Faculty of Engineering, LTH

# The Business Impact of Internet of Things

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# Preface

This master thesis was conducted during spring 2016 in collaboration with ASSA ABLOY Entrance systems. The master thesis represents the completion of our Master of Science in Industrial Engineering and Management at the Faculty of Engineering (LTH), Lund University. It has given us the opportunity to apply a large part of the knowledge that we have gained during our five years at LTH.

Throughout the semester we have gained many valuable insights. We have gained knowledge about the manufacturing industry, and we have increased our understanding of the relations between theory and practice. But, maybe one of the most valuable insights for the next coming years, is the learnings related to the working life.

We are grateful for this experience, and would therefore like to thank ASSA ABLOY Entrance Systems for giving us the opportunity to conduct our master thesis in cooperation with them. We would especially like to thank our supervisor at ASSA ABLOY Entrance Systems, Mats Nordén, for the great collaboration and useful insights. Special thanks also go to Kudret Kahraman, who has been giving us great support throughout our work. We would also like to acknowledge all interviewees at ASSA ABLOY Entrance Systems, who have helped us in gaining knowledge about the company and contributed with other useful insights during the process.

Furthermore, we would like to thank Ola Alexanderson, our supervisor at LTH, for his support, guidance and feedback during the work. We would also like to acknowledge our opponent Alexandra Wikström, who has critically evaluated our work and assured the quality of our master thesis. Last but not least we would like to thank family and friends who have been supporting us throughout the entire process.

Lund, June 2016

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# Abstract


**Title** The Business Impact of Internet of Things

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**Problem Description** Both academic researches and consulting firms claim that Internet of Things will come to change the society we live in, as well as create entirely new business opportunities for companies. However, there is little research that analyzes the actual benefits with Internet of Things, how companies should act in order to find these benefits, and in what way their business models must be adjusted to fit in the new era of Internet of Things.

This thesis aims to fil that gap. An empirical study, with the aim to identify, concretize and estimate the potential of Internet of Things in a business context, has been conducted. More specifically, the thesis identifies how a technology-based manufacturing firm with a service business can capture value from implementing Internet of Things.

**Purpose** The purpose of this thesis is to investigate whether Internet of Things will change existing business models of technology-based manufacturing firms with a service business. The study also aims at examining how three parts of the Business Model Canvas – *Cost Structure, Value Proposition and Revenue Streams* – will be affected by Internet of Things.

**Delimitations** This study focuses on Internet of Things in a business context, with a focus on service business, i.e. how manufacturing firms should act in order to capture value from Internet of Things. The study might touch but will not focus on technology, system integration, security, patents, infrastructure and marketing.

**Methodology** This study mainly has an exploratory research approach, where an embedded case study of ASSA ABLOY Entrance Systems (AAES) has been performed. A literature study, qualitative interviews with employees and one customer interview have been conducted. Quantitative data in terms of statistics of service history has also been analyzed. The Business Model Canvas (BMC) has been used as a theoretical framework, with a focus on the three parts: Cost Structure, Value Proposition and Revenue Streams.

The research questions have been answered and recommendations have been given to AAES about how to exploit value from Internet of Things. Future research as well as academic contribution have been discussed.

**Conclusion** Internet of Things does not necessary change the business model of a firm, it rather triggers a transformation. Manufacturing firms need to transform their business models in order to stay viable in an Internet of Things context over the long term.

This master thesis has proved a cost savings potential of 11-17 % per year and customer when introducing Internet of Things in the service business of a manufacturing firm. The cost savings arise from the possibility to eliminate certain service visits. Internet of Things can also enable new ways to deliver value to customers, for example through maximizing uptime of equipment or creating customized solutions. Finally the thesis has showed that the introduction of Internet of Things brings a large focus on basing prices on value instead of costs.

**Keywords** Internet of Things, Business Model, Cost Structure, Value Proposition, Revenue Streams, Servitization, Lean Service, Pricing Strategy

# List of Definitions

| | |
|---|---|
| Internet of Things (IoT) | IoT includes software and hardware that enable physical objects to be wireless connected to the Internet, which in turn enables the objects to communicate with each other or with people. The online connection makes it possible for the objects to exchange and collect data, or to be controlled remotely. |
| Big Data | The gathering, management and analysis of large amounts of data created by IoT. The data includes traditional data, social data and data generated from machines and sensors. |
| Business Model | A business model describes how an organization creates and delivers value to its customers and how the organization manages incomes and costs. The business model thus describes how business activities are organized. |
| Business Model Canvas (BMC) | The BMC is a strategic management tool used for helping firms to develop their business models. The BMC consists of nine building blocks: customer segments, value proposition, channels, customer relationships, revenue streams, key resources, key activities, key partnerships and cost structure. |
| Preventive versus Predictive Maintenance | Preventive maintenance is carried out at regular intervals, with the aim of avoiding failures of equipment in the future. An example of a preventive measure is changing parts before they break. |

Predictive maintenance is also planned in advance, but the maintenance is based on monitoring the actual condition of equipment and predict upcoming failures. Only necessary maintenance is conducted when needed.

Reactive vs Proactive Service

Reactive service is performed when breakdowns of equipment occur. Proactive service on the other hand includes all types of service that are planned in advance, i.e. preventive and predictive maintenance. The purpose is to prevent failures of equipment and hence reduce the occurrence of reactive service visits or transform reactive visits to proactive visits.

Servitization

Servitization refers to the sale of integrated combinations of goods and services in order to meet customer needs and deliver benefits. Servitization constitutes an opportunity to create customized solutions and to differentiate from competitors.

# Table of Content

# 1 Introduction

*This chapter begins with an introduction to the subject, followed by a description of the background and the problem definition of the master thesis. Thereafter, the purpose, research questions and delimitations are described. The chapter is concluded by an overview of the disposal of the thesis.*

During the last years a new technological change has started to emerge: the Internet of Things. The phenomenon has received much attention and many experts, researchers and consulting firms have engaged in the debate about the future of IoT. Many consulting firms have published white papers about the subject, where they claim that IoT has the potential to fundamentally disrupt the way we live and work (Verizon 2015). IoT is said to be able to transform industry structures and the basis of competition, as well as offering companies completely new opportunities to create and capture value, and change the way the company operates (Heppelman & Porter 2014). However, the statements of the consulting firms should be referred to with caution, since there is, in all probability, a selling motive behind the published material.

Moving on to the academic research, the studies of IoT are little less dramatic. The published academic material on IoT states that IoT is generating a new technological change, which will open up for many new business opportunities in various areas. It is also mentioned that companies need to mobilize and change their business models in order to stay competitive in the era of IoT (Dijkman, Sprenkels, Peeters & Janssen 2015). The following section starts with a definition and explanation of the concept of IoT. Thereafter follows a review of opportunities and challenges emerging with IoT. Lastly a set of success factors, i.e. factors necessary for companies to succeed with IoT, are described.

## 1.1 Background

### 1.1.1 Definition of IoT

Internet of Things is a term that emerged more than ten years ago, but it was not until 2005, when ITU (United Nations' specialized agency for information and communication technologies) published the first report on the subject, that IoT started to receive attention (Glova, Sabol & Vajda 2014).

There are many definitions of IoT, but ITU and IERC (European Research Cluster on the Internet of Things) choose to define it as following: "The Internet of Things is a dynamic global network infrastructure with self-configuring capabilities based on standard and interoperable communication protocols where physical and virtual "things" have identities, physical attributes and virtual personalities, use intelligent interfaces and are seamlessly integrated into the information network" (Vermesan & Friess 2014). Barquet et al (2016) explain that IoT includes software and hardware that makes it possible for objects to communicate and interact with each other. In an article of Glova, Sabol & Vajda (2014), the authors describe that IoT enables online communication not just between things themselves, but also between people and things. This communication is enabled by embedded smart wireless sensors and identification technologies (Glova, Sabol & Vajda 2014). Things and objects are thus equipped with tags, radiofrequency identification, actuators, sensors and more, which enable the objects to collect and exchange data (Barquet et al 2016).

IoT comprises smart, connected products, which according to Heppelman & Porter have three core elements. The first one is physical components which include mechanical and electrical parts. Smart, connected products also contain smart components such as sensors, microprocessors, data storage, controls, software, an embedded operating system and enhanced user interface. Finally, the products contain connectivity components, which makes it possible for the products to connect to other products, the user or the manufacturer. Connectivity components generally consist of ports, antennas and protocols that enable wireless or wired connections (Heppelman & Porter 2014).

Verizon, a consulting firm within innovative communications and technology solutions and services, claims that the concept of IoT could be demonstrated by the "Three As": Aware, Autonomous and Actionable.

With Aware, Verizon means that the connected product must be able to sense something about its surroundings, such as temperature, vibration or motion. Autonomous means that the data gathered from connected assets have to be transmitted to a central location automatically. The transfer can occur at regular periods in time, or when a certain condition is met. Actionable concerns the value of IoT; the gathered data has to be used in order to make better decisions. After analyzing the data, it has to be integrated into the business processes of the company (Verizon 2015).

### 1.1.2 The Potential of IoT

Many consulting firms and experts have tried to predict the future market potential of IoT. In April 2014 Cisco estimated that 12.1 billion units were connected to the Internet, a number which, at that time, was forecasted to reach more than 50 billion by 2020 (Greengard, cited in Koutonen 2015). Another estimation comes from Verizon, who has forecasted that the installed base of IoT units would grow from 9.7 billion in 2014 to more than 25.6 billion in 2019, and thereafter reaching 30 billion in 2020 (Verizon 2016).

If the number of connected devices grows in accordance with the predictions of consultants and experts, IoT could also, according to the same sources, bring large economic potential. According to Bradley, Barbier, and Handler IoT could generate $14.4 trillion in value between 2013 and 2022 as a result of increased revenues and lower costs among companies (Lee & Lee 2015). In a report published by IERC in 2014, it was forecasted that IoT product and service suppliers would generate more than $300 billion, resulting mostly from services, in 2020 (IERC 2014). Last but not least, Verizon estimated the value of the IoT market in a report from 2015. In their report they claimed that the IoT market spend would rise from $592 billion in 2014 to $1.3 trillion in 2019 (Verizon 2016). To conclude, most studies show that the economic potential of IoT is large, but the estimations vary in size.

### 1.1.3 Big Data

One of the building blocks of IoT is the gathering, management and analysis of large amounts of data, so called Big Data. Types of data that are often referred to as Big Data are traditional data, social data and data generated by machines or sensors (Opresnik & Taisch 2015).

Although Big Data brings many challenges in terms of data management, there are also many benefits that could be exploited. Capturing and extracting value of the collected data is crucial for companies to gain competitive advantage (Heppelman & Porter 2015). Davenport explains that the utilization of Big Data could lead to cost reductions, decision improvements and products and service improvements. Better decisions arise from the fact that Big Data encourages data and fact-driven decisions instead of decisions based on intuition. When it comes to product and service development Big Data could help companies in providing insights about customer behaviors and what factors that are driving customer value (Davenport 2014).

### 1.1.4 Business Opportunities Arising from IoT

Both academic researchers and consulting firms have indicated that there are an enormous amount of business opportunities, within various areas, emerging from IoT. The consulting firms are very positive about the future and claim that almost everything is possible with the introduction of IoT. According to McKinsey and Accenture there are primarily two types of opportunities arising from IoT. The first one relates to the fact that IoT can transform business processes and improve operating efficiency, which includes e.g. predictive maintenance, better asset utilization and higher productivity. The second one is the enabling of new business models and creating new sources of revenue, for example offering anything-as-a-service (McKinsey 2015, Accenture 2015).

Lee & Lee (2015) identify three areas in which IoT could be applied in companies, and thereby create customer value. The first one is monitoring and control, where the primary objective is considered to be collection of data concerning equipment performance. The second one is related to Big Data and business analytics, which means that products connected to the Internet generate large amounts of data, that later can be analyzed and used as decision basis. The third application area is related to information sharing and collaboration between things, between people and between people and things (Lee & Lee 2015).

Heppelman & Porter (2014) extend this reasoning by describing that connected products can create four new, unique product capabilities. In accordance with Lee & Lee they confirm that monitoring will become the first large opportunity, since it leads to insights about product performance and usage. They also point out that control operations, i.e. accessing product operations remotely, will be of great importance. Combining monitoring and controlling can in turn facilitate two new functions: optimization, e.g. improvement of product performance, and autonomy, e.g. the fact that products can adapt to user preferences or service themselves (Heppelman & Porter 2014).

All new applications enabled by IoT will come to change the way products and services are bundled, marketed and distributed (Glova, Sabol & Vajda 2014). Several consulting firms argue that manufacturing firms are already using, and will in the future use IoT technology to shift from selling products to selling service, for instance through offering "as-a-service" approach (McKinsey 2015, Accenture 2015). In the new service model, manufacturing companies can ensure a certain level of machinery uptime by providing remote monitoring and predictive maintenance. By gathering data on usage patterns it would also be possible to anticipate emerging needs of the customers and develop new functions and features based on the gathered data (McKinsey 2015). As companies move from selling products towards selling service, the type of relationship with customers also change. The relationships become more constant and open-ended (Heppelman & Porter 2015).

In an article of Heppelman & Porter (2015) the authors describe that smart, connected products can bring opportunities in basically all functions of a company: product development, manufacturing, logistics, marketing and sales, after-sale service, security and human resources. In the process of product development, IoT can for instance enable new user interfaces, connected service, ongoing quality management and low-cost variability where varying customer needs are satisfied through software. In manufacturing IoT technology could automate and optimize production through networked machines, as well as enabling configuration of products after the products have left the factory. Within marketing and sales, IoT changes focus from selling a physical product to maximizing customer value over time, through delivering continual value to the customer (Heppelman & Porter 2015).

Regarding after-sale service, smart connected products can transform reactive service into proactive service, for instance through remote maintenance, where products can be diagnosed and repaired without a physical visit at customer's site. Another type of proactive service is predictive maintenance, where problems can be detected and solved before a breakdown occurs (Heppelman & Porter 2015). This reasoning is in line with the one of McKinsey and Accenture, who contends that companies can prioritize and optimize maintenance resources, and thereby save costs, by introducing smart technology and detecting early signs of failure (McKinsey 2015, Accenture 2015). After-sale service could also include giving advice to the customers about how to use their equipment as efficiently as possible, based on usage data (Heppelman & Porter 2015).

Markendahl & Laya (2015) claim that the largest target group for IoT applications is businesses, and not end consumers. The groups of companies that can benefit the most from by introducing connected products are product manufacturers and service suppliers (Markendahl & Laya 2013). Lee & Lee (2015) also confirm that the manufacturing industry is the industry where IoT will generate most economic value the next coming years. However, IoT technology can be applied in various industries and there are already many examples of applications that have been realized. In the health sector, IoT technology could enable remote health management, care at home and managing life-style related diseases. Within the facility management sector examples include smart homes, energy management and increasing security levels (IERC 2015a). Within the agricultural sector, smart applications could help farmers plan sowing and harvest based on e.g. weather forecasts (IERC 2015b). However, these are just a few examples of applications; there are many more, and new applications are emerging continuously.

**Different Types of Maintenance**

There are three main types of maintenance: reactive, preventive and predictive. Reactive maintenance is performed only when breakdowns of equipment occur, and thus not planned in advance (Aboelmaged 2015). Typical reactive maintenance activities are repair and replacement of equipment (Swanson 2001). Preventive maintenance on the other hand are carried out at regular intervals, with the aim of avoiding failures in the future. The regularity of preventive maintenance visits are determined based on for example failure patterns, expected life span on equipment or after a certain period of time (Aboelmaged 2015). Examples of preventive measures are changing spare parts before they break (Kans & Ingwald 2015).

The third type of maintenance, predictive, is based on monitoring the condition of equipment, predict upcoming failures and take actions depending on the degree of deterioration (Kans & Ingwald 2015). The possibility to exploit predictive maintenance is increasing with the development of new technology. By using technology it is feasible to gather data on a set of pre-determined parameters e.g. vibrations, temperature and pressure. When critical levels of the parameters are reached, appropriate maintenance activities can be undertaken (Ungureanu & Ungureanu 2015). In this way only necessary maintenance is conducted on a planned basis (Aboelmaged 2015). There are several advantages with predictive maintenance, for instance the opportunity to eliminate occasional breakdowns of equipment, which in turn can lead to an uninterrupted working condition. Maintenance intervention is thus done before the predicted time of a breakdown (Ungureanu & Ungureanu 2015).

Hereafter preventive and predictive maintenance will be grouped into proactive maintenance, since both types aim to eliminate the occurrence of breakdowns and maximize uptime of equipment.

### 1.1.5 Challenges with IoT

Although there is a huge amount of opportunities arising from exploiting IoT, both academic researchers and consulting firms agree that there are also many barriers to overcome in order to succeed. One of the biggest challenges with IoT and Big Data is how to derive value from collected information and create new viable product-service offerings. Despite the hype around IoT, few companies have been capable of successfully generate business value from the information generated from IoT (Opresnik & Taisch 2015). According to Dijkman et al (2015) traditional business models will not be applicable to IoT and therefore a transformation of companies' business models will be required. If companies do not adapt their ways of doing business to the conditions of the new technological change, other actors will emerge and take over the activities (Markendahl & Laya 2013).

One of the difficulties with developing new business models is that IoT opens up for complex value constellations and almost requires an integration of products and services as well as creation of new partnerships. The traditional provider-customer model is not applicable anymore (Markendahl & Laya 2013). Instead a network structure with modified roles of the different actors is necessary (Andersson & Mattson 2015). Another challenge related to business models is the customers' unwillingness to pay. Traditionally the customers are accustomed to one-time payments, where they take over the ownership of a physical product in return for a fixed price. However, with the rise of IoT, the customers will be exposed to an additional bill in terms of connectivity, a functionality that many customers might do not want to pay for (Forbes 2013, Heppelman & Porter 2014).

Another challenge that is highly relevant in the case of IoT is the management of security and privacy risks. Remote access brings for example an increased risk of IT attacks, since existing components do not support modern security controls (Cisco 2015). Data management might also become a challenge for many companies, since IoT brings a large amount of data that need to be both stored and managed (Lee & Lee 2015). Last but not least, Heppelman & Porter warn that many companies are not yet ready to make the organizational transformation required to succeed with IoT. One large risk with IoT is that companies wait too long to get started, and overestimate their own internal capabilities. There is also a risk of failing to foresee potential competitive threats (Heppelman & Porter 2014).

### 1.1.6 Factors Needed to Succeed with IoT

In order for companies to deal with the challenges of IoT and instead succeed with the exploitation, there are many different kinds of measures that can be taken. In the existing literature, as well as in recommendations from consulting firms, different kinds of success factors are described. The success factors are related to areas ranging from technology and business to users and social aspects (Vermesan & Friess 2014).

First and foremost, a viable IoT technology and infrastructure is a prerequisite for creating successful IoT offerings. In order to capture optimal value from smart, connected products a completely new technology infrastructure is necessary. This infrastructure includes several layers, including technology for products, connectivity and the product cloud. The products must be equipped with both new hardware, such as embedded sensors and a connectivity port, and new software, such as an embedded operating system and an enhanced user interface. The connectivity technology includes network communication that establishes communication between the product and the cloud. The product cloud comprises for instance software applications that can manage monitoring and control of product functions, a product database that can handle large amounts of data and an analytics engine with Big Data analytical capabilities (Heppelman & Porter 2014). McKinsey mentions that one important aspect that spans over all types of technology is interoperability, which means standardization of technology and ability to integrate across technology providers. Interoperability is necessary in order to share information between IoT systems (McKinsey 2015).

Since traditional business models will not be applicable to IoT, Markendahl & Laya (2013) emphasize that companies will have to completely remake their existing business model and create new ways to capture value in the technological shift. Heppelman & Porter explains that companies will need to reconsider their core business, for example through moving towards a product-as-a-service business model (Heppelman & Porter 2015). The utilization of business models in connection to IoT has several advantages. Firstly, it helps companies to be better prepared for understanding the challenges with IoT and sharing this knowledge with stakeholders. Secondly, using business models can facilitate change since the different parts can easily be modified and adjusted to the surrounding circumstances.

Finally, the business model can facilitate the alignment of technology development and economic value creation (Glova, Sabol & Vajda 2014). Companies that are capable to adjust their business models to leverage the data generated by IoT will gain considerable competitive advantage compared to companies that do not succeed with that (Muhtaroglu et al 2013).

Several authors stress the importance of customer focus when developing a new value offering within IoT. Claropartners, a consulting firm that helps companies with managing disruptive shifts, highlights that the offer must meet real human needs and create new value to the users. Perceived challenges among the users, and not technology, should be the foundation of the new value offering (Claropartners 2014). This is aligned with the reasoning of Vermesan & Friess (2014), who explain that product development should be based on user needs.

An unavoidable challenge with IoT is security and confidentiality risks, which force companies to develop measures to cope with it. Companies should acquire robust IoT technology that guarantees a secure environment regarding privacy of users, integrity, data transfer confidentiality and communication (Borgia 2014). Cisco (2015) suggests several measures to minimize security risks regarding controlling remote access points. Examples include changing default passwords, logging all access and avoiding shared accounts. McKinsey (2015) brings up the issue of intellectual property rights and patents to manage the risk of imitating products and services. They also mention the importance of establishing trust with customers when it comes do data collection and sharing (McKinsey 2015).

As mentioned earlier, one big challenge with IoT is organizational transformation. The literature brings up several organizational implications for manufacturing firms that aims to succeed with IoT. For example, increased collaboration between different divisions in the company is to prefer, since there will emerge a need to coordinate product design, service improvement and cloud operation. A specific example is the need of stronger collaboration between R&D and IT departments. As the development of IoT moves forward, new critical functions that have not existed before, also appears. Examples of such functions are customer success management and data management. An idea suggested by Heppelman & Porter is to develop a stand-alone business unit whose primary task is to work with IoT and coordinate other departments within the area of IoT (Heppelman & Porter 2015). Another critical factor to succeed is to acquire the right competence.

Skills within data science and software development become increasingly important (Accenture 2015), and expertise within data analytics will become a competitive advantage (Heppelman & Porter 2015).

Several consulting firms and academic researchers claim that a crucial factor for realizing the business potential in IoT is to analyze a company's business system and stakeholders in order to find the right business partners (Accenture 2015, Glova, Sabol & Vajda 2014). As the development of IoT solutions increases, many firms move from building internal competence to growing partnerships (Hui 2014). Except gaining access to the right knowledge, collaborating with stakeholders also could spur the creation of interconnected services, experiences and business models. This could in turn facilitate interoperability (Claropartners 2014, McKinsey 2015). Claropartners (2014) gives the advice to not develop a product that is isolated from the rest of the ecosystem, instead it is recommended to see one company's products and services as a part of a broader system. Lastly, Borgia (2014) has summarized some factors that are critical to extract value from IoT. One of them is scalability, which means enabling large-scale adoption. Other examples are heterogeneity, i.e. managing a variety of devices and technology, and cost minimization, which means optimization of operational costs (Borgia 2014).

