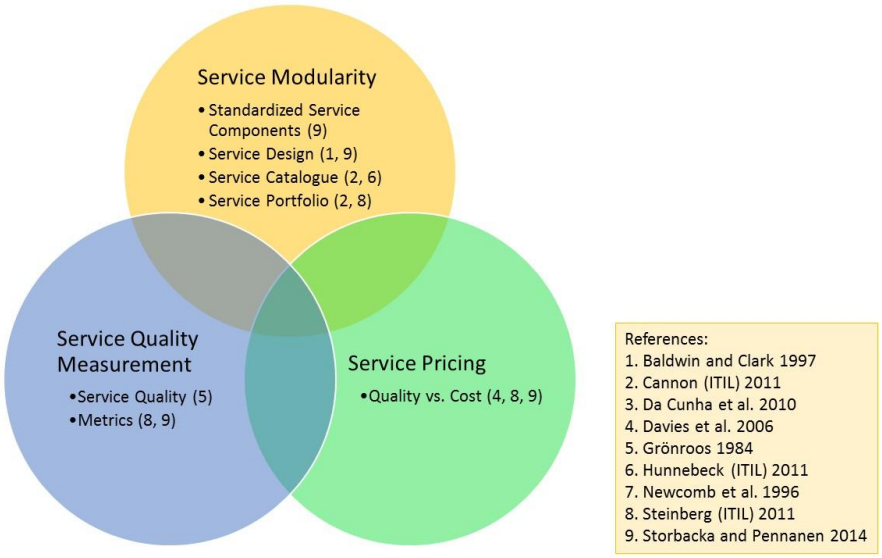


Figure 17. Conceptual framework of the service design

The conceptual framework in Figure 17 consists of three main elements that affect each other. Thus, the design of the elements is overlapping. All of these elements are taken into consideration in the design of the configuration tool for IT services included in the service deliveries.

Service modularity introduces the basic components that are used to build the services and service solutions. It also includes the ideas for service catalog and service portfolio management. *Service quality measurement* is used to define the level of service to be delivered to the customers, as it has the biggest effect on the *pricing*, which is the last element. With proper pricing and settings, the viability of certain services can improve. The fingings from the current state analysis introduced in Table 6 use the same color-coding is used for the different elements of the conceptual framework. All these things included in the conceptual framework have an effect on the solution configuration tool.

The initial proposal for the solution configuration tool is described in the next section.

5 Building Proposal for the Case Company

This section discusses the building of the proposal for a configuration tool for creating different IT configurations for the service deliveries done by the Digital Services unit. The IT solutions are designed and provided by the internal IT department with help from business partners.

5.1 Combining Data for the Proposal

The current state analysis points out the issues in the current way of designing customer provided service solutions. The IT related costs are not taken into consideration in the depth needed. There is also a clear gap in the understanding between the business units and the internal IT department. The best practices reviewed from the existing literature shows how the service catalog needs to be built up from small, modular components. Then these services are available in service portfolio, to show the roadmap the services. There is also discussion about the change needed in the case company organization to be successful in selling the services. This organizational change has already started, and some changes have already been implemented to narrow down the gap between the IT department and the Digital Services unit.

This section of the study combines the results of the current state analysis and the conceptual framework to the building of the initial proposal, as illustrated in Figure 18 below.

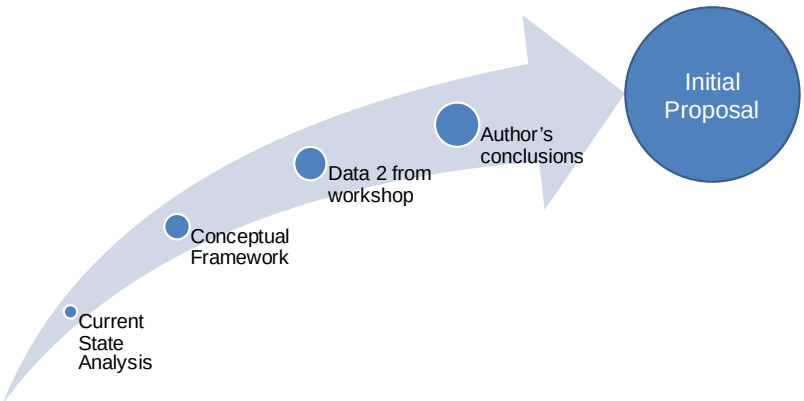


Figure 18. Steps in building the proposal for the solution configuration tool

As shown in Figure 18, building the initial proposal for the solution configuration tool started by identifying the key strengths and weaknesses in the previously delivered customer cases. Literature was reviewed to find best practices and solutions for these findings in the CSA. The ITIL best practices were studied from multiple authors concerning ITIL service design, strategy, and operation. Some key elements in this study are based on the ideas introduced by Storbacka and Pennanen. These key findings from both stages were introduced to the key stakeholders in a workshop. They have also been introduced a concept design of the tool to make it easier to perceive the design.

