CHALMERS
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Trying before Buying:

The Development of a Starter Offering for Needs-Based Cleaning Services

Master's thesis in Product Development

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Cover: Selection of storyboard frames and UI prototype views for the final proposed concept

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Abstract

The usage of IoT solutions is emerging fast in all sorts of areas. One of the businesses where this trend is uprising is the cleaning industry. Sensors are for example implemented to track visitor traffic, supply consumption and predict cleaning needs. Global hygiene and health company Essity is delivering a B2B service for needs based-cleaning. This thesis is made on behalf of Essity, and aims to research and develop a concept for an introduction service to enable customers to test the service before implementing it for their whole business and support Essity in reaching new customers.

The project was initiated by the making of a market and company analysis, establishing opportunities in the cleaning industry market. To gain better understanding of the key factors driving customer value, qualitative customer needs research was performed as a next step. Due to the service oriented nature of the offering, the concepts were developed and evaluated in an iterative process where interviewees were involved in several steps. When the most promising concept had been identified, the service was developed more in detail to provide a better visualization of the concept.

The results from the customer needs research showed a need of adaptability regarding both size and data collected. Another key insight was the need of providing support in both the implementation and evaluation of the offering. This resulted in a proposed Starter Offering promoted by sales calls, however the system is adapted to let customers order it by themselves. The sensors are ordered in predefined kits with possible addition of other types of sensors. This gives the customer ability to adapt the offering to their business needs.

The research during the project answered the first research question *What are the key factors determining customer value in an introduction service for needs based cleaning?*. Using this information, the service concept was developed to drive customer value during the whole customer journey. By this the second research question *How can an introduction service be designed to support the customer during their whole journey, from discovery to potential scaling?* was answered as well. Moving forward, further research needs to be done in order to develop the internal processes of Essity.

Keywords: IoT, PSS, Cleaning services, Service design.

Acknowledgements

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To begin with, we want to extend our appreciation to Peter Blomström and Maria Zevgren Sundberg at Essity for the opportunity they gave us with this master's thesis. They have, along with the rest of the service team, supported us with advice, feedback and insights which enabled so many learnings. Yet, they have also supported us by trusting our competence and valuing our perspectives, making the thesis truly worth the effort.

We would also like to thank our supervisor Massimo Panarotto, Associate Professor at Chalmers University of Technology, who have not only given valuable advisement but also challenged us to step out of our comfort zone and expand our knowledge into new areas. In addition, we want to express our gratitude to our examiner Ola Isaksson, Full Professor at Chalmers University of Technology, for putting time and effort into supporting us in the final steps of our education.

At last, we want to highlight the impact made by all participants in the customer needs research. The insights they provided was crucial for the project outcome. Without the stories and knowledge they shared about their areas of expertise, the proposed solution by the end of this thesis would be nothing more than a shot in the dark.

Olivia Johansen & Simon Svensson, Gothenburg, June 2023

List of Acronyms

A list of acronyms that have been used through out the thesis is listed below. The list includes acronyms for general terms, methods as well as acronyms specific for Essity, used to describe their offerings.

BMC	Business Model Canvas
BPMN	Business Process Model and Notation
B2B	Business to Business
B2C	Business to Customer
DIY	Do It Yourself
DSM	Design Structure Matrix
FPD	Functional Product Development
GDP	Gross Domestic Product
IoT	Internet of Things
PS	Product-Service
PSS	Product-Service System
SK	Starter Kit
TRM	Technology Roadmap
TVC	Tork Vision Cleaning
UI	User Interface

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1

Introduction

This chapters provides an introduction to Essity and their offering for needs based-cleaning. Furthermore, the scope and limitations of the project is presented, ending with the research questions the thesis aims to answer.

1.1 Background

Essity is a global hygiene and health company. Their business areas are divided into three categories; (1) Health & Medicine, (2) Consumer Goods, and (3) Professional Hygiene. This Master's thesis project is within the area of Professional Hygiene, which includes hygiene solutions such as toilet paper, paper towels, hand soap, hand lotion, hand disinfection, cleaning and wiping products as well as online service. Essity supplies all these products under the brand Tork (Essity, n.d.-b).

Professional Hygiene has several services under Tork connected to the products they offer. One of them is Tork Vision Cleaning (TVC), an Internet of Things (IoT) offering for needs-based cleaning. It's exclusively a business-to-business (B2B) solution intended for medium to large companies operating in buildings, preferably office buildings, with more than 50 bathroom stalls. Different types of sensors are installed at the customer's site, which track the visitor traffic and refill levels in Tork dispensers (e.g. toilet paper and soap). Tracking visitor traffic is done since variability in facility traffic can cause unforeseen cleaning needs. For example, the need for cleaning will be greater in parts of buildings that are busier than in parts with less movement. Keeping track of the movement makes it possible to place the available cleaners where needed. The data is collected by several gateways, which transfer it to the cloud. This makes it possible to access real-time information about the current status in each room, through the application. Based on the information a cleaning plan is created, supporting the cleaning staff in taking action on where and when to clean to provide better efficiency as well as quality (Essity, n.d.-g). A simple illustration of the flow in the TVC offering can be seen in Figure 1.1.

Figure 1.1: Illustration of the process of Tork Vision Cleaning

TVC is an extensive solution, which requires a big transformation for its customers. Therefore, a way to try it out before fully implementing it could support in reaching more customers, and even new market segments. Due to this reason, Essity has developed a solution called the People Counter Starter Kit (SK). The SK is meant to be a service that introduces Tork's customers to the use of IoT data on a smaller scale, to later scale up and invest in the TVC when they have experienced the benefits on their own. The SK only includes sensors that track visitor traffic in two rooms, which means the refill levels of the dispensers aren't monitored as they could be with TVC fully implemented. Along with the sensors, called People Counters, the SK includes one gateway and access to a simple application. An illustration of the setup of one SK can be seen in Figure 1.2. The distribution of the current SK is different compared to TVC, as the idea is that customers should be able to discover, order and install the PSS themselves, without any involvement of the sales unit. This would make it possible for the customers to discover the advantages of using needs-based cleaning on their own. The SK is offered free of charge for a trial period before a monthly fee is introduced if the customer wishes to continue the subscription or upgrade to TVC.

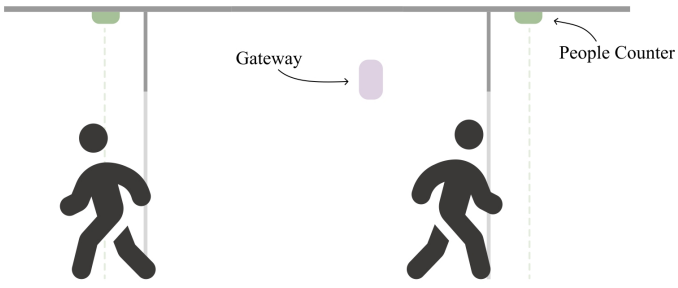


Figure 1.2: Illustration of the setup of the current SK offering; the people counters measures the movements of passing people

Several uncertainties arose when the concept of the People Counter SK was explored qualitatively by an external consultancy company. The feedback received showed

that many participants in the study perceived the offering as limiting and expensive. The value of only connecting two rooms was questioned. Another reason for these perceptions was the scalability, as questions about the next step after the trial period emerged. An additional issue that arose during the study was the need to get approval from senior management to implement the system. Some interviewees expressed a wish for a proof of concept for this reason. With this learning about customer needs and behavior, a need occurred to revisit the core concept of the SK and make sure it's valuable and attractive to the customer. Is visitor traffic the most valuable to monitor when introducing needs-based cleaning, or can other types of data provide a better starting point? There's also a need of exploring how the concept should be shaped to attract people in managerial positions, which often orders the system, but at the same time be possible to implement in the daily cleaning processes. The scaling from the SK to fully implemented TVC needs to be investigated from the customer's point of view, along with the overall customer journey. These areas will be of certain importance for the development of a new concept to replace the People Counter SK.

1.2 Aim

The aim of the thesis is to deliver a concept for a service offering, which will serve as a bridge between traditional cleaning and needs-based cleaning. The concept should support the cleaning staff and their needs during changes in the cleaning processes and provide a basis for the manager to implement needs-based cleaning for the whole organization.

The process of scaling from this service offering to more advanced IoT solutions will be planned, as a part of the concept. The development will be based on knowledge of the current People Counter Starter Kit solution but will not necessarily build on that solution. The ultimate goal is to create a compelling and actionable value proposition that can help drive the adoption of needs-based cleaning, taking these areas into account.

1.3 Limitations

In order to deliver the intended outcomes during the project a set of limitations was applied. The reasoning behind the chosen limitations is discussed below, along with possible implications for the result of the project.

1.3.1 Time and resources

A master thesis at Chalmers is limited to be done in 20 weeks, therefore the project could not be extended or finished earlier. This made the planning crucial. The resources available were mostly dependent on Essity. However, some of Chalmers resources could be used as well, e.g. software. There was no allocated budget for the project, so each expense needed to be applied for separately.

1.3.2 Market segments

The project was limited to the countries where TVC are launched. This is 7-10 countries in Europe and North America. The new concept will be a tool for introducing potential customers for TVC to the advantages of IoT data, not make TVC reach new countries. The reason why TVC is not launched in more countries depends on the needed certification of electrical equipment.

The market of TVC is broad, and the potential customers can vary a lot. In order to make a fruitful customer needs analysis, a more niche market segment was selected. The segment has been chosen through research and discussion with several employees involved in the development of the SK, with the reasoning to select a business that is a good representative of the target group of TVC. The group that was contacted were companies with many bathrooms but on several smaller sites. For example, restaurants, that are part of some kind of franchise.

1.3.3 Technology

Since the service offering is introducing the customer to Tork Vision Cleaning it was limited to using the hardware already existing in the TVC portfolio. This constrains the solution space for the offering, however, it was needed in order to keep the solution a part of TVC and not its own offering.

Furthermore, the project only aims- to deliver a detailed concept of the offering. This means no development of new software needed to realize the final concept was done. Nor does the project aim to deliver a final UI design, even though UI prototyping was used as a part of the development process.

1.4 Research questions

In order to fulfill the aim of the thesis two research questions have been stated as follows:

- What are the key factors determining customer value in an preliminary test service for needs based cleaning?
- How can a preliminary test service for needs-based cleaning be designed to support the customer during their whole journey?

2

Literature Review

This chapter introduces the methods relevant to the project, their background, and the benefits of using them. The succeeding chapter address how the methods have been applied, while this chapter presents them generally and explains their relevance for a project with this scope.

2.1 Market and Company analysis for product development

Ulrich et al. (2020) calls the idea for a new product or service an opportunity. Further, they provide a framework for identifying and developing the opportunity, before beginning with the actual product development. As this project has a starting point in an opportunity that is not fully defined, some of the strategies proposed by Ulrich et al. to generate and sense opportunities are appropriate to further assess the prerequisites.

2.1.1 PESTEL as a tool for analyzing market trends

Analyzing market trends is one of the strategies which Ulrich et al. (2020) suggests to explore opportunities for new offerings. They describe how increasing trends can create a larger need for particular products or services, creating innovation opportunities. Ulrich et al. further suggests the trends considered should cover those with social, environmental, technological, and economic impacts. A PESTEL analysis is a method used for scanning the business environment. PESTEL is an acronym of Political, Economic, Social, Technological, Environmental, and Legal, which names the factors covered in the analysis (Carruthers, 2009). Since PESTEL covers the four aspects proposed by Ulrich et al., it is a suitable method to apply to realize a thorough market analysis.

2.1.2 Describing business models with BMC

When exploring how an organization intends to foster profit-making, it's appropriate to analyze how they create, deliver and capture value. Several methods can be used for this cause, for example, a cost-volume-profit analysis. This describes patterns, and evolution characteristics of business cost by e.g. describing relations between

income, sales structure, costs, production volume, and profits. However, it does require deep knowledge about the actual numbers associated with these metrics. (Buşan, Dina, et al., 2009). Another model for how organizations can create, deliver, and capture value is the business model. The business model can be expressed by making a Business Model Canvas (BMC). It consists of 9 building blocks, listed below.

1. Customer segments
2. Value propositions
3. Channels
4. Customer relationships
5. Revenue streams
6. Key partners
7. Key resources
8. Key activities
9. Cost structure

Each of these nine parameters is analyzed for the organization in question. This method is applicable to establish the business model internally, but it can also be used for creating an overview of another organization, e.g. a competitor (Osterwalder & Pigneur, 2010). The nine parameters cover the analysis of how the organization creates, delivers, and captures value on a high level, without the deep knowledge of the actual numbers needed. When investigating this early in a project, it can be beneficial to use the organization's business model.

2.1.3 Competitor benchmarking to identify opportunities

Another strategy to discover opportunities suggested by Ulrich et al. (2020) is as they describe it *"imitate, but better"*. They refer to the possibility of investigating other, already successful offerings. As these offerings are proof of a good business idea, the opportunity to meet the same needs with another solution arises, as well as the other way around- the opportunity to address new needs using the same solution.

Benchmarking is a process with the aim to identify approaches to reach a competitive advantage. It can be applied in several different ways, where a common one is competitor benchmarking. This is done to do a comparison with companies with competing offerings, operating in the same market (Elmuti & Kathawala, 1997). This makes it an appropriate procedure to seek opportunities in other companies' offerings in a structured manner. The benchmarking method can vary a lot, however, some major themes are essential and therefore present in most variants. These are measuring the performance of best-in-class to critical performance variables, determining how the performance is achieved, and using the information for the creation of an improvement plan (Omachonu & Ross, 2004).

2.1.4 SWOT analysis as a tool for strategic planning

Strategic planning is commonly done by organizations for the identification and examination of current resources, and investigation of trends and patterns, externally and internally, as well as how these affect their businesses (Namugenyi et al., 2019). SWOT analysis is a tool commonly used for businesses for strategic planning. It contains four fields that state the business's Strengths, Weaknesses, Opportunities, and Threats. Benzaghta et al. (2021) defines the content in a SWOT analysis as factors. Where in the SWOT the factor is positioned depends on where the factor is internal or external, and if its outcome is helpful or harmful. A factor considered a Strength is internal and helpful. A Weakness is internal but harmful. Opportunities are externally helpful factors and Threats are externally harmful. The SWOT analysis covers the aspects and is for that reason a suitable method to use for strategic planning.

2.2 Customer Needs Research

For a product to succeed Ulrich et al. (2020) describes the importance of having a channel between the customers in the target market and the development team. The purpose of performing customer needs research is to understand their needs and effectively communicate them. Ulrich et al. (2020) also describes a suitable process for finding the customer needs in five steps, which are presented below and the following sections describes how these steps can be achieved.

1. Gather raw data from customers.
2. Interpret the raw data in terms of customer needs.
3. Organize the needs into a hierarchy.
4. Establish the relative importance of the needs.
5. Reflect on the results and processes.

2.2.1 Qualitative information gathering methods

Ulrich et al. (2020) proposes three methods for gathering information from customers. These are Interviews, User Observations, and Focus Groups. All these methods are examples of qualitative methods which according to Bachiochi and Weiner (2004) are appropriate to use when the context and the participants' interpretation are important for the research questions, the depth of the data is essential, and the research is exploratory. In this project all these factors are concerned, especially the depth of the participants data and therefore the qualitative data collection has been used.

Interviews are sessions where an interviewee gets a number of questions to answer connected to the research questions. A focus group is a session where a group is discussing a topic supervised by a facilitator with the same intention as the interview. Observations are a method to find a pattern or behavior of the observed stakeholder

that they don't want to say out loud or don't know they are doing (Bachiochi & Weiner, 2004).

2.2.2 KJ method for data analysis

For analysis of the data the KJ method is a commonly used tool. The KJ method is used by grouping the key takeaways from activities such as interviews and observations to find patterns and themes (Scupin, 1997). The advantages with the KJ method are according to Plain (2007) the ability it provides to quickly organize, and make sense of large amounts of data. Scupin (1997) proposes the method to be performed in four steps.

1. Label making
2. Label grouping
3. Chart-making
4. Written explanation

The first step is to compress the information from the observation or interview to notes consisting of only one sentence or word that represents the key takeaways. The next step is about grouping the takeaways that are similar or in other ways connected. The groups are then put on a chart and the meaning of the chart is described in words.

2.2.3 Customer needs list

Ulrich et al. (2020) proposes to transform the raw data coming from the qualitative information-gathering methods in terms of customer needs. The needs are formulated in terms of what the product or system is supposed to do, not how they are supposed to do it. The needs are internally ranked against each other on the importance and put in a list. When needs are formulated, they may conflict with each other. It is then the ranking that determines which of the conflicting needs should be retained. They further states that the customer needs list is crucial for the guarantee that the final solution fits the customer, and that no important need is forgotten.

2.2.4 Translating the Customer needs to measurable metrics with Requirements specification

Customer needs are expressed in a way that is easily understood, even by the customer. In order to develop any of them, the needs must be translated into measurable parameters. This is done with a requirements specification. The usage of a needs-metrics matrix allows the connection of the customer needs to the measurable metrics. By doing so, it ensures that all customer needs are represented in the requirements specification. After the matrix acceptable marginal values and wanted ideal values are set for each metric. The metrics and their values in the requirements

specification are then used as a tool for evaluation of concepts and metrics when performing tests (Ulrich et al., 2020).

2.3 Adapting concept generation for PSS

So far the literature brought up follows a quite traditional product development process. However, this thesis concerns a Product-Service System (PSS). Tukker and Tischner (2006) describes a Product-Service (PS) as "a tangible product and an intangible service designed to jointly fulfilling a need", and a PSS as "the product-service including the network, infrastructure, and governance structure to deliver the product-service". Since the PSS does not only contain tangible products the development process differs a bit from traditional product development. Shostack (1982) is also differentiating between product and service elements, describing how product elements exist in both time and space while services only exist in time. She further explains how combinations of products and services can be complex, and therefore requires to be viewed in an organic manner rather than static. Isaksson et al. (2009) proposes Functional Product Development (FPD) where the target of developing the total solution for the customer needs, including hardware, software, etc. rather than only the goods. Several methods are mentioned in the literature, but no uniform way has been proposed since the design of a PSS is complex.

2.3.1 Functional analysis with DSM of a PSS

When working with development on a system level, Eppinger et al. (2012) proposes a Design Structure Matrix (DSM) as a beneficial tool to use for modeling the architecture. They further describe how the elements and interactions in a system make behavior and functions emerge, and that improvements can be made by changing the structuring of the elements. To adapt the tool for PSS, Heungwook et al. (2018) proposes to divide the elements into different categories to distinguish between service and product elements.

The procedure of doing a DSM can be divided into five steps. Each step is described below, based on the explanations of Eppinger et al.

1. **Decompose** the system into all its required elements.
2. **Identify** the dependencies between all elements.
3. **Analyze** the relationships and the structure to gain insights into the implications of the behavior of the system.
4. **Display** the DSM model in order to highlight features that are of great interest.
5. **Improve** the system by taking actions based on the resulting analysis of the DSM.

There are several advantages of using DSM to analyze the structure of a system, compared to other methods. One aspect is visualization, as DSM supports in iden-

tifying parts of a system with many interactions, indicating a potential benefit in making the elements a module. Furthermore, DSM is beneficial to use due to the system-level view it provides, easing the process of making improvements that are globally strong (Eppinger et al., 2012).

2.3.2 Storyboarding in initial PSS development

In the early development of a physical product sketches or easy CAD drawings are common tools used to get an idea of the concept. In service development, there are intangible service elements that cannot be represented by only one sketch. For this reason, storyboards are a method used for describing concepts. A storyboard is a sequence of pictures describing key steps of the service concept, instead of only one sketch (Ulrich et al., 2020). Due to the simplicity of the method, it is beneficial to use in the early steps of the PSS development process, as a way to visualize several concepts.

2.3.3 Use case diagrams

Analyzing use cases can support capturing the behavioral requirements of a system, in addition to the functional ones. A use case diagram provides an overview of related use cases and actors required to perform the use cases (Rosenberg & Scott, 2007). Use case diagrams are beneficial to use to ease the requirements analysis. For instance, in a comparison between use case diagrams and class diagrams, Siau and Lee (2004) found that the interpretation of use case diagrams was easier, and gave a more complete view of the system as a whole.

2.3.4 Business process model and notation

To model the processes needed for delivering a PSS a Business process modeling notation (BPMN) can be used. White (2004) describes the BPMN as "a network of graphical objects, which are activities (i.e., work) and the flow controls that define their order of performance". It is in other words a flowchart with the needed activities, stakeholders, and decisions to deliver the PSS to the customer. This makes BPMN beneficial to use when examining the organizational activities of a PSS.

2.3.5 Evaluation of PSS

Ulrich et al. (2020) describes the differences between developing a product and a service. When developing a service the customer generally plays a huge role in the development phase by providing input which can be used for the development and evaluation of concepts. The level of customization and modularization is generally higher for services, and the development is more of an iterative process.

2.4 Detailed service development

The delivered result, the service offering, is the ultimate purpose of the delivery of a service. It is the value proposition to the customers, from the service providers. However, for a service to be successful there must also be a compatible value proposition for the service provider. Due to this, the service must be designed with the user context in mind, as well as the service organization (Penin, 2018). Therefore, it's beneficial to incorporate different methods, enabling taking both the customer perspective as well as the service organization into consideration.

2.4.1 Customer journey map

Temkin (2010) describes the importance of considering the customers' point of view during development. Otherwise, it is easy to miss the customer needs along the way, perhaps because of internal politics in the development team. According to Temkin (2010) is mapping the customer journey a way to have an outside-in perspective on the service.

2.4.2 UI prototyping

Bäumer et al. (1996) states how a conscious approach of including User Interface (UI) prototyping in the development process seems to generate greater possibilities of making projects successful, based on several case studies. Further, they identify an emerging trend of using UI prototypes as a tool to develop and demonstrate innovative systems. Penin (2018) describes how when prototyping digital interactions, the strategy should be dependent on the purpose of the prototype. This means the prototype can end up as hand-drawn on paper, as well as a more advanced digital prototype developed using some design software. She further establishes how one of the key advantages of doing a UI prototype is how it speeds up the validation process since it enables customer feedback early in the process.

2.4.3 Service prototyping

Prototyping is the most common way of testing functions. When prototyping a product several tests are made on the hardware to see if it behaves as expected. Prototyping a service differs since a service does contain more than hardware and in some cases no hardware at all. Services are for this reason instead prototyped by approximating the process of the service. Services without any hardware can be prototyped by for example a website, and a service with included hardware can be prototyped by a pilot (Ulrich et al., 2020).

2.4.4 TRM based on DSM

Heungwook et al. (2018) proposes how the results of the previously introduced DSM can be used to develop a Technology Road Map (TRM), to plan the development of a new PSS. A TRM is a tool for aligning product and technology strategies, allowing

the establishment of a long-term strategy, which distinguishes it from other planning tools. When developing a DSM to enable the making of a TRM, the approach suggested by Heungwook et al. is slightly different from the approach described in section 2.3.1. After establishing the dependencies between all elements, the sequence of their development is determined.

3

Methodology

In this chapter all the chosen methods for the thesis are presented. An overview of the methodology can be seen in Figure 3.1. As can be seen in the picture the project has been carried out in five phases. The first phase, the planning phase, had the purpose of framing the project scope, researching methods and planning out a methodology. This chapter will therefore explain the methodology of the four following phases, going through how each method have been applied and how it's connected to the other methods which have been used.