## 1.2 Problem Description

Both academic researches and consulting firms claim that IoT will come to change the society we live in, as well as creating entirely new business opportunities for companies. However, there is little research that analyzes the actual benefits with IoT, how companies should act in order to find these benefits, and in what way their business models must be adjusted to fit in the new era of IoT.

Existing studies on IoT are more focused on technology, whereas few can be found regarding IoT's affection on marketing and management (Andersson & Mattson 2015). Many companies are introducing IoT in their businesses right now and there are some companies that have created new products and services with the aid of IoT. However, the area of IoT is still very secretive and unfamiliar, and studies of how the companies have done and whether and why they have been successful or not seem to be missing.

This study aims to fill that gap. An empirical study, with the aim to identify, concretize and estimate the potential of IoT in a business context has been conducted. More specifically, the study will look at how a technology-based manufacturing firm with a service business can capture value from implementing IoT.

## 1.3 Purpose and Research Questions

The purpose of this study is to identify how the business model of technology-based manufacturing firms with a service business can come to change with the introduction of IoT.

More specifically, the study aims to answer the following questions:

- ***Will*** *IoT change the current business models of technology-based manufacturing firms with a service business?*

- ***How*** *could IoT affect existing business models within technology-based manufacturing firms with a service business? More specifically:*
    - How could IoT affect the **cost structure**?
    - How could IoT affect the **value proposition**?
    - How could IoT affect **revenue streams**?

## 1.4 Delimitations

This study focuses on IoT in a business context, i.e. how manufacturing firms should act in order to capture the new value created by IoT. The starting-point is business models with service business as a focus area. The study will hence not dig deeper into following aspects:

- Technology
  It is assumed that the required IoT technology is existing. Therefore the study will not dig deeper into the technology behind IoT, including technological development, difficulties or challenges.
- System integration
  Solutions for integrating different types of connected devices, e.g. home appliances and ventilation, will not be analyzed.

- Reliability
  Whether the technology and Internet connection in IoT solutions can be regarded as reliable or not, will not be discussed.
- Security
  Security challenges such as protection against hackers or product safety will not be investigated.
- Patents
  The legal issue of patents will not be considered.
- Infrastructure
  Discussions related to IoT infrastructure will be excluded.
- Marketing
  The study will contain investigations about how the offer of manufacturing firms changes with the introduction of IoT. However, development of concrete offers and marketing campaigns are excluded.

Delimitations made related to the specific case of ASSA ABLOY Entrance Systems are discussed in *Chapter 5*.

## 1.5 Disposal of the Thesis

This section describes the disposal of the report, to show an overview of the master thesis. An overview of the disposal can be seen in *Figure 1* below.

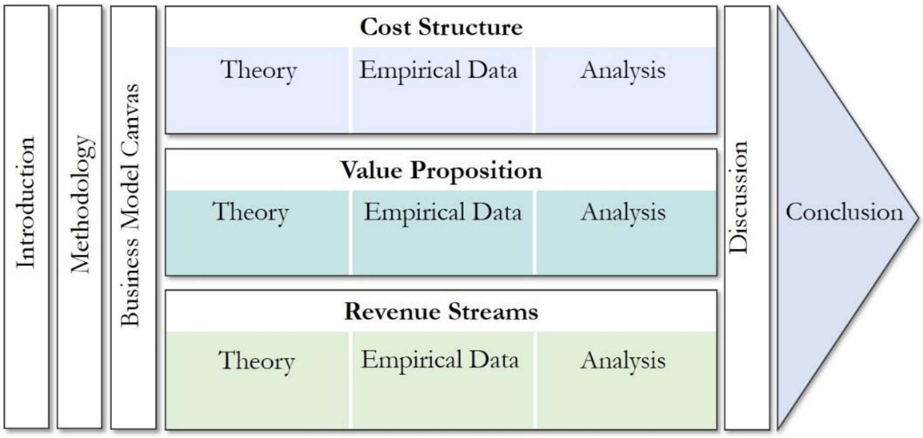


**Figure 1** An overview of the disposal of the thesis

After the introduction chapter, a description of the methodology will follow. Thereafter the theoretical framework, where the findings from the literature review are presented. The Theory chapter is divided into three main parts, which correspond to the chosen building blocks of the Business Model Canvas: Cost Structure, Value Proposition and Revenue Streams. The three parts will be present throughout the whole report, since they are creating the foundation of the work.

The Theory chapter is followed by an introduction to ASSA ABLOY Entrance Systems (AAES). Thereafter, a detailed investigation of AAES' current Cost Structure, Value Proposition and Revenue Streams are presented. The investigation is based on the empirical data gathered through the previously described methods for data collection. Each part of the investigation is followed by an analysis, including application of related theory. Consequently, the main part of the report consists of an integrated chapter including both results and analysis of Cost Structure, Value proposition and Revenue Streams. Subsequently there is an overall discussion, interweaving the analyses from the three different parts. The report is finished by a conclusion, a description of academic contribution and suggestions for future research.

# 2 Methodology

*This section describes the methodology used throughout the project. First the work process is described, including which steps that have been taken and what decisions that have been made. Thereafter follows a section describing credibility.*

## 2.1 Work Process

The work process of this master thesis can be divided into five main steps, following a linear approach. It should be noted that the five steps represent the general work process, implying that some activities within different steps might have been performed in parallel.

The five main steps can be seen in *Figure 2* and will be described below.

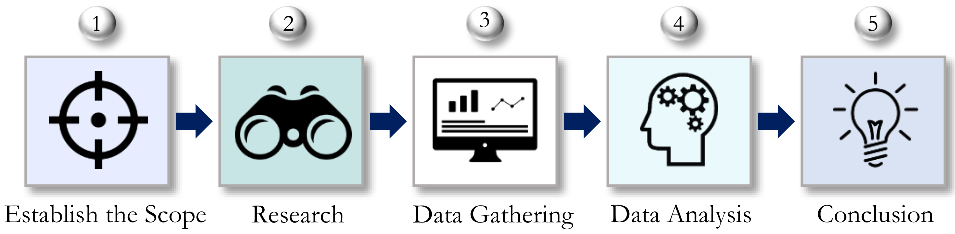


**Figure 2** An overview of the work process

### 2.1.1 Establishing the Scope

The first step started with an exploration of the subject, which was followed by establishing the structure of the work. This included setting the scope of the project, i.e. formulating the purpose and research questions, and creating a project plan. The purpose and research questions were determined in dialogue with the supervisor at LTH and the supervisor at AAES.

The research approach and research strategy were determined based on the purpose of the thesis. Both of them are described below.

#### 2.1.1.1 Research Approach

The research approach of this study is exploratory, with elements of descriptive. The descriptive approach has been used in the beginning of the work, in order to understand and describe the subject before moving on to data collection. The main research approach, however, is exploratory since the aim of the work has been to search for new insights and to investigate the rather unexplored area of IoT. The exploratory approach of the research implies that the focus of the master thesis was initially broad and became narrower as the work progressed (Saunders et al 2007). The direction of the work hence changed as new information and insights appeared (Saunders et al 2007). In this work, this method took the form of starting broadly by investigating general business opportunities with IoT. Thereafter, as the work progressed, specific opportunities for manufacturing firms, especially for the case company, were identified. Specific parts of a business model and how they will come to change with the introduction of IoT, were investigated. Lastly, since the subject of this work is relatively new, this work provides guidelines for further studies.

#### 2.1.1.2 Research Strategy

Depending on which research approach that is chosen, different research strategies, i.e. how empirical data is collected and analyzed, are used. A case study is suitable when conducting an exploratory study, when the explored situation does not have a clear outcome (Höst, Regnell & Runesson 2006). By using a case study it is possible to receive a deep understanding of the research situation and the processes that take place within it. In this work an embedded case study has been conducted. An embedded case study comprises several units of analyses. The case study first examines an organization as a whole, and thereafter analyzes logical sub-units within the organization (Saunders et al 2007). In this work, the company AAES constituted the main case, whereas three of AAES' Key Account were investigated in more detail. The reason for choosing more than one customer was to search for similarities and differences between the cases, which could help to draw conclusions about generalization. Due to confidentiality reasons the key account customers are called Key Account 1 (KA1), Key Account 2 (KA2) and Key Account 3 (KA3).

The three Key Accounts were chosen based on the following common characteristics:

- They are from the same European country, hereafter called Country A
- They are all nationally presented Key Accounts
- They belong to the retail segment
- All doors of the Key Accounts are under AAES' Gold contracts and they have no doors under competitors' service contracts. Gold contract is a type of all-inclusive service contract which will be described in more detail in Service contract section.
- They have a good relation to the National Accounts Manager in Country A

The reason for choosing customers in Country A is that customers in that country generally has shown an interest in innovative solutions such as IoT. Another argument for choosing Country A is that data has been accessible, which has not been the case for several other countries. One more reason is that Country A has a high share of Gold contracts, with approximately 50 percent of the service contracts being Gold contracts.

### 2.1.2 Research

The purpose of the second step was to explore the literature and establishing the theoretical framework, as well as exploring the case company.

#### 2.1.2.1 Literature Study

A literature study was conducted in order to achieve an in-depth understanding of the subject, and to investigate previously performed studies on IoT. Different types of sources were used. Except academic articles, journals and books, white papers published by consulting firms as well as websites were also explored. The business perspective on IoT is such a new and unexplored area, which means that the academic research on the subject is still incomplete. Although the literature study was focused to the first weeks of the project, there has been a continuous search for new literature as the work has been progressing. This is due to the reason that IoT is such a new area, and that new articles on the subject are published regularly.

The sources that were utilized when searching for literature were the following:

- LUB Search: Lund University's shared search engine for academic publications, journals, and articles.
- Google Scholar: Google's web search engine for academic journals, books, articles etcetera.
- Web sites of consulting firms
- Books

In this work the Business Model Canvas (BMC) is used as a theoretical frame of reference. More specifically, the work is delimited to three parts of the BMC: Value Proposition, Cost Structure and Revenue Streams. Each part has been investigated in more detail, resulting in specific theoretical models for each part. In addition, general information about IoT, business opportunities, success factors and barriers have been searched for. The current situation of the case company has been analyzed by a comparison with the literature. The literature has also been applied to the area of IoT with the aim to investigate how an implementation of IoT will affect the case company. The results of the literature study can be found in the *Chapter 3*.

#### 2.1.2.2 Exploration of the Case Company

The purpose with the investigation of the case company was to understand the organization, the business and processes in general. Information about the case company was collected through various sources, such as the company's internal and external websites, sales and marketing materials and interviews with employees. The result of the case company investigation can be found in *Chapter 4*.

### 2.1.3 Data Gathering

The third step constitutes the data collection part. In order to get a comprehensive picture of the situation, a case study is recommended to include different data collection techniques and multiple data sources. Preferably both quantitative and qualitative data should be collected. Quantitative data refers to numerical data, which can be collected through for example questionnaires. Qualitative data on the other hand refers to non-numerical data that cannot be measured. It can be collected through e.g. interviews.

More specifically, data collection methods that are appropriate for a case study are interviews, observations, documentary analyses and questionnaires (Saunders et al 2006).

In this work, mainly three types of data collection methods have been used. Qualitative methods include interviews with employees at AAES as well as one customer interview. The quantitative methods is represented by collection of statistics on service history. The information extracted from these three sources has been complemented by information gathered from websites and internal documents of AAES.

#### 2.1.3.1 Interviews with Employees at AAES

Interviews with around 20 employees at AAES were conducted to understand the business and the organization, and too see what have been done so far within the area of IoT. By interviewing employees a deep understanding of the three chosen parts of the BMC, Cost Structure, Value Proposition and Revenues Streams in relation to AAES, could be achieved. Another purpose of the interviews was to get an understanding of customers' needs and wishes, both in general and when it comes to IoT, since many employees have had some contact with customers themselves.

The employees that were interviewed work within different areas of the company, such as R&D, service business, marketing and sales. They also work in different countries, in this report called Country A, Country B and Country C. Even if the majority of this master thesis is focused on Country A, both in the Cost Structure, Value Proposition and Revenue Streams sections, employees from Country B and C were also interviewed. The reason is that it in general has been difficult to collect information about customers' needs and wishes. However, in Country B and C, the sales people have had some discussions with customers about IoT and demands in general, which was one reason for including these countries. Country B is a European country, while country C is a North American country. A complete list of the interviewed employees can be found in *Appendix D*.

The interviews have been both of semi-structured and unstructured character. At almost every interview, both of the two authors have been present. One of the authors has been main responsible for asking questions, while the other has been taking notes. Most of the interviews were personal meetings.

However, when the interviewees were located in other countries, the interviews were conducted over telephone or video conference call.

Most of the interviews with employees at AAES were held during the first half of the project. However, the authors have constantly been in contact with several employees in order to receive the latest and updated information about the progress of IoT projects.

#### 2.1.3.2 Statistics of Service History

In the Cost Structure section of the thesis, the aim has been to quantify potential cost savings that IoT can bring. In order to achieve that, quantitative data has been collected. The quantitative data consist of statistics of service history of the three Key Accounts, KA1, KA2 and KA3. The statistics were presented in Excel and included information such as service order numbers, and travelling and working time for service technicians.

#### 2.1.3.3 Customer Interview

In order to get an understanding of customer needs and wishes in relation to IoT in the Value Proposition and Revenue Streams sections, one interview with a Key Account, KA2, in Country A was conducted. The Key Account was selected based on the previously defined scope of the project, i.e. the interviewed customer was one of the customers that were also analyzed in the Cost Structure-section. The intention was to interview all of the three Key Accounts, in order to get a comprehensive picture of both Cost Structure, Value Proposition and Revenues Streams. All of the Key Accounts were consequently given the chance to be interviewed. However, only one of them, KA2, accepted the invitation.

The reason for choosing a qualitative interview with KA2 was the aim of deeply understanding the needs and wishes of the Key Account. Instead of just discovering *whether* the customer would be interested in a new solution or not, the qualitative character of the interview could help to understand *why* the customer would be interested in a new solution or not. The qualitative character contributed with the possibility to ask open-ended questions as well as follow-up questions, which would not have been possible to the same degree with a questionnaire.

The first step of the interview process was to formulate an interview guide in consultation with the supervisor at AAES as well as other concerned employees. The interview guide started with a few introductory questions, covering e.g. explanation of the interviewee's work task. The main part consisted of specific questions about features and functions of doors, which had the purpose of examining the customer's interest in IoT solutions. Finally, some summarizing and more open questions were asked, where the interviewee had the chance to add comments or elaborate issues about the subject. The complete interview guide can be found in *Appendix C*. Before the interview was held, the interview questions were sent to the National Accounts Manager in Country A in order to secure the quality. Since the National Account Manager has regular contact with the customers and therefore knows them well, suggestions of questions to remove and refine were taken into consideration.

The second step was to actually conduct the interview. The questions were sent to the interviewee by e-mail in advance, so the interviewee would have a chance to go through the questions. After that, a telephone meeting was scheduled and the interview was conducted. The interview can be classified as semi-structured since there was a list of pre-determined questions, but they were adjusted to some degree as the interview progressed. Furthermore there were no pre-determined answering alternatives. Whether the results from the interview are applicable to in other situations, i.e. the generalizability, is discussed in the credibility section.

To summarize, the data gathered through interviews and history of service statistics are both qualitative and quantitative.

### 2.1.4 Data Analysis

After collecting data, all information was analyzed in parallel, but with different methods. Firstly, the information from the interviews with employees were interpreted. The purpose of the analysis was first and foremost to understand and compile a description of current Value Proposition, Cost Structure and Revenue Streams of AAES. Furthermore, the information was used to describe how far AAES has come within the area of IoT as well as to understand existing customer needs and wishes.

Secondly, the service statistics of the three Key Accounts were analyzed through calculations in Excel. However, before performing calculations on potential cost savings, the data had to be refined, since it contained some deficiencies.

Moreover, assumptions had to be made in order to be able to conduct calculations. The refinement of the data as well as assumptions were discussed with the National Account Manager in Country A. Thereafter, when the calculations were made, potential cost savings of IoT could be estimated. Similarities and differences between the Key Accounts were identified.

Thirdly, the results from the customer interview were analyzed. By interpreting the answers, it was concluded whether that customer shows an interest in solutions enabled by IoT or not.

All findings were constantly compared with the theoretical framework, in order to interpret the current situation at AAES, and in order to speculate on what opportunities that could potentially be captured with IoT.

### 2.1.5 Conclusion

The final step of the work process consisted in drawing conclusions and discussing the results. More specifically, it included:

- Answering the research questions
- Giving recommendations to AAES whether they should invest in IoT or not, how they could potentially do it and proposing recommendations for further investigations.
- Suggesting areas for future research
- Describing the academic contribution of the work

## 2.2 Credibility

According to Höst et al (2006) there are three important categories of credibility: reliability, validity and representativeness. Each of the terms, what they mean and how they relate to this work, are discussed below.

### 2.2.1 Validity

Validity is the extent to which a conclusion or measurement is well-grounded, i.e. the degree to which a study measures the object that it actually aims to measure (Höst et al 2006). In order to increase the validity, triangulation, i.e. the utilization of several different data collection techniques, can be used (Saunders et al 2007).

In this work, several types of data collection methods, such as literature, websites, quantitative data and interviews, have been used in order to draw general conclusions. In order to get a clear and objective picture of AAES both internal documents, websites and interviews have been used.

### 2.2.2 Reliability

The degree to which data collection techniques and analyses will result in consistent findings is called reliability. Aspects to consider when evaluating reliability is whether the measures will yield the same results on other occasions, whether similar observations will be reached by other observers and whether there is transparency in how conclusions are drawn from the data (Saunders et al 2007).

In this project, several measures have been taken in order to establish reliability. In order to get a comprehensive picture of AAES, interviews with around 20 employees within different business areas have been conducted. The large number of interviews reduces the risk of subjectivity and the risk of being influenced by certain employees' opinions. Both of the authors have been present during the interviews, which increases the likelihood of understanding the information correctly. During the interviews, the authors have strained to be as neutral as possible, not influencing the interviewees.

One issue is that the quantitative data of service statistics have been more or less reliable. There have been obvious deficiencies in the data, for example missing information and different ways of reporting information. These deficiencies have been compensated for, by identifying and sorting out obvious inaccurate data. The data has also been structured in a certain way. Further calculations would require data to be structured in the same way.

Regarding the data collected from interviews with employees at AAES, important statements have been validated after the interviews. If there has been any confusion about the collected information, the interviewees have been asked the question once again in order to eliminate possible misunderstandings.

Another measure that has been taken to ensure the reliability is the careful description of the used methodology, including delimitations, assumptions and choices that have been made. All these factors have an impact on the interpretation of the results.

### 2.2.3 Representativeness

Representativeness refers to the fact that the research results are generalizable, i.e. that the findings can be applicable to other research settings, e.g. other companies. In principle, case studies are not generalizable. In this study, only one interview with a key account of AAES has been held, and the calculations on cost savings potential have been conducted for only three key accounts. Therefore the conclusions should be drawn with carefulness.

However, if the studied context is well described, it is easier for other studies to create a similar context, which increases the likelihood for achieving similar results. Therefore, to increase the representativeness, it is of great important that a case study includes a detailed description of the context (Höst et al 2006). For that reason, this work includes a detailed description of AAES but also of the three key accounts used in the Cost Structure and Value Proposition sections. The results for the three key accounts should in all probability at least be applicable to the same type of customers within AAES, i.e. customers of similar characteristics and conditions.

# 3 Theory

*This chapter describes the frame of reference for this study. Firstly, the Business Model Canvas (BMC), including the definition of a business model, will be presented. Thereafter the theory will be limited to, and divided into three parts of the BMC: Cost Structure, Value Proposition and Revenue Streams. In each sub-chapter further theories will be discussed in order to explain and get a more deep understanding of each area. An overview of the theoretical framework can be seen in Figure 3 below.*

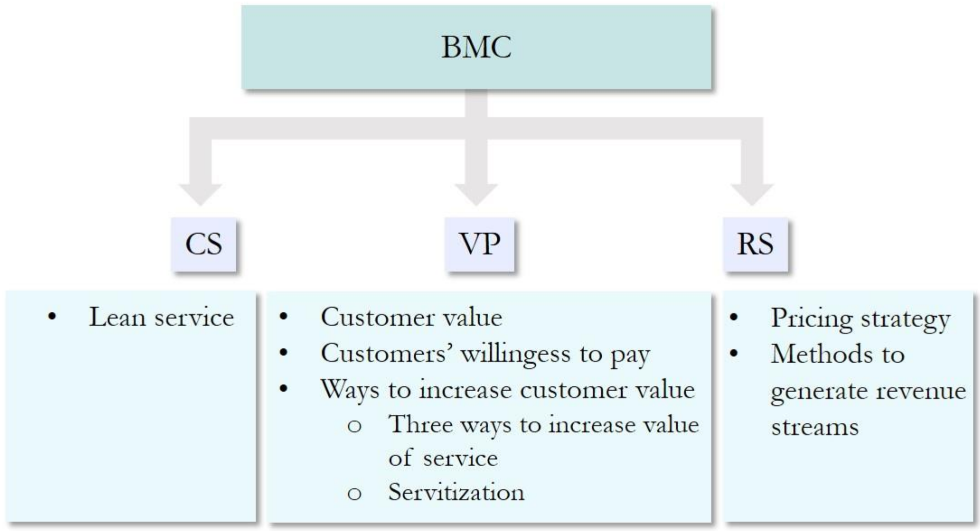


**Figure 3** An overview of the theoretical framework

## 3.1 Business Model Canvas

The Business Model Canvas (BMC) is one of the most frequently used strategic management tools. It was launched in 2010 by Osterwalder and Pigneur, who wanted to create a tool for helping firms developing their business models. The BMC uses a systematic process approach in order to analyze the customers' problems and needs, and thereafter take measures to respond to the changing customer requirements (Pisano, Pironti & Rieple 2015).

The different parts of the BMC will be described in more detail below, in order to get an understanding of the building blocks of a business model. However, before that a definition of a business model is necessary.

### 3.1.1 Definition of Business Model

There are many definitions of the term business model, but the definitions usually contain similar elements. According to Johnson, Scholes and Whittington a business model "describes how an organization manages incomes and costs through the structural arrangement of its activities". The business model thus clarifies how business activities are organized (Johnson, Scholes and Whittington 2012). On the other hand, the developers of the BMC, Osterwalder and Pigneur, choose to emphasize the value apect, by explaining the business model as "describing the rationale of how an organization creates, delivers and captures value" (Osterwalder & Pigneur 2010).