The key elements and options for the solutions configuration tool were designed in the workshop brainstorming with the key stakeholders. The workshop attendees, including the author, mainly create the system designs for the case company's IT infrastructure, including both internal or customer related cases. The workshop length was due to problematic schedules of the key stakeholders only 30 minutes, but it was long enough to collect all ideas and suggestions. Both stakeholders have been working with the previous cases and are working with the current one, so they know the agenda well and what is needed for the tool. The proposal for the design of the solution configuration tool was then created based on the author's knowledge in the IT infrastructure design.

The next section will introduce the design ideas and findings from the workshop held with the key stakeholders.

5.2 Findings of Data Collection 2

The main design ideas introduced in the workshop are shown in Table 11.

Table 11. Findings from Data 2

Findings from Data 2	
Design	Three Excel Sheets • Top-level summary • Tool/Questions • Hidden data for the tool
	Only dropdown menus and selections available
	Based on selections more or less information is shown
Key Points	Show the cost effect of SLA
	If service level requirements are set, external parties are needed for manage and maintain the systems with SLA
	Show the cost effect of customer managed systems and connections

As the Table 11 describes, the tool needs to be easy to use and clearly viewed on a single Excel spreadsheet, with a sheet with a top-level summary. The data used for the questions and options are hidden on a separate sheet. The tool is designed to give immediate feedback for the salesperson, concerning how some basic options affect the cost of the IT services related to running the IT infrastructure. The IT development manager pointed out the mismatch in the current cost realization in the case company.

> *About cost control, the biggest thing affecting that is, we specify the solution and make it cheap, but the requirements given to us, are not meeting the cost they are willing to pay for the solution. They require too much for the money that is available for use. (Data 2)*

It was agreed by all stakeholders in the workshop that the high-level design tool needs to be static in a sense that the user of the tool can only select options, but does not require to input any text, as stated by the networking service manager.

> *If using Excel, there should be open text fields as little as possible. You should use pull-down menus or checkboxes. There are no options for that. As this is mainly to be used by people with no technical background. (Data 2)*

It was brought up to attention that the service level has the highest effect on the price of the total solution if the IT infrastructure is delivered by the case company instead of

the customer. If a service level with high-availability is required, the external service provider is needed to provide the monitoring and maintenance service. The service manager for networking stated very clearly: “One important criterion is if there are service level requirements. If so it means, that external party is required.” (Data 2)

When providing the services for customers, it would be optimal to use the IT infrastructure provided by the customer and the case company would provide only that part required running the systems. It was discussed in the workshop, that the customer locations are often in difficult, distant locations, far from cities, what creates difficulties to provide hardware and connections to the customer location.

> *It is also preferred that customer would provide the hardware as well. We would only deliver the application and maintenance of it. Therefore, we do not deliver the actual IT Infra, but the IT infra is provided the customer. We deliver only the service. At this moment, we need to buy the infrastructure maintenance from somewhere else, and IT (the IT infrastructure) is located in the customer environment somewhere in the middle of nowhere. That is not very good business. (Data 2)*

The location also affects the service level setting and risk assessment. If the customer facility is located in a distant place, where it is hard to get support fast in a case of emergency. The location sets some requirements for the system configuration.

As mentioned earlier, these ideas are combined with the earlier findings to the design of the solution configuration tool. The design included in the proposal is introduced in the next section.

5.3 Draft of the Proposal for the Design of the Solution Tool

Based on the data from CSA, the conceptual framework, and the Data 2, the author created the high-level design for the solution configuration tool. This section introduces the drafting of the proposal. The different sections of the questionnaire are introduced here.

The first question is: "*Will the customer provide Internet/network connectivity?*"

Will the customer provide Internet/network connectivity?		
YES		NO
Question: "Does customer manage firewalls?"		Action: "Request quoting and delivery estimates from ISP."
YES	NO	
Action: "Add cost for internal/sub-contractor FW/VPN management."	Action: "Add firewall hardware and management costs."	Action: "Add firewall hardware and management costs."

Answering *YES* to the first question opens another question, "*Does customer manage firewalls?*".

- Answering *YES*, leads to action: "*Add costs for internal/sub-contractor FW/VPN management*".
- Answering *NO*, prompts the following action notification: "*Add firewall hardware and management costs*".

Answering *NO* to the first question prompts for following two actions

- "*Request quoting and delivery estimates from ISP.*"
- "*Add firewall hardware and management costs.*"

The next main question is, "*Will customer provide server infrastructure?*"

Will customer provide server infrastructure?		
YES	NO	
No actions needed	Question: "Is there a requirement for high-availability (HA)?"	
	YES	NO
	Action: Select service level: A, B, C	Action: Select server sizing: S, M, L
	Action: Select server sizing: S, M, L	

The answer *YES* is followed with next top-level question.