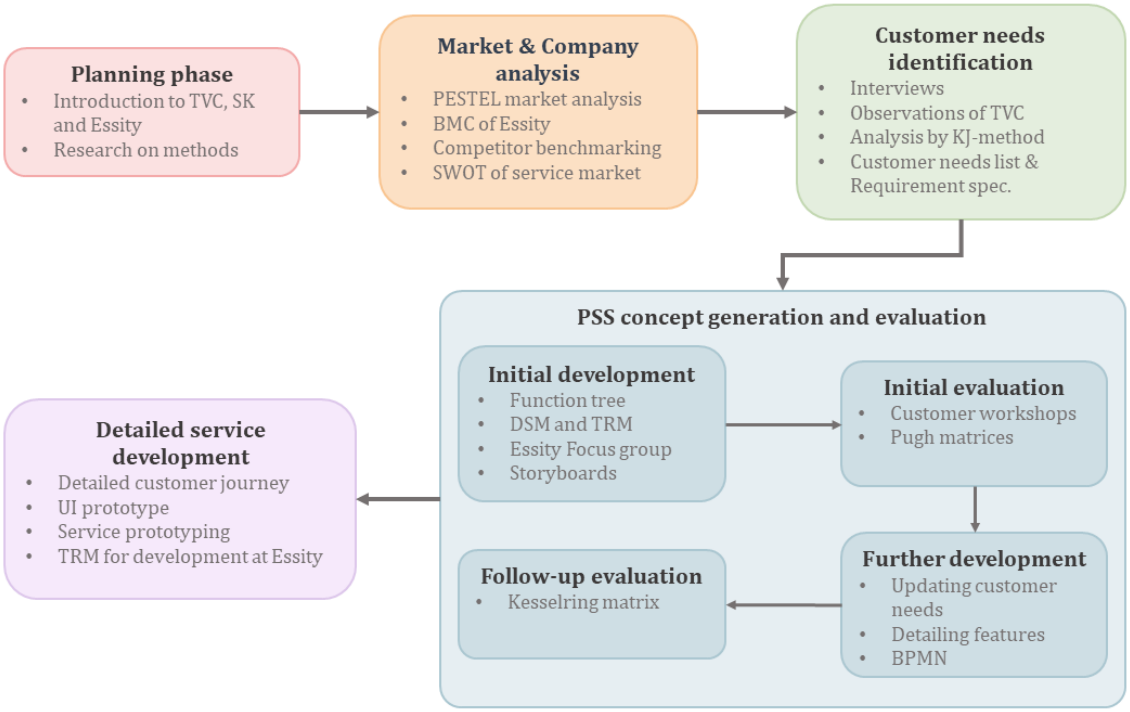


Figure 3.1: An overview of the methodology used in the project, with the included phases and methods

3.1 Market and Company Analysis

This phase was carried out in order to create a better understanding of the cleaning market and further explore the opportunity in reaching new customers with a Starter

Offering. An overview of the methods used in this phase can be seen in Figure 3.2, with the application of each method further explained in the following sub-sections.

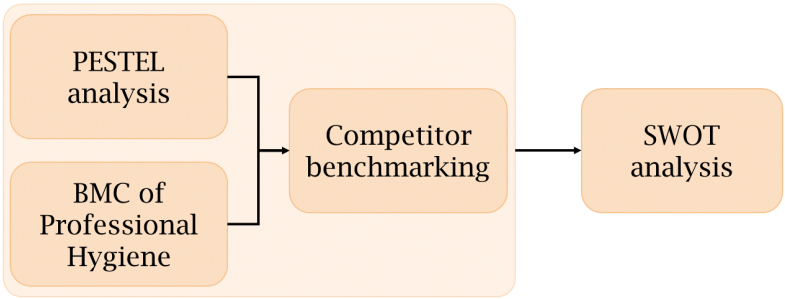


Figure 3.2: Methodology for Market and Company analysis

3.1.1 PESTEL Analysis

The first step when doing the PESTEL analysis was to define the objectives with the analysis, seen in the list below.

1. Ensure growth of market
2. Explore markets segments outside of TVC's target segment

These objectives supported the establishment of the scope of the information gathering, which can be found in Table 3.1. By defining the objectives and the scope of the analysis beforehand helped in keeping the research efficient and relevant for the project scope. The first objective was mainly addressed by economical and socio-cultural factors. The other objective was however much broader, and could probably have been addressed as it's own thesis. Following this, the limitations in section 1.3.2 addressing the market segments was essential when defining the scope for the second objective.

Table 3.1: Scope of PESTEL information search

Political	**Economic**	**Socio-cultural**
GDPR and IoT	Cleaning market growth Cleaning labour costs	Adoption of IoT solutions People flow
Techonolgical	**Environmental**	**Legal**
Advancements in IoT	Energy consumption Effects on efficiency	Regulations and compliance Organization standards

The information search was mainly done among external, public sources. However Essity's already existing market research was studied as well to give understanding about the factors they usually take into consideration and which they haven't so far.

3.1.2 Business Model Canvas

To further assess TVC and its business area Professional Hygiene a BMC was made. The scope of the BMC was limited to this business area, since the other areas which Essity operates in are very different in their value propositions as they are aimed towards completely different market segments. Some products are similar, as the business area Consumer Goods for example also offers toilet paper and hand towels. However they are sold to households instead of B2B as the toilet paper and hand towels offered by Tork. The limitation of the scope supported in keeping the research relevant for TVC and thereby the new Starter Offering. The research was carried out using both external and internal information sources.

3.1.3 Competitors Benchmarking

Using the insights made from the PESTEL analysis and the BMC, the next step in the process of exploring the market and potential opportunities was to investigate the competitive landscape. Companies operating in the same market with offerings related to TVC was therefore identified and researched in a competitor benchmarking.

To narrow down what offerings which should be investigated the relevant characteristics were pre-defined. Both offerings which are directly competing with TVC in the cleaning market and offerings using similar technology targeting other market segments were of interest. This resulted in the characteristics listed below, where the offering were to meet at least one of them to be considered relevant.

- Monitors people flow using IoT-solutions
- Monitors refill levels in dispenser using IoT-solutions
- Provides a software to increase cleaning efficiency

3.1.4 SWOT analysis to assess TVC

To synthesize the knowledge gained from the PESTEL analysis, BMC and competitors benchmarking, a SWOT analysis was conducted. The purpose was to clearly define the current situation of TVC, which in turn could be used to define the business idea of the Starter Offering more in detail.

3.2 Customer Needs Research

In order to map out what needs the Starter Kit offering should fulfill a thorough customer- and user research was done. The information was gathered from customer interviews and an user observation. The purpose with this was to provide triangulation. The data was then analyzed by the KJ method which subsequently led to a customer needs list. The customer needs were then translated to more quantified metrics in a requirements specification. An overiview of the methodology for this part can be seen in figure 3.3.

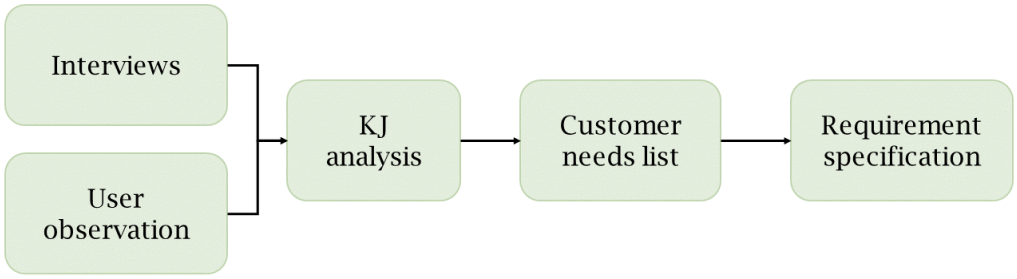


Figure 3.3: Methodology for Customer Needs Research

3.2.1 Exploring needs using in depth interviews

In order to explore the customer needs of the Starter Offering, in depth interviews were carried out. The interviews went through a planning stage, and an execution stage. The planning required preparations in two parallel steps; the selection and recruitment of interviewees along with the establishment of an interview template.

Interview planning

As the Starter Offering should support in reaching new customers without expanding to completely new market segments, the profile of the interviewees and the business they were working in had to be within the targeted market segments of TVC, according to the limitations in section 1.3.2. Therefore the recruitment of interviewees was aimed towards persons fulfilling the requirements listed in table 3.2 below.

Table 3.2: Requirements and wishes when selecting interviewees

Requirements
· The person has a managerial position, having the general responsibility of the cleaning in the organization · The organization has a varying people flow · The organization have several sites or is a part of a group of businesses
Wishes
· The organization is located in or near the Gothenburg area

In addition, a variation between internal cleaning personnel and hired cleaning services was of interest, supporting the selection of interviewees as well.

The interviews were prepared to be semi-structured, meaning a set of questions were established with a suggested order. This kind of structure allowed for changes to be made in the order of questions, to provide a more natural flow in the conversation, as well as the addition of follow-up questions to enable a deeper understanding of certain topics.

Interview execution

All interviewees were informed that both they as persons and the company they work for would be presented anonymously. This choice was made in order to generate answers as close to the truth as possible, without causing any concerns for potential effects on the company.

During the interviews, one of the authors led all the interviews and the other took notes. Along with the notes, all interviews were recorded to ensure that no information was lost and that no misinterpretations occurred. The recordings were later transcribed by using the built-in transcription function in Microsoft Word.

3.2.2 User Observation

To further explore the user needs when implementing changes in the cleaning processes an observation was done at the site of an existing TVC customer. This was done in order to complement the insights gained from the interviews, as the observation allowed for the discovery of latent needs. The customer is a company owning and operating multiple airports in Sweden, and the visited site was one of these airports.

Tour of the cleaning route

The main part of the visit was a tour around the airport. Visits was made at both the landside, i.e. the entrance hall of the airport, as well as the airside, the areas after the check in. In order to gain deeper understanding of how TVC is applied in their cleaning routines, the tour was following a predefined route which the cleaners were working accordingly to. The site was divided into smaller areas, where the cleaning staff was assigned. The guiding was done by the cleaning coordinator at the site, who were also in charge of the maintenance and operations of TVC. This enabled thorough explanation of each step in their cleaning process, along with comments on common deviations from the predefined route.

After the tour, an employee from the cleaning staff joined for questions. These were asked in order to gain deeper understanding in how TVC was used in a real life setting, as well as how they experienced implementing and maintaining the system. A lot of focus were put into getting to know potential obstacles new personnel might face when learning to work with the new system. The idea behind this was that the new Starter Offering should not only be easy to implement as a system, but also easy to adopt among the users.

Discussion with the team lead

Following the tour a set of questions were asked to the cleaning staff team lead. Similar to the in depth interviews, a template of questions was defined beforehand, also following a semi-structured approach. The purpose of this meeting was to gain better understanding of the actual usage of TVC, and potential challenges it might include. Due to this, the questions focused on the cleaning staff's point of view.

3.2.3 Using the KJ method to synthesize customer needs

To synthesize the large amount of information from the interviews and observations into concrete customer needs the KJ method was used. The method was applied by first summarizing the key takeaways from the transcriptions and notes in a few words or sentences on post-it notes. This was done in the software Mural, as it allows for online collaboration. The takeaways were initially sorted by interviewee and consisted of all information which was considered valuable. An overview of the takeaways can be seen in Figure 3.4.

Figure 3.4: Key takeaways from the interviews

The next step was to arrange the post-its with the same theme together in clusters. Due to the volume of the notes this was done in two steps. Firstly the notes were arranged in bigger "main groups" to later be arranged in clusters within the main groups. For example one main group was named "Changes" and a cluster in the group was called "Communication" which then refers to communication during changes. An overview with a brief example of the clusters in the KJ method can be seen in Figure 3.5.

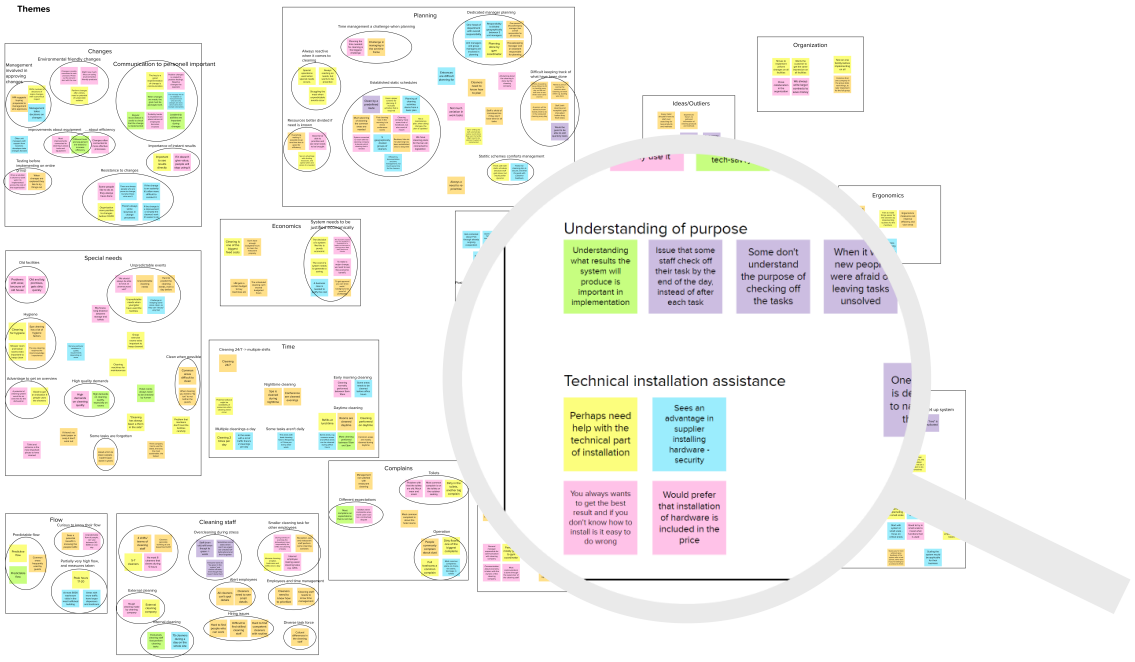


Figure 3.5: Key takeaways from interviews and observations arranged in clusters by the KJ method

3.2.4 Customer Needs List

The initial customer needs list was established using the clusters created with the KJ method. The clusters and groups generated the base from which each customer need was formulated. Further were the customer needs divided in five phases. The phases is divided due to when in the offerings life cycle it is relevant.

The list has afterwards been continuously updated during the project as new customer feedback has arose. As an example, interviewees were involved in a part of the evaluation. This evaluation gave better understanding of the customer needs, leading to a review and update of the customer needs list.

Each need was prioritized on a scale from 1-3, where the highest priority is 3. The priority was based on the statements from the interviews and observations. Needs connecting to many key takeaways from multiple interviewees were prioritized higher. Needs that were mentioned with emphasis were also prioritized higher. The definition of each of the priorities is listed in Table 3.3.

Table 3.3: Definition of customer needs prioritization scale

3	Critical: Indicates that the need is absolutely essential to fulfill for the success of the offering and its absence would make it unusable for most customers.
2	Important: Indicates that the need is a key factor for many customers, and its absence could lead to a loss of business.
1	Nice-to-have: Indicates that the need is desirable to some customers, but it is not a critical factor in their decision to implement and use the offering.

3.2.5 Requirements specification

When the customer needs list was in place, the next step was to create the first version of a requirements specification. This was needed in order to establish measurable details of the offering as a whole, yet still independent of a solution.

Using the format for a product specification proposed by Ulrich et al. (2020), each requirement were listed with a metric along with a target values. As a first step, a list of metrics were defined along with units for measurements and their relative importance, defined in an descending scale from 5 to 1, listed below in table 3.4.

Table 3.4: Definition of requirement importance scale

5	Utmost importance, critical for success of the offering
4	High importance, significant contribution to desired outcomes
3	Reasonable significance, but not directly impacting the core objectives
2	Lower level of importance, can be deprioritized if needed
1	Minimal impact on the core objectives

The draft of the requirements specification was then compared to the customer needs list in a needs-metrics matrix. Through this comparison it could be ensured that all customer needs were addressed, as those who weren't yet were translated into new requirements. The numbers of the related customers needs were added to the requirement specification for better traceability. Furthermore, the importance could be reviewed as the customer needs were previously prioritized. Relations to several customer needs for one requirement was also an indication of higher importance.

The target values were then specified for each metric. At first the marginal value was established, i.e. the value the offering must meet to fulfill its purpose. Afterwards the ideal value of each requirement was established. In addition a metric number was assigned for each requirement. During all stages of development this process have been iterated, as new customer needs have been discovered along with deeper insights in the relative importance.

3.3 Concept Generation

3.3.1 Functional analysis

In order to gain deeper understanding in what functions the Starter Offering needs to provide to the customers, a functional analysis was done. This was done stepwise, by analyzing firstly establish what functions the Starter Offering would need to have. This was done with a function tree. Afterwards the established functions was compared to the elements of TVC, which in turn enabled identification of the modules needed to form the Starter Offering.

Function tree

To establish what functions the Starter Offering needs to offer, a function tree was developed based on the customer needs list. It begun with the establishment of its main function, followed by breakdown into sub-functions in two levels. At this stage, the analysis was done in a not solution oriented way in order to keep the solution space as broad as possible.

Analysis of TVC by function fulfillment's and DSM

The purpose of the Starter Offering is to introduce the customer to needs based cleaning and the goal of its implementation is to convince the customer to move on to TVC. This is why one of this thesis limitations is to not include any new kind hardware. Another implication is that even though one or several applications might be developed just for the Starter Offering, they aren't supposed to introduce any major features which aren't included in the current TVC offering.

For these reasons an analysis of TVC was made to establish the relationship between the identified sub-functions and the current elements of TVC. Each element which can be used in TVC was listed, both product elements and service elements. As the next step, each element of TVC was mapped towards the sub-functions it could contribute to solve. After this was done an analysis could be made to establish which parts of TVC were essential to use in the Starter Offering, and which were not.

When these relationships were analyzed it became clear that in several cases many elements needed to be included to solve a single sub-function, and many sub-functions shared elements as well. This indicated that an analysis of TVC as a modular system needed to be done. The modules of TVC was identified by doing a DSM of TVC and analyzing the dependencies of the different elements.

The DSM was done by list the service and product elements of TVC and find the dependencies between them. By doing this clusters could be found, where each cluster became a module.

Comparing the identified modules and the relationships between the Starter Offering sub-functions and TVC elements, modules appropriate for the Starter Offering could be established. Since the system couldn't be completely modular, each module was

paired with the sub-function it mainly solves, even though some contributed to the fulfillment of several sub-functions.

3.3.2 Idea Generation

The idea generation was done in two phases: internal focus group, and brainstorming sessions.

Internal Focus Group

In order to explore the breadth of the solution space for the starter offering, two focus groups were done with Essity employees working in the Service team. They were chosen as they all have good, yet not the same, insights in TVC and Essity's overall operations.

Brainstorming

In order to generate concepts a brainstorming session was performed. Several methods for idea generations through brainstorming was considered. Brainwriting, Crazy 8, and 6-3-5 method were methods that was researched and considered, but rejected. VanGundy (1984) describes six methods of brainwriting, where all includes more than four participants and for this case was none of these used. This was the same reason to why Crazy 8 and the 6-3-5 method where rejected. The fact that the outcome of this thesis is an introduction service for an existing service was also limiting the design space, which required more frames than the mentioned methods offers.

Instead the brainstorming was carried out in two steps. Firstly the team members during a five minute period were creating entire concepts with different themes. The themes were Economical, Efficiency, High-quality, User-friendly, and Quick-start. This method was good for starting think of solutions freely, but it was early found that the concepts were very different in level of comprehensiveness and this made them hard to evaluate.

Instead the development of modules which solves the sub-functions were established and the brainstorming was done by creating solutions for the modules. These solutions were then set up in a morphological matrix.

3.3.3 Concept creation

The concepts were generated by combining the solutions for each module in the morpholgical matrix thematically. The themes were chosen to be the same as the initial brainstorming User-friendly, Economical, Efficient, High-quality, and Quick-start.

Use case diagrams

To model the interactions with the system for each concept, use case diagrams were developed. It began with identifying all actors who were interacting with the system. The next step was to identify the system boundaries.

3.4 Concept Evaluation and Further Development

After concepts of a Starter Offering had been generated, the next phase was to evaluate and continue develop them iteratively. An overview of the process, including the previous phase, can be seen in Figure 3.6.

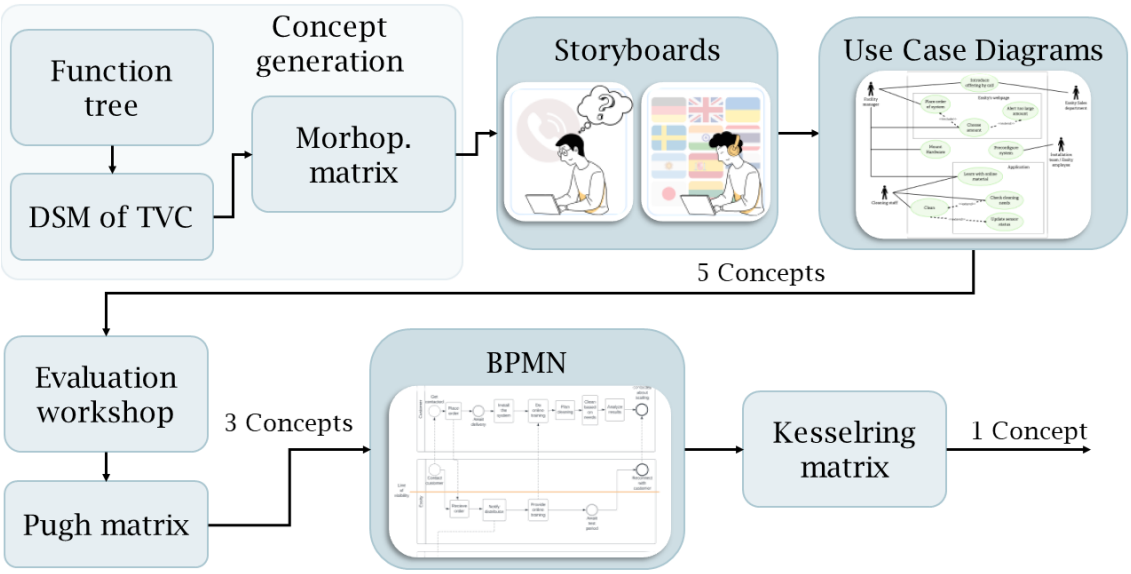


Figure 3.6: Overview of concept generetation, evaluation and development methodology

3.4.1 Elimination matrix

To ensure all concepts were able to meet the marginal values of the requirements specified, an elimination matrix was done.

3.4.2 Evaluation workshop with customers

In order to gain better insights in the customer needs, workshops were scheduled as part of the evaluation. This allowed for confirmation of the previously expressed needs. In addition, several of the requirements with subjective measurement were appropriate to evaluate with persons outside of Essity to get truthful answers and prevent the influence of biased opinions.

Selection of Interviewees

To ensure the validity of the evaluation the choice of interviewees became important. Reconnecting with the interviewees from the customer needs research phase was considered appropriate as they had been introduced to the idea of needs-based cleaning but not detailed solutions. However, one of the five interviewees was not considered appropriate for the evaluation phase as it became clear that TVC was not suitable for the area they were working in, and therefore not suitable for the

Starter Offering. Instead, one new interviewee working in the restaurant business was recruited.

Structure of workshop

The workshop was performed with each one of the interviewees separately. The storyboards which were created during the concept generation phase were used to present the concepts. Each concept was presented in a chronological sequence, describing the interactions required from the customer and their users. Following that, the interviewee gave their initial response to the concept as a whole. The purpose of that approach was to gain insight into which modules and features matter the most and which are of less priority for the customer. The interviewee was asked to state if they would want to implement that concept for trying out needs-based cleaning. Afterwards, the interviewee shared their thoughts on each separate module.

3.4.3 Systematic evaluation with Pugh matrices

Three iterations of the Pugh evaluation was done. In the first iteration the existing SK was the reference to explore its potential benefits. Due to the outcome, it was decided to not include it in the following two iterations. The concept which were ranked at third place, i.e. a medium ranking, in the first iteration were chose to be the reference in the second. In the second iteration, two concepts received the equal ranking of third place. Due to this, the concept which were most different from the previous references for chosen as reference for the third iteration. The results started to converge and the advantages and disadvantages of the different modules became clear. Therefore, the third iteration was the last one.

Crossbreeding of concepts

The results in the Pugh matrices were used to identify the advantages and disadvantages of each concept. Alternative solutions were then investigated and discussed, in order to create the most appealing concepts.

3.4.4 Further concept development

As a next step of the development process, the remaining and refined concepts was modeled into further detail.

Detailing features

During the customer workshop new critical aspects of the concepts were identified. Some clarifications of the concepts regarding e.g. what sensors included in the offering etc. was stated.

BPMN

The remaining concepts were further developed through Business Process Modeling Notations (BPMN). This was done by take all stakeholders in considerations as well as how activities, decisions, and events affect the processes for delivering the offering.

Each stakeholder were represented in their own pool and the internal functions were represented as lanes. The starting- and ending events for the pools was presented as well as the activities and messages between the pools. Additionally a line of visibility was drawn to what is shown as front end towards the customer, and what is on the other side is the back end.

3.4.5 Evaluation with Kesselring matrix

To identify the most promising concept among the final ones, Kesselring was used as a method of concept scoring.

Determining relative importance of metrics

A first step in this evaluation process was to determine the selection of metrics to be used. Metrics which had the same marginal and ideal value weren't included in the Kesselring, since a concept can't perform better or worse regarding those. Another aspect which were taken into consideration was the verification method. Metrics which had verification methods which couldn't be performed in this stage, user studies and hardware testing, couldn't be evaluated.

The next step was making a pairwise comparison of the selected metrics. An illustration of this process is shown in Table 3.5, where each metric have been compared to the others one by one. If Metric 1 is considered more important than Metric 2, the cell at the row of Metric 1 and column of Metric 2 is filled with a 1, while the opposite cell is filled with a 0. In cases where the metrics were considered equally important both cells were filled with 0,5. However, this is not optimal as the purpose of the comparison is to determine the relative importance of the metrics. Due to this, 0,5 was carefully used. A summation of these comparison scorings was done for each metric, as well as in total. Dividing the metric summation by the total summation, a relative weight-factor was defined for each metric.