Andersson and Mattson (2015) sum up the discussion about business models by explaining that the primary function of the business model is to connect technical potential with realization of economic value. More specifically, a business model "expresses the business logic of the firm, what value the company offers to customers, and relating the concept to a business network perspective, the architecture of the network of partners" (Andersson & Mattson 2015).

To summarize, a business model is a model describing how a company can create and deliver value, as well as how revenues can be generated from that value and how related costs can be managed.

### 3.1.2 The Nine Building Blocks of Business Model Canvas

The Business Model Canvas covers four main areas of a business: customers, offer, infrastructure and financial viability. More specifically, these areas are divided into nine building blocks, which represent the most essential components of a business. The model also describes how the nine pieces fit together and may therefore be used as a blueprint when designing organizational structures, processes and systems in order to implement a strategy (Osterwalder & Pigneur 2010).

The nine building blocks are the following: customer segments, value proposition, channels, customer relationships, revenue streams, key resources, key activities, key partnerships and cost structure. Below each building block is described briefly.

1. Customer segments
   Customer segments represent the groups of people or organizations that the firm intends to address and serve. A customer segment thus comprises customers with common behaviors, common needs or other attributes.

2. Value proposition
   The value proposition summarizes why a customer should buy a product or use a service. It describes the bundle of products and/or services that creates value for a specific customer segment.

3. Channels
   The channels describe the firm's interface with the customers, i.e. how the value proposition is delivered to the customer segments through the right mix of sales channels, distribution and communication.

4. Customer relationships
   The customer relationships cover the types of relationships to be pursued with different types of customer segments. The firm should review which relationships that are already established and what types of relationships that the customers expect the firm to create and maintain.

5. Revenue streams
   Revenue streams are generated when the value propositions are delivered to the customers, i.e. representing the firm's approach to capture value.

6. Key resources
   The key resources range from human and intellectual to physical and financial, and represent the most important assets that are needed to fulfil the other parts of the business model.

7. Key activities
   The key activities describe the activities that have to be performed in order to deliver the value proposition, the distribution channels, the customer relationships and the revenue streams. The activities can be of different kind, and must therefore be carefully designed for specific cases.

8. Key partnerships
   The firm will likely have to develop a network of suppliers and partners, i.e. create partnerships, in order to realize the business model. The partnerships can be of varying kind, such as strategic alliances, joint ventures and buyer-supplier relationships.

9. Cost structure
   The cost structure identifies all costs generated when the business model is realized.

The nine building blocks described above form the Business Model Canvas, which can be seen in *Figure 4* below. In this study, three of the building blocks – Cost Structure, Value Proposition and Revenue Streams – will be explored in more detail. These building blocks are highlighted in *Figure 4.* The three building blocks have been chosen since they are considered to have most influence on the future of IoT. The value proposition is explored since it can be considered to be the most important building block in the BMC (Dijkman et al 2015). Many studies also show that the value proposition can come to change entirely with the introduction of IoT, which makes it interesting to investigate further. One of the aims of this study is to quantify the potential of IoT, which is a reason for studying cost structure. Since studies also have shown that IoT can generate additional revenues streams and enable completely new ways to charge customers (Dijkman et al 2015), theories related to revenue streams are investigated.

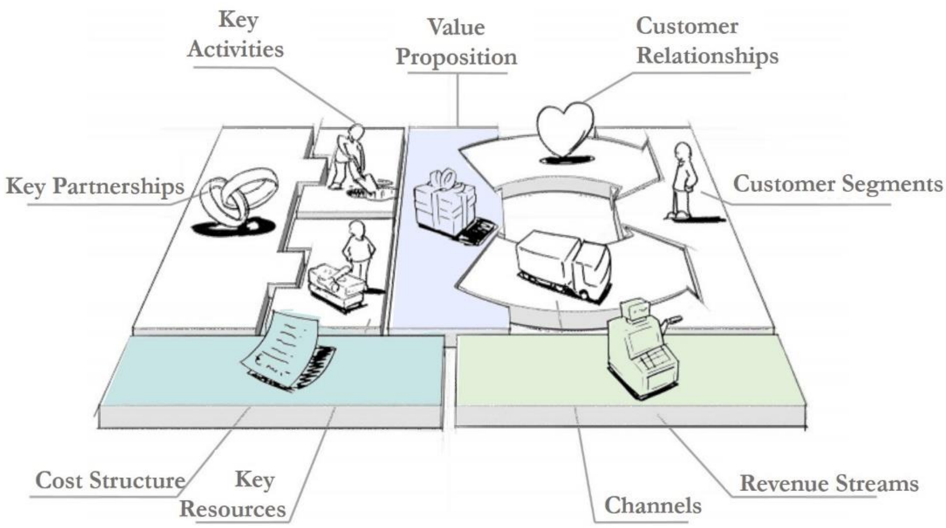


**Figure 4** Business Model Canvas where the building blocks in focus are highlighted

In the following section specific theories related to value proposition, cost structure and revenue streams will be explained.

## 3.2 Cost Structure

The Cost Structure-section of the Business Model Canvas aims to identify all costs generated when the business model is realized. Important questions to consider, according to Osterwalder & Pigneur, are:

- What are the most important costs in the business model?
- Which key resources and key activities are most expensive?

In general, firms should always strive for minimizing costs in their business model. However, the cost structures can be classified into two categories, cost-driven and value-driven, where focus on minimizing costs is significantly more important in the first category. Cost-driven business models are characterized by the leanest possible cost structure. Low price value propositions, outsourcing and a high degree of automation are typical characteristics. The second type of structure is value-driven and focuses on value creation, which includes personalized service and premium value propositions (Osterwalder & Pigneur 2010).

Cost structures can have different characteristics: fixed versus variable costs and economies of scale versus economies of scope. Fixed costs are independent of the volume of products/services produced. Examples are manufacturing facilities and rents. Variable costs on the other hand vary proportionally with the volume of produced goods/services. Economies of scale imply that a company exploits cost advantages when the volume of produced goods/services increase, whereas economies of scope imply that a company experiences cost advantages due to a larger scope of operations. One example of economies of scope is when the same marketing activities can be utilized for several products (Osterwalder & Pigneur 2010).

### 3.2.1 Lean Service

One theoretical model that will be used to dig deeper into the cost structure of firms, within the service business, is the lean service model. The lean concept is originally about working in team-based forms towards continuous improvement in order to identify and eliminate non-value-adding activities, so called wastes. Lean was first introduced in the 1940s when Toyota Production System in Japan went from a demand pull mass production system to a demand pull production system, designed to eliminate inconsistency, overburden and wastes (Mayerson 2012).

To become lean, radical changes might have to be done depending on the current status of the company. The culture among the employees and the management team must therefore be supportive and the people must have a willingness to change. To be able to realize radical changes throughout the company a top-down management is required. However, lean also requires a bottom-up approach to enable participation and idea flow from the employees. Management must thus command the employees that a change will be made, but then give up control to workers to enable the change. Money should be spent on training and improvements to make sure the competence in identifying and eliminating wastes lies within the employees of the company (Mayerson 2012).

The lean concept is well proved in the manufacturing industry. However, Andrés-Lópeza et al have done research about how the lean concept can be applied to the service industry. The results of their study showed that the service industry can benefit from using the lean concept. Benefits include an increase of organizational competitiveness, customer satisfaction and reduction of process variability and wastes (Andrés-Lópeza et al 2015).

By reducing wastes, cost savings can be achieved. However, to be able to reduce wastes, the company first identify the wastes. The lean concept in the manufacturing industry comprises eight wastes that can be eliminated or reduced. However, since service operations are intangible, waste determination in the service industry differs somewhat from the eight wastes described in the manufacturing industry. Andrés-Lópeza et al mean that one of the major challenges in service organizations is to actually be able to recognize the wastes. However, Andrés-Lópeza et al have identified wastes for the service industry and compared them to the traditional eight wastes of lean. These wastes can be seen in *Table 1* and will be explained in more detail below (Andrés-Lópeza et al 2015).

| **Service** | **Manufacturing** |
|---|---|
| Overproduction | Overproduction |
| Delay | Waiting |
| Unneeded transport or movement | Motion<br>Transport |
| Over-quality<br>Duplication | Over-processing |
| Lack of standardization | Inventory |
| Failure demand<br>Lack of customer's focus<br>Obsolescence or inadequacy<br>Loss of opportunity<br>Miscommunication | Defects |
| Underutilized resources | |
| Manager's resistance to change | Manager's resistance to change |

**Table 1** The wastes in the Lean Service model compared to the traditional wastes in the manufacturing industry

Andrés-Lópeza et al choose to describe the wastes as follows:

- Overproduction
  Completion of more work than needed or prior to its being demanded by customer.
- Delay
  Delays in terms of employees or customers waiting for information or service delivery.

- Unneeded Transport or Movement
  Needless, non-value-adding movement of resources (people or items). The movement can be both physical, such as from office to office, and virtual, such as methods, approaches, paths or tools for performing the same work.
- Over-Quality, Duplication
  Activities or processes that do not answer to a real need and are adding more value to the service than what the customers are willing to pay for.
- Excessive Variation, Lack of Standardization
  Lack of standardization in the offer or processes, procedures, formats, including expired or outdated with no standard time defined.
- Failure Demand, Lack of Customer's Focus
  Any aspect of a service that fails to conform to customers' expectations or needs, which results in miscommunication and/or opportunity loss.
- Underutilized Resources
  Waste of resources, especially human potential, for example not leveraging employee's talent and potential, or under-using their skills, creative abilities and knowledge.
- Manager's Resistance to Change
  "Saying no" attitude from the management, not encouraging the employees to get involved in the continuous improvement process.

## 3.3 Value Proposition

The value proposition constitutes the benefits that a firm offers to its customer segments. It describes the bundle of products and/or services that creates value for a specific customer segment, and it aims to satisfy customer needs and solve customer problems. It is the value proposition that makes the customers choose the company in question ahead of competitors. The value proposition can be both qualitative, such as design and customer experience, and quantitative, such as price or speed of service (Osterwalder & Pigneur 2010).

Questions to ask when designing the value proposition are, according to Osterwalder & Pigneur (2010):

- What value do we deliver to the customer?
- Which customer needs are we satisfying?
- Which of the customer's problems are we contributing to solve?
- What bundles of product and services are we offering to each customer segment?

### 3.3.1 Customer Value

There are many definitions of customer value. It could be measured in monetary terms, but most often value has to do with perceptions. Grönroos explains that value is delivered to a customer when the customer perceives a situation as better than before, after being supported by a service provider. If the customer on the contrary perceives a situation as worse than before, a reduction in value has taken place (Grönroos 2015).

Osterwalder and Pigneur (2010) point out that it is important to create awareness about what the customers want and need. They mention several examples of aspects that can create customer value. One example is newness, which means that the value proposition addresses needs that the customer has not perceived before. Another way to increase value creation is to improve the performance of the product or service. Customization, i.e. creating tailored solutions to the specific needs of individual customer segments, is another opportunity.

Another important aspect to have in mind when developing the value proposition is to consider how the firm can help the customer to get a certain job done. One example of this situation is Rolls-Royce, whose airline customers pay a fee for every hour an engine runs. In this way the customers can focus on running their airlines, while Rolls-Royce is responsible for both manufacturing and maintaining their jet engines. There are also other ways to create customer value, for example through price, design, brand, cost reduction, risk reduction, accessibility and convenience (Osterwalder & Pigneur 2010).

### 3.3.2 Customers' Willingness to Pay

Before moving on to finding new ways to increase customer value, and later determining pricing strategy, it is important for companies to understand what value the customers are willing to pay for (Osterwalder & Pigneur 2010). Bonnemeier et al (2010) point out that the willingness to pay for new products and services could increase if the provider shows the benefits of the new solution to the customer.

Grönroos (2015) also mentions that one problem when it comes to new and improved services is that many customers do not realize that the improvements result in more value for them. Therefore, the service providers have to make the customers aware of the potential of new services, and that the services can actually bring benefits to the customers. Grönroos believes that there are four main reasons behind the fact that customers are <u>not</u> willing to pay extra for new or improved services:

1. The service provider has not be able to show the customers what benefits the new or improved service can bring. The benefits can range from increased convenience, support, safety and security to cost savings and increased revenues.
2. The service provider has not been able to show the customers that the long-term cost aspects of the service offering is more important than the actual price.
3. The service offering is not as customer oriented as it should be. The offering does not provide the customers with the benefits that they actually demand or wish.
4. Certain customers are not interested in value-adding services, they are only interested in purchasing the core product to the lowest price possible.

(Grönroos 2015)

### 3.3.3 Ways to Increase Customer Value

Different methods that can be used by companies to increase customer value are described below.

#### 3.3.3.1 Three Ways to Increase the Value of Service

According to Grönroos there are three different ways for a firm to strengthen the value of services in the relation between the firm and the customer:

1. Development of new services to offer the customer
2. Activation of existing but hidden services
3. Conversion of the physical component to a service

The three ways are illustrated in *Figure 5* below.

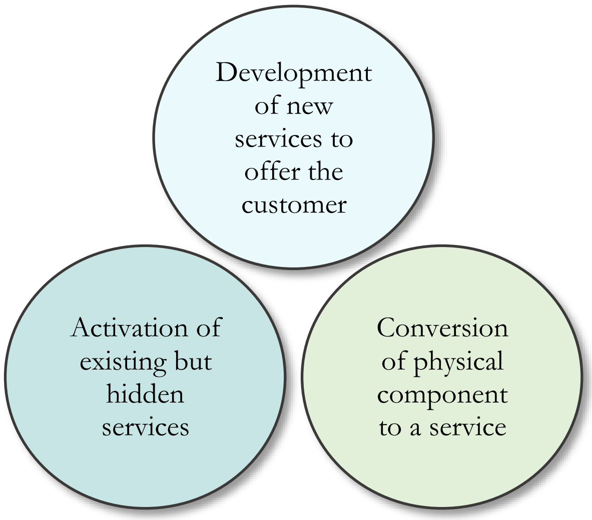


**Figure 5** Three ways to increase the value of service according to Grönroos

##### 3.3.3.1.1 Development of New Services to Offer the Customer

Development of new services to offer the customer means that the company adds new services to the existing customer offering. Typical examples of this type of services are information services, web sites, logistics services, consulting services, training and education or repair and maintenance. Adding unique services is an opportunity for the company to differentiate from competitors. However, Grönroos remarks that new services cause new investments and higher costs, which implies that the costs have to be outweighed by an expected increase of revenues.

##### 3.3.3.1.2 Activation of Existing but Hidden Services

Activation of Existing but hidden services aims to take advantage of existing but hidden, often non-billable, service components in the relation between the seller and the buyer. Consequently, the service components are already present in the customer relation, but the challenge lies in identifying them and utilizing their value creating opportunities.

Examples of this type of services are occasional advice, deliveries, invoicing, complaints handling and technical quality control. The customers already pay for these types of services, but they are often regarded as administrative routines rather than provided services. However, by realizing their potential to create value and making the customers perceive them as services instead of routines, the company can strengthen their competitiveness.

The development of hidden services does not have to result in large investments or high costs. In most cases it is sufficient to reorganize resources and processes.

##### 3.3.3.1.3 Conversion of the Physical Component into a Service

The last approach includes tailoring the physical components to the needs and wishes of the customer. This can be achieved by installing, maintaining and upgrading the product, making the products easy to understand and maintain. Through this strategy, the physical component will likely be perceived as a service by the customers (Grönroos 2015).

The idea of converting a physical component into a service can be related to the concept of servitization, which describes the process of combining products and services to different degrees. The concept of servitization, what opportunities it might bring to companies and how it can be related to IoT is further examined in the Servitization section below.

#### 3.3.3.2 Servitization

IoT underpins the development of new services and one major opportunity for the application of IoT is servitization. The bundling of products and services can be leveraged with the presence of IoT, a phenomenon that can be observed in many industries (Barquet et al 2016).

#### 3.3.3.2.1 Definition of Servitization

Many definitions of servitization exist, although many of them include the same core aspects. Bustinza et al (2015) choose to define servitization as selling an integrated combination of goods and services. Opresnik & Taisch (2015) is slightly more detailed in their definition of the term; servitization is "a market package or bundle of customer-focused combinations of goods, services, support, self-service and knowledge". Barquet et al (2016), on the other hand, chooses to use the term PSS (Product-Service System), to describe the same phenomenon. They explain that PSS is used to meet customer needs and deliver benefits by offering combinations of products and services.

Regardless of the exact definition of servitization, most studies argue that servitization is a new way of delivering value to customers. Servitization constitutes an opportunity for companies to differentiate from competitors, to establish a sustainable competitive advantage (Bustinza et al 2015) and to satisfy specific user needs. For example, by offering remote monitoring and remote operation, the company can access and configure the customers' machines according to specific needs (Barquet et al 2016). By adding services to products, manufacturing companies can create and capture value during the whole product life cycle, allowing for generation of new revenue streams. Many studies show that adding and increasing the presence of services lead to long-term benefits for manufacturing firms (Bustinza et al 2015).

When developing a value proposition for servitization, it is important for a firm to first have a deep understanding of the customer needs. One important aspect to consider is to what degree the company should be servitized, since there are various levels of servitization (Avlonitis et al 2014). Opresnik & Taisch explain that there are four combinations of products and services, ranging from pure product to pure functionality, where the latter corresponds to a product-as-a-service offering (Opresnik & Taisch 2015). Bustinza et al (2015) classify services into three categories: base (e.g. spare parts provision, product/equipment provision), intermediate (e.g. maintenance, repair, training) and advanced (outcome-based contracts or customer support agreements).

Finally, Avlonitis et al (2014) explain that servitization develops gradually based on the company's core product offering. This development is built on four steps, which illustrates one way of extending the company's value proposition. The different steps can be seen in *Figure 6* below.

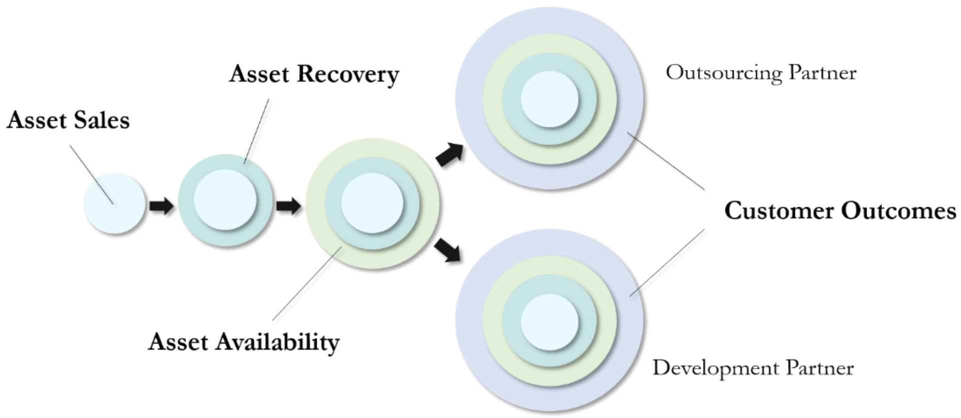


**Figure 6** Different degrees of servitization: extending the core product to customer outcomes. Adapted from Avlonitis et al 2015.

The first step is called asset sales, which basically means that the company's offer consists of a physical product. Aspects that matter to the customer are quality and performance of equipment. The next step is asset recovery, in which the company starts to perform after-sales service. The objective is to minimize disruption in case of equipment breakdown, i.e. the company repairs and recovers equipment after being notified about a problem. The third step is called asset availability, where the objective changes focus to fault free equipment. The company should strive for maximizing uptime and provide constant support, for example through remote maintenance. Lastly the company reaches the customer outcomes phase. At this level the firm supports the customers in fulfilling their goals, for example through taking over customer activities. The firm can act either as a development partner, for example by supporting their customers in R&D activities, or as an outsourcing partner, which for instance includes reducing the customers' capital employed (Avlonitis 2014).

#### 3.3.3.2.2 Leveraging Servitization with IoT

Combining products and services has already become a successful differentiation strategy for manufacturing firms to create and maintain their competitive advantage. However, servitization is slowly becoming commoditized, and will likely become a necessary, but not sufficient strategy to create added-value and secure revenue streams in the future.

According to Opresnik & Taisch, this development indicates that manufacturing firms needs to start searching for new methods, beyond servitization, in order to uphold their competitive advantage (Opresnik & Taisch 2015).

One method for adding value to servitization is to take advantage of Big Data, enabled by IoT. By developing smart products and thereby exploiting IoT, data can be collected from products during the client usage lifecycle phase. The collected data can thereafter be used in primarily two ways; either in the own product development process or by selling the data to third parties. In the product development process the data can be analyzed and used as input to a new, innovative combination of products and services. The data can also be sold to e.g. other manufacturing companies that produces complementary products, or independent service providers aiming to create a new service. Another opportunity is to sell the gathered information to marketing agencies that require behavioral data (Opresnik & Taisch 2015).

Consequently, an opportunity for manufacturing companies is to add an information layer to their product-service system in order to enhance the added-value and to retain competitive advantage. The generation and exploitation of Big Data becomes an opportunity to additionally differentiate from other firms that are servitizing. The new competitive advantage, based on integration of Big Data into servitization, is more difficult for competitors to imitate. Moreover, servitization and strategies involving exploitation of Big Data can reinforce each other. The more servitized product a company has, the more users they have, which leads to more collected data. This large amount of data can thereafter be analyzed and reused or resold (Opresnik & Taisch 2015).

##### 3.3.3.2.3 Servitization Requires New Business Models

Not to forget, the development of product-service combinations does not only change companies' traditional view of products and services. It also enforces a modification of the entire business model and the business processes within the firm (Barquet et al 2016). Servitization also brings the need of organizational transformation from selling goods to selling a combination of goods and services (Bustinza 2015). The organization needs to become a customer-centric organization which focuses on providing the customer with product-service combinations that improve the customer's business. As the service offers change from focusing on physical products to focusing on performance and end-user's processes, a stronger focus on customer interaction is needed.

The interaction with customers should be changed from a transactional perspective to relational processes, in which the customer should be seen as a co-producer. Servitization also requires a completely re-orientation of the pricing strategy within the company (Bonnemeier et al 2010).

## 3.4 Revenue Streams

Revenue streams are generated when value is delivered to the customers. For each customer segment the firm can establish one or several revenues streams. According to Osterwalder & Pigneur (2010) a company should consider the following questions when determining revenue streams:

- For what value are the customers really willing to pay?
- For what value do they currently pay?
- How are they currently paying?
- How would they prefer to pay?
- How much does each revenue stream contribute to overall revenues?

### 3.4.1 Pricing Strategy

Revenue streams and profitability are highly influenced by the pricing strategy of the company. If pricing decisions are not made correctly, it is difficult to exploit the full financial potential from the business (Osterwalder & Pigneur 2010). When it comes to service in product-oriented firms, service offerings are often underpriced or promised at a performance level which give no room for profitability (Rapaccini 2015).