Answering *NO* opens the question, "*Is there a requirement for high-availability (HA)?*".

- Answering YES, opens selection, "*Select service level: A, B, C*". The options for the service level are predefined and introduced in detail in the tool.
    - After selecting the service level opens selection, "*Select server sizing: S, M, L*". The options for the server sizing are predefined and described in three different use scenarios.
- Answering *NO* to the question will open the same server sizing question as above.

The next top-level question concerns personnel costs, "*How many persons are working with this?*".

How many persons are working with this?	
Number of white-collar personnel?	
Number of blue-collar personnel?	

This question is followed by the selection tool for personnel options. The number of different user types is inserted, and cost per user is calculated for each user type. The user cost consists of multiple internal service costs, like a computer, access management, software used. Services for these personnel categories are based on the default services defined for these personnel categories. There may be some variation in the services used depending on the duties of each person, site location, and other factors. The wording of the question is set in above manner, as the persons may work on-site and off-site, but for the basic service configuration is the same, only cost may be projected to other cost centers. The off-site personnel does remote monitoring and possibly remote maintenance.

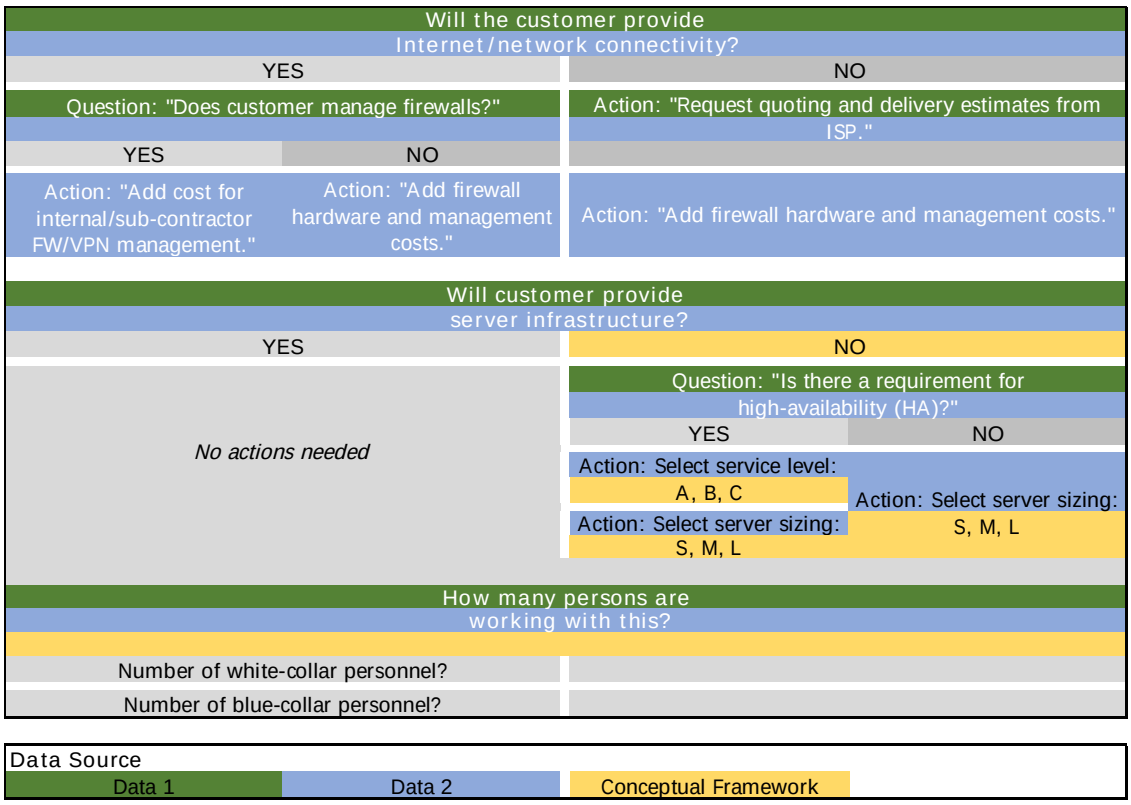
By using the information provided in the previous steps, a rough estimate is calculated. If there are some unclear options selected or they do not have price information, information is presented accordingly.

The information the initial proposal is based on is introduced in the next section.

5.4 Information for the Proposal

The data collected in CSA and the best practices of the conceptual framework are embedded into the tool. As the high-level design tool is not going very deep into the different topics, the information behind the options is described in this section. The data sources for the initial proposal are visually mapped in Table 12.