Table 3.5: Example of pairwise comparison

	Metric 1	Metric 2	Metric 3	Metric 4	$\sum$	$\sum_{rel}$
Metric 1	-	1	0	1	2	0,333333
Metric 2	0	-	1	0,5	1,5	0,25
Metric 3	1	0	-	1	2	0,333333
Metric 4	0	0,5	0	-	0,5	0,083333
					6	1

Value scale definition

Another part of the process was to define value scales for each metric to be used in the Kesselring matrix. The most appropriate range of the scale was 3, as it was compatible with both metrics regarding performance and metrics more dependent on subjective input. Since the concepts were still in a conceptual phase with no possibility for product testing, some performances were established based on estimations. This made a scale with the range 1-3 appropriate since more steps would require more precise estimations.

Evaluation of concepts

The final step in the process was to begin evaluating the concepts. Each concept received a score ranging from 1-3 regarding each metric. The score was then multiplied with the weight w for that metric. These results were then summarized for each concept, enabling ranking of the concepts.

Sensitivity analysis

To determine the robustness of the result of the Kesselring, its sensitivity was analyzed. The purpose was to create an understanding of the accuracy of the evaluation was, and by that making sure there were no hesitations in moving forward with the concept scoring highest in total. The analysis was done by trying slight alterations of metric weighting and concept scoring, following an analysis of how the concept ranking was affected.

3.5 Detailed Development of final concept

When a final concept was chosen it was ready for more detailed service development, as well as prototyping. This phase mostly focused on the user perspective and a methodology overview is seen below in Figure 3.7.

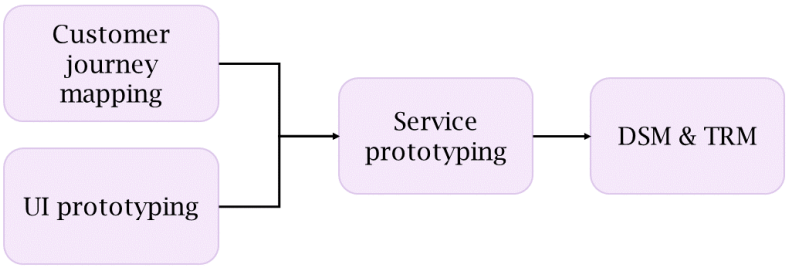


Figure 3.7: Methodology for detailed development

3.5.1 Customer journey map

A Customer journey map was developed to describe the offering from a customer's point of view. The journey was divided into the same phases that had been used during earlier parts of the development. In these phases, the "Actions", "Touchpoints",

and "Customer Thoughts" were listed. The Actions are the activities that happen for the customers, the Touchpoints are the part of the service the customer interacts with, and the Customer's Thoughts are the feelings and thoughts the customer experiences.

3.5.2 Prototyping with UI

In order to make a visual representation of the usage phase in the final concept, a UI prototype was done using the software Figma. It requires neither backend nor frontend development, which makes the software suitable for conceptual development in early-stage PSS development. The purpose was to visualize the concept in the usage phase but also to provide the prototype as a mediating tool in the upcoming service prototyping.

3.5.3 Validation through service prototyping

To validate the final concept, a service prototyping session was performed. The method of service prototyping was chosen as it's focusing on the user experience, which have been defined as a critical factor regarding the success of the Starter Offering. One participant with no experience of needs based-cleaning was recruited, as the primary purpose was to investigate and validate the main function *Provide preliminary test of effective cleaning services*. The participant did not have experience in facility management, making them unaware of typical cleaning procedures and methods.

A brief explanation of the refill procedures of dispensers was shared, e.g. highlighting that the dispensers must be opened when checking the refill level. Following this, the participant got to explain their thoughts about organizing cleaning for a building. Afterwards the participant was introduced to the UI prototype on a smartphone, which also served as an opportunity to collect feedback of the User Experience (UX). The UI prototype was set up to show a situation where dispensers in only 2 out of 6 toilets were in need of a refill. The participant got to share how they would change the organization of the cleaning in the case where they had access to the Starter Offering. The participant was also asked to share potential benefits and disadvantages they saw in needs-based cleaning in general, in order to evaluate if the offering supported the customer in their learning about working with a data-driven approach.

3.5.4 Using DSM and TRM for development planning

When all development and prototyping of the Starter Offering was done, the final step in the development process was making a DSM for the Starter Offering. It was saved at last to make use of all available knowledge about the PSS concept, and by that enable the most detailed DSM as possible.

The DSM was made by first listing all needed elements, divided into product and service elements, just as in the making of a DSM for TVC explained in subsection

3.3.1. These were then put into the DSM, where the dependencies between different elements were evaluated. Afterwards, these dependencies were analyzed to create a better understanding of the development process. Elements that were interdependent needed to be developed simultaneously and were therefore divided into modules. Identifying elements that are dependent on one or several other elements helps in determining the sequence in which they can be developed.

Taking the dependencies into account along with the elements of the PSS which is already developed and in usage for TVC, a TRM was developed. The purpose of the TRM was to provide an overview of the order the parts of the PSS could be developed, and which parts could be developed in parallel. This can for future work serve as support in potential project planning, as well as determining technology strategy for the full product portfolio of Essity.

4

Results

This chapter describes the results from the Market and Company analysis, Customer Needs research, Concept generation, and evaluation as well as the final service design.

4.1 Market and Company analysis

This section presents the analysis made to investigate the market and competitive landscape for Essity, as well as the current state of Professional Hygiene's service TVC.

4.1.1 PESTEL analysis

In order to explore the market a PESTEL analysis was done. To keep it focused on the relevant business area it investigates market trends for cleaning in general, as well as emerging developments with IoT solutions.

Political

The General Data Protection Regulation (GDPR) affects the IoT industry when it comes to consent of personal information. IoT companies gather a lot of data without knowing what the analyze might show. If companies finds patterns in behaviors of the data gathered a consent is needed from the customer or person if the IoT company wants to sell on to a third party (Seo et al., 2018).

Economic

The European cleaning industry has a steady trend of growth, as the turnover tripled from 1995 to 2016. To put this in context, it can be compared to the growth of the Gross Domestic Product (GDP) in Europe during the same time period which doubled (European Federation of Clinical Immunology Societies, 2019b). By 2018, the overall turnover reached 120 billion euro (European Federation of Clinical Immunology Societies, 2021).

Socio-Cultural

One of the large impacts of COVID-19 was the increase in remote work for employees. Compared to before the pandemic, the work which can be done without a productivity loss is four to five times higher. This corresponds to remotely working three to five days a week (McKinsey & Company, 2021). An implication from this can be a less predictable flow of people, especially in offices.

A case study done in The Netherlands showed that technology which enables data driven decision making can improve the working conditions for cleaners, since the cleaning is done more efficiently and the tasks become more varying (European Agency for Safety and Health at Work, 2022). The trend of internet usage is rising. In 2020 approximately 79% stated that they were using internet every day or almost every day, which were a growth of 23 percentage units since 2011 (Eurostat, n.d.). This can be considered beneficial in terms of adoption of IoT solutions, as more people grow confident in using graphical interfaces.

Technological

IoT technologies have gone through years of steady adoption and is increasingly applied for mainstream business use (Dahlqvist et al., 2019). European Federation of Clinical Immunology Societies describes the trend of IoT and connected buildings as a trend with great potential to transform the production model of cleaning businesses. There is a challenge in keeping routine based cleaning along with increasing nomadism, i.e. remote working, co-working spaces etc. The opportunity connected buildings brings to address this problem is recognized, as customized cleaning becomes way more feasible (2019a).

Environmental

The correlation between sustainable development and the emerge of IoT solutions is twofold. An increased implementation of IoT in businesses as way as everyday life will lead to a growth in the production of IoT devices, e.g. computers, gateways and sensors. In turn, electronic waste as well as energy consumption is increased. (Maksimovic, 2018).

Legal

When distributing products and services, the laws and standards of the areas you're operating in have to be addressed. As an example, when trading in EU the goods have to comply with all relevant EU rules. This puts requirements on different aspects of the product, e.g. the products hygiene, electrical properties and energy efficiency (EU, n.d.).

When examining the legal environment for the cleaning industry, no consistent guidelines from any government or similar have been found. However, several organizations in the industry provide certain standards and guidelines. The leading trade association for the worldwide cleaning industry is called ISSA. A part of their

work is the standards for cleaning quality and efficiency they've established. In addition they offer education and certification programs, all to help companies to be recognized for high quality and strong service reputation (ISSA, n.d.).

4.1.2 Business Model Canvas

To get an understanding of how Professional Hygiene is making a profit a Business Model Canvas (BMC) was created. An overview of the BMC is presented in Figure 4.1.

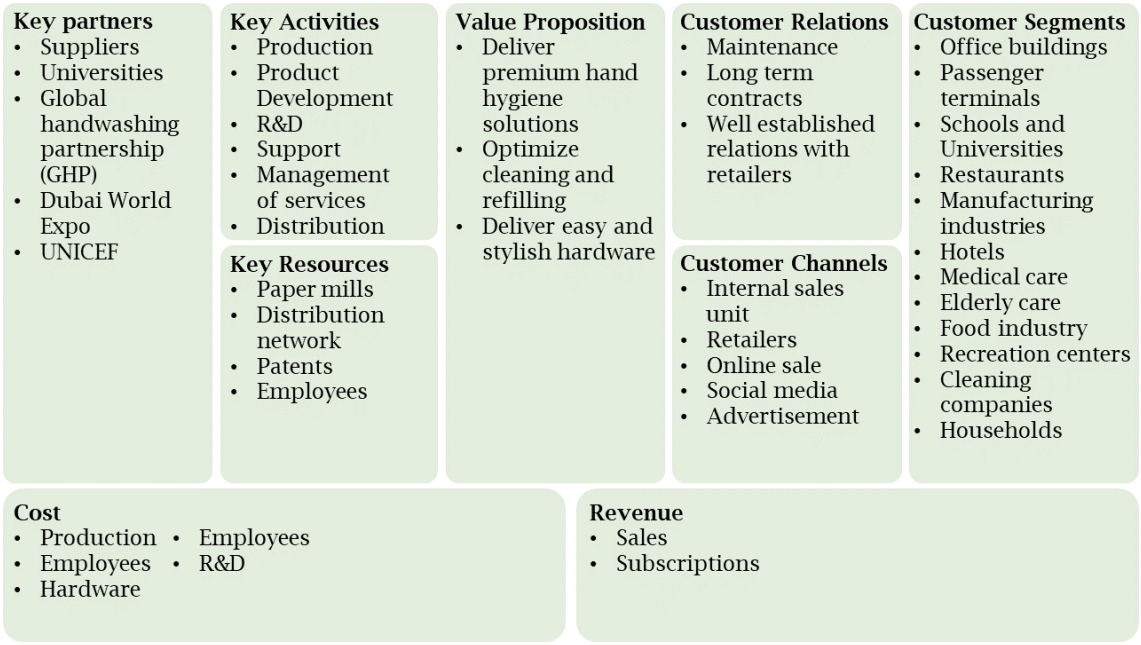


Figure 4.1: Business Model Canvas for Professional Hygiene

Essity's Professional Hygiene business has as its core business and value proposition to deliver complete hand hygiene solutions of the highest quality (Essity, n.d.-a). To do this, Essity supplies a number of products under the Tork brand. Tork's product catalog includes toilet paper, napkins, hand soap, hand lotion, hand sanitizers, dispensers, cleaning products, wiping products as well as a number of services (Essity, n.d.-c). All dispensers and hardware are designed to be easy to use and stylish. Tork's services are to a big extent developed to optimize the usage of Tork consumables, as well to optimize the cleaning for the customer. This is another value proposition for the brand (Essity, n.d.-a). The services Tork offer for this purpose is Tork Vision Cleaning and Tork Paper Circle. In addition, the services Healthy Hands, Hygiene Stand, and AD-a-glance are delivered (Essity, n.d.-f).

Professional Hygiene works exclusively with business-to-business (B2B) sales. The customer segments consist of customers who need a lot of paper consumables, e.g. companies with many public toilets. This can be e.g. recreation facilities, office buildings, and passenger terminals (Essity, n.d.-e). Professional Hygiene reaches its customers through retailers and online sales. The majority of Professional Hygiene's

sales are made from the internal sales unit to retailers who then distribute to the different customer segments. Sales of Professional Hygiene services are made directly to the end customer from the internal sales unit. Essity has a sales unit in each regional office. It is possible for household customers to purchase paper consumables from Tork, but only from resellers. The revenues of Essity's Professional Hygiene business come from the sale of various types of products and subscriptions to services.

What Professional Hygiene does and spends money on to deliver the value proposition can be seen on the left side of the BMC in Figure 4.1. Essity has significant assets at its disposal in terms of facilities, paper production, and employees. They also have many patented products (Essity, 2021). All of these assets are connected to variable and fixed costs for the company. The variable costs are to a high extent connected to the turnover, for example, paper production. The fixed costs are more connected with the assets like employees and facilities. Professional hygiene does many things by itself, but they also have good relationships with companies for outsourcing. For example they are using suppliers for the production of their hardware and software platform. For research and development, they have a number of projects together with different universities. In addition to this Professional hygiene is also part of the Global Handwashing Partnership, Dubai World Expo and UNICEF's "Hygiene is our right" initiative (Essity, n.d.-d). The day-to-day activities of Professional Hygiene are R&D, production, product development, service management, and support, and sales and distribution.

4.1.3 Competitors Benchmarking

To get an idea of the competitive landscape for Essity and how other companies operate a competitor's benchmarking was performed. Competitor benchmarking was also used for innovation by finding ideas through other solutions. For this reason, competitor benchmarking has been focusing on the competitive companies and the services they provide for need-based cleaning. A summary of the competitor benchmarking can be seen in Table 4.1.

Table 4.1: Benchmarking of competitors

	Essity	**Datec AS**	**Georgia Pacific**	**Kimberly-Clarke & GOJO**	**Clean-telligent**	**Swept Tech.**	**Zan compute**	**Haltian**	**Trax Analysis**
Cleaning Service	TVC	Clean Pilot	KOLO	Onvation	Cleantelligent software	Swept	Zanitor, Occupancy	Thingesee IoT	CleanConnect
Planning tool	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes
FM App	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Cleaning staff application	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Connected dispensers	Yes	No	Yes	Yes	No	No	Yes	Yes	Yes
People counting	Yes	Yes	No	Yes	No	No	Yes	Yes	Yes
Scalable	No	Yes	Yes	Yes	Yes	No	Yes	Yes	No
Different versions	Yes	No	No	No	Yes	No	Yes	Yes	Yes

Georgia Pacific

Georgia Pacific (GP) is a company with roots in the forest industry and has since the 60s been a player in the paper market (Georgia Pacific, n.d.-a). Today they are producing both paper products and dispensers. GP is an American company and holds according to Statista Research Department (2023) 28% of the market shares of paper tissue production capacity in 2020 in North America. GP offers KOLO - Smart Restroom Monitoring System (Georgia Pacific, n.d.-b). The offering is aimed at the same type of customers as TVC and creates cleaning schedules based on connected dispensers. There are applications for both the facility manager and the cleaning staff. A difference between TVC and KOLO seems to be the usage of people counters. TVC gathers much information about the need-based cleaning on the movement of people while KOLO has no people counters included. The information is based only on the dispensers, which have sensors that signal when the paper or battery runs out, or when they break (Georgia Pacific, n.d.-b).

Kimberly-Clarke and GOJO

Another big player in the American market within the capacity of paper tissue production is Kimberly-Clarke (K-C) (Statista Research Department, 2023). In 2018 it was announced that the companies K-C and GOJO together launched the smart restroom management system Onvation (PR Newswire, 2018). GOJO is a company focusing on hand hygiene and skincare founded in 1946 (GOJO, n.d.). Onvation is a service similar to TVC which uses connected dispensers and measures the flow of people. Unlike TVC, Onvation is launched in only one version. Another difference is Onvation's software which creates a prediction of the upcoming cleaning needs using artificial intelligence (Kimberly-Clarke, n.d.).

Datec AS

Datec AS is a Norweigan company which develop digital solutions for sanitation and facility management (Datec AS, n.d.-b). Datec offers the service Clean Pilot which is a tool for needs-based cleaning. The offering is based on the need for cleaning depending on the traffic of people in the area. Contrary to TVC, Clean Pilot does not connect dispensers to gather information on refill levels. The data is gathered by people counting and user surveys. The tool is aimed at big facilities with unpredictable traffic (Datec AS, n.d.-a).

Zan Compute

Zan Compute is a digital company with a focus on AI and IoT solutions within janitorial service and floor optimization (Zan Compute, n.d.-a). Zan offers the services Zanwave Occupancy and Zanitor. Zanwave Occupancy is a service for people counting. The counting of people works by a radar placed on the ceiling emitting radio waves into the room and by measuring the time for the waves to return to the radar, the number of people in the room is tracked with a high degree of accuracy (Zan Compute, n.d.-c). The service Zanitor uses the technology from Zanwave Occupancy but also includes several relevant sensors for needs-based cleaning. Zan

Compute has developed sensors to connect dispensers, independent of the dispenser manufacturer. This gives an advantage to Zan Compute since they can focus on the software and don't need to force their customers to purchase new dispensers. With the data generated by the sensors and radars the software uses AI technologies to plan the optimal plan for utilization of resources (Zan Compute, n.d.-b).

Trax Analytics

Trax Analytics develops several services to create the most effective janitorial practices (Trax Analytics, n.d.-a). The company offers three types of services. The CleanConnect offering is a service where facility managers can schedule cleaning for staff and for cleaners to report a need for maintenance. It is also possible for the managers to get the position of the staff in real-time, and the software uses the history of the cleaning routes to create the optimal cleaning plan (Trax Analytics, n.d.-c).

SmartRestroom from Trax Analytics is a software that shows if restrooms need maintenance. Using sensor data, you can immediately see when maintenance is needed but also predict when it is needed. Trax does not develop its own hardware for restrooms, which makes the service offering dependent on the customer using connectable dispensers (Trax Analytics, n.d.-d).

The flagship of the Trax Analytics service portfolio is Clean+Inspect (C+I). The C+I includes the opportunity to see the real-time position of the cleaning staff, give tasks, reporting needs, and keep track of the level of refill in dispensers. Together with AI which keeps the history of need and creates an optimal plan for the maintenance staff (Trax Analytics, n.d.-b).

Haltian

Haltian is a Finnish company that was founded by experienced product developers from Nokia in 2012. The company is producing IoT devices for different purposes, including office maintenance solutions (Haltian, n.d.-a). The solution of Haltian is to connect buildings, but the customer needs to decide what to do with the data. For example, are they producing sensors for people counting, air quality, and fill level in dispensers but the company don't provide any software which can be used for planning. Unlike other competitors of Tork, Haltian connects devices, but currently, additional software is needed to exploit the benefits of the data (Haltian, n.d.-b).

Cleantelligent

Cleantelligent is a company founded in the 90s which provides cleaning business software. The Cleantelligent software lets the facility managers which uses it schedule the cleaning digitally and give work orders for unpredictable events. The software spots cleaning trends of gathered history which it presents in customized reports and dashboards. Cleantelligent does not use any sensors for connecting dispensers. The

system is only used on data gathered from the input of facility managers, cleaners, and customers which can give feedback by using QR codes (Cleantelligent, n.d.).

Swept Technologies

Swept Technologies develops software for janitorial services and they are aiming for cleaning companies. The software has a huge number of functions for managers to manage staff which is spread over several different locations. The software gives the opportunity to plan the route, it gives a real-time location of the staff and you can include all agreements that have been made with your clients. The software also includes a function where your messages are directly translated to the language the device of the receiver is set to. The swept app does not include any sensor data (Swept technologies, n.d.).

4.1.4 SWOT analysis

The SWOT analysis presented in Figure 4.2 summarizes the research presented in this chapter and shows how it relates to TVC.

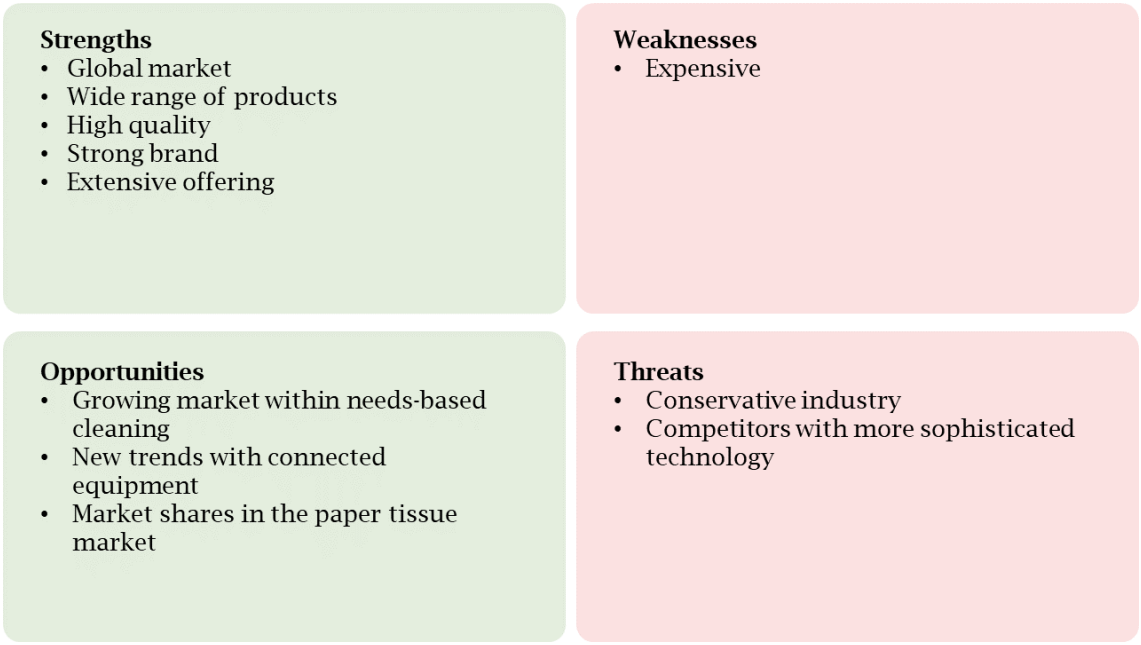


Figure 4.2: SWOT analysis of TVC

Strengths and Opportunities

To the left in Figure 4.2 the strengths and opportunities can be seen. When Professional Hygiene started delivering its services, it already had the advantage of being an established brand in a global market, which it continues to benefit from. Tork is associated with high quality and the company knows what customers require and value. As mentioned in section 4.1.1 the market is expected to grow in the future as the industry becomes more ready for the use of IoT solutions. More and more

equipment is becoming connected in almost every industry and with this, there is a great opportunity for Professional Hygiene to benefit as they have an established service. Professional Hygiene is also well established with market shares in the paper tissue market which can give a smooth transition for their customers to connect their dispensers.

Weaknesses and Threats

To the right in Figure 4.2 the weaknesses and threats can be seen. The disadvantages of the current service are that it is expensive for customers to buy and for Essity to maintain. It can be argued that there is more sophisticated technologies in terms of accuracy and speed on the market when looking at similar equipment. Another threat to the service is the conservative attitude of the cleaning industry. This differs from country to country where, for example, Sweden and the other Nordic countries are more open to trying this type of technology, but in southern Europe the industry is more traditional.

4.2 Customer Needs Research

This section presents the results from the performed customer needs research. The final result of the research is the generated requirements specification which needs to be fulfilled for the starter service solution. By developing it with the basis in corporation with the customers the probability to develop a more successful service increases.

4.2.1 Customer Interviews

In this section the five interviewees are presented, along with information about their business and its cleaning needs. The basic information of the interviewees can be seen in Table 4.2. To grant them anonymity, they have been assigned gender neutral made up names. The table also include their age, their current position, and in what industry they operate.

Table 4.2: Basic information about the interviewees

Name	Age	Title	Industry	Continent
Kim	40	Co-CEO	Gym	Europe
Jackie	40	General manager	Nightclub & Event	Europe
Robin	47	Housekeeping manager	Hotel	Europe
Tintin	54	Operational developer	Education & Research	Europe
Mika	45	Housekeeping manager	Hotel, Spa & Conference	Europe

Kim, Co-CEO at Gym Group

Kim is Co-CEO for a smaller group of gyms. The responsibilities connected to the role are mainly related to the visitor experience. This means Kim is in charge of the development of the facilities, as well as HR and organizational matters. Before taking on their current role, Kim was site manager at the same company. That role had similar responsibilities, and counting their overall experience within facility management in the company it adds up to approximately 5 years. Furthermore Kim is optimistic towards connected solutions, even though they don't describe themselves as interested in technology.