According to Rapaccini (2015), pricing strategies can generally be divided into three different categories, which can be seen in *Table 2* below.

| **Pricing Strategy** | **Description** |
|---|---|
| Cost-based | With a cost-based pricing strategy, the price is determined by first allocating all costs of the product and then adding a desirable margin. |
| Competition-based | With a competition-based pricing strategy, the price includes influence from competitors’ pricing. |
| Value-based | With a value-based pricing strategy, the price is based on the value offered to the customers. |

**Table 2** Three different types of pricing strategies

Traditional pricing strategies such as cost-based pricing strategy and competition-based are most frequently used (Bonnemeier et al 2010). Cost-based pricing strategy is especially used among manufacturing, product-centric, and service-oriented companies (Rapaccini 2015).

According to a study performed by Rapaccini (2015), pricing strategy of service offerings within product-centric companies relate to their extent of servitization. The more servitized manufacturing companies are, the more customized, bundled and integrated service offerings are created, such as full service contracts. It is important to remember that supplying customized solutions are more cost-intensive than selling standardized products. This effect should be compensated by setting a sufficiently high price (Bonnemeier et al 2010).

As servitization increases, the pricing process also becomes more organizational restructured in terms of new positions and information systems enforcing the pricing strategy. Innovative pricing strategies, such as value-based, tend to be more adopted in firms with tailored and integrated service offerings, characterized by longer term relationships with the customers. Manufacturing companies that are becoming more servitized should thus shift revenue models and pricing strategies from cost-based towards value-based (Rapaccini 2015). Instead of simply optimizing the transaction price and base the price on the cost of the service, the new price, and hence the revenue, should be based on the value created for the customers. However, even if a value-based pricing strategy is being adopted, cost-based pricing still exists for the most standardized offerings, the ones characterized by material and time reactive logic, and transactional deals (Rapaccini 2015). It is still crucial to ensure that costs are covered. Competitors' pricing and customers' willingness to pay are also important to take into account (Bonnemeier et al 2010).

Estimating the value created for the customer can often be considered more difficult than basing the price solely on market prices or allocated costs. One method that can be used for estimating value is to use monetary figures. When a service provider implement new solutions, cost savings or profitability changes for the customer should be quantified in order to put a number on the generated value. Total Cost of Ownership (TCO) is an example of such a method that can be used. Non-monetary aspects, such as customer satisfaction, should also be used when estimating value, even if such aspects are more difficult to quantify (Bonnemeier et al 2010).

Rapaccini claims that when setting a value-based price, the company should go from pricing the offerings as items, to pricing comprehensive contracts so that the profit and risks can be shared between the customer and the provider. Full-service contracts, that are common within servitized companies, can be difficult to price. The price setting can however be facilitated by simulation models. By developing simulation models used for predicting life cycle cost for each solution, the extent of required calculations of repair cost and failure events can be reduced. Skills in value and life cycle engineering and maintenance are needed to create such simulation models (Rapaccini 2015).

Bonnemeier et al (2010) enhance the fact that many manufacturing companies fail in capturing value from their customers due to the continuous usage of traditional revenue models, such as cost-based pricing strategy.

When changing the revenue model and setting new prices, servitized companies, especially manufacturing firms, should consider the following:

- Develop pricing capabilities to determine the right price for the service offerings for each customer. The key resources needed for this are guidance for price setting through strict pricing objectives, clear procedures and information systems, web-based applications, pricing team, worksheets and price leader (Rapaccini 2015).
- Visualize the value to convince the customer about the benefits and value from the service offer. The key resources needed for developing value visualization capabilities are simulation tools, web-based applications and templates. Clear procedures and information systems are also needed (Rapaccini 2015).
- Assess and mitigate the risks with the service provision by developing risk management capabilities. To be able to evaluate risks, simulation tools are needed key resources (Rapaccini 2015). One example of a situation where risk management is important is when the service provider takes over the operation of activities that were previously conducted by the customer. In that situation the risk is transferred to the supplier, and should therefore be integrated in the price (Bonnemeier et al 2010).

### 3.4.2 Methods to Generate Revenue Streams

According to Osterwalder and Pigneur (2010) there are two main methods to generate revenue streams; the first one is transactions generated from one-time payments, whereas the second one is recurring revenues generated from ongoing payments. Below is a more detailed list of different ways to generate revenue streams.

- Asset sale

  Asset sale means that the firm is selling ownership rights to a physical product. Examples of asset sales are the sale of books or consumer electronics.
- Usage fee

  Usage fees are applied when the customer pays for the use of a certain service. The more the service is used, the more the customer pays.

  One example where this type of fee is used is telecom operators. The customers are charged differently depending on number of minutes spent on the phone.
- Subscription fees

  One example of subscription fee is the sale of membership at a gym. In order to receive access to the gym facilities, the members pay a monthly or yearly subscription fee. This revenue stream is thus generated when selling access to a service.
- Lending/Renting/Leasing

  When a firm aims to sell the rights to use an asset for a fixed period of time, principles of lending, renting or leasing can be used. A benefit for the lender is the fact that recurring revenues are secured. On the other side, the renter enjoys the benefit of avoiding paying the full costs of ownership. One example of a company using the principle of renting is Zipcar, who lets the customers rent cars in exchange for an hourly fee.
- Licensing

  Licensing means that the customers are allowed to use protected intellectual property in return for a fee. This principle is utilized e.g. in technology sector, where patent holders allow others to use a patented technology if paying a license fee.

- Brokerage
  Revenue streams from brokerage fees are generated when intermediation services are performed. One classic example is credit card providers, who earns a certain percentage of the value each time a sale transaction between a customer and a merchant is fulfilled.
- Advertising
  Advertising is frequently used in the media industry, and means that revenue streams are generated through fees for advertising (Osterwalder & Pigneur 2010).

The shift towards value-based pricing strategies in manufacturing firms leads to more innovative revenue models such as pay-per-outcome, pay-per-use and risk-reward sharing (Rapaccini 2015). Avlonitis et al (2014) enhance that the price setting and methods to generate revenue change as the level of servitization increases. In the beginning, when a manufacturing firm has a low degree of servitization, service offerings are often integrated in the product price. The service could also be sold at ad hoc basis, where the customers pay for service in case of equipment breakdown.

As the relative importance of services in the company increases, the company often moves towards service and maintenance contracts for equipment. The contracts have fixed prices that cover at least some of the activities needed to perform maintenance during a specific period. When the importance of services, and hence investments in the service business, increase further, the method for setting prices becomes more complex. Avlonitis et al agree with Rapaccini and states that a company should move towards a pay-per-use model as the development of servitization increases (Avlonitis et al 2014). One advantage with the pay-per-use model is that the price offering is specifically designed to suit the usage patterns of the customers. The customers pay for the specific value they extract from the product-service system (Balasubramanian et al 2011).

The most advanced and competitive price offerings are the performance-based ones, in which the price offering is dependent on outcomes and/or the performance of the service provider (Avlonitis et al 2014). A performance-based agreement motivates the service provider to identify what delivers value to the customer. Another benefit is that the service provider is forced to only offer services that are absolutely necessary for the customer.

Furthermore, since the manufacturing firm often retains the product ownership, the firm is driven to develop as reliable and sustainable products as possible, to avoid unnecessary maintenance (Rapaccini 2015). If the company chooses to apply a performance-based price offering it is of great important to create a well-defined SLA[1] so both parts agree on what service level that should be achieved by the service provider (Avlonitis 2014).

Before determining which methods to use to generate revenue, it is important for a service provider to fully understand which factors that are driving customer decisions and what aspects that add value to the customers, which has been stressed previously (Avlonitis et al 2014).

[1] SLA (Service Level Agreement) is an agreement between a service provider and service receiver, where the service is formally defined and specified.

# 4 Case Company: ASSA ABLOY Entrance Systems

*This chapter starts with an introduction of the case company ASSA ABLOY Entrance Systems (AAES). Thereafter, the service business of AAES is described in detail. Thereafter it is described how far AAES has come within the area of IoT, including specific projects.*

ASSA ABLOY is one of the world's largest supplier of door opening solutions. The company was created in 1994, through a merger of the Swedish company ASSA and the Finnish company Abloy (Assa Abloy 2016a).

The strategic action plan of ASSA ABLOY is built on the following three building blocks:

- Market presence
  The market presence is realized by growing the core business as well as expanding into new markets and segments.
- Product leadership
  The product leadership is achieved by innovation and continuous development of products that deliver value to the customers.
- Cost efficiency
  Within the cost efficiency building block, ASSA ABLOY is continuously looking for ways to be more cost efficient and hence reduce costs (Assa Abloy 2016b).

This master thesis is delimited to ASSA ABLOY Entrance Systems, hereafter referred to as AAES, which is a division within ASSA ABLOY. AAES offers comprehensive entrance solutions (Assa Abloy 2016c). The direct sales channel of AAES is divided into three main business areas: Pedestrian Door Solutions (PDS), Industrial Door & Docking Solutions (IDDS) and High Performance Door Solutions (HPDS). This study is delimited to PDS. The main door solutions sold within PDS are automated swing doors, sliding doors and revolving doors, where sliding doors represent the largest sales volume. Pictures of the three door types can be seen below, in *Figure 7* (AAES n.d. a).

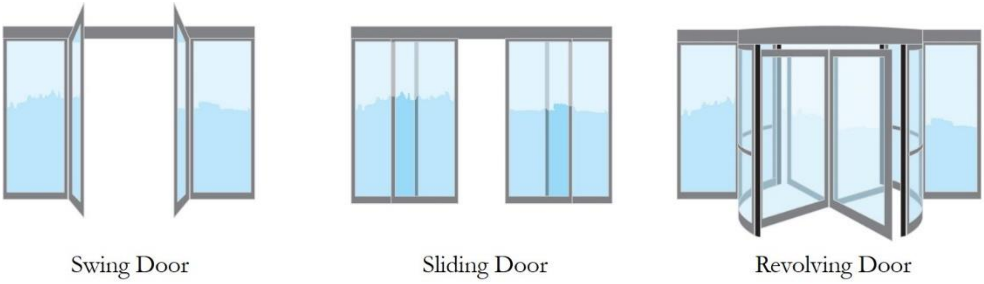


**Figure 7** The different types of doors within PDS (AAES' internal media bank)

In addition to physical door solutions, AAES provides service and maintenance, including upgrade kits and recommendations to improve performance of the doors (AAES n.d. b). All offers related to service are described in Service business section. AAES can be categorized as a technology-based manufacturing firm with a service business. Technology based means that the company has a strong focus on automated doors and entrance solutions, requiring technology development. It can be considered that the core product traditionally has been physical products, but that the service business has been an important complement.

According to the President of PDS there are three cornerstones constituting the competitive advantage of AAES:

- The first one is that AAES is both a manufacturer and a service provider, which leads to large knowledge about the products, and hence high quality of service. The company turns into a specialist instead of a generalist.
- The second competitive advantage is the large geographical coverage compared to other, smaller service providers. Customers whose facilities are widely spread geographically can get all service they need from AAES.
- Thirdly, the ethics of the service technicians plays an important role at AAES. Except excellent service, the customers should get a good impression of the service technician at site. AAES therefore provides education and training for all their service technicians (President of PDS, 2016 pers. comm., 19 April).

The Global Retail Segment Director at AAES has explained that AAES' customers are divided into ten different segments, used for example when developing new products and creating marketing material. The segments can be seen in the list below:

- Retail
- Manufacturing
- Heavy industry/mining
- Distribution and Logistics
- Healthcare
- Transportation
- Hospitality
- Private Sector
- Public Sectors
- Aviation and Shipyards

(Global Retail Segment Director at AAES 2016, pers. comm., 17 May)

This master thesis is delimited to the retail segment since it is the largest segment within PDS (Global Retail Segment Director at AAES, 2016, pers. comm., 3 March). The following information about the retail segment have been found in an externally used brochure from AAES:

> *Retail facilities handle high-volume turnover and a wide variety of goods, some with their own special requirements. Entrance solutions for retail manage many different tasks, but their common goal is convenience and comfort for customers. In addition, they must provide appropriate security and meet stringent safety regulations. (*AAES n.d. a)

## 4.1 Service Business

This master thesis focuses first and foremost on how IoT can come to affect the service business of AAES. Therefore a detailed description of the service business is presented below.

The vision of the service business is "to be the preferred service solution choice in our defined industry segments" (IMD Entrance Systems Team, AAES 2014). The *preferred* choice means that AAES is perceived as the best performing service provider, both by the employees and the customers. Furthermore, the vision states that various commercial offerings should be specifically targeted to the predetermined customer segments of the company. The vision guides AAES in which direction to move, and should be present in all activities (AAES n.d. c).

The mission of AAES reads as follows: "With certified, service-minded engineers and specialized personnel, conduct Global Repair, Maintenance and Modernization according to customer needs regardless of brand". The mission describes what AAES should strive for on a daily basis (IMD Entrance Systems Team, AAES 2014). Today AAES uses preventive maintenance but is striving towards predictive maintenance and servitization (VP Service Development at AAES, 2016, pers. comm., 8 Feb.).

### 4.1.1 Reactive and Proactive Service Visits

Today the service visits performed by AAES can be categorized as *Reactive visits* and *Proactive visits*. Reactive visits include repairs when problems or breakdowns occur, e.g. in situations where the customer's equipment does not operate. If such a situation occurs, the customer calls AAES and a technician is sent to the site. AAES can perform these visits regardless if the customer's door is under a service contract or not, with an exception of some countries where a service contract is required for any type of visit. Proactive visits are visits that have been planned in advanced. The purpose of these visits is to work proactively on preventing problems and hence reduce the occurrence of reactive visits (AAES n.d. b). Proactive visits are included in different service contracts, which are described below.

An example of a measure that aims to prevent reactive visits is proactive substitution of tear and wear consumables. Another measure is the education of service technicians.

The role of the service technician is about to change from repairing and fixing already occurred problems, to identifying the need of substituting components that might break in the future. There is thus a wish of improving the competence regarding proactive maintenance, within AAES (President of PDS, 2016, pers. comm., 19 April).

It should be noted that reactive visits are more expensive for AAES than proactive visits. AAES therefore strives towards preventing future issues of their doors by changing teared parts in advance, before they break (AAES n.d. c). The VP of Service Development also confirms that reactive visits are more expensive due to the fact that they cannot be planned in advance. Within PDS reactive visits correspond to approximately a third of all performed service visits (VP Service Development at AAES, 2016, pers. comm., 18 Feb.).

Service, regardless of type, can be performed both on AAES' own install base and on competitors' equipment (AAES n.d. c). It should also be noted that a warranty period of one year is included when buying a new door at AAES (Field Operation Manager at AAES, 2016, pers. comm., 23 March).

#### 4.1.1.1 Service Contracts

As mentioned above, proactive visits, and to some degree reactive visits, are included in the service contracts offered by AAES, however, the frequency of the visits are depending on e.g. country. There are three different types of service contracts: Bronze, Silver and Gold. The three different types of contracts can be found within all country divisions, with some exceptions (VP Service Development at AAES, 2016, pers. comm., 8 Feb). The service contracts are described in more detail below.

AAES currently has one million doors under contract globally (VP Service Development at AAES, 2016, pers. comm., 18 Feb.) Most of the service contracts are sold directly to end users (VP Service Development at AAES, 2016, pers. comm., 16 May). Therefore, this master thesis is delimited to customers that are end users. It is thus the needs and wishes of the end users that will be taken into consideration when investigating added value for customers through IoT.

##### 4.1.1.1.1 Bronze Contract

The Bronze contract includes proactive visits, but costs of exchanging parts to fulfil safety requirements and legislations are not included in the price.

Reactive visits are not included in the Bronze contract. The customers are thus fully charged for all costs regarding these types of visits.

#### 4.1.1.1.2 Silver Contract

In addition to the features in a Bronze contract, a silver contract also includes costs of spare parts needed to fulfil legislation and safety requirements as well as labor and travelling costs for reactive visits during regular business hours.

#### 4.1.1.1.3 Gold Contract

A Gold contract includes the same features as Bronze and Silver contracts, but replacement of spare parts, both for reactive and proactive visits, are also included. The labor and travel costs for reactive visits are thus paid by AAES (AAES n.d. c).

The Service Development Director means that cost savings potential lies within being able to reduce reactive visits on doors under Gold contracts, since AAES are paying for these visits (Service Development Director at PDS, 2016, pers. comm., 17 Feb). This is an argument for delimiting this master thesis to customers with Gold contracts.

AAES also offers a contract called Tailor Flex, where the customer can design the service contract together with AAES. Tailor Flex is a flexible contract where features can be added or removed depending on the wish of the customer (AAES n.d. b). An overview of the different types of contracts, and what they include, can be found in appendix E. Service technicians can also sell additional parts or upgrades when visiting the customers' sites. These type of additional sales provide additional revenue to AAES (AAES n.d. b).

As mentioned before, AAES can also provide service to customers that have not signed a service contract. The customers are then fully charged for the costs of the service visits (AAES n.d. b).

#### 4.1.1.1.4 Service Contracts in Country A

Since this study focuses on Country A, the contract mix for Country A can be seen in *Table 3*. The contract mix shows the distribution of different types of contracts, in percentage of the total number of contracts. The numbers were compiled in November 2015 but do not sum up to 100 % due to data deficiency (Winstedt 2015).

| Type of Contract | % of Total Number of Contracts |
|---|---|
| Reactive service | 0 |
| Bronze contract | 23.5 |
| Silver contract | 15.0 |
| Gold contract | 55.0 |
| Tailor Flex | 0 |

**Table 3** The distribution of different types of contracts in Country A

AAES has no standardized way of selling service contracts in connection to the sale of physical doors (Field Operations Manager at AAES, 2016, pers. comm., 23 March). All service contracts are not sold to the customer the same year as the door is sold. The percentage of service contracts sold in Country A the first, second and third year after the door was sold to the customer are presented in *Table 4* below. The results are presented for the three main types of doors within PDS. The numbers were compiled in November 2015 (Winstedt 2015).

| Contract Hit Rate in Country A (%) | Swing Doors | Sliding Doors | Revolving Doors |
|---|---|---|---|
| First year | 30 | 14 | 18 |
| Second year | 33 | 23 | 33 |
| Third year | 31 | 26 | 34 |

**Table 4** Contract hit rate for different types of doors in country A

#### 4.1.1.2 Upgrade Kits

When interviewed on 19 April 2016, the President of PDS explained that the purpose of upgrade kits is to improve and adjust the entrance solutions after they have been bought, installed and used for a period of time. A specific example of such a situation is when the buyer is not the same person as the end user, and thus the buyer might not have bought a door according to the end user's needs and wishes. In such cases the end user can upgrade the door through an upgrade kit, and hence get a solution tailored to its needs. An upgrade kit can be installed within five years after the door has been installed (President of PDS, 2016, pers. comm., 19 April). After five years, the upgrade kit is replaced by a so called modernization kit, which lifts the door to the latest standards and regulations (AAES n.d. b).

#### 4.1.1.3 The Service Process

The process for a service visit, i.e. what is happening from the moment a customer calls AAES' service division until the problem is solved, has been mapped. Currently the process differs somewhat from country to country since there is no globally standardized process within AAES (Field Operation Manager at AAES, 2016, pers. comm., 23 March). However, after analyzing the service process for three countries it was noted that the main steps are similar, and therefore a service process model with the general steps could be developed. A picture summarizing the five steps can be seen in *Figure 8*. Explanations of each step can be seen below.

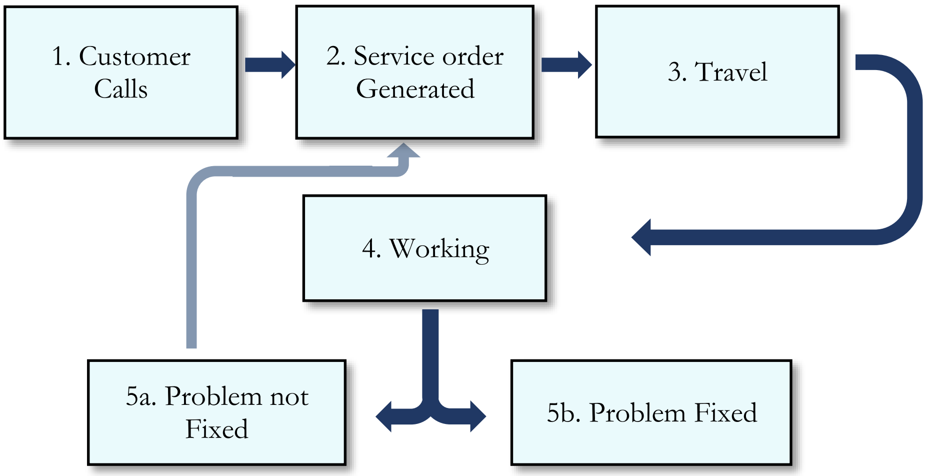


**Figure 8** An overview of the service process.

1. Customer Calls

In the case of a reactive service visit, the service process begins when a customer calls AAES' helpdesk in order to report a problem that has occurred on the customer's door. The helpdesk checks the location of the door and whether the door is under a service contract or warranty period or nor. The employee at the helpdesk then discusses the error of the door with the customer, to see if it is possible to solve the problem over telephone. The employee also views the call history of the customer in order to check if any similar problems have occurred before.

It should however be noted that some customers in some countries do not call the helpdesk when a problem occurs, instead they call directly to the service technician (Field Operation Manager at AAES, 2016, pers. comm., 13 May).

In the case of a proactive visits step 1 looks somewhat different. AAES initiates the contact with the customer and schedules a time for service. After step 1 however, the service process is similar for both reactive and proactive visits.

### 2. Service Order Generated

If the problem cannot be solved over telephone when the customer calls, the helpdesk creates a service order in the ERP system[2], after ensuring that the site address, door ID and billing address are correctly specified. The service order includes specifications of the door's error, contact information to the customer, access times and other relevant information. The service order is transferred to the planning department, which plans the job according to the Service Level Agreement. The work is then assigned to a suitable service technician, and the service order is exported to the technician. However, in some countries the responsibility of planning the visits lies on the service technicians themselves rather than the planning department (Field Operation Manager at AAES, 2016, pers. comm., 13 May).

It should be noted that AAES, except accessing their own employed service technicians, also can assign jobs to subcontracted service technicians. The following steps of the model are however delimited to the process when AAES' own service technicians are being used (Field Operation Manager at AAES, 2016, pers. comm., 23 March).

### 3. Travelling

When a service technician has received a job request, it is time to conduct the service. The first step is to travel to the customer's site.

### 4. Working

When the technician reaches the customer's site, the technician performs the needed service.