Table 12. Data sources for the initial proposal



To descibe in more detail the data sources visualized in Table 12 the different sections are explained here one by one. As each service system is built from independently working “building blocks”, it is important to identify what is to be provided by the case company and what is provided by the customer. For the first section in the questionnaire concerning network connectivity, the information of the provider is important. If the case company is providing the connection, an Internet service provider (ISP) is needed for the connection. There may also be a requirement for a service partner to monitor and maintain the firewalls securing the connection if a high-availability service level requirement is set. Then for the customer to provide and maintain the connections, is the most preferred option as the service level management is done by the customer. In

such case, the case company is responsible for the production system or a part of it, depending on the case. The connectivity responsibility affects on the OPEX costs, and possibly to the CAPEX costs. OPEX costs are higher if the connection is provided by the case company and a service partner is providing management service for the firewalls.

In the second section of the questionnaire, the top-level question has the biggest influence on the costs depending who provides the server infrastructure. If the case company provides the server infrastructure, the costs are highly affected by the service-level setting. With high-availability systems, a service partner is needed to provide the monitoring and management service for the system, which affects the OPEX costs as there is a monthly cost for the service. If the delivered system is not business critical and has low service-level, it can be managed by the case company's internal IT.

The ideal situation is to have the customer provide the infrastructure in addition to the network connectivity. In such cases, the case company only provides the system, possibly as a virtual machine, directly to the customer server system. Thus, the service level is monitored and maintained by the customer. Then both, the OPEX and CAPEX, costs for the system delivery are minimal.

The three different SLA settings in the tool are based on the standard service levels currently used in the case company. The highest SLA also affects the customer site connectivity if it is provided by the case company. The connection and the hardware related need to be doubled for high availability. The highest SLA will have the most significant effect on the CAPEX and OPEX costs as the initial hardware procurement costs are higher, and the maintenance costs of the service provider are also high.

The server sizing is dependent on the set service level as mentioned earlier. The different sized systems are built from the standard hardware used by the case company. It may differ in different types of cases, but for this high-level sales tool, similar configurations are used for both, HA and non-HA, options. The levels are measured as follows. The S-sized system is planned to gather data from the customer system or environment. By default, a data logger is not critical as it is delivering only log data to the case company. If it is unavailable, the production is not affected. The M-sized system is designed to run

one operational system and possibly some minor local services, like file share and print queues. The L-sized system will run multiple operational systems and local services.

The service level setting affects mainly the M and L-sized systems. If a high-availability system is required, the amount of servers required is at least doubled. When there are two or more servers, they need to have storage system to provide them shared resources to enable the high-availability. The storage system will increase the costs quite a lot. When implementing the high-availability systems, a backup solution is required to secure the data, which increases the CAPEX costs. The backup solution needs to be monitored and maintained, and a third party services need to be involved.

The initial proposal for the design of the solution configuration tool is introduced in the next section.

5.5 Initial Proposal for the Design of the Solution Tool

As the background for designing the tool is introduced earlier, the design for the proposal is illustrated in Figure 19.