> *"I'm bad at debugging and I am not super interested in technical solutions, more than the results brought"*

The company operates three facilities located in the same region. They have all in all about 200 employees, where workout instructors, safety personnel and receptionists are included. The main cleaning activities are performed by an external cleaning company, while the receptionists are doing tasks as paper refill and emptying trash cans. When doing changes they prefer to do the change for the entire organization for a more uniform feeling both for their employees and their customers.

Jackie, General Manager at Nightclub and Event Facility

Jackie is 40 years old and works as general manager at a company acting in several business areas. They are operating a nightclub, facilitating events and acting as venue for concerts, all in the same facility. Jackie has been working in the restaurant business for 22 years, where 10 of those were in a managerial position with similar responsibilities. They have responsibility for operational and economical matters. During the interview they described their experience with IoT-solutions extensive, and expressed a big interest in using it to conduct various tasks more efficiently.

> *"I like to implement new things because I like to streamline tasks, both my own and the employees"*

Due to the large differences in daily operations, the people flow is very inconsistent regarding both guests and employees. The workforce consists of about 8 permanent employees, but can roughly estimated extend to 600 individuals working at least once during a full year. The main cleaning is done by an external cleaning company, while e.g. dishers are in charge of keeping the toilets tidy during opening hours. The company is included in a business group, owning and operating several companies within the hospitality industry. They're geographically scattered within Sweden.

Robin, Room Housekeeping Manager at Traditional Hotel

Robin has recently started working in the position as Housekeeping Manager at a Hotel which opened spring 2023, responsible for the cleaning of the hotel rooms. Besides this position, Robin has 20 years of previous experience in managing cleaning activities in other industries. They have experience with need-based cleaning systems from their previous workplace.

The hotel have around 250 employees at peak season. Some meeting rooms are available, but facilitating larger conferences is not a part of the business. All cleaning staff is internally employed.

Tintin, Business Developer at Education Facilities

Tintin is a 54 years old business developer, working for a department handling facility management in university premises. They have worked with the same type of responsibilities during the last 9 years, and have recently been in charge of a process of implementing a new system for the business. Tintin is familiar with TVC since they've considered implementing it in their facilities. When asked about their interest in connected solutions, the interviewee answered:

> *"I think it's very good, I mean this is Internet of Things. It's a great opportunity ahead"*

In total the department have approximately 100 employees, and the cleaning is exclusively done by internal staff. The flow in the facilities has a large weekly variation, as the amount of people tends to increase as the exam period is approaching.

Mika, Head of Housekeeping at Spa & Conference Hotel

Mika have recently started working as Head of Housekeeping at a hotel operating spa, conference and restaurant business. They are 45 years old and have worked in similar roles before. Mika is responsible for the cleaning in all of the hotel's business areas. The interest for IoT in general is quite low, but a clear interest in trying out innovative solutions for the cleaning industry was expressed:

> *"I can get frustrated sometimes because one still cleans like you did in the nineteenth century"*

The hotel is owned by a company, among three other hotels. The owning company operates economy and marketing for all hotels. Due to this, the hotels tend to use the same systems. There are about 80 employees, however a part of them are working part time. Conferences are a big part of their busienss, with nearly 30 conference rooms. This contributes to a difference in the type of guests during the week, as conferences tend to make up most of the visitors Monday to Friday, while the weekend guests mainly consist of tourists.

4.2.2 User Observation

During the observation it was clear that the cleaning staff used the system enthusiastically. The site was divided in several areas and the cleaners were assigned to each area. The system was used for planning and tracking of the cleaners by the managers. However the manager expressed that the function for planning was a bit complicated.

The cleaner expressed the meaning of the different symbols in the app was not clear to them when beginning the use of TVC. As an example, the symbol displaying a roll of toilet paper wasn't understood and therefore not associated with that type

of dispenser. A problem with navigating in the application was also expressed, as it was experienced that a lot of scrolling was required. A good and frequently used function according to the cleaners was the "last cleaned" function which tells when the area last has been cleaned, for prioritization.

Regarding the maintenance of the connected dispensers, the cleaning coordinator expressed difficulty in reaching one type of sensor, but didn't seem to struggle with any other types.

The cleaning coordinator mentioned that the system is helpful for the cleaning staff and especially for cleaning of the bathrooms. When introducing a new employee to the system they let them follow a more experienced cleaner for ten days. One of these days are purely dedicated to learn the application and after these ten days the new employee is self-sufficient.

4.2.3 KJ method

The main groups and the clusters in each group are presented in Table 4.3. The main groups are Change, Planning, Data, Communication, Implementation, Complains, Cleaning staff, Flow, Special needs, Time, Economics, Ergonomics, and Organization.

Table 4.3: Themes and clusters from the KJ method

Main groups	***Clusters***
Changes	Management involved in approving changes
	Environmental friendly changes
	Communication to employees is important
	Improvements about equipment
	Improvements about efficiency
	Importance of instant result
	Testing before implementing on entire group
	Resistance to changes
Planning	Always reactive when it comes to cleaning
	Time management is a challenge when planning
	Resources better divided if need is known
	Established static schedules
	Static schemes comforts management
	Difficult keeping track of what has been done
	Dedicated manager planning
Data	Different idustries have different needs
	Positive attitude towards data usage
	Already using data systems
	An overview is wanted
	System can not slow down processes during stress
Communication	Multiple nationalities
	Challenge in communication
	Feedback management
	Cleaners have access to phones
	Uses email, teams etc. for communication already
Implementation	Need of very simple UI
	Difficult to set up system
	Start with small scale
	Technical installation assistance
	Understanding of purpose
Complains	Toilets
	Different expectations
	Operation

Cleaning staff	Overcleaning during stress
	Smaller cleaning tasks for other employees
	Employees and time management
	Alert employees
	Hiring issues
	External cleaning
	Internal cleaning
	Diverse task force
Flow	Predictable flow
	Partially very high flow, measures taken
	Curiousity to know their flow
Special needs	Old facilities
	Unpredictable events
	Hygiene
	Advantage to get an overview
	Clean when possible
	High quality demands
	Some tasks are forgotten
Time	Early morning cleaning
	Daytime cleaning
	Nighttime cleaning
	Cleaning 24/7
	Multiple cleanings a day
	Some tasks are not daily
Economics	System needs to be justified economically
	Cleaning is a big fixed cost
Ergonomics	Factor when performing changes
Organization	Close collaboration within the group
	Wants to buy in large volume to get lower price

Changes

The upper management is always involved in decisions like this. Mostly searching for new equipment when it comes to efficiency, environmental, and ergonomics. Communication is key to a good change, but there are often resistance to the changes from some individuals. It is described as difficult to find information about new things on the cleaning market since there is not a uniform place where you can find new things you need.

Planning

"The cleaning is most often reactive, never proactive" was a quote which was expressed. Time management is the biggest problem and resources can be better divided if the need is known. Static schedules often comforts management because people know what should be done, but they dislike the fact that they are not completely sure if it really gets done. In most cases there is a dedicated manager that creates the planning for the cleaning.

Data

There was an overall a positive attitude towards using data. Many organizations is already using data systems in other parts of the organization and it would be with as few systems as possible to collect everything on the same place. An overview is wanted and it can not slow down operations during stressful times.

Communication

There is a spoken challenge in communication with this kind of diverse task force. Many people does not talk the language. Many cleaners have already access to phones and uses teams, email, sms etc. for communication. Feedback about the cleaning reaches different people depending on organization, but often it is some operational position that handles it with external cleaning companies.

Implementation

Need of a very simple UI for the users. Might be difficult to set up the system, or rather "easy to do wrong". Technical installation assistance would be preferable and to start in a small scale. If the involved persons understands the purpose of the newly implemented processes of equipment it is better.

Complains

Most complaints filed for the organizations was about dirty toilets and areas connected to the operations. Another was about different expectations between management and cleaning staff, or customers.

Cleaning staff

Both internal and external cleaning staff are used and in some cases other employees perform smaller cleaning tasks such as refills or emptying trash cans. It was expressed that it's hard to find good cleaners.

Flow

Some companies were very well aware of the flow of people in their facilities, others were more curious to measure it. The ones that knew their flow most often had pretty clear peaks and high flow during times.

Special needs

It was clear that different businesses had different special needs connected to their operations. Some had the problems with old facilities that is hard to keep clean because of wear, while some had cleaning standards which needed to be met to not lose customers.

Time

The cleaning activities for the companies varied. Some had 24/7 cleaning, some cleaned a couple of times a day, some activities were not performed on a daily basis. The cleaning could be performed at morning, day, evening or night.

Economics

The economical question was to a high extent stressed. Cleaning is one of the biggest fixed costs, and when changing something related to the cleaning it must pay off economically.

Organization

The organizations which were part of bigger groups had a close collaboration with the other subsidiaries.

4.2.4 Customer Needs List

The full customer needs list generated is presented in Table 4.4. This section describes the needs in each phase more thorough. The phases are *Discovery*, *Decision-making*, *Implementation*, *Usage*, and *Scaling*. *Discovery* covers the customer needs connected to how the customer finds the offering and how it attracts attention. The *Decision-making* customer needs is about what makes the customer take the leap to implement the offering. When the decision is made there are customer needs that is connected to the *Implementation*, followed by the *Usage* of the offering. The final phase is what customer needs there is for *Scaling* the offering.

Table 4.4: Customer needs list

Phase	***No.***	***Need***	***Prio.***
Discovery	1	The offering attracts attention by being environmentally friendly	1
	2	The offering attracts attention by increasing efficiency	3
	3	The offering attracts attention by increasing quality	3
	4	The offering attracts attention by increase ergonomics for the cleaning staff	2
	5	The offering require the same or smaller sized cleaning workforce	3
	6	The offernig is explained for the decision-making stakeholder	3
Decision-making	7	The offering is easily presented to higher management	3
	8	The offering is justified economically	3
	9	The offering is an opportunity to test needs-based cleaning	3
	10	The offering is adapted differently depending on which customer segment that uses it	3
	11	The offering is applicable to different types of rooms	3
	12	The offering gives the possibility to log what has been decided with the cleaning company	1
Implem-enation	13	The offering supports management in communicating the change in cleaning practices	3
	14	The offering is attractive to use	2
	15	The offering provides knowledge of its own purpose	3
	16	The offering offers the possibility to get help with the installation	2
	17	The offering is implemented in a small scale to begin with	3
	18	The offering supports users of multiple nationalities	2
	19	The offering is accessible to companies that have in-house or outsourced cleaning.	2

Usage	20	The offering brings immediate improvements to the operations for the users	3
	21	The offering gives the opportuinity for managers to plan the cleaning	3
	22	The offering gives the opportuinity to save history of cleaning events	3
	23	The offering makes it possible to divide resources more efficiently	3
	24	The offering is not delaying other work activities	3
	25	The offering is communicating with already implemented data systems	1
	26	The offering supports structure and clarification of tasks	3
	27	The offering has a selfexplanatory user interface	3
	28	The offering supports the user in handling unpredictable events	3
	29	The offering supports communication between management and cleaning staff	3
	30	The offering gives the possibility to divide cleaning tasks to the person concerned	2
	31	The offering is used on a tablet or phone	2
	32	The offering can be used by employees from other groups occasionaly	2
Scaling	33	The offering allows exploration of needs for expansion of the system	3
	34	The offering gives the opportunity to scale up the system stepwise	3

Discovery

In the Discovery phase the interviews suggests that the offering will attract attention if it can increase efficiency and/or quality on operations connected to the cleaning. It is desirable if the offering can increase ergonomics for the cleaning staff and improve environmental impact for the company. The efficiency and quality was mentioned with more accentuation during the interviews which gave those needs prioritized higher.

During the interviews it was found that it is a problem for facility managers to find new tools and equipment's to improve the cleaning and the processes. This makes it extra important for the offering to bring attraction and to be offered to the customers. It is rare that browsing new things is part of the day-to-day operations. They browse new things depending on need.

Decision-making

When it comes to the decision-making the interviewees could not be more clear than they were. The offer needs to be justified economically to even be considered. The decisions of this type is typically taken by the upper management in the organization, this makes it important to easily able to present the offering for this group, with the financial advantages clearly stated. The interviewees expressed that one way to convince the upper management that a system like TVC can be economically justified is to make a pilot in smaller scale. When taking the decision to try a system it will be important to ensure that the customer gets the proper data according to their type of business. It is for example not sure that a Spa & Conference Hotel and an Education facility can get the same economical advantage from the same type of KPI. This makes it preferable to make the offering adjustable with for example what kind of rooms that are monitored depending on which customer segment which will use it.

Implementation

During the research the interviewees stressed that any type of changes to the usual operations always are received differently by the employees, which affects implementation of new processes. Multiple of the interviewee stressed that the key to a good change is clear and thorough communication. When the employees understands the purpose of the change they are the most receptive of changes. For this reason, the offer should support the management when communicating the change, and the purpose of it. A challenge related to this is the diverse task force which will use the system. It is common with multiple nationalities and languages on the workplace, which needs to be taken into account. Another possible challenge will be if the system is to complicated. If it is to complicated, it will not be used and no one wants to pay for something which is not used. For the reason the offering should be attractive for the users. It varied among the interviewees whether they use internal or external cleaning. The offering should be applicable for both cases.

Usage

The interviews and observations provided many different opinions and ideas for how the system can be used. With the main idea in mind which means the system is an introduction to IoT solutions the interviewees stressed the importance of instant results. This connects to the earlier needs to proving the economical benefits as well as keeping the interest for the users to keep using it. The instant results can be economical or immediate improvements for the users, but of course most preferable both. Planning expected and unexpected events, communication between

management and cleaning staff, and dividing resources for efficient are other needs which were found. A potential challenge which was discovered was the usage of the system can not slow down the processes. Especially during stressful times the usage of the system needs to be effective enough to not fall back in old manners and clean as they did before. For this reason it would be preferable to have the system on a tablet or phone to quickly log what has been done.

Scaling

As mentioned earlier the interviewees sees the possibility to scale the system very positively. This gives the opportunity to find the relevant KPIs by exploring the system, which can be implemented in a larger scale when it's proven to work.

4.2.5 Requirements Specification

The requirements specification can be seen in Table 4.5. In the table the metrics are stated, what needs each metric are connected to, what unit the metric is measured by, how the verification and validation is done. The marginal value stated in the specification is the minimum allowable value to fulfill the requirement, while the ideal value is a preferred value to reach.

Table 4.5: Requirements specification

Metric No.	***Needs No.***	***Metric***	***Imp.***	***Unit***	***Marginal Value***	***Ideal Value***	***V&V***
1	7, 8	Cost for customer	5	Euro	10	10	Financial estimate
2	1, 2, 3, 4	Time for customer to order	5	min	<40	15-30	Binary
3	-	Time for Essity to create order	5	min	<120	<60	Product test
4	6, 13, 30	Has an UI for cleaner	3	Binary	No Pass	Pass	Binary
5	12,14, 26	Is self-explanatory for cleaners	4	Subj.	3	5	User survey
6	-	Time for Essity to teach	4	min	<180	<90	Product test
7	17	Available onboarding languages	4	Pcs	1	>10	Product test
8	20, 21	Saves history of cleaning events	3	Months	>3	>12	User test
9	3, 8, 9, 19	Number of rooms possible to connect	3	Pcs	>3	6_10	Product test
10	10	Compatible with more types of rooms than washroom	3	Binary	No Pass	Pass	Product test
11	16, 32, 33	Scaling to TVC don't r equire replacement of hardware	5	Binary	Pass	Pass	Binary

12	15	Maximum time required from customer during installation	4	min	<300	<180	User obs.
13	15	Maximum time for Essity required during installation	4	min	<180	<120	User obs.
14	4, 23	Maximal time delay per room for user	4	s	<30	<10	Timing
15	27	Maximal time for information to reach the user	4	s	<300	<300	Timing
16	4, 5, 8	Decrease the number of cleaning actions for the connected area	5	%	>10	>30	User obs.
17	18, 31	The system allows several users	5	Binary	Pass	Pass	Binary
18	18	The system allows usage from different stakeholders	3	Binary	No Pass	Pass	Binary
19	24	Can communicate with other data systems	2	Binary	No pass	Pass	Binary
20	11	Can keep track of agreements	1	Binary	No Pass	Pass	Binary
21	32, 33	Features can be added gradually	3	Binary	No Pass	Pass	Binary
22	25, 28, 29	Supports internal communication	2	Binary	No Pass	Pass	Binary
23	2, 20, 22, 25, 29	Supports planning of frequency based activites	4	Binary	No Pass	Pass	Binary
24	6, 7,	Measures cleaning performance	4	Binary	Pass	Pass	Binary
25	6	Preferred (by customer) service level in distribution	5	Subj.	Medium	High	User interview
26	15	Adaptable service level in installation	5	Subj.	3	5	Product test
27	12, 14	Preferred (by customer) service level in onboarding	4	Subj.	High	Medium	User interview
28	9, 10	Flexibility in choise of hardware	4	Subj.	Medium	High	User interview
29	9, 10	Flexibility in amount of hardware	4	Subj.	Medium	High	User interview
30	9, 10, 20, 21	Flexibility in included software	4	Subj.	Low	Medium	User interview
31	32	Preferred (by customer) service level in scaling options	5	Subj.	Medium	High	User interview

4.3 Concept Generation

This section presents how the concepts were generated. It presents the functional analysis which generated a number of modules which were brainstormed upon during brainstorming. The ideas of solutions in the modules were summarized in a morphological matrix. Concepts were then combined thematically in the matrix and described with text and Use-case diagrams.

4.3.1 Functional analysis

The two steps of functional analysis is presented here which gives the functions for the starter offering, as well as modules based on TVC which later were used for idea generation.

Function tree for Starter offering

It is displayed in Figure 4.3, with the main function branching out into to 4 different sub-functions. These are themselves divided into 12 lower-level sub-functions in total.

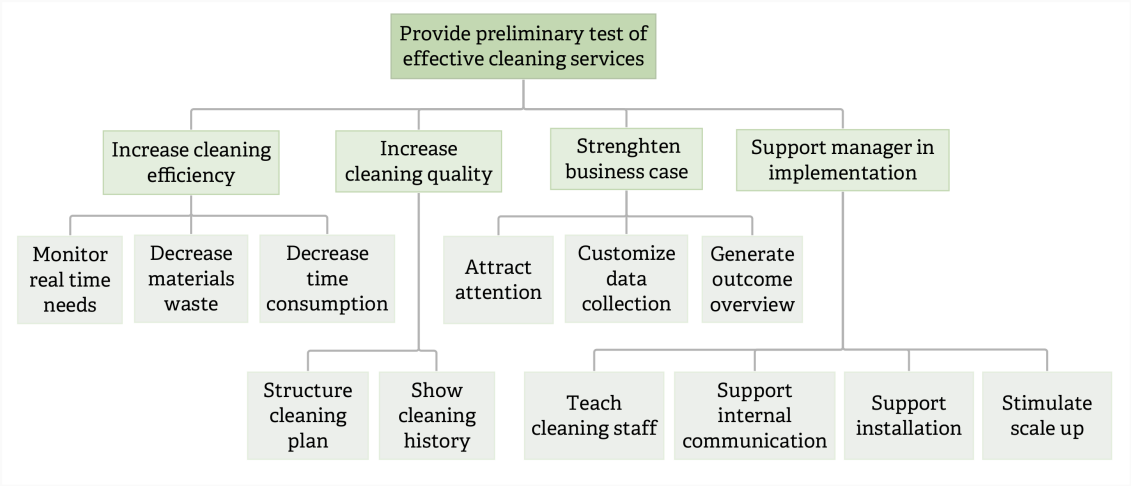


Figure 4.3: Function tree for Starter offering

The main function is stated as *Provide preliminary test of effective cleaning services*, which stems from the purpose of the project. It describes how the starter offering can help customers gain experience of the advantages, and support their transition towards needs-based cleaning. The idea is that the test service should provide the customer with enough experience of needs-based cleaning to understand the value TVC could bring in their organization. Note how the purpose of the , as that would rather be the main function of TVC.

Looking at the first level of sub-functions, two of them are clearly associated with the general functions in needs-based cleaning. These are *Increase cleaning efficiency* and *Increase cleaning quality*, which both are central functions in the TVC offering.

The other two sub-functions in the same level, *Provide business case* and *Support manager in implementation*, are more associated with the actual implementation of a system. These sub-functions and their children are more unique for the starter offering when compared to TVC.

The lower level sub-functions is seen with their corresponding numbering in the list below.

SF1 Monitor real time needs

SF2 Decrease materials waste

SF3 Decrease time consumption

SF4 Structure cleaning plan

SF5 Show cleaning history

SF6 Attract attention

SF7 Customize data collection

SF8 Generate outcome overview

SF9 Teach cleaning staff

SF10 Support internal communication

SF11 Support installation

SF12 Stimulate scale up

The sub-functions to support *Increase cleaning efficiency* are focusing on decreasing waste and to know whats needs to be done at the right time. This is done with the sub-functions *Monitor real time needs*, *Decrease materials waste*, and *Decrease time consumption*. When it comes to the functions supporting *Increase cleaning quality* the processes are more in focus. The supporting sub-functions is for this reason *Structure cleaning plan*, and *Show cleaning history*.

To support the sub-function *Provide business case* the focus has been to generate functions which relates to persons in decision-making positions, e.g. management. They need to get knowledge about the offering, they need to use the offering appropriate to their business, and they need to see the results of the offering. For these reasons the functions were stated as *Attract attention*, *Customize data collection*, and *Generate outcome overview*.

When it comes to the sub-function *Support management in implementation* the supporting functions includes some measures for change management, actual installation, and scoping how the next step is taken. This by the functions *Teach cleaning staff*, *Support internal communication*, *Support installation*, and *Stimulate scale up*.

Relations between sub-functions and TVC elements

The elements which are included in the full scale TVC offering were identified and can be seen in Table 4.6. Both the product and service elements are presented.

Table 4.6: Elements in the full scale TVC offering

Product	P1	Facility Manager Application
	P2	Cleaner Application
	P3	Cleaning planner feature
	P4	Internal communication feature
	P5	Admin app
	P6	On the go
	P7	PC Sensor
	P8	Level Sensor
	P9	Sensor communication unit
	P10	Bin sensor
	P11	Skincare sensor
	P12	Gateways
	P13	Cloud storage
	P14	Install tool
Service	S1	Hardware installation service
	S2	User introduction service
	S3	App Quick guides
	S4	Hardware Quick guide
	S5	Maintenance service

The relations between the elements in TVC and the identified sub-functions for the starter offering can be seen in Figure 4.7. Each row represents one sub-function, while each column is representing one element from TVC. A relation between an element and sub-function is presented with an "X". As an example, the monitoring of real time cleaning needs (SF1) is done by the usage of several different sensors, one or several gateways and cloud storage. However in order to actually be able to access the data, the cleaner application is a part of the solution as well.

Table 4.7: Relations between Starter offering sub-functions and TVC Elements

		FM app	Cleaner app	Cleaning planner feature	Internal communication feautre	Admin app	On the go	PC sensor	Level sensor	Sensor communication units	Bin sensors	Skincare sensors	Gateways	Cloud storage	Install tool	Hardware installation service	User introduction service	App Quick guides	Hardware Quick guides	Maintenance service
		P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11	P12	P13	P14	S1	S2	S3	S4	S5
SF1	Monitor real time needs		X					X	X	X	X	X	X	X						
SF2	Decrease materials waste		X					X	X	X	X	X	X	X						
SF3	Decrease time consumption		X					X	X	X	X	X	X	X						
SF4	Structure cleaning plan	X	X	X																
SF5	Show cleaning history	X	X	X										X						
SF6	Attract attention																			
SF7	Customize data collection					X									X	X				
SF8	Generate outcome overview	X																		
SF9	Teach cleaning staff				X												X	X		
SF10	Support internal communication	X	X	X	X		X													
SF11	Support installation														X	X		X	X	
SF12	Stimulate scale up																			

In the table it can be seen that two sub-functions are not related to any element in TVC. These are *Attract attention* and *Scale up*. These functions needs to be covered by elements in the new starter offering. As can be seen in the table some sub-functions was not by one single element. The conclusion drawn from this was that the function are solved by a module of elements. What also can be seen in the table is that the service element Maintenance service does no fill any function in the starter offering and does not to be taken under consideration during the development.

DSM of TVC

The Design structure matrix (DSM) of the elements in TVC can be seen in table 4.8. In the DSM elements which are highly dependent of each other are divided in modules. Seven modules were found where the two biggest contained elements

concerning application and sensors. The smaller modules were cloud storage, installation, user introduction service, quick guides, and maintenance service.