[2] ERP = Enterprise Resource Planning

### 5a. Problem Not Fixed

If the problem cannot be fixed during the first visit, a return visit is required and the process will start over from the second step in the model. The resources required for solving the problem will be registered, and quoted if needed.

### 5b. Problem Fixed

When the problem is solved, the service technician writes and sends a report to AAES' back office with information about the problem and how it was solved. Back office checks if an invoice will be sent to the customer or not, depending on the type of problem and the customer's type of service contract. The service order will be registered as solved and the technician can move on to the next service order.

Even if the technician solves the problem during the first visit, a return visit might be required to assure or improve the performance of the door. The technician can also sell additional material and features to the customer that need to be quoted and signed before installation. That also requires another visit at site. The process of the return visit is the same as the process for the first visit, starting the second step in the service process model.

One thing that should be noted regarding the service process is that the service technicians have spare parts to a determined maximum value stocked in their vehicles. The limited value of spare parts means that the service technicians cannot store all different types of spare parts in their vehicles (Field Operation Manager at AAES, 2016, pers. comm., 10 March).

## 4.2 IoT within AAES

A pre-study has been performed to investigate how far AAES has come regarding IoT today.

A couple of years ago, the idea about connected doors through IoT was born within AAES. AAES decided to investigate further into what potential value IoT could bring. AAES uses the following definition of IoT:

> *Scenario in which objects, animals or people are provided with unique identifiers and the ability to transfer data over a network without requiring human-to-human or human-to-computer interaction.*
> (AAES 2016)

A pilot study, led by the Concept Innovation Manager, was conducted to prove that integrating IoT in the doors would be technologically possible. Data was successfully gathered from three doors through wireless communication technology. Three potential stakeholders were also specified. They are listed as follow:

- AAES' service organization
  It was believed that IoT could result in cost efficiency within the service business.
- Product managers and product development team
  Customers' usage patterns could be gathered through IoT, and later used by the product managers and developers to gain knowledge about customers' needs.
- End user
  End users could be considered as a possible stakeholder if gathered data were to be sold.

(Concept Innovation Manager at AAES, 2016, pers. comm., 2016, 8 Feb)

A more detailed description of the pilot study can be found in *Appendix A*. After the pilot study was terminated the work on IoT has been brought forward to other projects and business areas. The R&D division is currently working on developing the technology of IoT further. Information from doors can currently be extracted by using a Bluetooth connected tablet.

The tablet is currently being tested by service technicians in some countries, since the aim of the tablet is to facilitate the work of the service technicians. For example, it is possible to get an overview of the technical status of the door through the tablet. However, the utilization of the tablet is not yet fully exploited (Software Engineer at R&D AAES, 2016, pers. comm., 13 April).

The integration of IoT features differ in prioritization across the different product groups within PDS. The ideal case would be to integrate IoT on all doors within PDS but the intention is to first gather data and integrate remote control in one selected product group (VP Service Development at AAES, 2016, pers. comm., 18 Feb.). In this master thesis, all types of products within PDS, i.e. swing doors, sliding doors and revolving doors are discussed.

The current technology must be further developed before an IoT integrated product can be released on the market. However, in this master thesis technology of IoT is assumed to reach work faultlessly when released. Hence, the conducted research and suggested results will not be limited to solutions that are technologically feasible at this point. The physical functioning of the door is also assumed to keep the same level of performance before and after implementing IoT technology.

It is currently uncertain what value IoT will bring to customers (VP Service Development at AAES, 2016, pers. comm., 18 Feb.) It is a common thought of the employees at AAES that IoT will bring benefits to the business, but there is no business case showing a quantified value of IoT (VP Service Development, at AAES, 2016, pers. comm., 18 Feb & Senior Project Manager, R&D, PDS, 2016, pers. comm., 19 Feb). According to the Product Manager of Information Services, it is challenging to estimate the value, and match it with the development and implementation costs (Product Manager Information Services at Assa Abloy, 2016, pers. comm., 1 March). It is also uncertain if the customers are interested in the changes in products and services that IoT might bring (Senior Project Manager, R&D, PDS, 2016, pers. comm., 19 Feb).

### 4.2.1 Vision of IoT

The service organization within AAES hopes that an implementation of IoT can bring benefits such as cost savings regarding maintenance (VP Service Development at AAES, 2016, pers. comm., 8 Feb.). The Product Manager of Information Services states that it is important to act quickly regarding IoT but also to be patient regarding the payback time. For a full implementation of IoT, business models and business processes will need to change and it is important to have a long term approach regarding IoT (Product Manager Information Services at Assa Abloy, 2016, pers. comm., 1 March).

The Product Manager of Information Services also believes that IoT can lead to internal efficiency within the service business. The National Accounts Manager in Country A agrees that IoT could enable better planning of service visits, and thus lead to increased efficiency. However, the Account Manager believes that it will be more difficult to extract value from IoT from a sales point of view. Implementing IoT will enable predictive maintenance and reduce the cost of service visits, but the cost reduction cannot be used as a sales point if the monetary reduction is not visible to the customer (National Accounts Manager at AAES, Country A, 2016, pers. comm., 1 March).

An R&D consultant involved in the development of IoT integration at AAES believes that it could be beneficial to extract information about parameter settings of the doors through IoT. Wrong parameter settings can namely result in breakdowns. If information about parameter settings could be extracted through IoT, measures could be made to avoid such breakdowns (SW Developer at AAES, 2016, pers. comm., 23 March).

By combining statistics from the doors with usage patterns and the environmental surroundings of the doors, the Service Manager at IDDS believes that service can be predicted in a better way, resulting in more efficient service planning. If AAES could perform service customized to each door, the professional image of AAES could be enhanced (Service Manager at AAES, 2016, pers. comm., 7 March).

The VP of Service Development explains that Key Accounts might be more interested in IoT solutions compared to other customers, since the Key Accounts previously have shown a large interest in new, innovative solutions. However, the VP of Service Development also confirms that the number of doors hold by Key Accounts are all together less than for small customers.

This could imply that an integration of IoT should be focused to small customers (VP Service Development at AAES, 2016, pers. comm., 8 Feb.). Considering this matter, this study will, however, focus on Key Accounts. An interest in innovation and an understanding of IoT, that the Key Accounts are showing, are considered to be valuable from a sales point of view, and thus an argument for focusing on Key Accounts. Another argument is that Key Accounts have a large impact on AAES' business. For example, if a solution is implemented successfully in one store, the same Key Account might be willing to implement the same solution in other stores.

# 5 Results & Analysis

*This chapter will be divided into three main parts: Cost Structure, Value Proposition and Revenue Streams. Each part begins with an investigation of the current situation at AAES, which is followed by an analysis of how IoT will come to change the part in question.*

Strategic tools such as the Business Model Canvas (BMC) are not used to a large extent within AAES today (VP Service Development at AAES, 2016, pers. comm., 8 Feb.). However, the three previously selected parts of the BMC are used as a framework for finding out the business impact of IoT regarding service. In the Cost Structure section data is analyzed to determine potential cost savings enabled by IoT. In the Value Proposition section new potential value for customers will be investigated. Finally, in the Revenue Streams section, new revenue streams arising from the value proposition will be discussed. The results concerning AAES' current situation are based on information collected from interviews with employees at AAES together with various collected material described in the Methodology chapter.

Other delimitations have been discussed previously in the report, but are also summarized in *Figure 9* below.

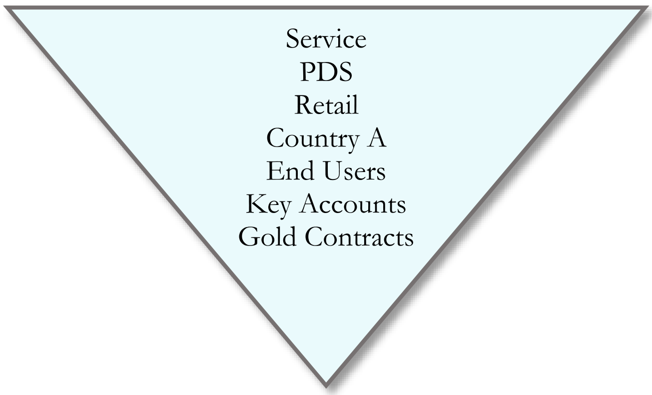


**Figure 9** An overview of the delimitations that have been made within AAES

## 5.1 Cost Structure

*This section starts with a presentation of the results from the calculations on cost savings potential, based on the Lean Service model. The section is concluded by an analysis of the Cost Structure.*

### 5.1.1 Current Cost Structure at AAES

Earlier in the report the process of a service visit was mapped. That model was utilized when applying the Lean Service model of Andrés-Lópeza, in order to identify and eliminate wastes in the service business of AAES. The Lean Service model has thus been applied to identify cost savings potential regarding service visits.

### 5.1.2 Lean Service

Statistics of service history for three key accounts in Country A were analyzed in order to investigate how costs are distributed over the different steps in the service process. The available statistics showed only costs for travelling and working. For this reason, the calculations of potential cost savings are limited to the third step (*Travelling*) and the fourth step (*Working*) in the service process model. The wastes that have been identified and calculated within the third and fourth step in the service process model are Unneeded transport, Inadequacy, Miscommunication and Delay. Thus, not all wastes in the Lean Service model have been identified in the service process of AAES.

As mentioned before, the Key Accounts belong to the retail segment of AAES. However, the characteristics of their businesses are somewhat different. KA1 is a pharmacy chain, KA2 is a banking and financial services company and KA3 is a supermarket chain. For all three Key Accounts there is most commonly one door per store. Almost all the doors are swing doors or sliding doors, whereas only a few revolving doors can be found in the asset registers. Information about number of stores, doors and service visits are presented below in *Table 5*. The distribution of different types of visits, reactive, proactive and other, is also shown in the table.

| Information | KA1 | KA2 | KA3 |
|---|---|---|---|
| Total number of stores | 2 200 | 1 310 | 770 |
| Total number of doors | 2 400 | 1 630 | 1 150 |
| Total number of visits | 3 610 | 3 260 | 2 590 |
| - Reactive | 53.6 % | 44.8 % | 54.2 % |
| - Proactive | 42.5 % | 53.0 % | 41.6 % |
| - Other | 3.9 % | 2.2 % | 4.2 % |
| Total cost of all service visits | 247 000 € | 197 000 € | 163 000 € |

**Table 5** Information about the Key Accounts

The time spent on each service visit can be found in the service statistics. The time is registered divided into travelling time and working time. The cost of a service visit has been calculated by multiplying the hourly cost of a service technician in Country A (36.77 €), with the time spent on the visit. The hourly cost includes both total employment costs and non-employment costs (Finance Director at PDS, 2016, pers. comm., 3 May).

The calculations have been conducted for visits on swing doors, sliding doors and revolving doors. Only non-value adding visits have been included in the calculations, i.e. visits that do not disrupt any revenue streams, and are paid by AAES. Visits that the customer should be charged for are excluded based on an examination of the contract terms for each Key Account. The customers are charged when AAES is not responsible for the cause that requires the visit, such as damage caused by the customer, vandalism or if no fault of the door was detected by the service technician. Visits that lead to a documented revenue for AAES have also been excluded. By excluding those visits it is reassured that the visits included in the analysis will only lead to beneficial cost savings for AAES and not harm any potential revenue flow.

Cost savings results from the identified wastes are presented below.

#### 5.1.2.1 Unneeded Transport

Unneeded transport includes service visits that could be done remotely through IoT, hence leading to reductions in travelling time for the service technicians. More specifically, this type of visits consists of making adjustments of the door. Approximately one third of all current adjustment visits are estimated to concern changing settings of the door, such as adjusting opening speed and opening width. These changes could in all probability be made remotely with IoT.

Therefore, it is assumed that the travelling costs for one third of the current adjustment visits could be eliminated in the future, hence resulting in cost savings. The results are shown for each Key Account in *Table 6.* Average time includes both travelling and working time, where the travelling time represents approximately half of the total time. The same goes for the average cost. The cost savings potential in percentage has been calculated by dividing the total cost of all Unneeded transport visits with the total cost of all types of visits during 2015.

| **Unneeded Transport** | **KA1** | **KA2** | **KA3** |
|---|---|---|---|
| Number of visits | 140 | 100 | 100 |
| % of total visits | 4.0 % | 3.2 % | 3.7 % |
| Average time | 1 h 58 min | 1 h 56 min | 1 h 52 min |
| Average cost | 72.8 € | 71.2 € | 68.6 € |
| Total cost | 5 070 € | 3 500 € | 1 130 € |
| **% cost savings** | **2.1 %** | **1.8 %** | **1.9 %** |

**Table 6** Summary of the results for Unneeded transport visits

Proactive visits where adjustments have been performed are excluded from the calculations. The reason is that the service technicians have not only performed adjustments, but also other activities, during the maintenance visits. Adjusting the door was thus not the only reason for the maintenance visit, which implies that the visit would have taken place anyway.

#### 5.1.2.2 Inadequacy

Inadequacy comprises service visits that require a returning visit, but without offering any extra value to the customer. Consequently, reducing or eliminating this type of visits could result in cost savings without impacting the customer value negatively.

Examples of reasons causing returning visits are lack of resources, such as when the service technician does not have the correct spare parts or tools needed to solve the problem, or when more time or manpower is required to finish the work.

If required resources can be correctly pre-estimated, the service technician can have the right spare parts and tools in the vehicle during the first visit and consequently the requirement of another return visit can be reduced or eliminated. Therefore both travelling cost and working cost can be eliminated. *Table 7* show the cost savings that can be made through a total elimination of such returning visits. The average time includes both travelling and working time, and the average cost does thus represent the cost of a complete visit, including travelling and working.

| Inadequacy | KA1 | KA2 | KA3 |
|---|---|---|---|
| Number of visits | 500 | 340 | 310 |
| % of total visits | 14.0 % | 10.4 % | 12.1 % |
| Average time | 1 h 55 min | 1 h 46 min | 1 h 42 min |
| Average cost | 71.1 € | 65.1 € | 63.0 € |
| Total cost | 36 000 € | 15 400 € | 14 700 € |
| **% cost savings** | **14.6 %** | **7.8 %** | **9.0 %** |

**Table 7** Summary of the results of Inadequacy visits

#### 5.1.2.3 Miscommunication

Miscommunication represents service visits that seem to be more or less unnecessary, for example when the customer's site is closed or when a door no longer exists. In these cases, the service technician travels to the customer's site but is unable to perform any work. These situations occur due to miscommunication between the customer and AAES, and could most likely be avoided in the future.

*Table 8* below shows possible cost savings that could be achieved if all unnecessary visits due to miscommunication were eliminated. The average time includes both travelling and working time, and the average cost does thus represent the cost of a complete visit, including travelling and working.

| Miscommunication | KA1 | KA2 | KA3 |
|---|---|---|---|
| Number of visits | 40 | 120 | 10 |
| % of total visits | 1.2 % | 3.8 % | 0.4 % |
| Average time | 1 h 13 min | 1 h 7 min | 1 h 12 min |
| Average cost | 45.1 € | 41.1 € | 44.1 € |
| Total cost | 1 940 € | 5 010 € | 400 € |
| **% cost savings** | **0.8 %** | **2.5 %** | **0.2 %** |

**Table 8** Summary of the results of Miscommunication visits

#### 5.1.2.4 Delay

Delay is another waste that can be found in the Lean Service model. Therefore customers' waiting time have been calculated in order to study whether IoT can reduce non-value added time. The VP of Finance in Country C has expressed that customers' waiting time vary much from visit to visit, which makes the customers' waiting times difficult to compare with each other. The VP of Finance has also explained that incorrect spare parts in the service technicians' vehicles cause long waiting time for customers. If needed spare parts are not brought to site, an order might have to be placed, and a new visit has to be made, which leads to longer waiting times (VP Finance in Country C, PDS, 2016, pers. comm., 14 March).

Customers' waiting time have been calculated for reactive Unneeded transport visits and reactive Inadequacy visits. Waiting times for Miscommunication visits have not been included since this type of visits is not requested by the customer, hence do not cause any waiting time for the customer. The waiting times are the median times of each type of visit.

The results for Unneeded transport visits in *Table 9* show the waiting time from the moment a customer reported a problem, to when the problem was registered as solved. Regarding Inadequacy visits, the results show the waiting time from the moment the first visit is marked as closed, to the moment when the return visit is marked as started. The result thus indicates how long the customer has to wait from the first visit, when the problem cannot be solved due to lack of resources, to when the service technician returns with the required resources.

For each Key Account, the median waiting time for a reactive visit in general, based on all different types of reactive visits, has also been calculated.

| Customers’ Waiting Time (Median) | KA1 | KA2 | KA3 |
|---|---|---|---|
| Unneeded transport visits | 1 d 2 h | 1 d 23 h | 1 d 0 h |
| Inadequacy visits | 6 d 23 h | 8 d 21 h | 8 d 17 h |
| Reactive visits in general | 1 d 1 h | 2 d 4 h | 1 d 0 h |

**Table 9** Summary of customers' waiting time for different types of service visits

#### 5.1.2.5 Total Cost Savings Potential

Finally, the results have been summarized in *Table 10* below to show the overall cost savings potential that AAES can achieve by reducing service visits performed at the three Key Accounts during one year, if implementing IoT in the service process.

| Total Cost Savings Potential | KA1 | KA2 | KA3 |
|---|---|---|---|
| Unneeded transport (€) | 5 060 | 3 500 | 3 130 |
| Inadequacy (€) | 36 000 | 15 400 | 14 700 |
| Miscommunication (€) | 1 940 | 5 010 | 400 |
| **Total cost savings** (€) | **43 000** | **23 900** | **18 200** |
| Total cost for ALL visits (€) | 247 000 | 197 000 | 163 000 |
| **Total cost savings potential** | **17.4 %** | **12.1 %** | **11.2 %** |

**Table 10** Summary of total cost savings potential for the three Key Accounts

### 5.1.3 Analysis: Cost Structure

An analysis of the Cost Structure is presented below. The analysis will be summarized by two important take-aways.

#### 5.1.3.1 Lean Service

Firstly the results from the calculations on service statistics will be analyzed for each waste category. After that an overall analysis, including all identified wastes and total cost savings potential, will be presented.

#### 5.1.3.1.1 Unneeded Transport

For all three Key Accounts, similar amounts of time and cost are spent on an average Unneeded transport visit. The concerned visits stands for 3-4 % of the total amount of visits performed during 2015, which corresponds to a cost savings potential of around 2 % for each Key Account. This number might seem low. However, if similar results can be found for other customers as well, AAES can save a significant amount of cost. The time spent on Unneeded transport visits can also be spent on other, more value-adding activities.

The cost savings were calculated by removing travelling costs for a third of all adjustment visits. Working costs will still remain after the implementation of IoT due to the fact that the work still has to be performed by someone, even if the work can be performed remotely. However, to be able to do adjustments remotely, a digital interface is needed. This could result in the settings being facilitated to adjust, i.e. the work of doing adjustments might be facilitated, leading to reduced working time and hence leading to further cost savings.

It should be noted that the results are based on that one third of all adjustment visits are considered to be remotely executable with IoT. AAES should investigate further into the extent of adjustments that will be affected by IoT since one third may not correspond to the full potential of remotely executable adjustments. Hence the cost savings potential might be even larger.

#### 5.1.3.1.2 Inadequacy

Results from calculations on Inadequacy visits show a large cost savings potential. The average time and cost for an Inadequacy visit differ somewhat between the three different Key Accounts. It is difficult to speculate about what causes this difference, and it should therefore be analyzed further by persons with the right knowledge. The high average cost of KA1 together with the large amount of Inadequacy visits, corresponding to 14 % of all visits, result in nearly 15 % cost savings potential. Even if the numbers for KA2 and KA3 are not that large, they still reach a cost savings potential of 8-9 %. AAES thus spends a significant amount of time and money on non-value adding visits. The need of having to do a return visit due to lack of resources can probably be reduced or completely removed with IoT.

To estimate required resources accurately, a correct description of the problem and its cause is required. Today the employee at the helpdesk needs to be able to interpret the information from the caller and send it forward to the planning team. Thus there is a risk of misinterpreting information. However, if the door itself can send information of occurring errors and performance status, and the information can be interpreted correctly, the required resources to solve the problem could be pre-estimated more correctly. Materials could be ordered in advance and service can be planned so that required time, manpower, tools and skills will be available for the visit. The planning team will be less dependent on the caller's descriptions, and the caller perceives convenience in not having to contact the helpdesk.
The lack of needed spare parts and tools is a commonly occurring issue, resulting in unnecessary high costs for AAES. As a first step AAES should therefore investigate further in how the selection of spare parts in the vehicles is made.

Another argument for eliminating return visits is that this type of visits often results in long waiting times for the customers. This is confirmed by calculations of waiting times, but also by the VP Finance in Country C.

##### 5.1.3.1.3 Miscommunication

The number of Miscommunication visits vary between the three Key Accounts. For KA1, Miscommunication visits are most frequently occurring, corresponding to a cost savings potential of 2.54 %. KA1 has the highest number of total visits, doors and stores, as can be seen in *Table 5.* However, the results show that Miscommunication visits are not related to the size and total amount of visits of a Key Account, since KA2's results surpass the results of KA1. Miscommunication visits seem to be more randomly occurring.

The average time and cost of a Miscommunication visit are, for all three Key Accounts, lower than the previously investigated visits. This might be due to the fact that the service technician has not been able to perform any work at site because the door has been taken out of use or the site has been closed. If IoT could enable the door to, by itself, notify and report if it is taken out of use, visits on no longer existing doors could be eliminated. If the door also could share information about the site's opening times, and maybe other relevant information about the site, visits to closed sites could be eliminated as well.

The variation of the results makes it difficult to draw conclusions. However, AAES should investigate further into Miscommunication visits in order to see if they occur for other Key Accounts as well.

The cost savings potential for the three Key Accounts are small. However, due to the random distribution of Miscommunication visits, other accounts might bring larger cost savings potential. The biggest saving from eliminating Miscommunication might not be direct cost reduction, but better utilization of service technicians. Time and resources can be used on other value-adding activities instead of unnecessary service visits.

##### 5.1.3.1.4 Delay

If a problem is solved remotely, the customer does not have to wait for a service technician to travel to site. The reduction or elimination of the investigated service visits does not only result in cost savings, but can thus reduce waiting time for customers. However, as the VP Finance in Country C explained, some delay time occurs when AAES has to wait for the customer to sign orders or needed material. Subcontractors can also cause waiting time, which is out of AAES' control. AAES should investigate further how large amount of delay time that can be allocated to AAES' own activities, as well as what causes the delays. Thereafter, it would be possible to determine which and how much time that can be reduced through IoT. Decreased waiting time most likely increases customer satisfaction and improve the relationship between AAES and its customers. It should therefore lie within AAES' interest to look further into reduction of customers' waiting times.