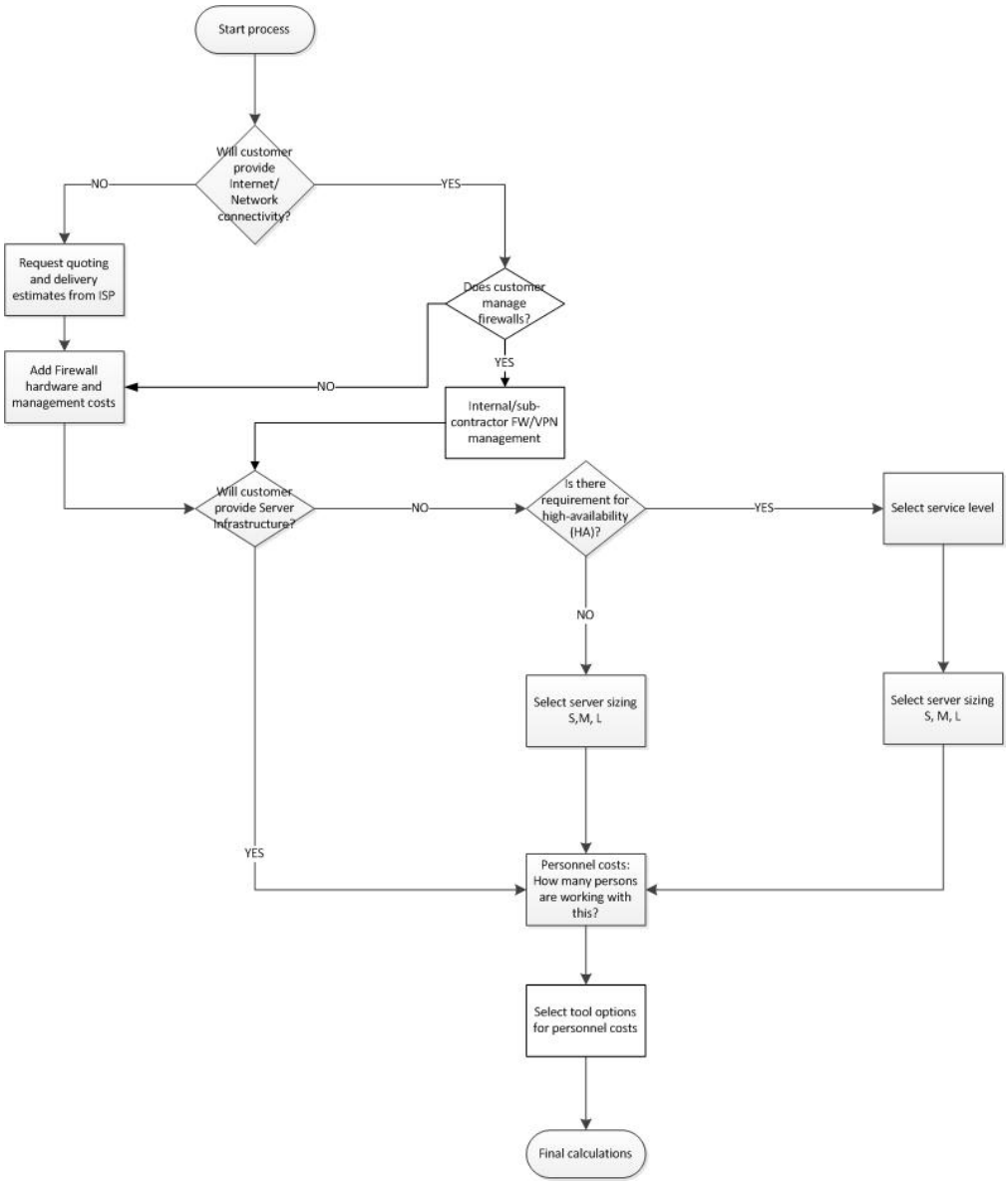


Figure 19. The design for the solution tool

The design for the initial proposal of the solution configuration tool introduced above in Figure 19 is presented in high-level and not very detailed because the different solutions include company-specific solutions and information. Thus, the data is introduced in the case company's internal version of the design only.

The next section discusses the validation of the initial proposal and the feedback gained from the validation process.

6 Validation of the Proposal

This section discusses the validation of the proposal, how it was conducted and what was the conclusion. There is also discussion about the next steps to implement the tool and to improve it.

6.1 Feedback on the Proposal for the Tool Design

Due to the changes in the case company's organization during this study, only one key stakeholder was performing the validation of the data. The proposal was validated in a workshop with the business case owner. At the beginning of the workshop, the background of the study and the previous findings from CSA, conceptual framework and Data 2 were introduced to the business case owner in a similar way as in the workshop for Data 2.

As the original target setting for this study was to be able to create a fully operational solution configuration tool, but due to schedule, it was altered to be a high-level tool for the sales to work with. One key element is that the users will not be technical persons. The business case owner agreed with this solution.

> *For now, the biggest issue has been what the salesman has written in the quote, the costs related to the deployment of some system. And it has not been thought through that if we have a five years' contract, what will be the cost just for running the system. And it always comes as a surprise. If we can show with this tool for the proposal management and sales teams, so they will understand the main points of what is going on, and they will also know whom to contact. (Data 3)*

In the discussion, the business case owner emphasized the need to bring all noticeable things to the salesperson's knowledge. As he stated following, "So we will have it built-in to the contract models, that this needs to be taken into consideration, if the case is for example about lifecycle management services" (Data 3).

As the proposal is only a design for the tool, the question process described in the proposal was gone through using verbal simulation of the tool design drawing. Feedback was collected in all of the steps.

On the server sizing section was decided to be set for three different levels, each with a described use case. The sizing is as follows: the S-sized system is designed for data collection or another small task, no operative systems are to be run on it. The M-sized system is designed to run one operative system. The L-sized system will have the capacity to run two or more operative systems.

> *I have previously thought it myself so if I have the initial local headcount working on the site, which has been the base for the design. If we have 100 persons working on-site, and these 100 persons need to have access to our company's network services, it means that the local infrastructure needs to be quite robust. Then this system needs to be size L so that we can run most things locally. If we have a small system, it doesn't have operative systems running on it. The medium could have one and the large one even more. (Data 3)*

Personnel costs will be separated only to white-collar and blue-collar workers. The IT related costs for the white-collar workers are higher than for the blue-collar workers. It was agreed that the personnel costs are only calculated from the services used per person. The basic IT infrastructure costs for providing the are calculated based on the personnel headcount, as for the network the number of users clearly defines the need for a certain amount of network switches and wireless access points because each device supports a certain amount of connections.