Table 4.8: DSM of elements in TVC

	FM app	Cleaner app	Cleaning planner feature	Internal communication feautre	Admin app	On the go app	PC sensors	Level sensor	Sensor communication units	Bin sensors	Skincare sensors	Gateways	Cloud storage	Install tool app	Hardware installation service	User introduction service	App Quick guides	Hardware Quick guides	Maintenance service
	P1 1	P2 2	P3 3	P4 4	P5 5	P6 6	P7 7	P8 8	P9 9	P10 10	P11 11	P12 12	P13 13	P14 14	S1 15	S2 16	S3 17	S4 18	S5 19
P1 1	1	1	1	1	1	1													
P2 2	1	2	1	1	1														
P3 3	1	1	3																
P4 4	1	1		4															
P5 5	1	1			5														
P6 6	1					6													
P7 7							7					1							
P8 8								8				1							
P9 9									9			1							
P10 10										10		1							
P11 11											11	1							
P12 12							1	1	1	1	1	12							
P14 13												1	13						
P15 14							1	1	1	1	1	1		14	1				
S1 15														1	15				
S2 16	1	1														16			
S3 17	1	1	1	1	1									1			17	1	
S4 18							1	1	1	1	1	1	1				1	18	
S5 19							1	1	1	1	1	1							19

Modules included for starter offering

To ensure the fulfillment of all sub-functions while adapting the offering to the limitations followed by TVC, a number of modules were decided upon. The modules and which sub-function each module mainly solves can be seen in Figure 4.9.

Table 4.9: Which function each module mainly solves

Module	**Sub-function**
Distribution	Attract attention
Flexibility	Customize data collection
Installation	Support installation
Onboarding	Teach cleaning staff
Sensors	Monitor real time needs
App(s)	Structure cleaning plan
Scaling	Stimulate scale up

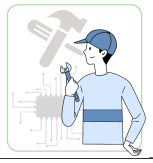
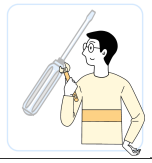
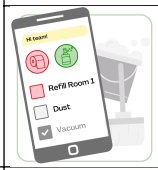
The distribution relates to the sub-function *Attract attention*. As seen in table 4.7 no element of TVC solves that sub-function. When it comes to the module flexibility it mainly relates to the sub-function *Customize data collection*. Since TVC can be adapted to a large extent to fit a customer's needs it's important that the flexibility of the Starter offering is well thought through. The installation module fulfills the sub-function *Support installation*, and in the relational table it's supported by several elements. The sub-function *Teach cleaning staff* was related to several elements of TVC and is solved by the module onboarding.

The three sub-functions *Monitor real time needs*, *Decrease material waste.* and *Decrease time consumption* were all solved by the same elements in TVC. For instance, all different types of hardware was related to these functions. This led to the forming of the module sensors, meaning one or several types of the sensors used in TVC have to be included in the Starter offering. Furthermore the cleaner app element was related to a lot of functions, while the other two app elements were related to some of the same sub-functions along with a few others. The module app(s) is for this reason related to several sub-functions but if one mainly are decided upon is it the *Structure cleaning plan*. Finally, the sub-function *Stimulate scale up* was not related to any of the elements in TVC as it tends to be implemented all at once or with a clear plan from start. This sub-function is specific to the Starter offering and therefore calls for a module of its own, called scaling.

4.3.2 Idea generation

The results from the idea generation sessions brainstorming and focus group meeting can be seen in Table 4.10. All the solutions of the modules and the sub-functions they mainly solves are presented.

Table 4.10: Solutions of each module

Module	**Funciton**	**Solutions**			
Distribution	Attract attention	All sale	Sales, then customer	Customer, then sale	Self-serve
					
Flexibility	Customize data collection	Fully customizable	A few options	One option	
					
Installation	Support installation	All service team	DIY Placement	All DIY	
					
Onboarding	Teach cleaning staff	Course	Manager Walkthrough	Online Training	FAQ/Videos
					
Sensors	Monitor real time needs	PC+Dispenser+Bin	PC+Dispenser	Dispenser Only	PC Only
					
App(s)	Structure cleaning plan	SS+Plan.+Com.	SS+Plan/Com.	SS only	Push only
					
Scaling	Stimulate scaling	App+Sales	Sales	App	
					

Distribution

For the distribution module which mainly solves the sub-function attract attention four solutions were decided upon. The *All sale* solution means that the sales department contacts the customer and together with the customer place the order. *Sales, then customer* is a solution where the sales department contacts the customer and informs about the offering, but the customer orders it by themselves. *Customer, then sale* means that the customer has a need to improve their cleaning processes or quality and contacts Essity themselves to order the offer. *Self-serve* is a solution where the customer finds and order the offering by themselves when they but their usual paper supplies.

Flexibility

For the flexibility module three solutions were created. The *Fully customizable* solution means that the offering can be adjustable to fit the customer. However are there a limited number of sensors which can be included. *A few options* is a solution where there are a number of kits with sensors which the customer can choose between. For example can one kit include only People counters or all level sensors. The customer can buy more than one kit to customize their order to fit the business. *One option* means that there is only one kit available for the customer to buy. The kit can include all sensors and the customer can buy more than one, but they can not change what the kit contains.

Installation

All service team means that the installation is completely performed by authorized installers from Essity. The two other options gives more responsibility to the customer as "Do it yourself" (DIY). *DIY placement* means that the customer installs the hardware themselves, but does not need to do anything for connecting the system. *DIY* means that the customer performs the entire installation themselves (with support from callcenter and online instructions).

Onboarding

For solving the sub-function teach cleaning staff included four solutions. *Course* means that Essity sends an instructor to the customer that holds a course for the customers entire cleaning staff and manager. *Manager walkthrough* means that Essity sends an instructor to the customer which teaches the customer about the system. *Online training* is an online interactive course that the customers and management take. The online training can be done in several languages. *FAQ/Videos* is meant to teach only through instruction videos and frequently asked questions (FAQ).

Sensors

Four solutions on what sensors to be included were made. *PC+Dispenser+Bin* means to include all available sensors for the offering. *PC+Dispenser* means to only

include people counter and the level sensors for dispensers. *Dispenser only* and *PC only* means that it only includes the different kind of sensors mentioned.

App(s)

Four app suggestions was made. *SS+Plan.+Com.* means that the sensors status are displayed, there is a function for planning, and a communication function. *SS+Plan./Com.* means that the sensors status are displayed and the customer can choose between having a planning function or a communication function. *SS only* displays only the sensors status. *Push only* only notifies the cleaners when the sensors indicates that measures needs to be taken.

Scaling

Three solutions for solving the scaling module was made. *App+Sales* means that the app gives suggestions on how to scale the system and that the sales department after a time period reconnects with the customer. *Sales* means that the sales just reconnects after a time period. *App* means that only the app gives suggestions on how to scale the system, and the customer can indicate that they wants to be contacted for review with the sales department.

4.3.3 Concept Descriptions and Use-case Diagrams

The thematically combined concepts can be seen in Table 4.11. A more extensive description of each concept together with it's use-case diagrams follows. The module which issues the Onboarding did not limit to use only one solution since it could be valuable to perform this in several ways.

The advantages with the User-friendly, Efficient, and High Quality concepts are that they are convenient for the customer, while a disadvantage for them might be they requires much time of Essity. The Economical and Quick-start concepts is on the other hand more convenient for Essity, while it is more uncertain that the customer finds and order the offering.

Table 4.11: The thematically combined concepts

Module	Function	User-friendly	Economical	Efficient	High-quality	Quick-start
Distribution	**Attract attention**	Sales, then customer	Self-serve	All sale	Customer, then sale	Sales, then customer
Flexibility	**Customize data collection**	A few options	One option	Fully customizable	Fully customizable	One option
Installation	**Support installation**	DIY Placement	All DIY	All service team	All service team	DIY Placement
Onboarding	**Teach cleaning staff**	Manager Walk-through and Online Training	Online Training and FAQ/Videos	Course and Online training	Manager Walk-through and Online Training	Online Training
Sensors	**Monitor real time needs**	PC+Dispenser	Dispenser only	PC+Dispenser +Bin	PC+Dispenser +Bin	PC+Dispenser +Bin
App(s)	**Structure cleaning plan**	SS+Plan./Com.	Push only	SS+Plan.+Com.	SS+Plan.+Com.	SS only
Scaling	**Stimulate scale up**	App+Sales	Sales	App	App	Sales

The User-friendly concept

The use-case diagram for the User-friendly concept can be seen in Figure 4.4. As can be seen in the figure the customer gets introduced to the offering by the sales organization of Essity. After the introduction the customer orders the offering themselves in their own pace. The offering includes either packages of people counters, or dispensers sensors for toilet paper, towels, and soap. However is there some flexibility in how many of packages it is possible to order and you may order both types of packages.

The customer could choose to install the equipment themselves, or let an installer do it for a complementary cost. An installer is anyway helping to connect the system. When the system is installed Essity provides a walkthrough of the system with the management to instruct how to use it properly. The cleaning staff gets an online tutorial of the system, provided in many different languages.

An app is included in the offering which shows the information of the chosen sensors as well as it gives the opportunity to schedule other cleaning activities. There are different options on what can be done in the app dependent if it is the management or the cleaners which uses it. For example can only the management plan the cleaning.

In order to scale the system the sales organization after a time period follows up with the customer to evaluate, and come with suggestions. If the customer wants to continue to try the system it, the testing period can be extended. When scaling this offering the target is primarily to connect more areas of the building before introducing more features in the application.

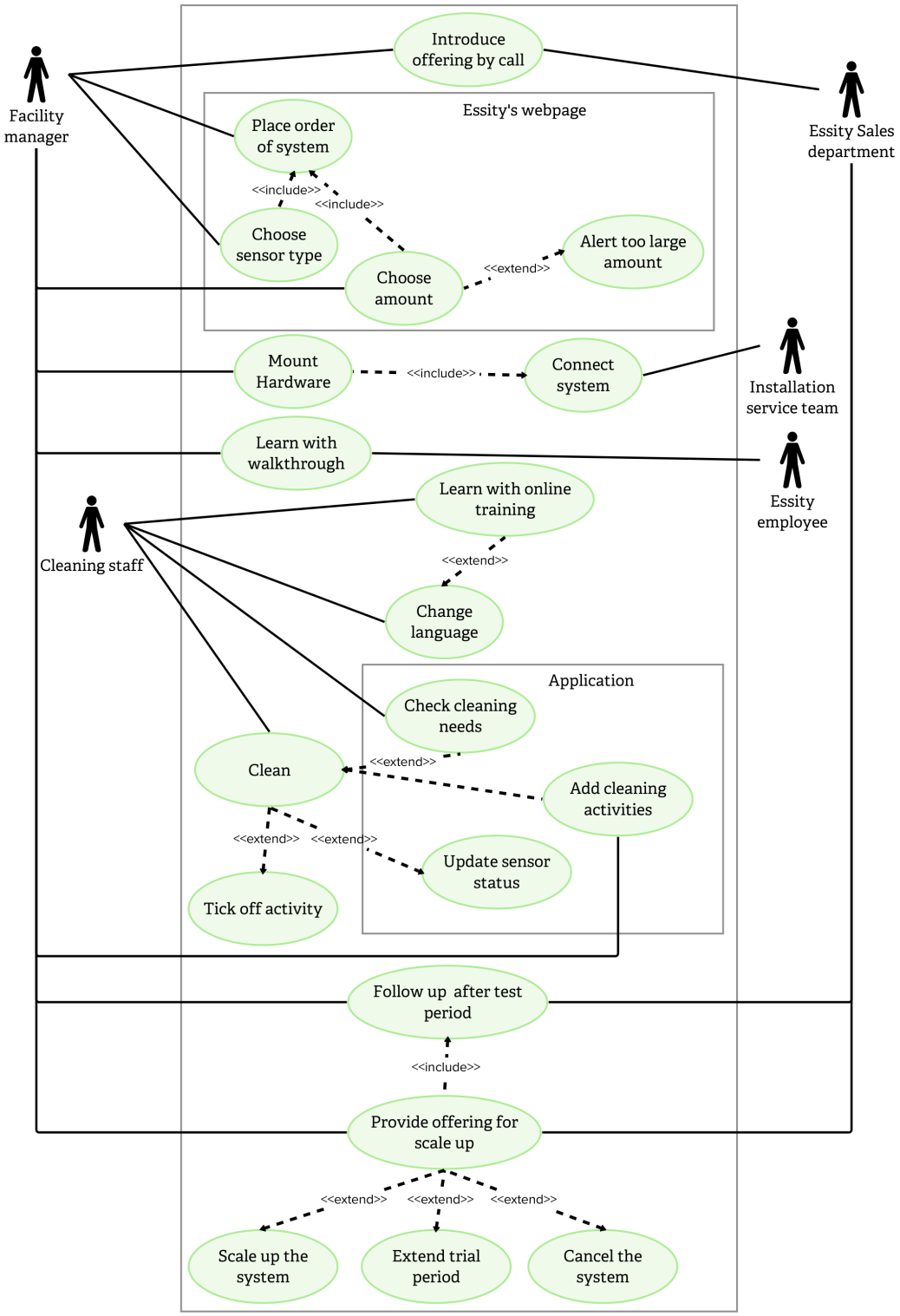


Figure 4.4: Use-case diagram for The User-friendly concept

The Economical concept

The economical offering is found by the customer when they are browsing for their regular paper supplies at a retailer. The offering has no option on what sensors to include, it is only the dispenser sensors for toilet paper, towels, and soap, however how many kit of sensors to buy is possible to choose. The installation of the equipment and the connection is completely performed by the customer, supported by online tutorials, the application, and if needed a call center.

Both the manager and the cleaning staff learn the system by online tutorial videos offered in several languages. The cleaning staff gets no application, they are only notified of the system by push notifications when the dispensers are running out of supplies. Since there are only sensors for dispensers the system automatically resets when the the dispenser is refilled. The manager gets an application for setting up the system, and get the information about how many times a month the cleaning staff have been notified.

A period after a user has been created in the application the Essity sales unit connect with the customer to provide suggestions on how the system can be scaled. The target is here to scale by include People counters, connect more areas and start using the application of TVC. If the customer don't want to scale the system after the trial period, the equipment is taken down. The use-case diagram for the Economical concept can be seen in Figure 4.5.

The Efficient concept

The Efficient concept is focusing on creating more efficient cleaning routines for the customer. The customer is contacted by the sales organization and together they agree on a number of sensors which is believed fit their specific needs. The offering may include dispenser sensors, people counters, or/and sensors for trash bins. The customer also gets the opportunity to choose a number of features in the application. The sensor data is always included, but they can choose to add a planning tool, a communication function, or both. The installation of this offering is performed by installer, which mounts the hardware and connects the system.

Essity educates the management and the cleaning staff about the system by a theoretical course, held at the cite. Additionally to the theoretical course online tutorials are available to repeat the information, as well as introduce new employees to the system. The application monitors the status of the included sensors and features. The application is also giving suggestions to scale the system by implementing more app features. The focus on scaling is to implement more app features since time already has been spent on finding sensors which meets the need for the customer. More areas is connected when TVC is implemented. The Efficient concept can be seen in Figure 4.6.

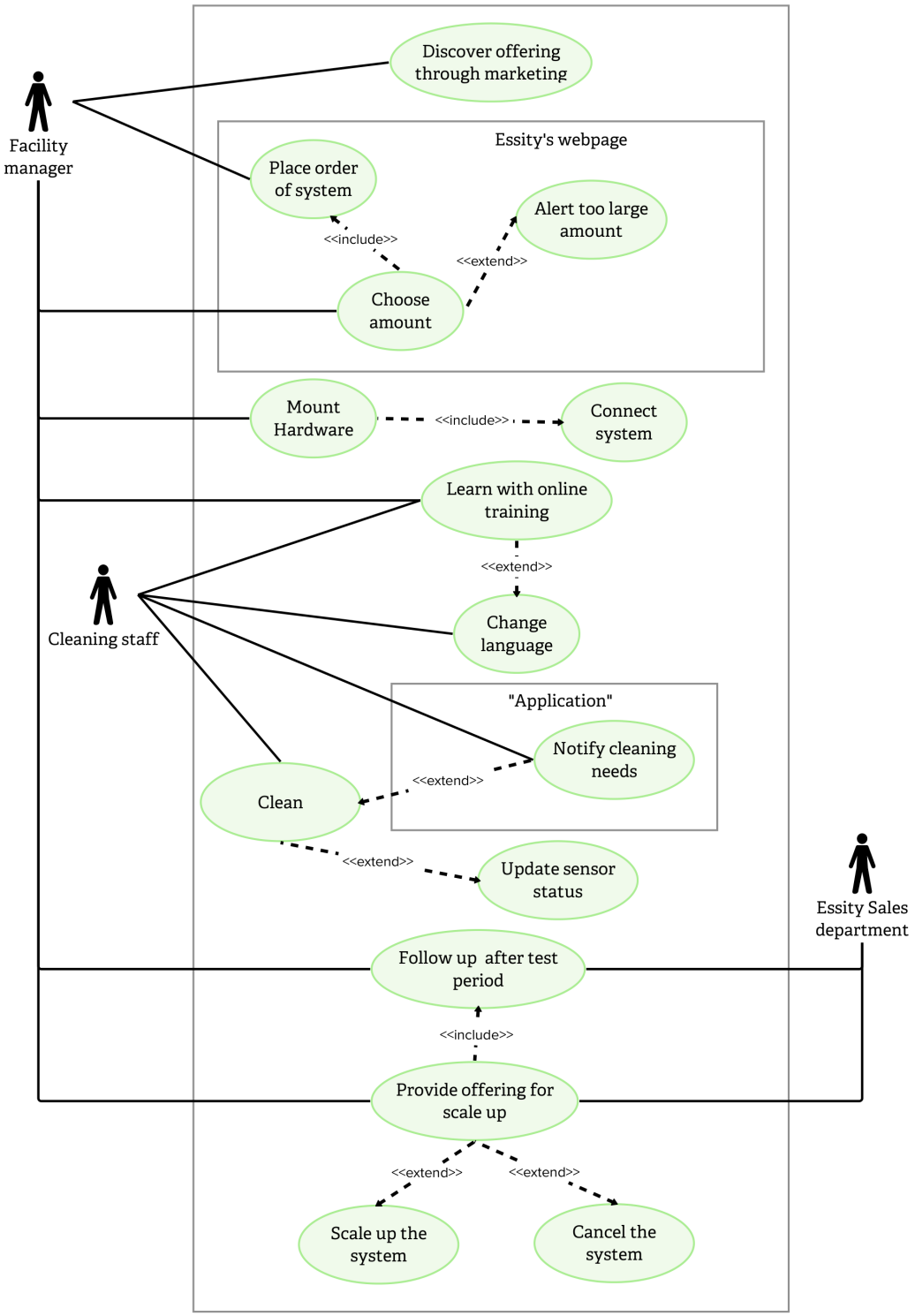


Figure 4.5: Use-case diagram for The Economical concept

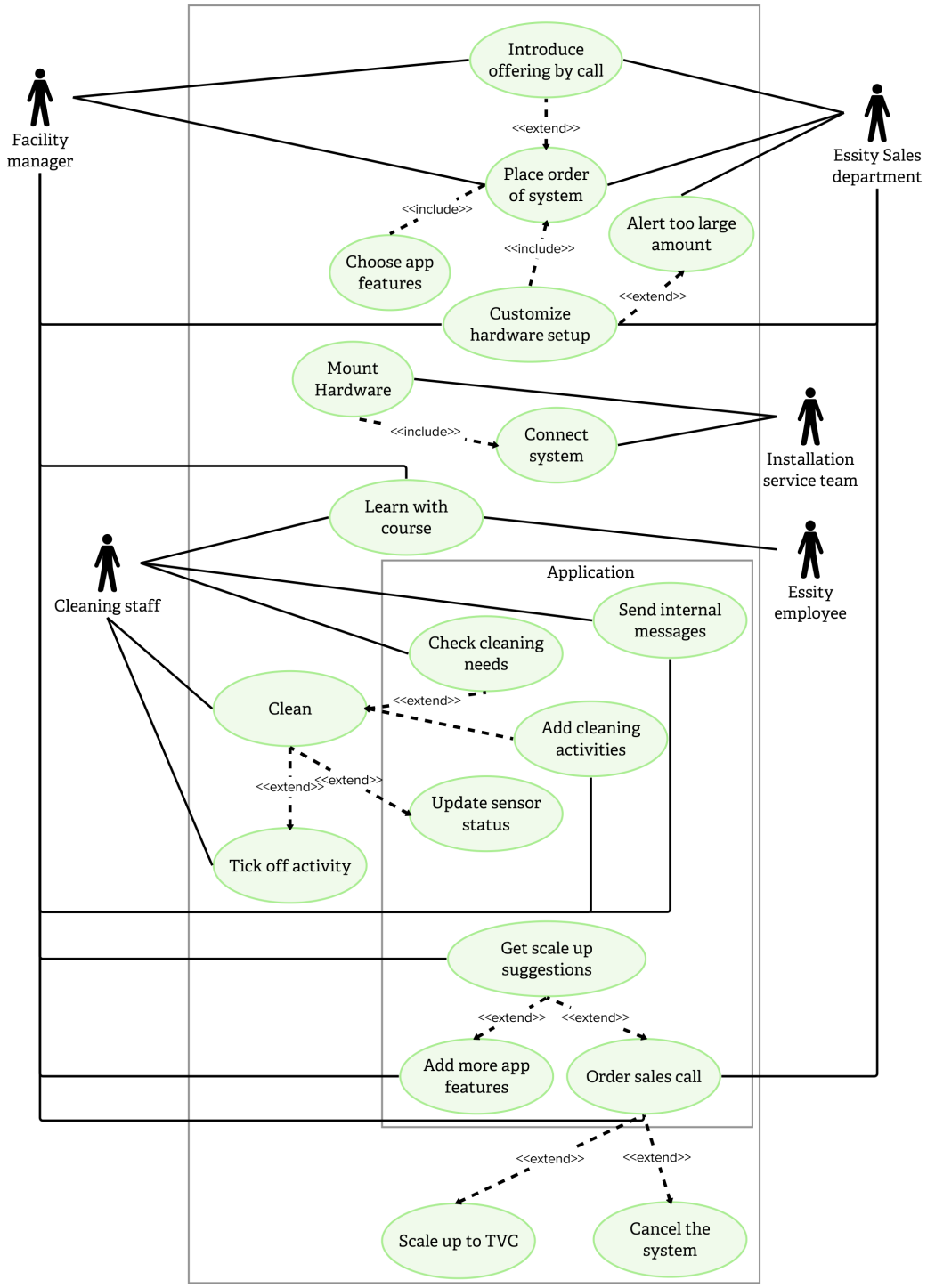


Figure 4.6: Use-case diagram for The Efficient concept

The High-quality concept

The high quality concept is based on the will from the customer to improve the overall level of cleaning in their facilities. By this cause the customer finds the offering themselves and contact Essity's sales organization. The offering is aggressively advertised with the purpose to increase cleaning quality and as a tool to reach cleaning standards from organizations as e.g. ISSA. Together with sales it is possible to fit a offering for the customer with any kind of sensors and what features the app should include.

The installation of the offering is done by installer and during the time of installment the management gets a walkthrough of the system. The cleaners gets online tutorials in several languages to learn the system. The app is used to monitor the chosen sensors and includes the chosen features. The app for this offering is also giving suggestions on more app features to scale the system and after a test period sales reconnect with the customer to scale more areas. The High-quality concept can be seen in Figure 4.7.

The Quick-start concept

This offering is focusing to be fast between the first interaction and starting to use the system. The customer gets contacted by Essity's sales organization to be informed about the offering. The customer is then ordering themselves, but there is only one option of sensors which includes people counters, and dispenser sensors. It is however up to the customer to decide how many kit's it wants to implement. The sensors are pre-configured so no connection needs to be done, but the customer mounts the equipment themselves. If there is any problem with the mounting a callcenter can be contacted.