KA1 has two days shorter waiting time on return visits compared to KA2 and KA3, which have a waiting time of eight days each. KA1 also has a significantly higher percentage of return visits than the other two Key Accounts. The high number of return visits indicates that AAES' pre-estimation of required resources is less accurate regarding KA1. However, KA1 has to wait less time for AAES to come back again to solve the problem. It would be interesting to investigate further if a correlation between waiting time and number of visits actually exists, as well as why Inadequacy visits are frequently occurring for KA1.

When a return visit is required due to lack of resources, it takes approximately one week to get a problem solved. Compared to the median waiting time for a reactive visit of one or two days, one week can be considered unusually long.

IoT could enable a more correct pre-estimation of required resources and thus reduce the number of return visits, reducing the corresponding waiting time for customers.

The median waiting time for Unneeded transport visits is similar to the median of an average reactive visits. Considering delay time solely, Unneeded transport visits are thus not more important to eliminate than other visits. With IoT, the problem could maybe be solved quicker if the service technician does not have to travel to customer's site, but since the waiting time currently is only one or two days, reducing travelling time will not reduce the waiting time for customer significantly. However, a reduction of Unneeded transport visits should still be considered as beneficial since it leads to cost reductions and time that can be used for creating more value.

##### 5.1.3.1.5 Analysis of Total Cost Savings

For the three Key Accounts, it is shown that approximately 50 % of all service visits are reactive. However, according to the VP of Service development, generally only a third of all visits are reactive visits. One possible cause for this difference is that the investigated Key Accounts have Gold contracts. Gold contracts include most types of service visits, which might encourage customers to call AAES more often than if they would have had to pay for each visit directly. AAES should however investigate the actual split of reactive and proactive visits further since this number relates to the potential cost savings arising from IoT. If errors can be predicted and planned through IoT, reactive visits will be reduced and transformed into proactive visits. The more reactive visits that can be reduced or transformed, the higher cost savings can be achieved.

The total cost savings potential for the three Key Accounts vary from 11 to 17 %. KA1 has the highest number of visits, stores and doors, and also the highest cost savings potential. It can therefore be argued that cost savings potential is proportional with the size of the customer. However, such a linear correlation cannot be confirmed since the difference between numbers of visits are not as significant as the difference in cost savings potential. The number of visits differ with around 600 between KA2 and KA3, and the overall cost savings potential differs with around one percent. However, 350 more visits have been performed on KA1 than KA2 but the cost savings potential differs with 5 %. KA2 has slightly less percentage of reactive visits, which might explain this difference.

The occurrence of some of the specific types of visits vary much between the Key Accounts, which imply that there is no linear correlation with the occurrence of a specific type of visit and the total number of visits.

KA1 has a significantly larger amount of Inadequacy visits, which cannot be explained solely on the larger size of the customer. The cause for all types of visits should be further investigated by AAES.

The results show a potential cost saving of 17 % per year for KA1, and 11-12 % for the other two Key Accounts. These percentages correspond to a cost saving of 43 000 € per year for KA1 and 18 200 € respective 23 900 € for the others. It should be noted that these are best-case scenario results, i.e. if AAES succeeds with implementing the technology required for IoT and remote control, and if the suggested elimination of service visits can be fulfilled. The results show cost savings potential for three Key Accounts, under Gold contracts, in Country A. Similar cost savings potential might exist for other customers as well.

In this master thesis, four of the eight wastes in the lean model of Andrés-Lópeza et al have been investigated regarding cost. It is suggested that AAES looks further into the other wastes, in order to see if more cost savings potential can be found.

#### 5.1.3.2 Important Take-Aways

Important take-aways from the Cost Structure analysis are presented in *Figure 10* below.

| **Important Take-Aways** |
|---|
| • For the three investigated Key Accounts, the cost savings potential arising from implementing IoT ranges from 11 % to 17 % per year and customer.<br>• Inadequacy visits show the highest cost savings potential. |

**Figure 10** Take-Aways from the Cost Structure section

## 5.2 Value Proposition

*This section starts with a description of the current Value Proposition of AAES, including results from the interview with KA2. The section is concluded by an analysis of the Value Proposition.*

### 5.2.1 Current Value Proposition of AAES

The current value proposition of AAES is that "the door should not be noticed". This means that the door is operating well, without any problem, and that the door enables an uninterrupted flow of people. In order to achieve this, the offering of AAES consists of two parts: a physical product and service of the product (President of PDS, 2016, pers. comm., 19 April).

#### 5.2.1.1 Customer Value

As mentioned earlier in the report, it is uncertain if AAES' customers are interested in the changes in products and services that are enabled by IoT. Generally, there is a lack of customer focus within AAES, according to the Global Retail Segmentation Director, among others. This opinion is also shared by the Service Manager at IDDS, who points out that AAES must be better at showing customers the benefits with AAES' offerings, and how AAES differentiates from competitors (Service Manager at IDDS, 2016, pers. comm., 7 March).

Currently AAES has no structured way of gathering information about customers' needs and wishes. The Global Retail Segmentation Director confirms that generally no market research is performed when developing new features and functions of doors (Global Retail Segment Director at AAES 2016, pers. comm., 3 March). ASSA ABLOY uses a concept called Voice of Customer (VoC) but this has not yet been implemented at AAES.

##### 5.2.1.1.1 Voice of the Customer

Voice of the Customer (VoC) is a program within ASSA ABLOY, with the aim to gain insights and knowledge about wishes and needs of customers. The Global Customer Insight Manager at ASSA ABLOY explains that the VoC aims at realizing how to transfer knowledge about customers into business opportunities. VoC consists of a five days program. Employees of ASSA ABLOY are taught how to gather customer insights, by using tools such as qualitative interviews and observation studies.

The participants then apply the tools on real customers of ASSA ABLOY through a field study. The program is concluded by analyzing the results from the field study, discussing how the gathered insights could be transformed into new business opportunities.

The program is not limited to employees with certain positions, but usually taught to cross functional teams from all different divisions of ASSA ABLOY. Each division has a VoC representative (Global Customer Insight Manager at Assa Abloy, 2016, pers. comm., 24 Feb). Even if AAES is not yet applying the VoC concept, they still have a representative.

According to the VoC representative of AAES, AAES has not been able to put resources into participating in the five days program. VoC is not prioritized. However, AAES is expressing a need of increased customer awareness. The VoC representative for AAES means that VoC at ASSA ABLOY currently offers tools for gaining customer knowledge in pre-product innovation projects. However, what AAES would need is tools that can be used for testing already developed products on customers. Such requested tools are for example templates and instructions on how to make customer surveys. The representative of VoC at AAES does not hold a responsibility of applying the concept into the daily work. The representative however expresses a wish for having an employee within AAES to focus only on customer awareness (Product Manager at AAES, 2016, pers. comm., 2 March).

##### 5.2.1.1.2 Customer Insights at AAES

Even though AAES is not participating in the VoC program, they have some contact with their customers through other channels. One channel is the sales people who have regular contact with the customers. Another channel is the service technicians, who meet customers during installations and service visits (Product Manager at AAES, 2016, pers. comm., 2 March).

The Sales Manager in Country B claims that the customers of PDS in general do not have any specific requirements regarding the doors; they just want the doors to operate without any problem (Sales Manager in Country B, 2016, pers. comm., 15 Feb). The Marketing Manager adds that the customers are only interested in a solution to a perceived problem; not specific features or functions of their doors.

The Marketing Manager confirms that the most important need of the customers is an operating door (Marketing Manager at PDS, 2016, pers. comm., 2 March).

When it comes to Key Accounts, the Sales Manager believes that the most important driving forces are environment, security and health. Environment includes for example heat loss and maintaining a good working environment for the employees. Security means for instance that robberies should be prevented as far as possible. By health the Sales Manager means that people need to feel safe around the door (Sales Manager in Country B, 2016, pers. comm., 15 Feb).

Through service technicians and sales people AAES has received some customer suggestions for improvements and desired features of their doors. However, very few of the suggestions are related to IoT and/or remote service. The few wishes that have been discovered in this area are described in the section about Customer wishes related to IoT, respectively for Country A, B and C.

##### 5.2.1.1.3 Value Drivers

AAES has tried to capture what aspects the customers find valuable through five so called value drivers: convenience, sustainability, aesthetics, security and safety. A large part of AAES' business is built on the value drivers, which serve as a foundation for AAES' offerings and development of new products. The value drivers are also used frequently in marketing activities (President of PDS, 2016, pers. comm., 19 April). The Marketing Manager of PDS confirms that the five value drivers pervade all activities within the company (Marketing Manager at PDS 2016, pers. comm., 2 March).

A description of the five value drivers can be seen in *Figure 11* below (AAES n.d. d).

**Convenience**
The idea behind convenience is to make things effortless and simple for the customers. This includes ensuring an uninterrupted flow of people passing the doors, for instance through adjusting settings such as opening width and opening time.

**Sustainability**
Through measures related to sustainability, AAES aims to support their customers in increasing energy savings as well as improving indoor climate, especially by reducing the heat loss during opening of the doors.

**Aesthetics**
Aesthetics relates to the appearance and impression of the door solution.

**Security**
The security aspect relates to secure entrances, which prevent crime and protect goods and people.

**Safety**
Safety concerns personal safety in and around the door systems

**Figure 11** AAES' five value drivers

#### 5.2.1.1.4 Customer Wishes Related to IoT

In some countries, sales persons have initiated a dialogue with customers in order to explore the demand for IoT. This matter has been further investigated for Country A, Country B and Country C.

Country A

According to the representative of VoC at AAES customers from Country A have shown interest in remote service. However, there is still no clear business case (Product Manager at AAES, 2016, pers. comm., 2 March). The National Accounts Manager in Country A has not noticed any clear results showing that more proactive service leads to fewer reactive visits.

This is an issue if trying to discuss IoT with the customers, since proactive maintenance cannot be used as a sales point if the benefits cannot be shown to the customers (National Accounts Manager at AAES, Country A, 2016, pers. comm., 1 March).

Country A has performed a case study on KA1. The case study does not directly relate to IoT but can be used as an indication of customers' interest in new technological solutions. The case study focused on potential energy savings resulting from a new modernization package. The results showed that by integrating new technology, the opening time of the doors could be significantly reduced, resulting in an average, yearly energy cost saving of 3 600 € per door. The case study was a trial, conducted at one store. After taking part of the results KA1 now would like to extend the trial by involving more stores. If the extension of the trial also show positive results, KA1 has shown an interest in implementing the solution in all of their stores, across the whole country (National Accounts Manager at AAES, Country A, 2016, pers. comm., 1 March). A more detailed description of the case study can be found in *Appendix B*.

The National Accounts Manager in Country A means that it is not only KA1 that has shown an interest in energy savings. There is a large focus on heat loss generally in Country A. This could imply that other stores except KA1 could be interested in products and services, enabling reduction of energy consumption. Two other Key Accounts within the retail segment have actually already shown such an interest. Both of them want to implement solutions similar to the one at KA1 (National Accounts Manager at AAES, Country A 2016, pers. comm., 1 March).

The National Accounts Manager has also discussed the general topic of IoT with some of Country A's customers. During some of the discussions it has appeared that the customers are interested in remote monitoring of their doors. With remote monitoring the customers could be able to, for example, diagnose problems remotely, reset the doors and capture data. However, no clear business case has been developed yet (National Accounts Manager at AAES, Country A 2016, pers. comm., 1 March).

### Country B

The Sales Manager of Country B confirms that there has been no discussion about IoT with the customers. This due to the fact that customers seldom are aware of what they want. Consequently, asking the customers would not lead to any useful insights. Discussing features and products that AAES currently cannot provide can also make the customers screen the market for other firms already providing such offers. Due to this issue, the Sales Manager of Country B only discusses existing products with the customers. However, based on experience, the Sales Manager believes that energy could be a successful sales point when it comes to IoT (Sales Manager in Country B, 2016, pers. comm., 15 Feb.).

### Country C

In Country C, AAES has initiated discussions about IoT with customers. One specific example is a high volume Key Account within the retail segment. The Key Account has expressed an explicit interest in implementing IoT in their doors. One reason for this is that the customer already has successfully integrated IoT in their refrigerators, for example enabling a warning to be sent if the temperature in the refrigerators drops. The customer believes that IoT could bring similar benefits regarding their doors. The customer's wish for IoT integrated in doors was first expressed in a discussion with the R&D Director of Country C in late 2014. The customer has also expressed a wish for being able to see the traffic flow of their customers, to identify which entrances that are being used most frequently. Monitoring the current status of the doors has also been of interest.

Except discussions with customers, no structured market research has been conducted regarding IoT integration in doors in Country C. Despite a vague interest shown among customers, there is no clear business case developed. However, based on experience and discussions with customers, the R&D Manager believes that the customers could be interested in energy efficiency. Since energy loss means unnecessary costs for the customers, they are interested in measures reducing energy loss. As always, the customers also require safe door solutions. According to the R&D Manager, IoT could reinforce the safety and liability aspect, since the information generated by IoT could help maintain the standard of the door. For example, by accessing information about why an accident occurred, or who was responsible, AAES could presumably prevent the same type of accident in the future (Director, R&D Country C, PDS 2016, pers. comm., 24 Feb).

##### 5.2.1.1.5 Customer Interview

From the previous chapters it can be concluded that AAES is currently working with introducing IoT in their doors. However, since there has been no market research showing the opinions of customers regarding IoT, an interview with one of three accounts, KA2, was conducted.

The customer interview had three main purposes:

- To explore what characteristics of doors the customer finds most important
- To investigate the interest in new door functions and features enabled by IoT
- To examine the customer's willingness to pay for new features and functions enabled by IoT

The development of questions about new functions and features was based on aspects described in appendix C. The complete interview guide can also be found in *Appendix C*.

##### 5.2.1.1.6 Description of the Interviewee

The interviewee is the facility management company of KA2. It should thus be noted that KA2 has no direct contact with AAES. Instead they use a facility management company to manage their facilities, including doors. The facility management company is responsible for looking after all doors at 1300 retail banks, as well as several corporate sites. The company can be described as an interface between KA2 and AAES, which also includes signing service contracts for the doors. It is thus the facility management company and not KA2 that is the owner of the service contract with AAES. Generally the facility management company is not involved in the purchasing of new doors, except at special occasions, e.g. when a door needs to be replaced.

If KA2 perceives a problem with a door, they will first call the help desk of the facility management company. If they are not able to solve the problem, the facility management company calls AAES, who will try to fix the problem. The interviewee in this study is employed by the facility management company, and is the facility service manager of KA2. Therefore the interviewee has good insight into KA2's needs and wishes, and is therefore capable of answering all the interview questions.

##### 5.2.1.1.7 Results

The results from the interview are presented below, divided into the main topics.

###### Requirements of the Doors

When it comes to doors, the interviewee considers that the most important aspect for KA2 is reliability. The doors should work properly. Another important aspect is aesthetics, in terms of the design contributing to maintain the reliability of the doors. The third driver for KA2 is energy. One example is that they would appreciate technology that can reduce the opening time of the doors and hence result in energy savings.

###### New Functions of the Door

Regarding new functions of the doors, enabled by IoT, the interviewee believes that it would be highly relevant for KA2 to be able to monitor the doors remotely. The security aspect is important for banks. Being able to remotely monitor the current status of the doors, i.e. to see which doors that are open, closed, locked or unlocked, would enhance the security. However, controlling the doors remotely is not seen as relevant due to the risks involved. Accidents might occur if a person controls the door without being at site to see what happens. The same opinion is expressed regarding adjusting the doors remotely.

The interviewee thinks that monitoring the energy consumption of doors is interesting, if such monitoring can be integrated in a control system for the whole facility. For example, the interviewee explains that measures for monitoring energy consumption for other devices, such as heating and air condition, are already in place. The interviewee adds that it would be interesting to compare the energy consumption of the doors with the energy consumption of the whole facility. Moreover, there is an interest in new technology that could reduce energy consumption. The facility management company is already looking at the opportunity to integrate sensors from AAES in KA2’s doors in order to achieve energy savings.

Another function that the interviewee finds valuable is having integrated pedestrian calculators in the doors. Information about the number of people passing a door could be used as input when deciding on how to operate the doors. However, identifying the type of persons passing the doors is not considered to be of any significant value for KA2. The interviewee believes that having surveillance cameras integrated in the doors is not relevant for KA2 either.

The reason is that KA2, as a bank, already has cameras installed in specific locations. However, it is possible that surveillance cameras could be of interest in the future, if such cameras are integrated in the doors from the beginning. At the current situation, KA2 would probably not be interested in an alarm going off in case of intrusion attempts. Once again, this is because they already have rigorous security systems in place. The interviewee notes that it might be relevant for other customers that are not banks.

The interviewee thinks that monitoring the performance of the doors, i.e. viewing technical status and statistics, would be very useful. The largest benefit is predictive maintenance, which can enable the facility management company to solve problems at KA2's doors themselves, to a larger extent. This could thus lead to fewer calls to AAES. The interviewee thinks that this function, along with the ability to see the operating mode of the doors, are the most interesting features. In general, all measures that are related to a proactive approach rather than a reactive approach when it comes to maintenance of doors are appreciated. Therefore, it would also be valuable to get real time advice regarding utilization of the doors in order to improve performance.

### Willingness to Pay

The interviewee thinks that it would be worth to pay extra for relevant new features and functions, if AAES would be able to demonstrate the benefits. Before investing in new products and/or services, KA2 and the facility management company want to ensure that the invested money will be returned. One example is that the investment in a new door could be covered by cost savings arising from energy savings or predictive maintenance. Return on investment thus plays an important role. Regarding payment, the facility management would be willing to have a pay-per-use contract if it is cheaper than the current payment model. If they would be offered a trial-period to test the new features and functions, they would accept the offer.

### The Contact with AAES

When it comes to the facility management company's contact with AAES, the interviewee thinks that there is no added-value in meeting a technician in person. Instead, added-value is created by quickly finding a solution to a problem. One example is that the customer should not have to wait a long period for the needed material before a problem can be fixed by AAES' technicians.

The most important thing is to achieve an uninterrupted flow of pedestrians, as well as keeping a high level of security.

#### 5.2.1.2 Customers' Willingness to Pay

No structured research has been done within AAES in order examine customers' willingness to pay for new products and services. However, since several employees at AAES have regular contact with customers, they could give indications about the willingness to pay.

The Sales Manager in Country B points out that the customers demand simplicity, and that they do not want to pay for any features except a well-operating door (Sales Manager, Country B 2016, pers. comm., 15 Feb.). The Product Manager of Information Services claims that customers cannot comment on whether they are willing to pay for a new product or not if they do not know what the exact price will be. The problem is that AAES seldom knows the price of a new product before they are ready to launch it. Consequently, if AAES asks the customers if they would be interested in a new feature of the door, AAES will most likely get the counter-question "What will I have to pay?". If AAES does not have an answer to that question, the customer will not be able to express an opinion. The customers want to know the price before considering a new product or service (Product Manager, Information Services 2016, pers. comm., 1 March).

After discussing IoT with the customers, the R&D Manager in Country C has concluded that most customers are not willing to pay for IoT solutions unless the potential added-value is obvious. Even if customers in general show an interest in new, innovative solutions, they are not willing to pay extra for it. Instead they are of the opinion that new features and functions should be included in the current price. However, the R&D Manager believes that, if AAES can explicitly demonstrate the value of new products and services, for example potential cost savings arising from energy savings, the customers are more willing to pay. However, the R&D Manager also notes that the willingness to pay varies from customer to customer. For example, some retailers care more about their stores and their doors, and therefore they are also willing to spend a little more money if they recognize the value generated. On the other hand, some retailers only want the cheapest solution possible, regardless of the value delivered (R&D Director in Country C, 2016, pers. comm., 24 Feb).

Finally, the case study performed at KA1 in Country A indicates that KA1 is willing to pay for new technology solutions. Although the study was not directly related to IoT, it showed that KA1 is willing to pay extra for technology that enables energy savings (National Accounts Manager at AAES, Country A, 2016, pers. comm., 1 March).

### 5.2.2 Analysis: Value Proposition

The chapter begins with a general discussion regarding value proposition. Thereafter the analysis will be divided into customer value and ways to increase customer value. The analysis will be summarized by two important take-aways.

One conclusion that can be drawn from the literature review is that a company's value proposition will be affected by the introduction of IoT. However, since the subject is still relatively new and undiscovered, it is still unsure how the value proposition will come to change. Therefore, the analysis below will focus at speculating about future opportunities.

#### 5.2.2.1 Customer Value

A prerequisite when developing a value proposition in an IoT context is to fully understand the customers' needs and wishes. Osterwalder & Pigneur (2010) stress the importance of defining the value delivered to the customers. One conclusion that can be drawn from the interview with the facility management company is that monitoring energy consumption and technology to achieve energy savings are considered to be useful. The interest in reducing energy consumption can also be derived from the case study at KA1, where the customer expressed an interest in such solutions. The fact that many customers show an interest in energy reduction is confirmed by several employees at AAES.

However, the main conclusion from the interview with the facility management company is that the most important wish seems to be a well-operating door. It can also be concluded that the interviewee encourages all features and functions that facilitate their own service of the door, for example occasional advice and monitoring of technical status. These features could lead to a more proactive approach, enabling predictive maintenance. Several employees at AAES also believe that many customers only demand a door in good condition; not specific features and functions, except the ones related to energy consumption.

Consequently, the current value proposition of AAES, “the door should not be noticed”, seems to reflect what customers actually demand.

However, when investigating customer needs it should be taken into consideration that different types of customers are driven by different factors. One example is whether the customer is the end user of the physical door, such as KA 2, or an end user of the service contract responsible for maintaining the door, e.g. the interviewed facility management company. The results from the customer interview leads to the insight that end users of service contracts, such as companies within facility services, are more likely to appreciate measures that facilitate their own maintenance of the door. On the other hand, from the interview it can be interpreted that end users of the physical door might be more interested in functions such as remote opening and closing of their doors. While the interviewee from the facility management company finds less contact with AAES as a positive thing, it is not certain what the end users of the physical door think of reduced personal contact.

##### 5.2.2.1.1 Alignment of Business Model and Customers’ Needs

In order to determine the specific needs and wishes of AAES’ customers, more investigations, such as market research, will be required. Based on the interview with the facility management company and interviews with employees, it is however concluded that the customers currently request well-operating doors of good quality, which is retained during the product’s lifecycle. Assumed that the five value drivers represent what generates value to the customers, it can be concluded that the customers basically demand establishment and retention of the value drivers during the product’s life cycle. Whether AAES successfully fulfils that request could however be questioned.

The current business of AAES is to a large extent based on generating revenue when the doors are not working. The customers are charged for the costs of service, included in service contracts or not, in order to get a problem solved by a service technician. Thus the customers pay for activities that cannot be regarded as value-adding, such as the service technician’s travelling time and working time. The more the customers’ doors are not functioning, the more revenue AAES generates. The fact that the business is based on fixing non-functioning doors is not aligned with the customers’ needs of fault free equipment. To summarize, AAES is currently not charging their customers for what really creates value to the customers.