The final proposal was created based on the responses from the workshop, and the final proposal is introduced in the next section.

6.2 Final Proposal

The initial proposal is used as the final proposal with minor changed details based on the feedback from Data 3. The changed details are describing in more the available options and requirements and the questionnaire process drawing illustrated in Figure 19 will remain as it is. The details will be added to the company specific data. It was agreed with the business case owner that there will be the second tool with larger selections available for the more detailed specifications.

> *I was thinking, that with these decisions, that need to be made, is quite extensive. This is how it goes. If we start splitting hair, for example for the data collection, there come things to consider: how has the customer's network been segmented, we need to have the box in some certain part, and will the customer allow this. Usually, they may allow this, but connections out of the network are not that easily allowed. You need to think these always from the customer's point of view, as you would probably do the same. (Data 3)*

As the design is the only outcome of the thesis, in the following section are introduced recommendations for an action plan for finalizing the sales personnel version of the tool and as next steps the designing and creation of the more detailed design tool. These are introduced in more detail in the following section.

6.3 Recommendations for an Action Plan

Due to the tight time limit of this study, there was no actual product delivered, but only the design for a solution configuration tool. The next steps to provide the complete tools are to create the first, high-level tool for sales personnel using Microsoft Excel. Once the tool for sales personnel is ready, based on it one or more workshops will be held with key stakeholders involved in the different data collection phases of this study. In the workshop or workshops, the design and options for the more detailed tool are designed and decided. Currently there are multiple service delivery cases on the roadmap, and those can be used to benchmark the second configuration tool. After the planning is done, the tool will be created using Microsoft Excel.

> *This is how it has been thought, it needs to be done. We have done many quotes for this kind of data loggers, and it seems there is demand for them. If there start to be tens of them, it will be impossible for us or third parties to manage them. The support for the infrastructure and the hosting platform needs to come from the customer's end. (Data3)*

The growing of the business also sets some requirements for the support functions, that need to be considered in the future, as more resources are needed to provide the support. To take all of future changes in to consideration the tool needs to be evaluated and updated from time to time. In the discussion, it also came up, that making business with large global companies can be troublesome. The business case owner told an example how a deal was made with a global company's branch office in Finland. When the time for implementation came, the solution was shot down by the global IT representative from the head office. The tool cannot solve this kind of issue, but it needs to be included in the sales process to involve the customer's representatives to agree with topics like this.

As the case company's service portfolio grows and it gains more experience of different types of customer cases, the high-level tool for sales teams can be updated with more pre-defined offerings. Currently the tool is designed only to meet the current portfolio.

The next section discusses the results of this thesis and analyses how the thesis managed to meet its goals. The next section concludes this thesis.

7 Discussion and Conclusions

This section summarizes the results of this study and evaluates the research done. In addition, it provides recommendations for next steps in the case company concerning the service solution deliveries in the Digital Services unit.

7.1 Summary

The objective of this study was to propose a configuration tool for Digital Services unit of the case company. The study was conducted by first collecting data of the case company's current state, and the data was analyzed. Secondly based the findings on the current state analysis, literature was reviewed to find best practices available. Data was collected for the proposal in the workshop, where the previously discovered information was introduced to the key stakeholders and then discussed with them. The findings from the current state analysis, the best practices, and the data from the workshop were then implemented to the creation of the initial proposal combined with the existing knowledge of the author. Due to the limited time, the proposal was limited only to the design of the tool.

The initial proposal was validated with the business case owner, and the final proposal was modified from the feedback gained from the business case owner.

There are clear benefits for the business from this study, as the first phase tool, designed in this study, will provide the sales teams more precise cost calculations. These calculations will help them to take the IT related CAPEX and OPEX costs into consideration, and so forth create more precise quotes for customers.

A more detailed tool will be designed and created in the next phase within the case company IT organization during the year. This tool will help the system design teams and the sales teams to get more precise pricing and detailed system designs. With more precise cost estimation, the delivered customer cases will hopefully be more profitable as the IT related costs are more precise. There is an option to use the more detailed tool for internal IT system configurations as well to help for example with budgeting.

The next section discusses on the practical implications of this thesis.

7.2 Practical Implications

The current state analysis revealed certain issues in project management in the deliveries of service systems. These issues included a) no person appointed to manage the designing and delivery of the IT solutions for the Digital Services, b) sales teams not necessarily familiar with the technical IT solutions needed to provide and maintain the delivered solution and c) IT costs are not always projected correctly.

To overcome these issues the case company needs a costing tool to fix many of these issues. The tool proposed in this study is designed so that a non-technical person can create working IT configurations with it, and get cost estimations from it. This high-level tool is designed to meet the needs of the sales teams, but it is of paramount importance that a more detailed and complex tool is created, to help the system designers design the IT systems required for service solution deliveries and calculate the costs to build and run these systems.