In this case the application has a very simple UI which only shows the status of the implemented sensors. The application has a starting tutorial function for both the management and cleaners to learn the system. The offering is used for a limited trial period before the sales organization reconnect to plan the scaling of areas application towards TVC. The use-case diagram for the Quick-start concept can be seen in Figure 4.8

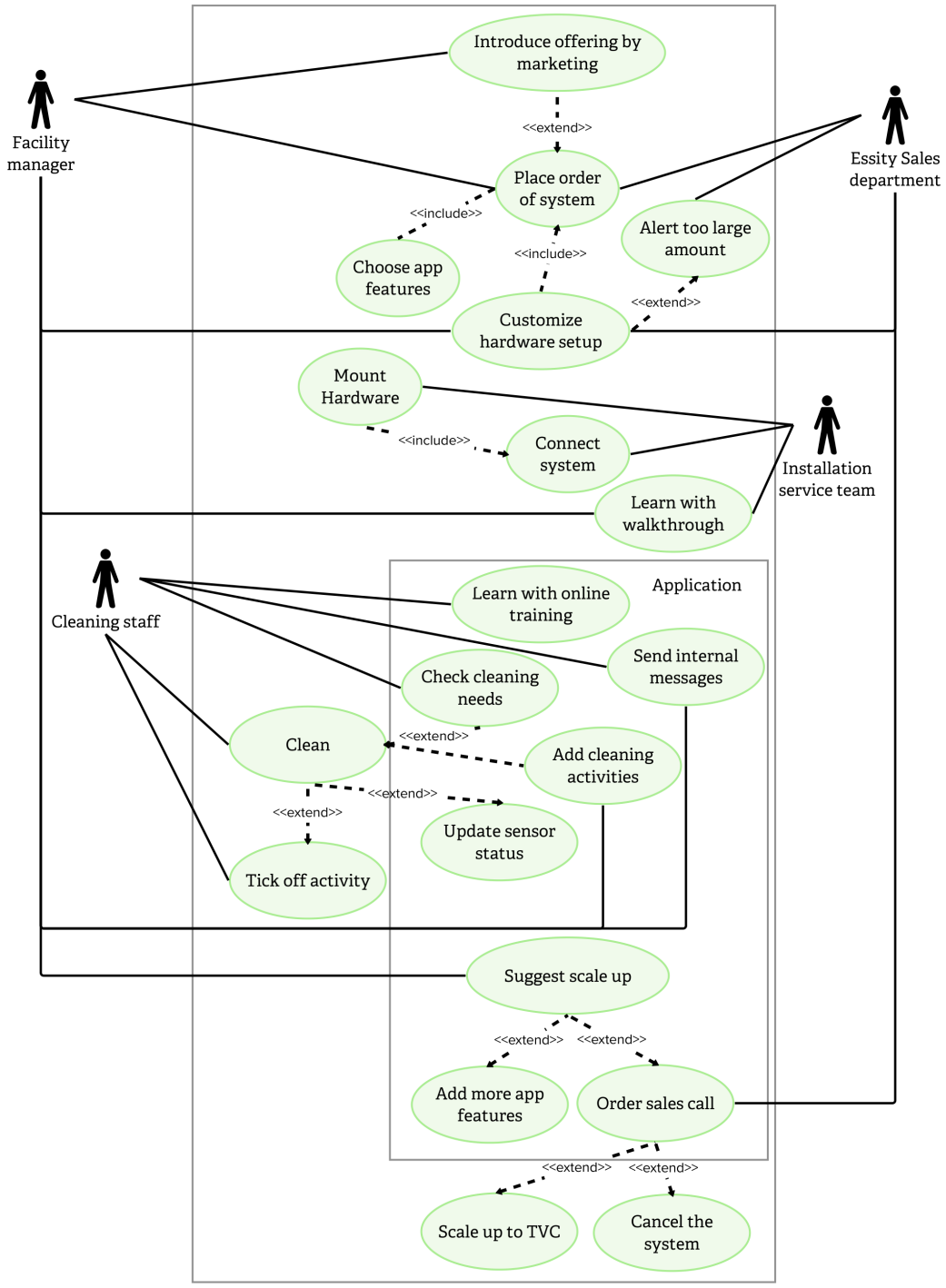


Figure 4.7: Use-case diagram for The High-quality concept

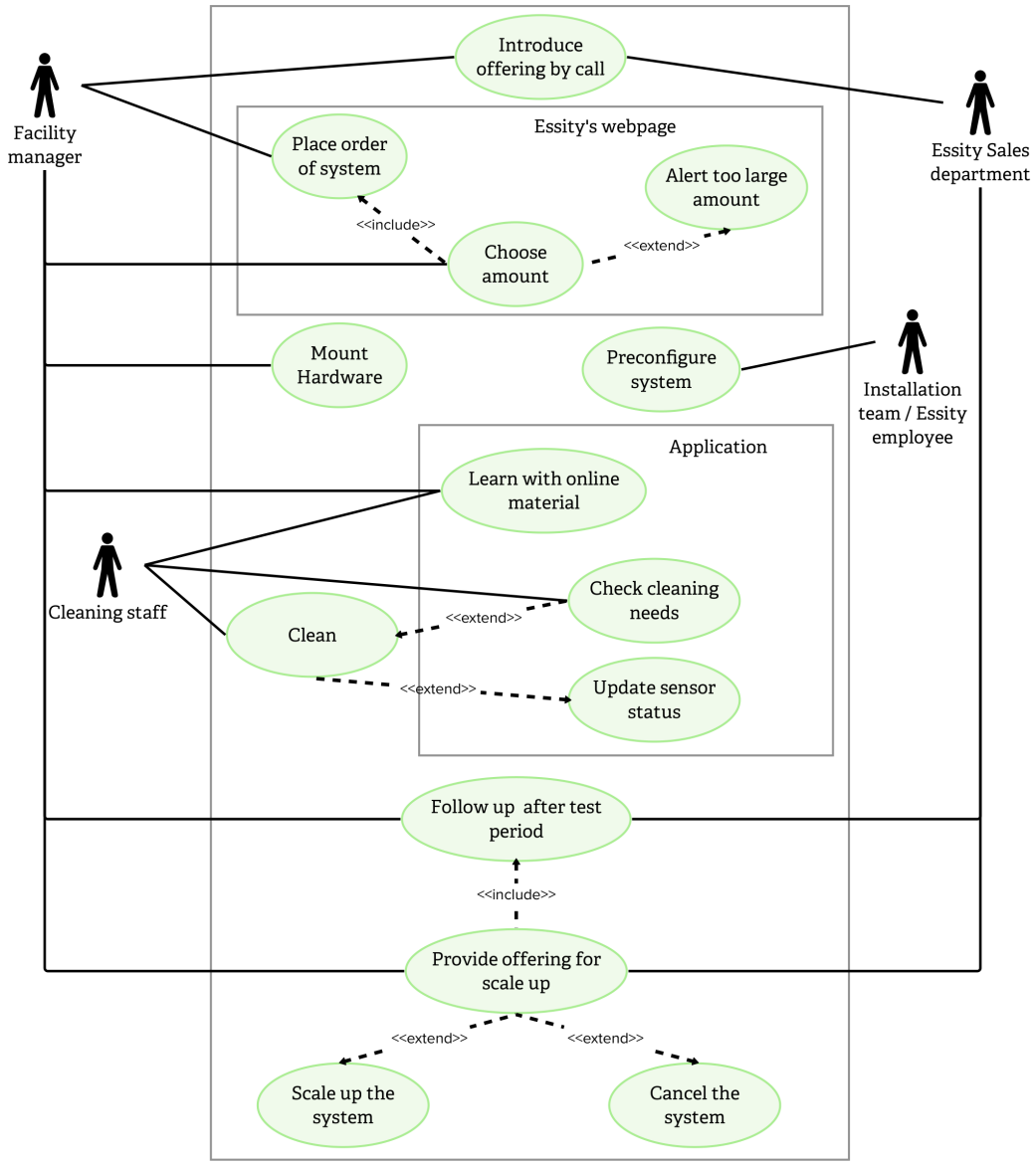


Figure 4.8: Use-case diagram for The Quick-start concept

4.4 Concept Screening & Refinement

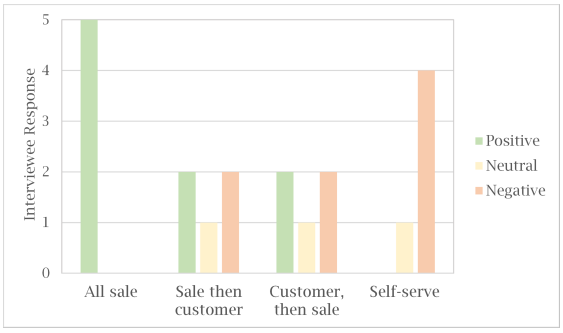
This section shows the results of the different stages of concept evaluation and how the concepts have been refined in between the screenings.

4.4.1 Evaluation of concepts by Elimination matrix

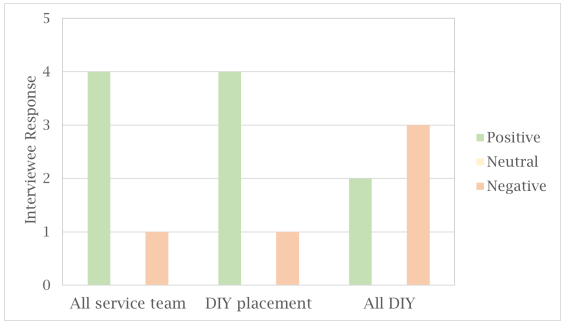
None of the generated concepts were eliminated in the elimination matrix. All concepts were in this stage considered to have the potential to fulfill the marginal value of the requirements possible to evaluate at this early stage. Due to this, all concepts were kept for further evaluation.

4.4.2 Customer evaluation workshop

During the five evaluation workshops held with customers, further insights were made regarding the customer needs. This allowed more detailed customer needs and requirement specification, creating a better foundation for the systematic evaluation. A lot of focus were put into evaluating the subjective metrics, e.g. preferred service level in different stages of the customer journey. The graphs below, shown in Figure 4.9a-4.9d, shows the variation in the response about sub-solutions.

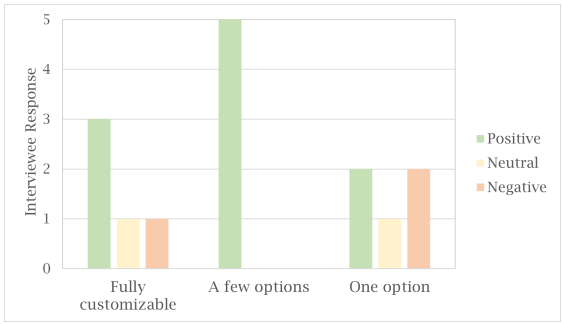


(a) Sales involvement in discovery



(b) Service level in installation

(c) Service level in onboarding



(d) Sensors indicating refill needs

Figure 4.9: Flexibility in included hardware

Figure 4.9a shows the feedback regarding the involvement of the sales department in the distribution module. All participants were positive to the process being handled all by sales, meaning sales would reach out and introduce the offering, followed by

placing the order on behalf of the customer. Almost all saw a complete self-serve solution for this module as unrealistic, and several of the participants expressed uncertainty in whether they would be able to understand the system and how it could help in their business. There were mixed opinions regarding alternatives were some effort were required from the customer, although most of the uncertainties stemmed from their own ability rather than their interest. One of these situations, referred as sales then customer in the table, means sales would contact the customer and introduce the offering, followed by the customer placing the order by themselves. Even though almost all interviewees saw benefits (e.g. cost savings, better understanding) in placing the order themselves they expressed hesitation in case the process would be complex.

The feedback seen in Figure 4.9b regarding the installation phase did not show a clear relationship with the service level. Most interviewees stated that it was dependent on the complexity of the installation, however they were more positive towards performing the the physical mounting themselves than connecting the sensors to the application. The preferred service level for onboarding, seen in Figure 4.9c, was not uniform either. Everyone was positive to using interactive online training material, but some participants expressed how they would still want a personal contact at Essity.

4.4.3 Evaluation of concepts by Pugh matrices

In the first iteration of the Pugh matrix, all concepts were compared how well they perform on metrics from the requirements specification with the previous Essity starter kit offering. In this evaluation, all concepts were proven better than the reference, and solely the reference was therefore eliminated to the second iteration.

The second iteration of the Pugh matrix can be seen in Table 4.12. In this iteration, the Efficient (Ef) concept was the reference. As shown in the Table only the High-quality (HQ) offering scores higher than the reference. The Efficient and High-quality concepts are quite similar, but with the difference that the High-quality concept has a more preferred onboarding than the Efficient concept. The User-friendly (UF) and Quick-start (QS) concepts got the same score, only one worse than the reference and the Economical (Ec) scored the lowest. However, the difference between the concepts to low to eliminate any concept.

The third iteration of the Pugh can be seen in Table 4.13. In this iteration, the User-friendly concept was the reference. In this iteration once again the High-quality offering had the highest score. The Efficient concept scored second, while the Quick-start offering and Economical offering scored lower than the reference. The economical concept scored the lowest also this time, and this time much lower than the reference. For this reason, it was eliminated.

The Efficient concept and the High-quality concept scores are very similar, with the only difference in how the teaching is performed and how the distribution is done. For this reason, it was decided to further develop these concepts as one, the High-quality concept. The Quick-start offering and the User-friendly offering were

also selected for further development.

Table 4.12: Second iteration of Pugh matrix

Metric		Concept				
Nr.		**UF**	**Ec**	**Ef**	**HQ**	**QS**
1	Cost for Customer	+	+	Reference	+	+
2	Time for customer to order	-	+		-	+
3	Time for Essity to create order	+	+		+	+
4	Has an UI for cleaner	0	-		0	0
6	Time for Essity to teach	+	+		+	+
7	Available onboarding languages	+	+		+	+
9	Number of rooms possible to connect	-	-		0	-
10	Compatible with more types of rooms than washroom	-	-		0	-
12	Maximum time required from customer during installation	-	-		0	-
13	Maximum time for Essity required during installation	+	+		0	+
14	Maximum time delay per room for user	0	+		0	+
17	The system allows several users	0	-		0	0
18	The system allows usage from different stakeholders	0	0		0	-
21	Features can be added gradually	0	-		0	-
22	Supports internal communication	-	-		0	-
23	Supports planning of frequency based activites	0	-		0	-
25	By customer preferred service level in distribution	-	-		-	-
26	Adaptable service level in installation					
27	Preferred (by customer) service level in onboarding	+	+		+	+
28	Flexibility in included hardware	-	-		0	-
29	Flexibility in included software	-	-		0	-
30	Preferred (by customer) service level in scaling options	+	+		0	+
∑+		7	9	0	5	9
∑ 0		6	1	0	14	2
∑ -		8	11	0	2	10
Net value		-1	-2	0	3	-1
Ranking		3	4	2	1	3

Table 4.13: Third iteration of Pugh

Metric		Concept				
Nr.		**UF**	**Ec**	**Ef**	**HQ**	**QS**
1	Cost for Customer	Reference	+	-	-	+
2	Time for customer to order		-	+	+	0
3	Time for Essity to create order		+	-	-	0
4	Has an UI for cleaner		-	0	0	0
6	Time for Essity to teach		+	-	+	+
7	Available onboarding languages		0	-	0	-
9	Number of rooms possible to connect		0	+	+	0
10	Compatible with more types of rooms than washroom		-	+	+	-
12	Maximum time required from customer during installation		-	+	+	0
13	Maximum time for Essity required during installation		+	-	-	+
14	Maximum time delay per room for user		+	0	0	+
17	The system allows several users		-	0	0	0
18	The system allows usage from different stakeholders		0	0	0	-
21	Features can be added gradually		-	0	0	-
22	Supports internal communication		0	+	+	0
23	Supports planning of frequency based activites		-	0	0	-
25	By customer preferred service level in distribution		-	+	+	0
26	Adaptable service level in installation					
27	Preferred (by customer) service level in onboarding		-	-	0	-
28	Flexibility in included hardware		-	+	+	-
29	Flexibility in included software		0	+	+	0
30	Preferred (by customer) service level in scaling options		0	-	-	0
∑+		0	5	8	9	4
∑ 0		0	6	6	8	10
∑ -		0	10	7	4	7
Net value		0	-5	1	5	-3
Ranking		3	5	2	1	4

4.5 The Crossbreed concepts

The concepts combined with the input from the Pugh matrix evaluation can be seen in Table 4.14.

Table 4.14: Combination of new concepts

Module	Function	User-friendly	High-quality	Quick-start
Distribution	**Attract attention**	Sales, then customer	All sale	Sales, then customer
Flexibility	**Customize data collection**	A few options	Fully customizable	A few options
Installation	**Support installation**	DIY placement	All service team	DIY placement
Onboarding	**Teach cleaning staff**	Manager Walk-through and Online training	Manager Walk-through and Online training	Online training
Sensors	**Monitor real time needs**	PC+Dispenser +Bin	PC+Dispenser +Bin	PC+Dispenser
App(s)	**Structure cleaning plan**	SS+Planning	SS+planning	SS+planning
Scaling	**Stimulate scale up**	Sales	Sales	Sales

A uniform change for all concepts is that all concepts now have the sensor status and planning feature in the app, as well as sales reconnect to scale the system. This was what scored best in the Pugh matrix, so all concepts now have these solutions.

The other changes made to the User-friendly concept is that instead of letting an installer come to connect the system to the equipment the customer gets the choice to let an installer do the entire installation or to get the kit pre-configured to mount themselves. For the High-quality offering, the distribution is changed to make the complete order together with the sales department. In the Quick-start offering the flexibility is changed to more than one option.

Flexibility with sensors

At this stage it was decided exactly which sensors were included in each offer. For the User-friendly offering four options of sensor packages were proposed. The options can be seen in Table 4.15. The offering is limited to purchasing two basic packages including gateway, level sensors and soap sensors. Additionally can people counters and bin sensors been purchased.

Table 4.15: Sensor options for the User-friendly offering

User-friendly	Few	Medium
Basic packages	1 Gateway 4 Level 2 Soap	1 Gateway 12 Level 6 Soap
	2 PC	6 PC
	2 Bin	6 Bin

The sensors included in the Quickstart offering can be seen in Table 4.16. This offer is limited to one basic package and the only additional sensor available is the people counter.

Table 4.16: Sensor options for the Quick-start offering

Quick-start	Few	Medium
Basic packages	1 Gateway 4 Level 2 Soap	1 Gateway 12 Level 6 Soap
	2 PC	6 PC

The sensors available for the High-quality offering can be seen in Table 4.17. In this offering the customer can choose in the range of sensors, but at least 18 sensors must be used.

Table 4.17: Sensors available for the High-quality offering

High-quality	Sensors
	1-2 Gateways 0-24 Level 0-12 Soap 0-12 PC 0-12 Bin

4.5.1 BPMN for the three new concepts

User-friendly

The BPMN for the new User-friendly concepts consisted of four pools, which represented the customer company, Essity, a third-party distribution company, and a third-party installation company. A simplified version of the BPMN for the User-friendly concept can be seen in Figure 4.10, and the complete BPMN can be seen in Appendix A. For the third part companies, there was only one lane considered since how the activities are divided within their organization Essity can't control.

The starting point for Essity and the customer company is that Essitys sales department contacts the customer to inform them about the offering. The customer then places the order which includes choosing the type of installation. When the customer has placed the order this triggers the starting event for the distributor and if the customer chooses to add the installation service their starting event occurs when the distributor knows when they can deliver the equipment. The installer then plans the installation from this information and when the installation is done the installer makes a walkthrough with the customer. If the customer wants to install the hardware themselves the distributor pre-configures the equipment before sending it. When the installation is done the cleaners perform the online training that is provided by Essity. The customer then uses the system for a test period before sales reconnect with the customer. By then the customer has analyzed the data and together a business case gets built. The final events for Essity and the customer company are when the sales department presents the business case for the customers' upper management about implementing TVC.

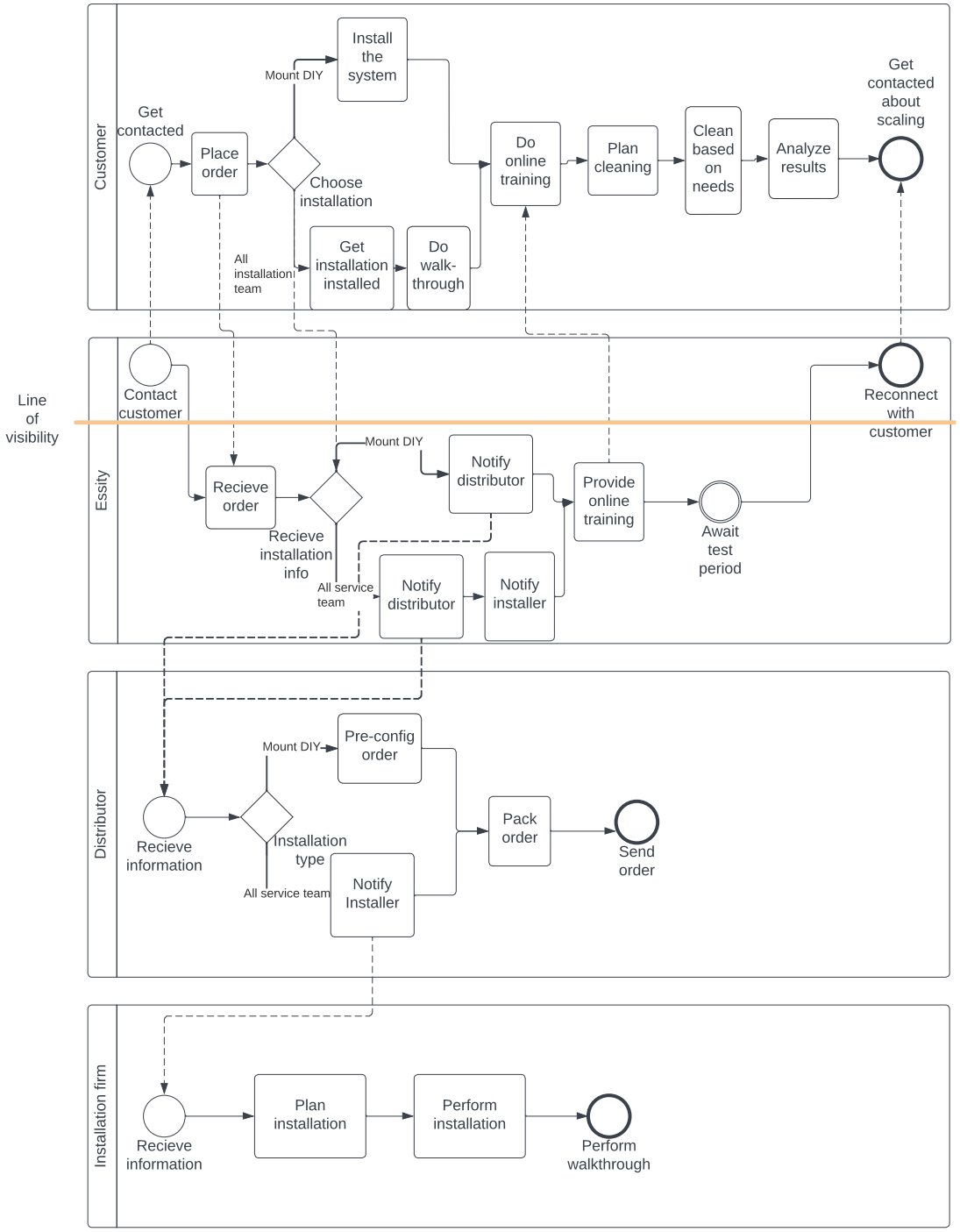


Figure 4.10: BPMN of the User-friendly concept

Quick-start

As can be seen in Figure 4.11 the Quick-start offering has three pools, Essity, a Customer company, and a third-party distributor. The starting event for this offer occurs when the customer gets contacted by the sales department. Also in this case the customer places the order themselves, which triggers the start event for the distributor which pre-configures, packs, and sends the equipment. When the equipment arrives to the customer they install it, do the online training, and use the system. The customer facility manager then analyzes the data on their own to present a business case for the upper management. After a test period, the sales department reconnects with the upper management about how to move on to TVC.