#### 5.2.2.1.2 Value Drivers and IoT Contract

When trying to concretize the value delivered to customers, the value drivers could be a good start. The value drivers are established when a door is produced, but IoT could significantly contribute to sustaining the value drivers during the life cycle of the product. An IoT contract based on the value drivers, and not costs, could hence be introduced in order to create customer value in the short term. In such a contract, customers could be offered customized service enabled by IoT.

How IoT could potentially affect the different value drivers are summarized in *Figure 12* below.

**Convenience**
Through the use of predictive maintenance, breakdowns could be prevented, resulting in higher uptime. This would significantly strengthen the convenience driver.

**Sustainability**
The sustainability aspect could be achieved by monitoring and reducing energy consumption.

**Aesthetics**
Aesthetics might not affect the service process directly, but it can contribute to the reliability of the door.

**Security**
The security driver could also be enhanced by IoT, for example through the fact that less downtime results in less risk of malfunctioning locks, which in turn decreases the risk of intrusion.

**Safety**
Accurately maintaining a door decreases the risk of accidents caused by operating faults, which in turn increases safety.

**Figure 12** A summary of how IoT could potentially affect the five value drivers

The value drivers will most likely be given different weights in a contract, since they presumably are of different importance to the customers. What value drivers that customers find most important depend on factors such as country and customer segment. The interviewee from the facility management company believes that KA 2 value reliability, sustainability and aesthetics. However, security could also be considered especially important since KA 2 is in the banking industry. The R&D Manager of Country C mentioned that liability is of high importance in Country C, which implies that safety (which is related to liability) could be weighted higher there.

Whether a new contract should be developed, and whether it should replace the current Bronze, Silver and Gold contracts or not, is up to AAES to decide. However, if a special IoT contract is developed, it seems reasonable to introduce it in parallel with the existence of current contracts. This approach could contribute to gradually creating a foundation for IoT. The contract could at first hand be tested on a limited number of chosen customers. Through an iterative process, and by having regular interaction with the customers, AAES can thereafter discover what aspects the customers regard as value-adding, as well as which aspects that are the most and least important. Hopefully it is also possible to find out how much the customers are willing to pay for the created value. Trying out the contract through an iterative process could thus increase the understanding of what value IoT could deliver to customers. At the same time it is a chance for AAES to explore and quantify the cost savings potential.

#### 5.2.2.2 Customers' Willingness to Pay

Instead of paying for repair and maintenance, the customers are most likely willing to pay for the fact that their doors operate continuously. According to the theory of Grönroos, one major reason why customers do not want to pay for improved service offerings is that the benefits or added-value are not obvious. Rapaccini also points out that it is of great importance to visualize the value in order to convince the customers about the benefits of an offer. The interviewee from the facility management company confirms that this is the case, through saying that they are willing to pay extra for new services if they clearly see the added-value. This is further confirmed by the case performed at KA1, who expressed a willingness to pay for energy reducing technology in case of clearly visible cost savings potential.

In the specific case of KA 2, it should be noted that KA2, the end user, and the facility management company, might have different willingness to pay. The interviewee from the facility management company expressed a willingness to pay for additional features reducing the need of service, but this is most likely seen only from a maintenance provider's perspective. KA 2 on the other hand could have a different view since they are responsible for the actual purchase of the doors. This problematic is probably relevant for other customers as well. The fact that end customers and intermediates can have different willingness to pay should be considered when developing new offers. The value should presumably be delivered in different ways depending on type of customer.

Once again, it should be noted that the willingness to pay differs between different types of customers. Grönroos points out that there are customers that simply not are interested in value-adding services, they are only interested in the lowest price possible. The R&D Manager in Country C confirms that some of AAES' customers within the retail segment prioritize cost when buying a new door or service, while others prioritize value. This could indicate that customers differ from each other despite the fact that they belong to the same customer segment. Further studies would be needed to establish different categories of customers and to determine whether they value new, innovative solutions higher than low prices, or the other way around.

According to Grönroos, another reason for customers' unwillingness to pay is that the service offering is not enough customer oriented. This reason reinforces the importance of developing an offer according to the customers' needs and wishes. To conclude the preceding discussion, there currently seems to be a mismatch between what the customers want and what they are offered by AAES. This gap could be bridged by charging the customers for the actual delivered value, i.e. the degree to which a door operates properly. The service should, based on predictive maintenance, only be performed when the door is actually in need of it. If the customers are charged based on e.g. usage patterns, customization will enhance significantly. According to Osterwalder and Pigneur, customization in itself, i.e. creating solutions tailored to individual customers, is one way for companies to create value for their customers. The new offering could even stretch as far as offering the customers compensation in case of malfunctioning doors.

### 5.2.2.3 Ways to Increase Customer Value

An analysis of how AAES concretely could increase customer value is presented below.

#### 5.2.2.3.1 Increased Servitization

To reach full exploitation of IoT, one way to go is to remove service contracts totally. Instead, as the theory suggests, the company could move towards a servitized offer where products and services are more integrated. The theory of Opresnik & Taisch explains that Big Data generated by IoT can be integrated in a product-service offering, hence leveraging the opportunity of servitization.

AAES can be considered to already be servitized to some degree, since the definition of servitization according to the literature is to sell some form of an integrated combination of goods and services. AAES' service contracts can be considered to leverage the value of the physical products. Despite that, the degree of integration between products and service offerings is not very strong, since it is possible for customers to buy products and service contracts in isolation from each other. For that reason, AAES can be placed at the second level, "intermediate servitization", in Bustinza et al's model of servitization. AAES offers maintenance and repair, but not fully integrated with the product and not with focus on the customers' outcomes.

In the model of Avlonitis et al, AAES can be placed between the second step, asset recovery, and the third step, asset availability, as can be seen in *Figure 13* below.

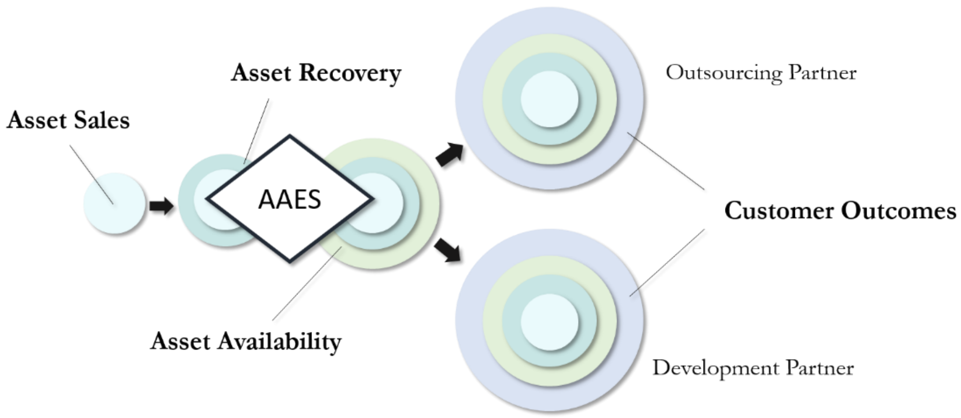


**Figure 13** AAES' degree of servitization in relation to the model of Avlonitis et al

It can be considered that AAES strives for fault free equipment through focusing on planned maintenance and changing parts before they break. However, an analysis of the service statistics show that there are still as many reactive service visits as proactive service visits, at least for the three chosen key accounts. For that reason, AAES cannot be considered to have fully reached fault free equipment.

If AAES chooses to increase the degree of servitization, they should, according to Avlonitis et al, firstly increase the focus on asset availability where the ultimate goal is to maximize uptime. The next step is to move towards customer outcomes, such as helping the customers to reach their goals. The theory of Avlonitis et al could indicate that AAES should focus on predictive maintenance and maximizing uptime before they move on to for example helping their customers reach cost savings through energy savings. At the current situation, AAES touches both, since they strive for well-functioning doors at the same time as they investigate the introduction of new features related to energy savings.

However, Bustinza et al do not make such a clear distinction between maximizing uptime and customer outcomes. Instead, the theory could indicate that AAES should move towards “advanced servitization”, which could include both realizing fault free equipment and customer outcomes. The highest level of servitization could be reached by offering products-as-a-service. According to Grönroos, converting a physical product into a service is namely one way to increase the value of service.

The advantage of a more servitized offer, combined with the introduction of Big Data through IoT, is that it could help AAES to differentiate from competitors. Customized solutions, where Big Data could open up for a wide range of opportunities, are namely more difficult for competitors to imitate.

There are however challenges that need be addressed before a possible introduction of a products-as-a-service offering. One of them has to do with the ownership of the door. Suppose that AAES would develop an offer consisting of a complete integration of doors and service. When a customer moves out of a facility a difficult situation will arise, since the door is attached to the property and the original buyer cannot keep the ownership in case of moving.

A positive effect of selling doors and services in a more integrated offer, is that it could lead to a higher contract hit rate. As the previous investigation showed, the contract hit rate in the Country A is generally low the first year. By offering a product-service combination, the issue of customers choosing to sign a contract or not, disappears. By paying for a well-operating door from the beginning, the customers can avoid to start pay AAES for repair and maintenance after a while, when their doors start to deteriorate. However, customers that already have gotten doors should of course be given the chance to buy the new type of service of AAES. This could preferably be done through IoT-integrated upgrade kits.

##### 5.2.2.3.2 Where Lies the Real Value of IoT?

The new functions and features that are enabled by IoT could be sold as additional services to the customers. Grönroos indeed states that the development of completely new services is one way to increase the value of service. The interview with the facility management company also showed an interest in the new functions. However, based on the driving forces of the customers, the greatest value of IoT from the customers' perspective does not seem to be found within such additional features.

Instead, the greatest potential value extraction lies in reinforcing the reason why the customers chose AAES in the first place: a well-operating door with features that are preserved during the lifecycle of the product. This in turn means that the value drivers, established when the customers purchased the door, are sustained during usage. Facilitating the customers' activities by taking a more overriding responsibility of the doors will probably lead to customers perceiving the situation as better than before, which is in line with Grönroos' definition of customer value.

The fact that the greatest value of IoT lies in a more integrated, customer-based offer does not mean that no new features and functions should be exploited. Some features, such as monitoring and reducing energy consumption and remote monitoring of doors, apparently seem to be valuable to the customers, at least according to performed studies. Consequently this type of functions could presumably be adding value in an IoT context and hence included in a contract.

However, one issue that not should be forgotten is that some new functions enable the customers to minimize their need for service. For instance, the interview with the facility management company indicated that they would appreciate all functions related to a proactive approach, e.g. monitoring the technical status of the door. In this way the customers might reduce the need of service themselves, leading to a competitive situation with AAES. There is hence a risk that AAES might lose the opportunity of specialized service. On the other hand, if the customers are able to maintain their doors to a larger extent, AAES could reduce their focus on service and instead charge the customers for the functioning of the doors. Lastly, it should be noted that the competitive situation might not arise for all type of customers. It is more likely to arise in the relation with intermediates such as facility management companies, whose task is to maintain the end users' doors.

To conclude all earlier reasoning about IoT, one implication is that the implementation of IoT results in fewer service visits. A potential disadvantage with fewer visits is the loss of the service technicians' personal contact with the customers. However, before drawing any definitive conclusions, it should be further investigated how important the personal meeting is to the customer. The customer interviewed claimed that there is no added-value in meeting a technician in person. The added-value is instead generated when problems are solved quickly. This instead confirms that customers considers that it is of utmost importance to be offered a door operating without disruptions.

To summarize, IoT is not in line with the current business of AAES. Even if the value proposition of "the door should not be noticed" seems to capture the customers' needs quite well, AAES has not fully achieved that value proposition yet. At the current situation, AAES earns more money as the number of service visits increases. The implementation of IoT will be beneficial if used only to remove non-value added visits that result in cost savings without disrupting revenue streams, such as Miscommunication, Unneeded transport, and Inadequacy visits. However if IoT is used to reduce other visits it will result in less income, without increasing the value delivered to customers. Thus, AAES cannot charge the customers for delivering any additional value, which finally undermines the current revenue model and the whole business. Implementing IoT fully, without reviewing the way value is delivered to customers and captured, could thus be devastating for AAES.

As Markendahl & Laya explained, companies will have to entirely change their business models and create new ways to capture value in order to stay viable in the era of IoT. This also indicates that the value proposition and revenue streams need to be more aligned. The pricing strategy and payment mechanisms needed to capture value in an IoT context are discussed in the revenue streams section.

#### 5.2.2.4 Important Take-Aways

Important take-aways from the Value Proposition analysis are found in *Figure 14* below.

| **Important Take-Aways** |
| --- |
| • The current business model of AAES, to charge customers for non-functioning doors, is not viable in an IoT context. The customers should pay for value-adding activities, which means that AAES should charge the customers when their doors are working.<br>• The full value of IoT does not mainly lie in offering additional, separate new |

**Figure 14** Take-aways from the Value Proposition section

## 5.3 Revenue Streams

*This section starts with a description of the current revenue streams of AAES. Thereafter an analysis will follow, including some results from the customer interview.*

### 5.3.1 Current Revenues Streams at AAES

Currently AAES captures value from their customers in basically two different ways: the sale of physical products and service contracts, which are sold separately from each other.

#### 5.3.1.1 Pricing Strategy

The price setting of the different service contracts is currently not standardized on a global level at AAES. It is up to each country to negotiate contract terms and prices with the customers (VP Service Development at AAES, 2016, pers. comm., 10 May). In Country A, the price of a new contract to existing customers is set based on a list of different factors. Some of the factors are presented in *Figure 15* below.

- Call history from the customers
- Volume of work that can be chargeable
- Condition of the doors
- Current price customers are paying

**Figure 15** Examples of factors that are considered when Country A determines prices of new service contracts for existing customers

For completely new customers where no historical information is available, the price is set using a cost model based on data from other customers. Examples of input data used for the cost model are presented in *Figure 16* below. After a cost estimation has been made the required margin is added to determine the price for the customer (National Accounts Manager at AAES in Country A, 2016, pers. comm., 17 May).

- Average travel time
- Average working time
- Average material cost
- Expected number of breakdowns
- Number of service visits required

**Figure 16** Examples of input data used when Country A determines prices on service contracts for new customers

#### 5.3.1.2 Methods to Generate Revenue Streams

Today AAES uses asset sales as a method for generating revenue from their physical products. The customers are also charged for the installation cost of the door (Product Portfolio Manager at AAES, 2016, pers. comm., 9 May). Regarding the service contracts, AAES charges their customers through a monthly based fee. This monthly based fee is however often paid as a lump sum once a year (VP Service Development at AAES, 2016, pers. comm., 18 Feb.).

### 5.3.2 Analysis: Revenue Streams

As discussed in the Value Proposition section, revenue streams should aligned with the value offered to customers: a well-operating door. Firstly an analysis of pricing strategy is presented, which is followed by an analysis of methods to generate revenue streams. The analysis will be summarized in two important take-aways.

#### 5.3.2.1 Pricing Strategy

Osterwalder & Pigneur point out that if pricing decisions are not made correctly it is difficult to exploit the full financial potential from the business. This statement emphasizes the importance of ensuring that prices are set based on the right decisions at AAES. Today the pricing strategy of AAES differs from country to country. By having a global standard set of factors that the price decision is based on, AAES could strengthen the possibility of correct price settings for all countries and thus increase the exploit of financial potential. IoT could ensure that pricing decisions are based on real data, extracted from service statistics sent from doors.

Even if AAES chooses to no set prices based on statistics extracted through IoT, it should be ensured that the prices are based on the same factors in all country divisions of the company.

Currently, the factors that the price of the service contracts are based on in Country A are all related to cost. The pricing strategy of Country A can therefore be categorized as cost-based. When comparing Rapaccini's pricing strategies for different degrees of servitization, to AAES' degree of servitization, value-based pricing should already be used within AAES. However, this is not the case. To match the pricing strategy with the degree of servitization, AAES should move towards value-based pricing, where the price is based on the value delivered to customers. Value-based pricing could, however, make internal decisions more complex and require new type of resources. AAES should be aware of that and consider the needed resources described by Rapaccini, as well as how IoT could potentially cover some of them. When making the shift towards value-based pricing, Bonnemeier et al enhance the importance of ensuring that costs are still covered.

Osterwalder & Pigneur (2010) mention that companies, when determining revenue streams, should consider what the customers are currently paying for and what value the customers are willing to pay for. As discussed in the Value Proposition section, AAES' customers are currently paying for downtime of the door, but they are most likely willing to pay for uptime. This emphasizes how important it is for AAES to charge the customers for a well-operating door. It is worth clarifying that according to Rapaccini (2015), charging customers for faults and errors instead of perceived value are common within service-oriented, and product-centric firms, and hence not unique for the service business at AAES.

To quantify the value of a well-operating door, measurable parameters need to be identified. It is up to AAES to identify and decide which measurable parameters the price should be based on. However, one example of a useful parameter that can be measured with IoT is the actual uptime of a door.

Implementing IoT in the current situation will be beneficial for AAES, since IoT will enable AAES to remove non-value adding service visits that currently only generate costs.

It should be stressed once again that the cost savings potential shown in this thesis are applicable only to the visits that are not disrupting revenue streams. However, these visits are limited, and hence the cost savings potential from IoT in the current situation of AAES is limited. A transformation of AAES' revenue model is required to exploit the full value of IoT. This statement is enhanced by Bonnemeier (2010), who explains that the use of traditional revenue models in servitized firms leads to a failure in capturing value from the customers. It can yet again be stressed that if AAES' revenue model is not aligned with the value offered to customers, an introduction of IoT might overturn the current business in the long run.

#### 5.3.2.2 Methods to Generate Revenue Streams

According to Rapaccini, value-based pricing strategies lead to innovative revenue models for firms with tailored and integrated service offerings. AAES could exploit this opportunity by looking into new methods to generate revenue streams. When deciding what methods to use, Bonnemeier et al (2010) stress the importance to fully understand what aspects that are value-adding for the customers. An example of an innovative method that is aligned with the value of a well-operating door, is performance-based price offerings. According to Avlonitis et al, performance-based price offerings are the most advanced and competitive ones. Avlonitis et al also claim that performance-based price offerings will motivate the service provider to identify what delivers value to the customer, which is in line with what AAES needs to do. Rapaccini adds that through performance-based price offerings, the manufacturing firm will be driven to develop as reliable and sustainable products as possible, to avoid unnecessary maintenance.

To be able to charge the customers for performance, the performance must be measurable and a desired performance level must be set. A concrete example is 95 % uptime. It is however up to AAES to decide a feasible performance level to offer their customers. When having a performance-based method to generate revenue streams, Avlonitis et al stress the importance of creating a well-defined SLA to ensure that AAES and the customer agree on what performance is included in the price.

Technology for measuring the performance of a door already exists, and such statistics can be extracted remotely from the doors through IoT.

As a first step, AAES should gather statistics to see the current proportions of downtime and uptime, run tests and implement IoT on some doors to receive knowledge about customers usage patterns. After that, qualitative interviews with customers could be performed to ensure that AAES has understood what aspects that are driving customer value.

To obtain a well-operating door, service will be required. The amount of required service will be higher on doors with higher usage rate. Since service visits bring costs for AAES, usage pattern is one factor that could affect the price. With IoT it is possible to measure usage rates as well as other parameters, and the price could therefore be customized for each customer. However, it is important to stress that even if the price will be customized, the price setting should be standardized, i.e. AAES should make sure that the price is set based on the same factors for all customers globally.

When it comes to price setting for new customers where statistics are not available, AAES could gather information from doors where IoT has been implemented, categorize the customers in groups depending on usage patterns and calculate a price model. The price can later be adjusted when real statistics on the new customer's door has been gathered.

The interview with the facility management company indicates that they are open for new payment methods. One payment method that could be used in order to charge the customers for a well-operating door is through ongoing payments. One example is subscription fee, where the customer needs to pay a monthly fee to get access to the delivered value. However, due to the fact that an entrance solution is attached to the property, one-time asset sale, which is being used today, might be the currently best method for generating revenue from the physical door. If AAES becomes more servitized they should investigate further into how this issue can be avoided and how they can charge a customer for the entire solution in one way.

#### 5.3.2.3 Lost Revenues due to Reduced Number of Service Visits

Implementation of IoT will lead to a reduction of service visits, if AAES chooses to perform only visits that are needed. With the current revenue model, applying IoT to all visits will consequently result in a revenue loss, since service technicians today are encouraged to sell extra spare parts and other equipment when they are visiting customers.

This is however not an issue for the visits addressed in Cost Structure section, since Miscommunication, Unneeded transport, and Inadequacy visits performed on customers under Gold contract are non-value adding visits that do not generate any revenue for AAES.

However, IoT can enable cost savings for other type of visits as well. But, exploiting IoT in this way will disrupt the current revenue generated by added sales. Osterwalder & Pigneur (2010) also mention that when a company determines revenue streams, they should quantify how much each revenue stream contribute to the overall revenues. AAES should therefore investigate how much the added sales from the service technicians actually contribute to the overall revenue. AAES could thereby analyze how big impact lost revenues from added sales has, when implementing IoT. If the contribution is high, AAES should examine how revenue can be achieved from other value-adding services instead. Furthermore, it should be remembered that service visits, regardless if they result in additional revenues or not, always bring costs. The possible loss in revenue might thus be covered by the cost savings resulting from eliminating visits.

#### 5.3.2.4 Important Take-Aways

Important take-aways from the Revenue Streams analysis are found in *Figure 17* below.

| **Important Take-Aways** |
|---|
| • Revenue streams should be changed from charging customers when the door is not working, to charging customers for the value they want to pay for; a well-operating door.<br>• The price should be performance-based, and price setting should be based on the same factors in all country divisions. However, the actual price should be customized based on usage pattern. |

**Figure 17** Take-aways from the Revenue Streams section

# 6 Discussion

*This section consists of an overall discussion, connecting the analyses from the Cost Structure, Value Proposition and Revenue Streams sections.*

In the beginning of this work, the literature study showed that companies have to change their business models completely, in order to exploit the value of IoT successfully. After investigating three parts of the business model at AAES – Cost Structure, Value Proposition and Revenue Streams – it can be concluded that changing at least these three parts will be required, to stay viable in the era of IoT over the long term. The Cost Structure section includes clear results based on calculations, hence pointing at real cost savings potential for AAES. The results from the Value Proposition and Revenue Streams sections include reasoning based on the literature study and one customer interview. The other six building blocks in the Business Model Canvas will most likely also come to change with the introduction of IoT, but future studies will have to reveal how.