In addition to the suggested tool, a person should be appointed to manage the designing and delivery of the IT solutions for the services solutions provided to the customers. At the moment there is no such person. Thus, there has been an organizational change done in the beginning of year 2016 to improve thet situation, as the IT hosting team helps with the IT management of the service deliveries.

To conclude, it would be recommendable for the case company to put special effort on the organizational change needed for the transformation to a service providing company. Even though the case company has already taken steps to transform its organization to meet the requirements of the role of a service provider, it would be highly advisable to continue on this development. One important factor to succeed in this is to improve the current service offering by finalizing the productization of the service products. Another factor is improving the availability of information for the sales organization. With more precise technical information and pre-defined offerings the sales organization can work more efficiently and be more precise.

The next section evaluates the whole thesis and how it succeeded to meet its targets.

7.3 Evaluation of the Thesis

The study performed to produce this thesis was done according to the instructions and rules given. The data collection, especially for Data 2 and Data 3, was limited to quite a few persons, as the organization changed during the study. One of the biggest changes company-wise was that the Digital Services unit was joined with the corporate IT organization. The management changed for the Digital Services unit, and the new organization manager has not been working with the previous customer cases, and the validation of the proposal was left to the business case owner. Some of the key stakeholders left the company during the study, making it hard to find the correct information. Nevertheless, the data was collected from key stakeholders from different organizational units using face-to-face meetings and workshops, and the data was enriched with the observation done by the author of the ongoing service delivery projects. There was company documentation available to be used for this study.

The scope of the study could have been broadened to the sales process, to indentify the strengths and weaknesses in the preparation of the initial customer proposal. Especially as the high-level tool is to be used by the sales teams. Now the sales processes were briefly covered in the discussions in the different data collection phases.

All in all, the results of this thesis can be considered to be positive as the previous pain points and successfactors were identified. Possible improvement ideas to solve these issues were introduced. Eventhough, the outcome of this thesis was left to design level due to tight schedule, a roadmap to complete suggested tools was introduced.

The next section discusses the reliability and validity of this study.

7.4 Reliability and Validity

To ensure the validity and reliability of this study, there were different actions done as described in section 2.3. First, the data for this study was collected using various sources, like case company internal documents, face-to-face interviews, and workshops. The author's involvement in ongoing projects related to the study provides information from the observations the author makes from the occurring happenings. Secondly, to avoid the study to be biased, key stakeholders from the business organization and the IT organization are involved. Thirdly, the conceptual framework for this study was based on established academic and business literature.

The next section concludes this study.

7.5 Final Words

This study discusses an important business problem of the case company's Digital services unit. The original objective of this thesis was to deliver a system configuration tool, that can help to solve some of the issues affecting this problem and on the other hand try to minimize the effect of other related issues. Due to schedule issues a design for the tool was proposed as the outcome. However, the data collected for the study can be used in the next steps to develop a more detailed system design tool. The next steps are also introduced in this study.

To conclude, as the services provided to the customer provide either tangible or intangible outcomes, it is important that both the service providing company and the customer have a mutual understanding of what the outcome should be. Ideally, the proposed tool will help the salesperson to make the customer also understand better what the customer is buying. It may also be that the intangible outcome affects the customer more than the actual tangible outcome.

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Appendix 1: Interview Field Notes Template for Data 1

Research Interview (Discussion)

TOPIC: _____

Information about the informant (Interview X)

Details	
Code of the informant	
Position in the case company	
Date of the interview	10.2.2016
Duration of the interview	1h
Document	Field notes

Field notes (Interview X)

	Topic(s) of the interview	QUESTIONS	FIELD NOTES
1	Starting point: the interviewee describes his/her experience in view of the topic/problem	How have you been involved in the previous service deliveries and their planning? At what state have you started working with this. What were your actual roles and responsibilities then? Have they remained the same whole time.	
2	Identify strengths/problems	What strengths do you see in the current operation model and how the quotation is done? What weaknesses do you see there? Do these follow throughout the whole process or only concerning the IT part?	

3	Key concerns	What were your key concerns in the previous iterations of the service delivery? What are your key concerns with the current one?	
3	Analysis	Which areas do you think need improvement? In what way? How could that be done or how it could help your work?	
4	Best practice	What have you learned from the previous projects, what are the “dos” and the “don’ts”	
5	Development needs	How would you develop the current model/process for future cases?	