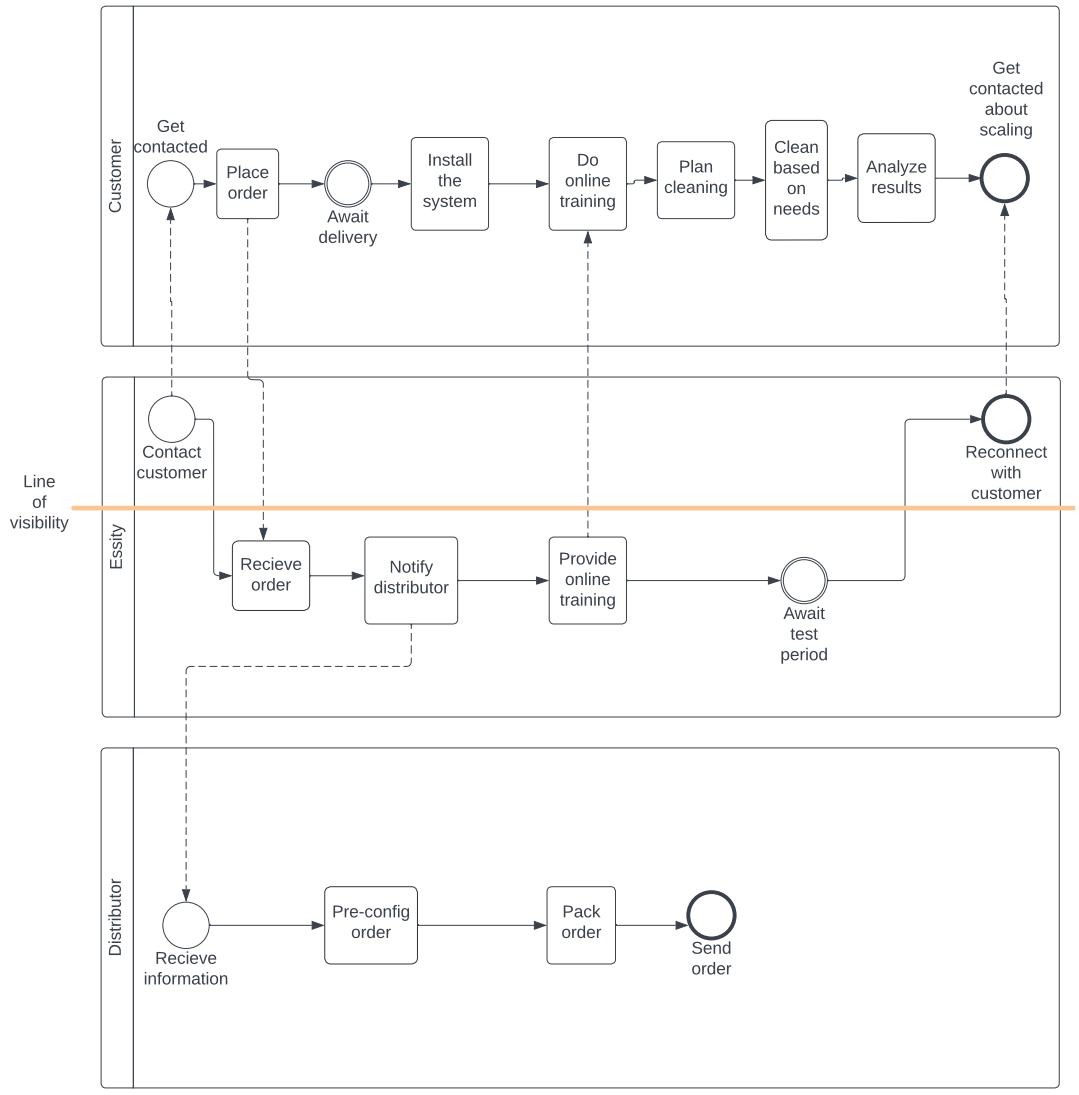


Figure 4.11: BPMN of the Quick-start concept

High-quality

The simplified BPMN of the High-quality concept can be seen in Figure 4.12. In this offering, the customer gets contacted by sales and together places the order. The distributor sends the equipment and gives the information about delivery to the installation company.

The customer receives the equipment and gets it installed. The management gets a walkthrough with the installer, and the staff makes the online training before the system is used. The sales department keeps track that the system is used in the right way, and analyzes the data to present the business case for scale-up to the customers' upper management.

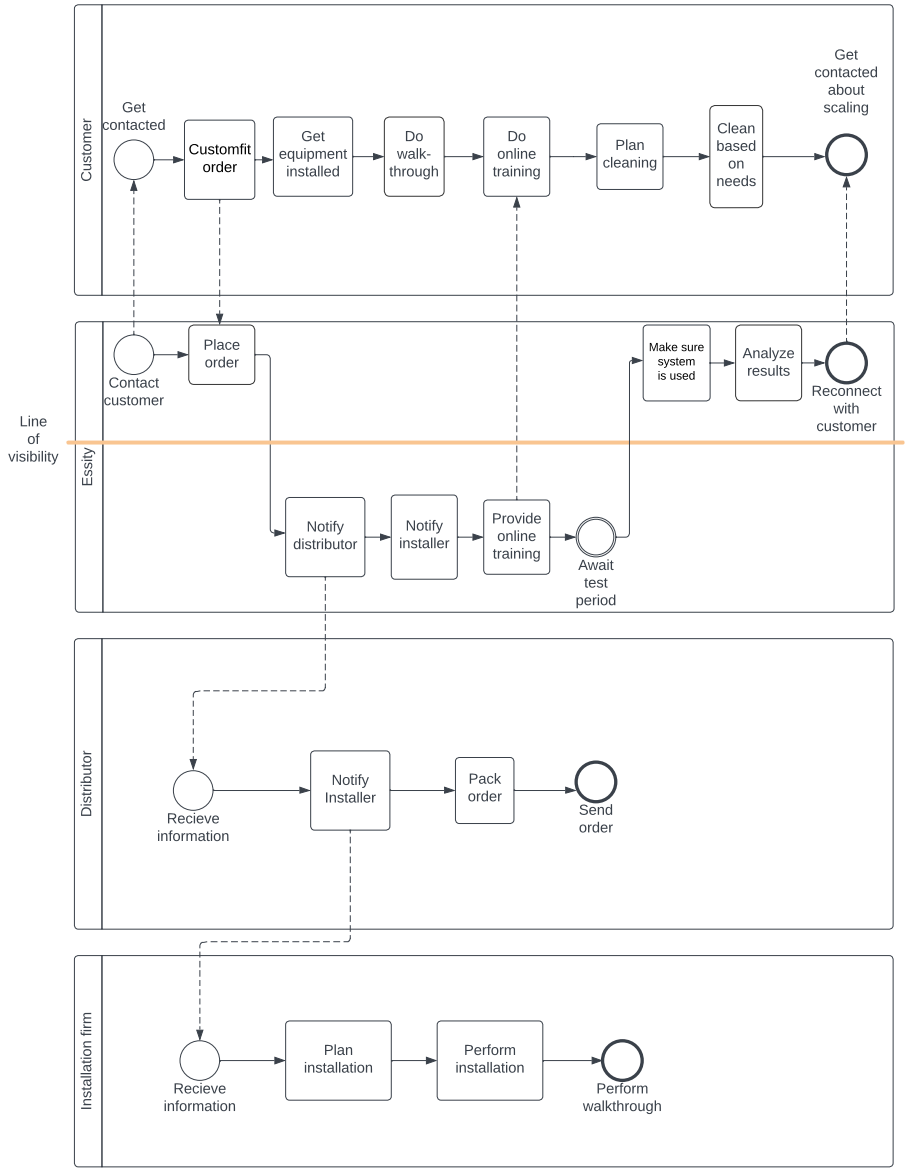


Figure 4.12: BPMN of the High-quality concept

4.6 Evaluation with Kesselring matrix

The three remaining concepts were evaluated using the concept scoring method Kesselring.

Selected metrics and value scale

The metrics selected and their weighted factors for the Kesselring matrix can be seen in Table 4.18. The highest weighted metrics were the Cost for customer, that the system allows several users, and the adaptable service level in installation.

Value scales were made for each metric and most of the values were linear to the marginal and ideal value in the requirements specification.

Evaluation of concepts

The evaluation with Kesselring matrix can be seen in Table 4.18. The offering with the highest score was the User-friendly offering.

The User-friendly offering had the highest total value and the highest weighted value. The offering had four weak factors meaning scoring 1. Two of these factors were the maximum time spent by Essity and the customer during installation. For the offer, both of these maximum timescales score the lowest, but in reality an installation method is chosen by the customer which determines whether it is Essity or the customer who needs to spend time, while the other does not. The other two weak factors were not highly weighted and all concepts scored low on these metrics. Because of the low weight of these metrics no changes were made.

Based on the result from the Kesselring matrix where the User-friendly had the highest score, the User-friendly concept was chosen to develop further in detail.

Table 4.18: Kesselring matrix

Requirements			Concepts							
			Ideal		QS		UF		HQ	
Nr	**Metric**	w	v	t	v	t	v	t	v	t
1	Cost for customer	0,074	3	0,22	3	0,222	2	0,148	1	0,074
2	Time for customer to order	0,066	3	0,20	2	0,132	2	0,132	3	0,198
3	Time for Essity to create order	0,045	3	0,13	3	0,134	3	0,134	1	0,045
6	Time for Essity to teach	0,027	3	0,08	3	0,082	2	0,054	2	0,054
7	Available onboarding languages	0,039	3	0,12	3	0,117	3	0,117	3	0,117
9	Number of rooms possible to connect	0,045	3	0,13	2	0,089	3	0,134	3	0,134
10	Compatible with more types of rooms than washroom	0,008	3	0,02	2	0,016	2	0,016	3	0,023
12	Maximum time required from customer during installation	0,045	3	0,13	1	0,045	1	0,045	3	0,134
13	Maximum time for Essity required during installation	0,056	3	0,17	3	0,169	1	0,056	1	0,056
16	Decrease the number of cleaning actions for the connected area	0,058	3	0,18	2	0,117	3	0,175	3	0,175
17	The system allows several users	0,064	3	0,19	3	0,193	3	0,193	3	0,193
18	The system allows usage from different stakeholders	0,004	3	0,01	3	0,012	3	0,012	3	0,012
19	Can communicate with other data systems	0,002	3	0,01	1	0,002	1	0,002	1	0,002
23	Supports planning of frequency based activites	0,060	3	0,18	3	0,181	3	0,181	3	0,181
24	Measures cleaning performance	0,047	3	0,14	2	0,093	3	0,14	3	0,14
25	Preferred (by customer) service level in distribution	0,054	3	0,16	2	0,109	2	0,109	3	0,163
26	Adaptable service level in installation	0,064	3	0,19	1	0,064	3	0,193	1	0,064
27	Preferred (by customer) service level in onboarding	0,039	3	0,12	2	0,078	3	0,117	3	0,117
28	Flexibility in choice of hardware	0,047	3	0,14	1	0,047	2	0,093	3	0,14
29	Flexibility in amount of hardware	0,027	3	0,08	2	0,054	3	0,082	2	0,054
30	Flexibility in included software	0,019	3	0,06	1	0,019	1	0,019	1	0,019
31	Preferred (by customer) service level in scaling options	0,051	3	0,15	2	0,101	3	0,152	2	0,101
T (Total value)			66	2,825	47	2,076	52	2,304	51	2,198
T / Tideal			1,00	0,04	0,71	0,03	0,79	0,03	0,77	0,03
Average			3,00	0,13	2,14	0,09	2,36	0,10	2,32	0,10
Std deviation			0,00	0,05	0,63	0,05	0,69	0,05	0,81	0,05
Median			3,00	0,14	2,00	0,09	3,00	0,12	3,00	0,11
Number of weak factors			0		5		4		6	
Ranking					3		1		2	

4.7 Detailed Service Development

This section shows the final service development of the proposed concept. It ended with a TRM, showing how the development process could be structured to realize the offering.

4.7.1 Customer journey map

The customer journey map can be seen in Figure 4.13. The journey was divided into the same five phases that have been used throughout the development; "Discovery", "Decision-making", "Implementation", "Usage", and "Scaling". The journey of each phase is explained more in detail in the paragraphs below. One important note of the resulting customer journey is how it allows the customer to both gain an understanding of and evaluate the PSS. This supports the fulfillment of the main function.

Discovery

In the discovery phase, the action the customer perform is to be introduced to the possibility to test needs-based cleaning by the sales department, which is the only touchpoint in this phase. This activity is meant to trigger an interest in the customer.

Decision-making

During the decision-making phase, the customer has several actions to consider. During this phase a decision is made to try the system, what package(s) of the sensor will be used, and how the installation should be performed. When these things have been decided upon the customer places the order. The touchpoints in this phase are the website and the ordering system.

Implementation

In the implementation phase, the customer gets the equipment, and the system is installed, but how it is installed depends on what installation option the customer has chosen. A baseline is created by installing the system without using it for two weeks. This baseline can later be used for evaluation of the system. After this, the cleaning staff performs the online course to learn about the system. In this phase, the customer interacts with the distribution, installation, customer, and online training services. The thought that they will go through is the comfort that the system is mounted in their preferred way, but also perhaps a fear from the cleaners of potentially being replaced by a data system.

Usage

In the usage phase, the customer tries the system by creating a cleaning plan and letting the cleaning staff act on the sensor data. During this phase, a curiosity arises about how this system makes a difference.

Scaling

In the scaling phase, the performance of the system is analyzed by using the application. The customer gets contacted by the sales department and together with them put together a business case that can be presented to upper management about scaling to TVC. In this phase, the customer truly realizes the perks of needs-based cleaning.

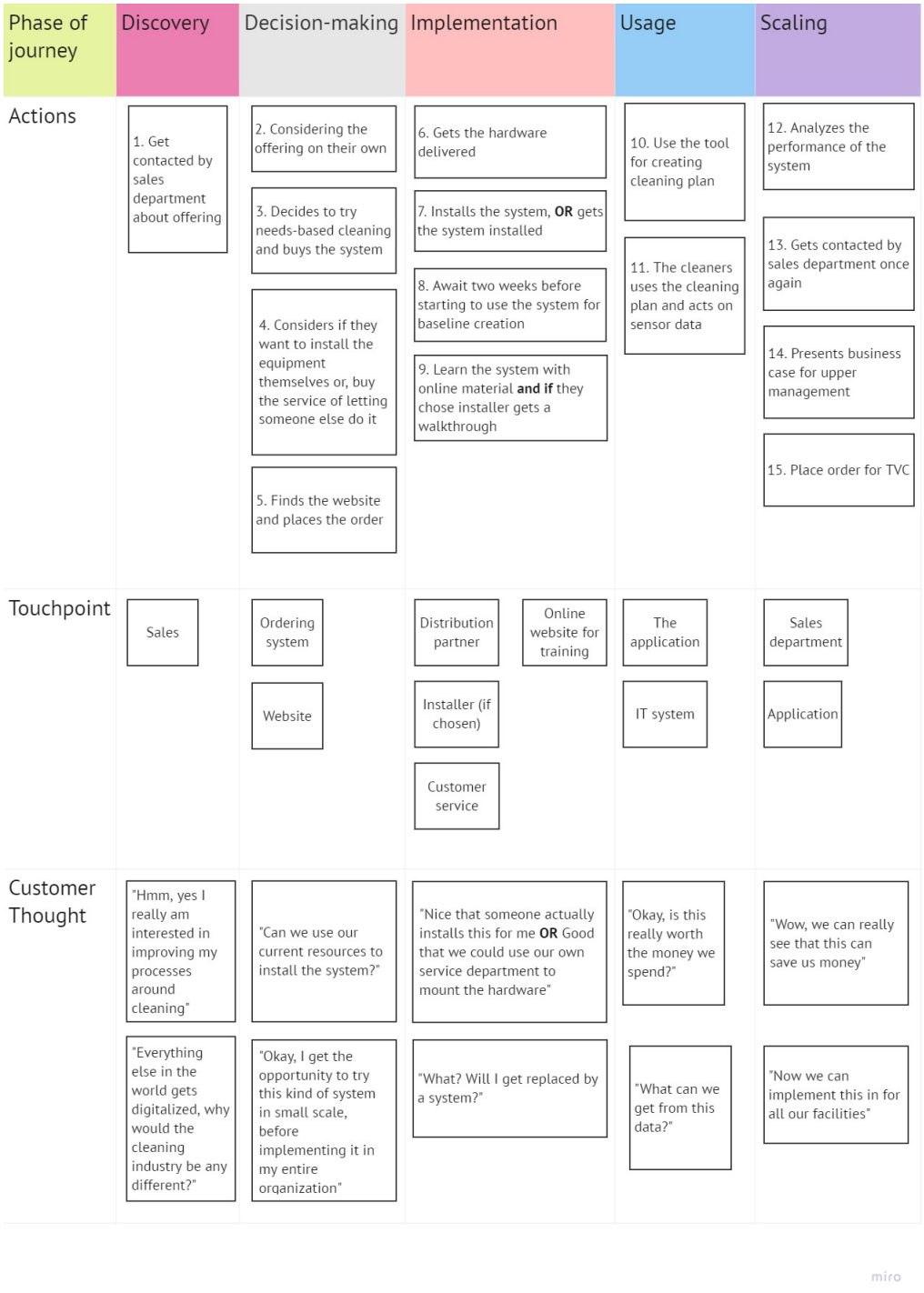
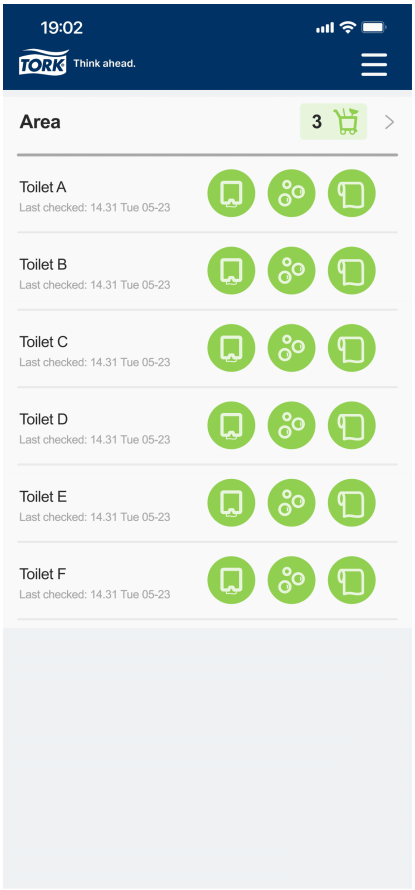


Figure 4.13: Customer Journey of final concept

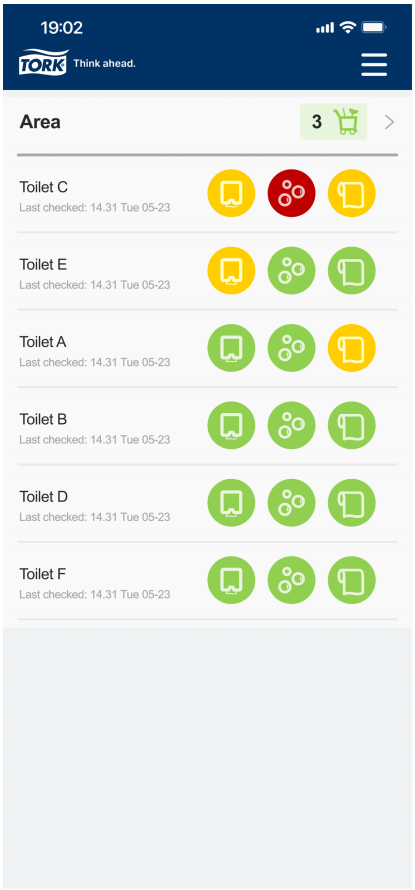
4.7.2 UI Prototype

The user interface (UI) prototype was developed for the two user groups, the facility manager and the cleaning staff. As the facility manager have some privileges all cleaning staff doesn't have, some parts of the application was designed differently depending on user. Since several interviewees expressed they would want the change between the Starter Offering and TVC to be as easy as possible. Due to this, the UI prototype of the Starter Offering Application is using the same design system as the TVC.

Figure 4.14a shows the view a cleaner would see in the case where the Starter Offering is implemented for 6 toilets. The icons to the right in each location card (Toilet A-F) display the refill status of each dispenser. Looking at 4.14a all icons are green meaning no dispenser needs to be refilled. Looking at 4.14b some of the icons have turned yellow or red, indicating refill is needed. The yellow status is displayed when refill is possible, however it's not urgent. Icons turn red when refill is needed and the dispensers are about to run out. To support usability, prevent unnecessary scrolling and through that decrease the time delay of using the application, the location cards are ordered after current cleaning needs, showing the location which has the most urgent needs at the top.



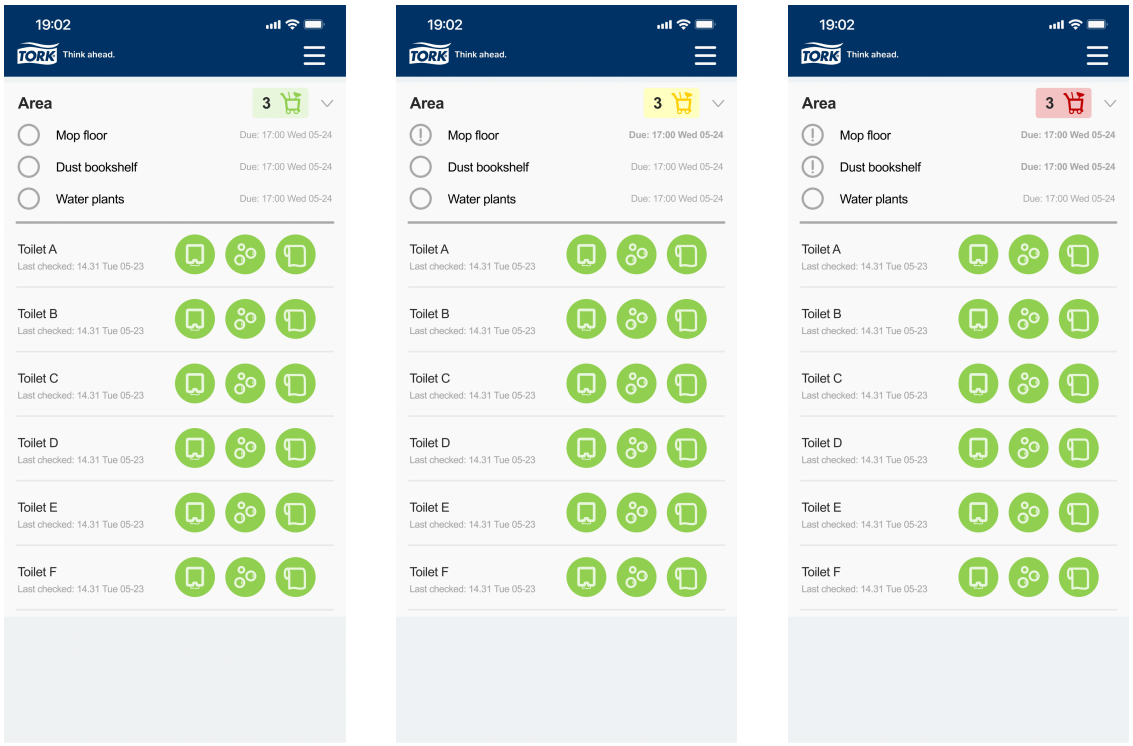
(a) Default cleaner view



(b) Sensors indicating refill needs

Figure 4.14: Cleaner view

A critical factor during the concept evaluation was the inclusion of a planning feature. To make the system compatible with frequency based cleaning tasks these are shown as simple to dos, shown in a drop down list enabled by pressing the area card at the top of the UI. This list is shown in Figures 4.15a-4.15c. The icon in the upper right corner shows the number of current tasks, and the color once again indicates the urgency. Yellow means there are one or several tasks due soon, while red means one or several tasks are overdue. The task "box" is also displayed with an exclamation mark for both cases.



(a) Not urgent cleaning tasks

(b) Cleaning tasks due soon

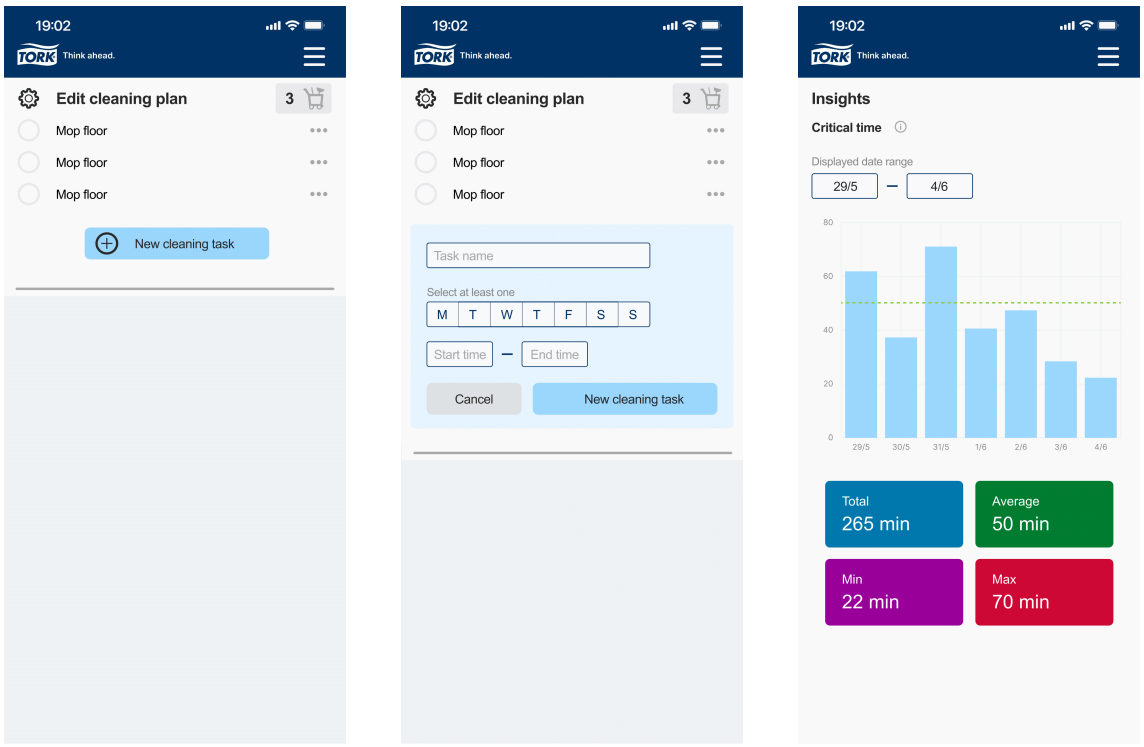
(c) Cleaning tasks are overdue

Figure 4.15: Cleaner view of frequency based tasks

The facility manager view provides the ability for some customization, as well as display insights based on the gathered data. The customization involves changing the name of the Area, as well as the name for each location card. As an example, the Area name could be changed to floor 2 or entrance hall, depending on where the system have been installed. Regarding the planning of frequency based tasks, the facility manager view allows addition and changes made to these tasks. By pressing the menu icon in the upper right corner, the facility manager can navigate to the view where the cleaning plan can be edited, seen in Figure 4.16a. By pressing the *New cleaning task* button, the facility manager can add another task to the list. As seen in 4.16b, a new cleaning task can be created by naming the task and specifying what days the task needs to be done, as well as the time range it should be completed within.