One of the main conclusions is that AAES' value proposition and revenue streams need to be aligned. IoT is not needed in order to succeed with the alignment, however, it is not recommended to try exploiting the full value of IoT without aligning value proposition and revenue streams. This thesis has shown that it is first and foremost the revenue model, including the service contracts, which have to be changed in order to actually capture the full value offered through the value proposition. The current value proposition of aiming at problem-free doors seems namely to be in line with what the customers demand, but it is not that type of value the customers are charged for today. Whether AAES today truly fulfils their current value proposition could also be questioned, since approximately 50 % of the service visits of the three Key Accounts are still reactive, i.e. fixing breakdowns, instead of preventing and predicting problems through proactive visits.

AAES should design their service offerings better in order to achieve service exactly when needed, based on usage patterns. One major benefit of service exactly when needed, is that it will supposedly enhance at least one of AAES' competitive advantages: specialization. AAES' service division becomes specialist of the customers' doors and when the doors are in need of service. The revenue model and pricing should then be based on performance, and the fact that the doors are operating properly.

An alignment of the value position and revenues streams requires a transformation of the entire business. However, it is not reasonable to change everything at the same time. Therefore it is suggested that AAES begins with implementing IoT in order to make their internal service process more efficient. The calculated results have shown a cost savings potential of 11-17%, by reducing non-value adding visits that the customers currently are not charged for. These cost savings are valid for the three investigated key accounts, but the results are most likely representative for other customers in the same situation. Therefore it is recommended to reduce these visits. Primarily AAES should focus on the so called Inadequacy visits, i.e. the visits that require return visits due to lack of material, skills etcetera, since Inadequacy visits correspond to the highest cost savings potential.

At the same time as IoT is utilized to achieve cost savings internally, there should be measures taken in order to achieve alignment of the value proposition and revenue streams. Because today, visits that can be removed without disrupting any revenue streams are limited. The largest part of all visits generate revenue through additional sales, and through the fact that they are not included in current service contracts. Examples of visits that are excluded from all types of contracts are situations where customer is responsible for the cause of the problem. Sooner or later, the issue concerning alignment has to be dealt with. Service visits that bring income cannot be eliminated without taking measures to ensure that the income is generated in other ways. However, it will probably take long time to implement such measures. Therefore, it might also be needed to accept less income during a limited period of time to achieve cost savings, when the business model is being transformed. An advantage with fewer service visits, however, is that resources can be utilized better, for example the time of service technicians. This time can be spent in a more efficient way, for instance through raising customer awareness, resulting in benefits in the long term..

The implementation of IoT in the business of AAES requires patience, since it will take time to change the current business model and find specific areas where IoT brings large benefits. As Heppelman & Porter mentioned, IoT will also require an organizational transformation. AAES needs to align the whole organization, including divisions in different countries, in order to get ready for exploiting the full value of IoT. It will also be necessary to increase the collaboration between business units such as R&D and IT.

Other factors that are crucial for AAES to consider according to the literature, but that have not received any attention in this project, is developing a viable IoT technology and infrastructure, finding the right business partners and considering security and privacy risks.

Since it will take time to reorient the current business model as well as consider general prerequisites to succeed with IoT, it is recommended that AAES regards IoT as a highly prioritized matter. Not only the technology, but also the business perspective, must be taken into consideration. This is stressed by Muhtaroglu et al (2013) who said that it is companies that can adjust their business models to leverage value from IoT that will gain competitive advantage. Since it will take time before potential benefits can be fully extracted, and since it is important to act before competitors understand the potential, it is critical to start working now.

# 7 Conclusions

*This chapter concludes the report and starts with summarizing the findings of the work. The research questions formulated in the purpose are answered. Thereafter follows a credibility discussion, a description of academic contribution and suggestions for future research.*

## 7.1 Findings

The findings of this master thesis are summarized below, through answering the research questions formulated in section of purpose and research questions.

- ***Will*** *IoT change the current business models of technology-based manufacturing firms with a service business?*

  This study has shown that IoT does not necessarily change the business model, but rather triggers a transformation. Manufacturing companies need to transform their business models in order to stay viable in an IoT context over the long term.

- ***How*** *could IoT affect existing business models within technology-based manufacturing firms with a service business? More specifically:*

  - *How could IoT affect the* ***cost structure****?*
    In this study a cost savings potential of 11-17 % has been proved when introducing IoT in the service business. The cost savings arise from the possibility to reduce or eliminate certain service visits, since IoT could lead to more accurate data about current status of the products. In this study, the cost savings mainly arise from reducing travelling and working time of service technicians.

  - *How could IoT affect the* ***value proposition****?*
    IoT can enable entirely new ways to deliver value to customers, alternatively help companies in fulfilling their current value proposition more accurately. In the case of technology based manufacturing companies offering service, IoT could first and foremost help to maximize uptime of the equipment.

Through Big Data, which is enabled by IoT, manufacturing firms with a service business can create more customized solutions and opportunities to differentiate from competitors.

- *How could IoT affect* ***revenue streams****?*
  The revenue streams naturally change as the other parts of the business model change, especially the value proposition. With IoT, there is even more focus on charging the customers for the actual delivered value. Hence, the pricing strategy often changes from cost- or competition-based to value-based.

But, the most important conclusion from this study is that the three different parts – the Cost Structure, Value Proposition and Revenues Streams – need to be more aligned, both with each other but most likely also to the other building blocks in in the Business Model Canvas, in order to extract the full value of IoT.

## 7.2 Credibility Discussion

Even though measures to increase the credibility of this thesis have been taken, there are some limitations that are worth discussing. First of all, since IoT is such a new and undiscovered area, new studies and discoveries are being made continuously. Even though the authors have tried to stay updated on the subject, there is a risk that new, updated studies have not been taken into account.

Since AAES is such a large organization, there is a risk that not all accessible information have been possible to collect, due to the limited scope of this thesis. The large number of interviews with different employees have, however, hopefully reduced this risk. Interviewing many employees has also reduced the risk of biased information. However, although the authors have tried not to be influenced by individual opinions, there is a risk that this might have occurred. Another issue that might have had an impact on the collected information is language. Several interviews and mail conversations have been held in English, but since all persons involved in this thesis are not English native speakers, possible misunderstandings might have occurred.

As mentioned in the methodology chapter, there have been deficiencies in the quantitative data.

Even though obvious inaccurate data has been sorted out, there are most likely other deficiencies in the data that have not been taken into account. One reason for that is the authors' limited knowledge about AAES' organization and the structure of their data. However, there have been many discussions with the National Accounts Manager in Country A, which have helped the authors in understanding and interpreting the data.

One issue concerning the customer interview is that the interviewee from the facility management company is an intermediate between AAES and the end user of the physical door, KA2. The facility management company is the one that has signed the contract with AAES and they are therefore fully capable of answering contract related questions. However, KA2 would have been better to interview concerning questions about e.g. remote control and identifying the people passing their doors. Although the interviewee at the facility management company has a tight collaboration with KA2 and therefore knows KA2 well, it is not certain that the interviewee completely represents KA2's opinions in all questions. Another limitation is that only three Key Accounts have been studied in the Cost Structure section, and only one of them has been interviewed in the Value Proposition section. The results from the customer interview thus represents one Key Account, and the conclusions should therefore only be seen as indications. More interviews are needed to determine the wishes and needs of the customers.

The studied Key Accounts have many specific characteristics, such as belonging to a specific customer segment and having a specific type of service contract. A conclusion related to the representativeness of the master thesis is therefore that the results of this study should be used with caution before more research is done on the subject.

When it comes to cost savings potential in the Cost Structure section, the results are most likely applicable to other customers in Country A, as long as the customers have the same conditions as the three Key Accounts. That means that the customers are Key Accounts and end users, that they belong to the retail segment and that they are under Gold contracts. One reason why the results most likely are applicable to similar customers in Country A is that the contract terms of Gold contracts, for example which service visits that AAES charge the customer for, are very similar between customers in Country A.

Furthermore, the cost of a service technician per hour is specific for a certain country, which indicates that the cost savings potential in this master thesis is applicable to Country A.

Whether the cost savings results can be applied to customers in other countries or not can be discussed. The most important aspect to consider is the fact that the customers have Gold contracts, since these contracts include visits that do not generate income and where AAES is responsible for all costs. However, depending on the exact contract terms of Gold contracts in different countries, the size of the cost savings potential might be different. Whether the results can be applied to other customer segments or not can also be discussed. In all probability there is cost savings potential within customer segments other than retail, since there is likely service visits can be eliminated and reduced. However, there are aspects that could affect the size of the cost savings potential. One example is the conducting of remote service. Although remote service of doors always brings a risk of not controlling the action on site, the risk of negative consequences might be higher for example in hospitals or airports.

There should be a cost savings potential within other technology based manufacturing firms with a service business as well. IoT namely enables monitoring of products remotely, as well as remote service. These components together lead to the possibility of monitoring the technical status of products, predict failures to a much larger extent than before and taking actions faster and without the need of visiting the customer's site. These characteristics could most likely be applicable to all types of firms that manufacture and maintain physical products, leading to cost savings. However, exactly which type of cost savings, and the size of it do most likely depend on the type of business, industry, products and more. However, since this master thesis has identified cost savings potential in the service business of a technology based manufacturing firm, it is difficult to determine whether the cost savings potential exists for manufacturing firms without a service business. Even if there is potential, it probably looks completely different.

In this master thesis it has been concluded that IoT will affect the value proposition of technology based manufacturing firms with a service business. The importance of reflecting on the value proposition and whether it satisfies customer needs are relevant for all types of companies.

In the majority of companies IoT enables new ways of delivering value to customers, as a result of the possibility to gather and analyze new type of information, use the information in product development or to improve existing products or to sell the information to other parties. In the specific case of technology based manufacturing firms with a service business, new ways to deliver value include maximizing uptime and customize service offerings to specific customer needs. The service aspect is not relevant for manufacturing firms without a service business. However, the possibility to customize products and services as well as gather information about customers' usage patterns of products remain. It can also be concluded that IoT in general could lead to new ways to measure delivered value and hence charge the customers for that value. The fact that it is possible to for example measure performance enables pricing based on value for many companies.

Finally, it can be considered that an introduction of IoT seems to trigger a change of the cost structure, value proposition and revenue streams in most types of companies. It is crucial for manufacturing firms with and without a service business to reflect on how IoT can come to change their businesses, and what is needed to align the different building blocks of the business model.

## 7.3 Academic Contribution

Since IoT is a relatively new and undiscovered area there is generally a lack of academic research treating the subject. As mentioned in the introduction chapter, existing studies on IoT are mainly focusing on technology, while studies related to marketing and management are still very few. There is also a lack of studies showing the cost savings potential arising when introducing IoT into the service business of a technology based manufacturing firm.

This master thesis has contributed to an understanding of the business perspective of IoT, especially how IoT could affect the business models of technology based manufacturing firms with a service business. More specifically, this master thesis has indicated how the value proposition, cost structure and revenues streams parts of the Business Model Canvas can come to change with the introduction of IoT. The master thesis has also contributed with a quantification of the cost savings potential emerging when introducing IoT into the service business of a technology based manufacturing firm.

## 7.4 Recommendations for Future Research

This master thesis has already treated aspects that AAES should dig deeper into in the future, in order to successfully integrate IoT in the business. However, in a broader academic perspective it would be interesting to further investigate how the complete business model will be affected if a technology based manufacturing firm with a service business chooses to introduce IoT into their business. In this study only three parts of the Business Model Canvas have been investigated. The other six parts of the canvas will most likely also be affected by IoT, but future studies could reveal how. The remaining six parts include customer segments, channels, customer relationships, key resources, key activities and key partnerships.

This master thesis has examined one technology based manufacturing firm with a service business. In would be interesting to expand the investigation to include other companies with the same conditions, in order to compare the results between companies and in order to confirm or disaffirm similarities between companies within the same sector.

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# Appendices

## A. Description of the IoT Pilot Study at AAES

Approximately one and a half year ago a pilot study was launched within AAES in order to test and prove the concept. The project focused primarily on technology, but is also initiated a discussion about the business perspective. A “connectivity vision” was created in order to describe what AAES should strive for in the area of IoT. In the ideal case all types of doors, including swing doors, slider doors and revolving doors, would be connected to the Internet through wireless communication technology. However, the proof of concept was applied to three doors from one product group (Concept Innovation Manager at AAES, 2016, pers. comm., 8 Feb).

During the proof of concept, three stakeholders that could potentially get use of connected doors were identified. The first one was AAES’ service organization, which could, by exploiting IoT functions, make the service process more cost efficient. It was also believed that IoT could come to change the service business model, leading to a completely new way of selling service. The second identified stakeholder was the product managers and product development team. By gathering and analyzing data of customers’ usage patterns, new products could be tailored to specific customer needs. Finally, the end customers were seen as a potential target group for IoT solutions, in terms of selling gathered data as statistics (Concept Innovation Manager at AAES, 2016, pers. comm., 8 Feb).

One technology that can be said to be the predecessor of doors connected to the cloud is the Bluetooth connected tablet. With the tablet it is possible for service technicians to connect to one door at a time, at the customers’ sites. With the aid of the tablet it is possible to extract some general statistics from the door and to change certain settings and adjustments remotely, through the tablet. The tablet is a first step towards capturing data and taking actions based on that data. A couple of countries, including Country A, have started to distribute tablets to their service technicians in order to prove the technology. The tablets aim to facilitate the work of the service technicians on site (Concept Innovation Manager at AAES, 2016, pers. comm., 8 Feb).

# B. Case Study at KA1

A case study that is not directly related to IoT, but that can be used as an indication of AAES' customers' interest in new technological solutions, is the one conducted at KA1. During the year of 2015 AAES in Country A performed a trial where the goal was to quantify the benefits of a modernization package. More specifically, the purpose was to calculate possible cost savings arising for more energy efficient door solutions.

One of KA1's stores was chosen for the case study. All four doors of the store were located on busy pedestrian routes (AAES Country A n.d. a). Two types of installations were made to enable data gathering and analysis during the project. The first one was a device that time-stamps every instance the door change open/closed state. The second one was a device that records a number of different datasets, but the specific data used in this case was "number of outer sensor activations" and "door open time". This system also allowed remote access to the data via the Internet (AAES Country A n.d. a).

The devices were installed by AAES' technicians on two of the doors, and thereafter data was gathered from the existing door solutions during 24 days. The information that was gathered consisted of number of sensor activations per hour and amount of time the doors spent in open/moving position per day. Subsequently modernization packages were installed on the two doors and new data was gathered during 32 days (AAES Country A n.d. a).

## Results

After the data gathering process several calculations were made with the aim to quantify how much energy costs KA1 could potentially save each year (AAES Country A n.d.a). The calculations were made through a standardized tool that used the following input information: reduction in open time, opening dimensions (width and height) and the customer's energy costs per kWh (AAES Country A n.d. b).

The calculations showed that for door 1 KA1 could save 2715 £/year for heating and 187 £/year for cooling, i.e. 2901 £/year in total. The same numbers for door 2 were 2618 £/year for heating and 180 £/year for cooling, i.e. 2798 £/year in total. These savings resulted from reductions in door open time achieved by the upgrade (AAES Country A n.d. a).

Except yearly savings in energy costs, the results could also be translated into a reduction in the carbon footprint of KA1. The upgrade resulted in yearly avoided pollution equivalent to 8.29 tons $CO_2$/year for door 1 and 8.00 tons $CO_2$/year for door 2 (AAES Country A n.d. a). Another advantage with the upgrade was better working environment for the staff, since reductions in door opening time lead to a warmer, and therefore more pleasant, climate to work in (National Accounts Manager at AAES, Country A, 2016, pers. comm., 1 March)

According to the National Accounts Manager in Country A, KA1 was satisfied with the results of the trial and therefore now wants to extend the trial to ten stores. If the extension indicates as successful results as for the store in the case study, KA1 has shown an interest in implementing the solution in all of their stores across the whole country. KA1 is willing to pay for getting access to the upgraded technology (National Accounts Manager at AAES, Country A, 2016, pers. comm., 1 March).

# C. Customer Interview

The development of the interview guide used at the interview with KA2 is described below. The description is followed by the interview guide.

## Development of the Interview Guide

During the interview with KA2, the interviewee was asked questions concerning new functions and features of doors. The questions were based mainly on three aspects, which is presented below.

- Technical information of the new doors
  The new doors will include 115 parameters that enable control, configuration and settings of the door (Senior Project Manager R&D, PDS, 2016, pers. comm., 19 Feb). Basing new services on the parameters is one way to extract value from IoT in the short term.
- Statistics extracted from the tablet
  Statistics about the doors, such as technical information, number of opening cycles and number of pedestrians passing the doors, can currently be extracted from the doors through a tablet. This information also shows which information that is relevant to share with the customers in the beginning of the introduction of IoT.

- Discussion with a software engineer at the R&D department of AAES
  In order to get an understanding of the technical parameters and the statistics, these issues were discussed with a software engineer at the R&D department at AAES. During the discussion, new potential features and functions were also discussed.

## Interview Guide

The complete interview guide can be found below.

### Introducing Questions

1. What does your relation to KA2 look like? To what degree is you (the facility management company) responsible for KA2's doors?
2. Who is responsible for purchasing the doors and negotiating the contracts for KA2?
3. What specific requirements do KA2 have for their doors? What do they find most important?

### Questions Related to Remote Functions of Doors

4. Do you find any value in being able to access the following functions through a web-based interface?
    a. Monitor the doors remotely (i.e. to see in real time whether the doors are open, closed, locked or unlocked)
    b. Control your doors remotely (such as opening, closing, locking, and unlocking the doors)
    c. Make adjustments of your doors remotely (for example adjusting opening speed and opening width of the doors)

### New Features

5. Do you find any value in having the following functions of your doors?
    a. Monitoring the energy consumption through a web-based interface
    b. Adding new functions that enable reduction of energy consumption
    c. Having an integrated pedestrian calculator in your doors

d. Identifying the persons passing your doors, e.g. if they are adults or children
e. Having integrated surveillance cameras
f. Having an alarm going off if there is an intrusion attempt
g. Monitoring the performance of your doors in terms of viewing technical status and statistics
h. Getting real time advice regarding utilization of the door in order to improve performance. One example is to get a recommendation to remove jam from the door if such indication is turned on.

## Overall Questions

6. Which of the above functions and features do you find most interesting (if any)?
7. Would you be interested in paying for any of the above mentioned functions and features? Please specify which and how much you would be willing to pay.
8. Would you be interested in testing the features and functions described above if you were offered a trial-period?
9. Do you have any other ideas of features or functions that you would like to have on your doors but that have not been mentioned here? Please specify.
10. Would you be interested in being able to have a pay-per-use contract on your doors? This means that the price of your service contract will be based on your doors' usage frequency rather than a fixed price.
11. Do you find any value in not having to contact AAES if an error occurs on your doors, supposed that new technology enables detecting and solving the error without your interaction?
12. Do you find any value in personally meeting the service technician?

# D. Personal Communication with Employees at AAES

A complete list of the employees that were interviewed at AAES can be seen in *Table 11* below.

| **Title** | **Date of Interview** | **Interview Method** | **Country** |
|---|---|---|---|
| Concept Innovation Manager, AAES | 8 Feb 2016 | Personal meeting | Country B |
| Field Operation Manager, AAES | 7 March, 10 March, 23 March, 5 April 2016 | Personal meetings | Country B |
| Finance Director, PDS | 3 May 2016 | Mail conversation | Country A |
| Global Customer Insight Manager, Assa Abloy | 24 Feb 2016 | Telephone meeting | Country B |
| Global Retail Segment Director, AAES | 3 March, 17 May 2016 | Personal meeting and mail conversation | Country A |
| Marketing Manager, PDS | 2 March 2016 | Personal meeting | Country B |
| National Accounts Manager, AAES | 1 March, 15 March, 30 March, 4 May 2016 | Conference call meetings | Country A |
| President of PDS | 19 April 2016 | Personal meeting | Country B |
| Product Manager, AAES | 2 March 2016 | Personal meeting | Country B |
| Product Manager, Information Services, Assa Abloy | 1 March 2016 | Telephone meeting | Country B |
| Product Portfolio Manager, AAES | 9 Feb, 15 Feb 2016 | Personal meetings | Country B |
| R&D Director | 24 Feb, 2016 | Conference call meeting | Country C |
| Sales Manager | 15 Feb 2016 | Personal meeting | Country B |
| Senior Project Manager R&D, PDS | 19 Feb 2016 | Personal meeting | Country B |

| | | | |
|---|---|---|---|
| Service Development Director, PDS | 17 Feb 2016 | Personal meeting | Country B |
| Service Manager, IDDS | 7 March 2016 | Telephone meeting | Country B |
| Software Engineer, R&D, AAES | 19 Feb, 2 March, 5 April, 13 April, 26 April 2016 | Personal meetings | Country B |
| SW Developer, AAES | 23 March 2016 | Personal meeting | Country B |
| Vice President of Finance, AAES | 14 March 2016 | Telephone meeting | Country C |
| Vice President of Service Development, AAES | 8 Feb, 18 Feb, 25 Apr 2016 | Personal meetings | Country B |

**Table 11** An overview of the interviewed employees at AAES

# E. Overview of the Service Contracts

An overview of AAES's different service contracts can be seen in *Figure 18* below.

| | Re-Active Service | | Pro-Active Care | | | |
|---|---|---|---|---|---|---|
| | Corrective | SafetyCheck | Pro-Active Bronze | Pro-Active Silver | Pro-Active Gold | Pro-Active Tailor Flex |
| Other customized requests such as Response Time, Performance InfoPack and Advanced User Training | | | ○ | ○ | ○ | ○ |
| Replacement of worn parts according to preventive Consumable Exchange Program | | | ○ | ○ | ● | ○ |
| Replacement of spare parts on breakdowns | | | ○ | ○ | ● | ○ |
| Travel and labor for additional call-out visits | | | ○ | ● | ● | ○ |
| Preventive maintenance visits 1-4 times per year | | | ● | ● | ● | ● |
| Travel and labor for preventive maintenance visits | | | ● | ● | ● | ● |
| Response time and priority on call-outs <24h | | | ● | ● | ● | ● |
| Preventive planned maintenance that meets the most demanding standards in the market | | | ● | ● | ● | ● |
| Safety and quality checks according to applicable regulations and norms. Documentation of test results provided | | ● | ● | ● | ● | ● |
| Documentation of equipment status, assessment and service provided, all generated on site | ● | ● | ● | ● | ● | ● |
| Highly trained professional technicians with extensive knowledge, state-of-the-art tools and the right spare parts* | ● | ● | ● | ● | ● | ● |
| Dedicated Professional Customer Care Hotline | ● | ● | ● | ● | ● | ● |

● = *Included as standard*

○ = *Available at special prices*

* *Well-stocked service vehicles with genuine and new spare parts*

**Figure 18** An overview of AAES' different service contracts