Appendix 2. Findings from the Interviews of Current State Analysis

Category	Findings from the Interviews of Current State Analysis	Current State
Cost	Paying for services, which are not in use yet.	🔴
Cost	Impossible to deliver a solution to the expected price.	🔴
Cost	OPEX costs for IT infrastructure are too high.	🔴
Cost	Connection prices differ highly in different locations, cost estimation not possible.	🔴
Cost	Cost projection not done correctly.	🔴
Cost	Only deployment project costs are considered, but not the costs for running the services.	🔴
Cost	No understanding how the SLA affects the price.	🔴
Cost	24/7 service not necessarily needed, but if the customer requires it, there is an effect on the price.	🔴
Cost	Expectation for the costs and delivered service level are not reasonable	🔴
Cost	Business not ready to lower SLA, to lower costs.	🔴
Cost	Use of global resources to lower costs.	🟡
Cost	Two different cost categories: User and facility costs	🟡
Cost	Long timespan between pricing and delivery, may cause cost pressure in the delivery phase.	🟡
Cost	For non-standard cases, a feasibility study is needed.	🟡
Hardware	Oversized hardware deliveries, the same solutions does not cover all customer cases.	🔴
Hardware	Hardware solution not standardized and productized well enough.	🔴
Hardware	Current business partner not agile enough. More agile solution for system deliveries needed.	🔴
Hardware	Modular solution needed. If a module breaks, it can be changed easily, but production is not affected.	🟡
Hardware	New remote management solution coming, can enable connections both ways	🟡
Hardware	For the solutions to be handed over to customer, the outsourcing model does not work.	🟡
Hardware	Delivery model gained maturity, even all goals set by business were not met.	🟡
Hardware	Business partner can deliver HW almost any corner of the world.	🟢
Hardware	Well operated and maintained solution.	🟢
Requirements	Everything needs to ready and validated on-site before anything is delivered.	🔴
Requirements	There may be some government set restrictions, e.g. China Internet connectivity.	🔴
Requirements	Too tight schedules, planning, delivery and building takes time.	🔴
Requirements	All facilities and connections need to be ready and validated before systems can be delivered.	🔴
Requirements	Knowledge of customer location and specifications needed, e.g. the customer facility may not have connectivity of any kind.	🔴
Requirements	Customer does not necessarily allow access to the customer's network.	🔴
Requirements	High security needed to secure customer data transfers, to satisfy customer needs.	🔴
Requirements	If connectivity is an issue, a local system needs to be delivered to secure operations, which will cost.	🔴
Requirements	Non-technical salesperson should have all technical information available concerning proposed solutions.	🟡
Requirements	All specifications need to match location, like correct dust-proof racks for desert locations.	🟡
Resources	Many times non-technical people negotiate the contract and technical information is lost in translation.	🔴
Resources	Project management is not planned enough and needs occur suprisingly.	🔴
Resources	Currently no specified resource for certain to maintain responsibilities.	🔴
Resources	No implementation manager who understands and speaks the same language with IT.	🔴
Resources	No dedicated IT resources available directly in certain business cases.	🔴
Resources	A catalogue needed, so salespersonnel know better what they are selling and what it requires from us and the customer.	🟡
Resources	No person who understands both automation and standard IT infrastructure.	🟡
Resources	Experienced personnel to get systems to work in difficult situations.	🟢
Resources	New organization helps resourcing within the organization	🟢
Resources	Good internal IT knowledge and expertise	🟢
Resources	Projects are delivered IT-wise in time even if schedule is tight.	🟢
Resources	IT understands business' need, even if specifications are not very clear.	🟢
Resources	Digital services were previously part of business organization, now in same organization as IT.	🟢
Resources	Able to access remote sites from own desk.	🟢
Roles & Resp.	Which party provides site connectivity?	🔴
Roles & Resp.	Customer needs to understand what is required from the customer.	🔴
Roles & Resp.	Previously only parts of the systems operated by us. Now we are operating the whole system.	🔴
Roles & Resp.	Using customer resources as much as possible is easier than providing hardware and connections to their secured system.	🟡
Roles & Resp.	Good documentation and solution security, which has been evaluated by a third party security company.	🟢
Service Level	Understanding how SLA correlates with price is lacking.	🔴
Service Level	Level of complexity needs to be reduced and documentation improved, now troubleshooting takes too much time.	🔴
Service Level	SLA vs real delivery. If we cannot deliver, there is no point that we pay the costs.	🔴
Service Level	These systems (energy providing have been running for previous 20 years, and they will do so now, even if the connection is down.	🟡
Service Level	Service level can be agreed with customer and some risk assessment can be done.	🟡
Service Level	Service provided by current business partner is compared to the agreed service level good.	🟢
Service Level	For most cases high SLA is not required, as data loss is not critical.	🟢
Service Level	In case of connectivity loss, the local service team will manage for some time.	🟢

Legend	
🟢	An already existing strength
🟡	Acknowledged area of improvement, not yet implemented
🔴	An acknowledged weakness