The most crucial part of the facility manager view is the option to provide a re-

sults overview, where the increased quality and time savings the system brings are presented. To see these statistics the facility manager once again use the menu to navigate, however this time they navigate to the *Insights view*, seen in Figure 4.16c. This view shows critical time, which is the time (measured in minutes) where dispensers have had the red status, meaning they are empty or very soon to be. This measurement is more related to cleaning quality. However, if people counters are chosen as an add on, insights regarding number of cleans can also be seen, which can be used as a measure of efficiency.



(a) Edit cleaning plan

(b) Add new cleaning task

(c) Insights

Figure 4.16: Facility manager view

Implementing the Starter Offering and have it running for an appropriate time period before it's actually used enables the creation of a baseline. This allows comparing the cleaning quality and efficiency before and after the Starter Offering was being used, which can in turn be used to create a business case to show the value of the system.

4.7.3 Service prototyping

The participant with no experience of needs-based cleaning understood the UI and the purpose of the service. The opportunity to see the sensor status instead of opening each dispenser was what impressed the participant the most. The participant expressed that perhaps just needing to open the door to the toilet to see if any cleaning is needed can save a lot of time compared to if the cleaner needs to

open each dispenser. The participant also thought that the knowledge of the refill levels can also be used for planning what supplies to be brought. This can ease the planning and save time if the cleaner don't need to carry more than they need.

The participant was a bit confused by the icon with the cleaning trolley. At first sight they were reminded of a shopping cart which is often used for online shopping.

To try in this small scale the participant thought was a good entry-point. To see the use of the system before implementing it on all their facilities. In summary the offering provided experience of effective cleaning services which was the function tested.

4.7.4 DSM & TRM

When the development of the Starter Offering concept had reached its end a new DSM was made, this time not for TVC but for the Starter Offering itself. In Table 4.19 the dependencies between all included product and service elements can be seen. The elements have been rearranged to provide a better overview of how they are dependent on each other. Looking at the diagonal, the upper left corner shows a completely independent element, followed by another independent one. Based on the dependencies, the system of the Starter Offering was divided into modules, shown with orange boarders. These modules are consisting of elements that are interdependent and therefore need to be developed simultaneously.

Table 4.19: DSM of Starter Offering

		Cloud storage	PC Sensor	Level Sensor	Bin sensor	Skincare sensor	Gateways	Admin application	Installation guides	Support call center	Starter Offering Application	Cleaning planner feature	Online training feature	Install feature	Hardware installation service	Manager walkthrough service	Sales introduction service	Scaling service	Distribution service	Pre configuration service
		P11	P6	P7	P8	P9	P10	P5	S5	S6	P1	P2	P3	P4	S3	S4	S7	S8	S1	S2
		11	6	7	8	9	10	5	16	17	1	2	3	4	14	15	18	19	12	13
P11	11	11																		
S5	16		6				1													
S7	18			7			1													
S8	19				8		1													
S1	12					9	1													
S2	13	1	1	1	1	1	10													
S6	17		1	1	1	1	1	5												
P6	6		1	1	1	1	1		16											
P7	7								1	17										
P8	8	1								1	1	1	1	1						
P9	9										1	2	1							
P10	10										1	1	3							
P5	5				1	1	1	1	1		1			4						
S3	14	1			1	1	1	1	1						14	1				
S4	15										1				1	15				
P1	1										1						18	1		
P2	2							1									1	19		
P3	3																		12	1
P4	4							1											1	13

After analyzing the elements and their dependencies a TRM was developed, shown in Figure 4.17. According to the modular division in the DSM, the modules are shown here as well in the darker-colored boxes holding the elements included in that module. The elements and modules which are already developed and in use for TVC are displayed with dashed outlines. By presuming no changes are made in the existing elements, this means the development of the Starter Offering could start with developing the cleaner application, the installation service module, and the support call center.

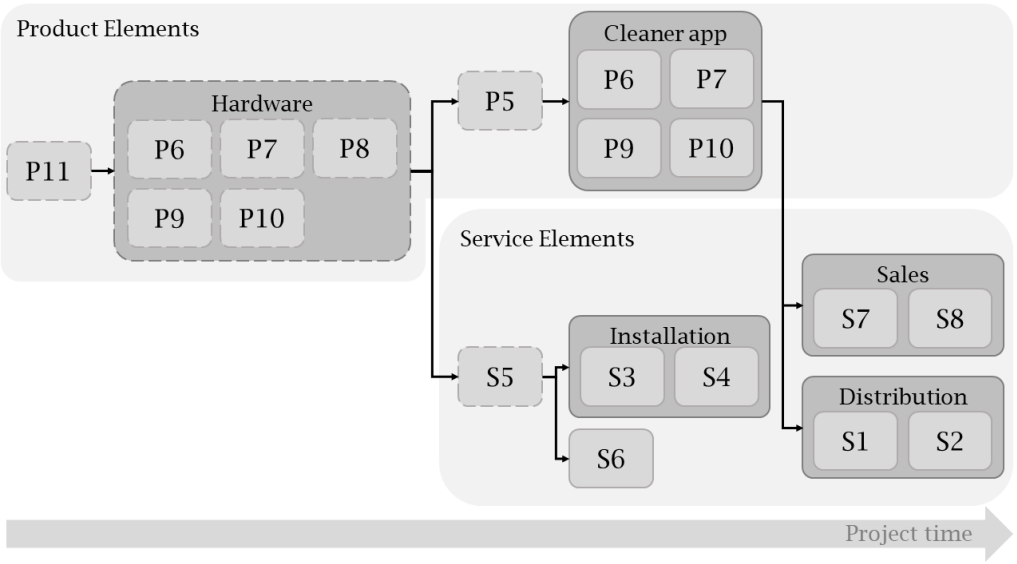


Figure 4.17: TRM of the development of the Starter Offering

The main insight this TRM provides is that the development of the Starter Offering can be done without great complexity. Out of the four new modules to be developed, the Starter Offering application is the only one which requires new product development. The installation module can be outsourced, as well as the distribution module.

5

Discussion

When the thesis was initiated, the purpose of the development of the Starter Offering was not completely defined by Essity. They wanted it to introduce customers to needs-based cleaning, but which customers? The Starter Offering could be developed to reach the same target market segment as TVC, but it could also be used to expand TVC into new segments. As this decision would affect both the market and company analysis and the customer needs research, it had to be decided before the major research had started. The limitation regarding the market segment to be addressed, described in 1.3.2, was a result of this. This limitation supports the idea that the Starter Offering can be used to expand TVC in other market segments than Essity's target one, but also increase market share in their target market segment since these segments have similarities. It's although important to highlight that the Starter Offering might not be suitable for the latter purpose, since customer needs research in fact haven't been done for that segment.

The results presented in section 4.2.4 did play an essential role during the concept development and evaluation. As qualitative research methods were used and the thesis had tight limitations regarding time and resources, the number of interviewees ended up quite low. To improve the reliability of these results, and thereby the customer value in the proposed solution, a quantitative research method could be a good complement. This could e.g. involve user surveys, which with the right tools could be targeted towards people working in facility management. This could support validation of the customer needs, making sure they are representative for that market segment.

However, the background and experiences of all interviewees during the customer needs research did represent the typical customer well. The age range of 40-54 did end up appropriate, as most people in managerial positions like facility managers seem to approximately be in that age range. However, in a few years when the younger generation starts to take on these positions, one can guess the market will change a lot. Interest in IoT solutions will increase, as younger people tend to be more tech-savvy. This can open up a lot of opportunities, e.g. better prerequisites for the customer to discover and understand the offering on their own. This calls for a need of customer needs research in the future and making it recurring, to allow comparison between the years and by that spot changes in the customer and user behavior.

Considering the growth of Business-to-Customer (B2C) IoT solutions, it's possible

the general attitude will turn more positive to the implementation of IoT in business contexts, not only for the younger generations. As many IoT solutions for private use, in the home for instance, are mounted and installed by the customer themselves, the experience of this will grow and people might grow more comfortable working with connected systems. This could drive a shift in the preferred service level in the implementation phase of the Starter Offering, and opportunities to shift towards self serve could arise even for TVC.

To fit the development of both the product and service elements of the offering, a mix of methods has been used. Tangible products can be considered easier to develop and evaluate more or less non-dependent by solution, while the design and interpretation of service elements depends more on the user. This called for customer involvement in both the development process and in parts of the evaluation. However, usability is a key aspect of the service elements and it's important to remember people in managerial positions are not the only user. The development process would benefit from involving cleaning staff the a larger extent, as they were only involved in the initial customer needs research but not in any stages of evaluation.

Similarly to the customer needs research, a larger amount of participants in the service prototyping would have made the validation more reliable. As this validation requires a qualitative analysis the method is considered appropriate. Therefore, no complementary method is needed, however, the results would benefit from applying the same service prototyping process with more participants. The choice of participants can also be discussed, as the validation would be more trustworthy if the participant fit the customer profile. It was an intended choice to not validate the offering with one or several of the participants from the customer needs research due to the reason that they already had an idea of the benefits the offering might bring. The time constraints caused issues in recruiting a participant with a suitable background. This led to a participant with no experience in facility management, jeopardizing the validity of the result.

6

Conclusion

This thesis was initiated by the business area Professional Hygiene at Essity, with the purpose to investigate a concept that could serve as a preliminary test service of needs-based cleaning, and by that TVC. The needs and constraints of such an offering have been thoroughly investigated during the work. One of the central aspects which emerged during the research is in fact the desire to try and evaluate a product or service before buying it, which emphasizes the fact that an offering like this could be needed in order to reach certain customers.

The research questions presented at the beginning of the thesis have been successfully answered. The iterative development process helped establish the key customer needs and by that answer Research Question 1. The key factors for customer value are for instance proving the importance of generating evidence of positive economical impact, and allowing some flexibility of the included sensors as well as the service level of the installation. The final Starter Offering concept shows how a preliminary test service of needs-based cleaning can be designed and therefore answers Research Question 2. In the concept, an appropriate level of support during the customer journey is presented.

This concept supports the customer in gaining experience in needs-based cleaning and trying it out in their organization. This is key, as the value proposition for the customer is the possibility to evaluate the PSS before investing in it. The Starter Offering can also bring value to Essity. A preliminary test service is not a source of large income in itself. The value for Essity in delivering the service is the opportunity it creates to gain more market shares, and even expand into new market segments.

Moving forward, further investigation of the internal processes of Essity needs to be carried out to realize the Starter Offering. As the final concept has an ordering and implementation process which is different from the current ones in use, these new processes need to be developed and put in place in a way that is compatible with the existing systems. Improving the internal processes can increase the implementation efficiency and by that reduce a lot of effort from Essity's side without a negative impact on the customer experience.

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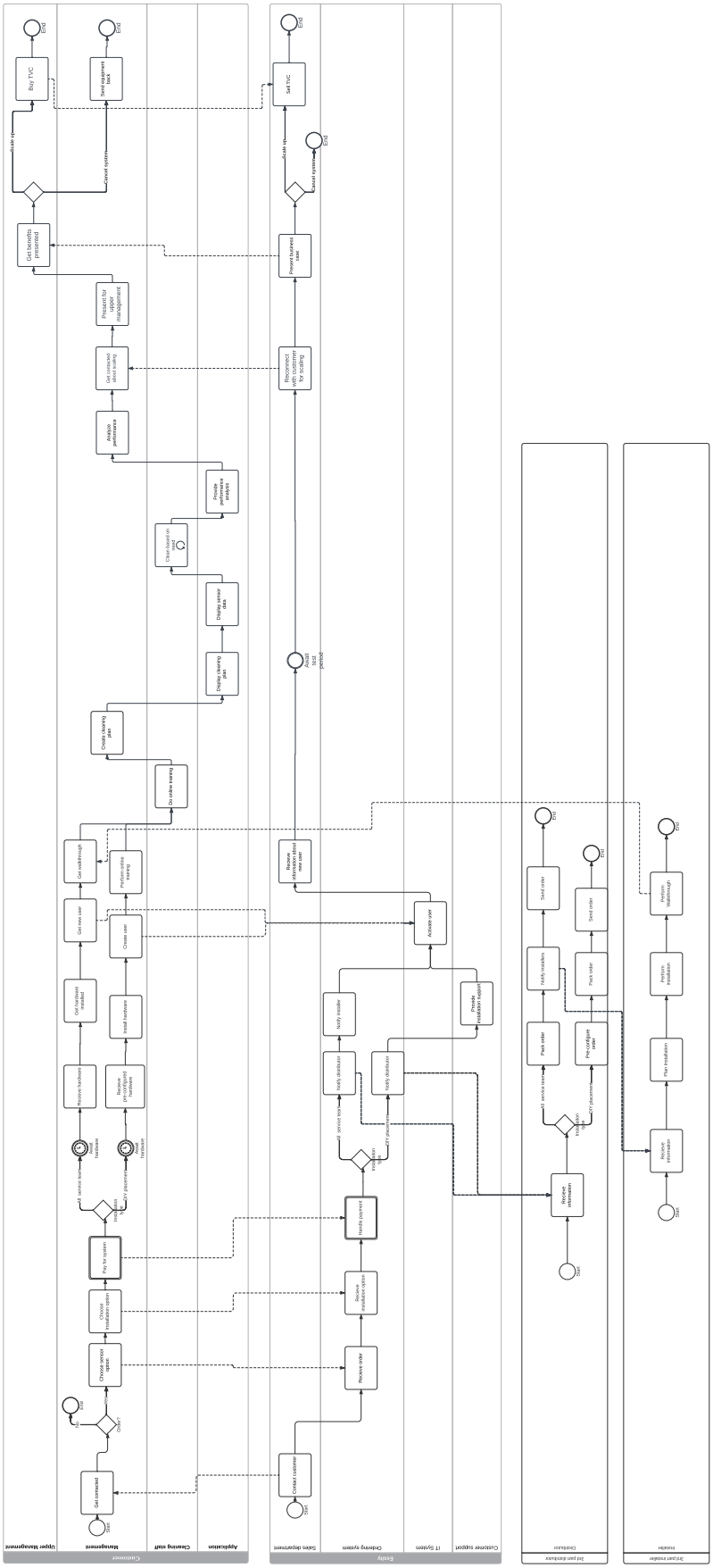
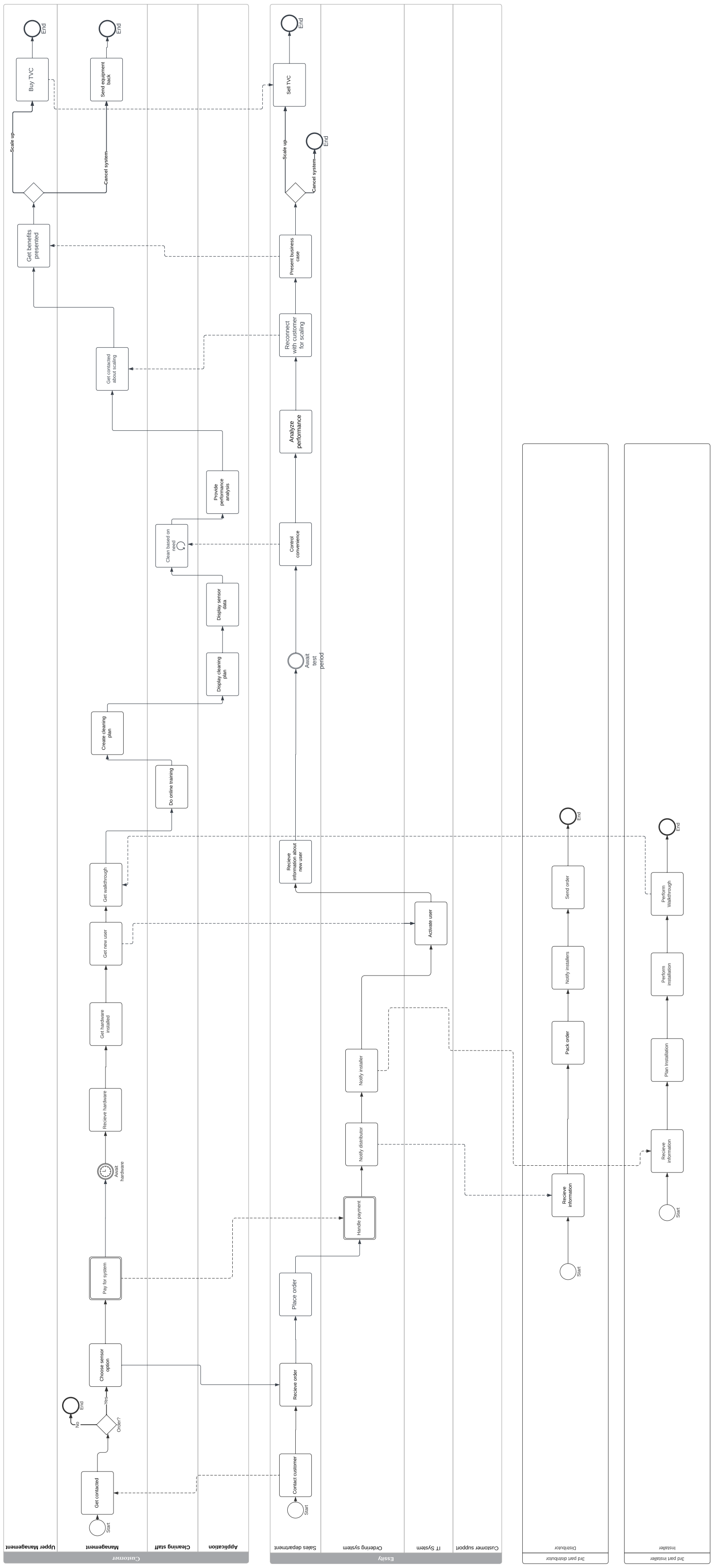
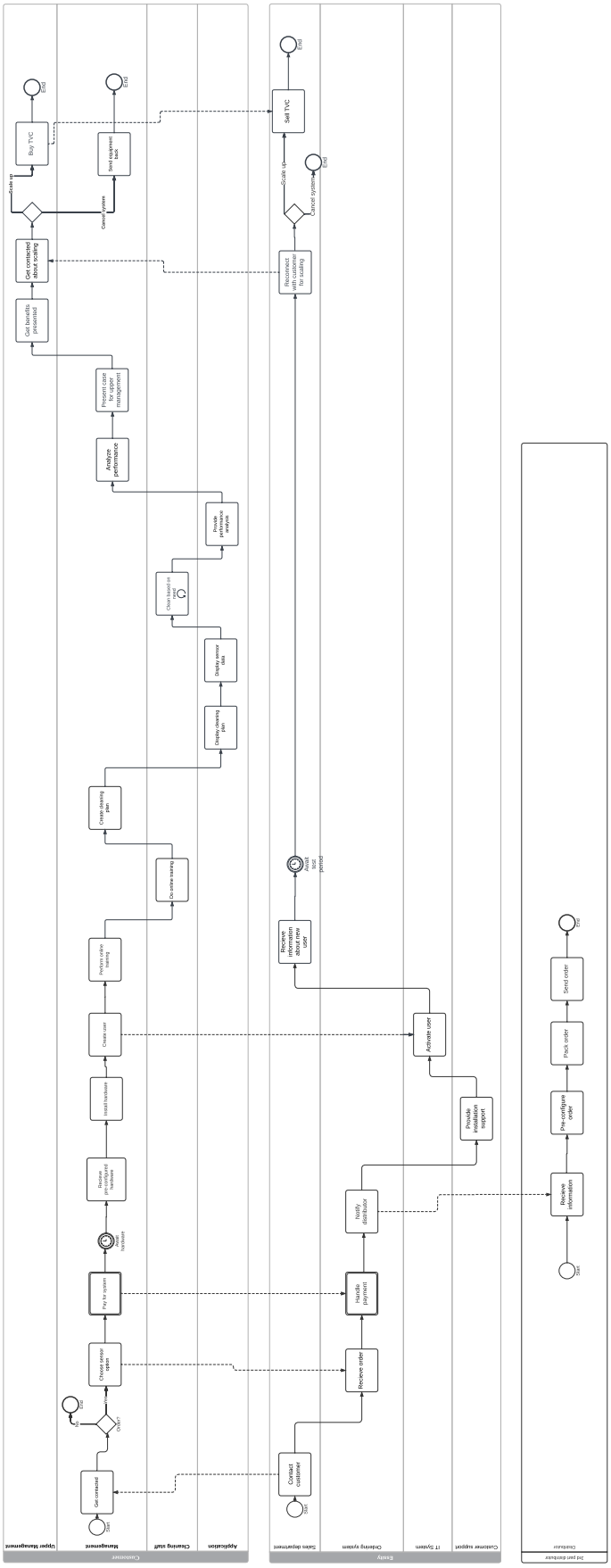
A

BPMN

This appendix presents the full BPMNs made for the three concepts left after the Pugh matrices. The BPMNs are presented in the same order as in the main report i.e. first the User-friendly, then the Quick-start, and lastly the High-quality offering.


Customer
Upper Management
Management
Cleaning staff
Application
Emily
Sales department
Cleaning system
IT System
Customer support
2nd part distributor
Customer
2nd part installer
Installer
Start
End
Buy TVC
Send equipment data
Cancel system
Get benefits presented
Present for upper management
Get contacted about scaling
Analyze performance
Provide performance analysis
Check dust
Display sensor data
Display cleaning plan
Create cleaning plan
Do online training
Get walkthrough
Perform online training
Get new user
Create user
Get hardware needed
Install hardware
Receive hardware
Receive preconfigured hardware
Wait hardware
Wait preconfigured hardware
All service teams ready
Check installation
Any placements left
Pay for system
Choose installation date
Choose sensor plan
Check?
Set contacted
Contact customer
Receive order
Receive installation option
Handle payment
Notify distributor
Notify installer
Provide installation support
Activate user
Request information about new user
Request dust payload
Present business case
Reconnect with customer for scaling
Set TVC
Activate TVC
Cancel system
Send order
Notify installers
Pack order
Pre-configure order
Receive hardware
Pack installation
Perform installation


Customer
Upper Management
Management
Cleaning staff
Application
Entity
Sales department
Ordering system
IT System
Customer support
3rd part distributor
Distributor
3rd part installer
Installer
Start
Get contacted
Order?
Yes
No
End
Choose sensor option
Pay for system
Await hardware
Recieve hardware
Get hardware installed
Get new user
Get walkthrough
Do online training
Create cleaning plan
Display cleaning plan
Display sensor data
Clean based on need
Provide performance analysis
Get contacted about scaling
Get benefits presented
Scale up
Cancel system
Buy TVC
Send equipment back
Contact customer
Recieve order
Place order
Handle payment
Notify distributor
Notify installer
Activate user
Recieve information about new user
Await test period
Control convenience
Analyze performance
Reconnect with customer for scaling
Present business case
Sell TVC
Recieve information
Pack order
Notify installers
Send order
Plan installation
Perform installation
Perform Walkthrough


Customer
Upper Management
Management
Cleaning staff
Application
Entity
Sales department
Cleaning system
IT System
Customer support
3rd part distributor
Distributor
Start
Get contacted
Choose sensor type
Pay for system
Receive purchased hardware
Install hardware
Create user
Perform video training
Do some training
Create cleaning plan
Display cleaning plan
Display sensor data
Clean layout on bed
Provide performance analysis
Analyze performance
Present case for upper management
Get benefits presented
Get contacted about scaling
Buy TVC
End
Cancel system
Lost payment data
Contact customer
Receive order
Handle payment
Notify distributor
Receive information about new user
Activate user
Provide installation support
Reconnect installation for scaling
Scale up
Cancel system
Sell TVC
Receive information
Pre-configure order
Pack order
Send order

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