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CUSTOMER-ORIENTED BUSINESS MODELS FOR INDUSTRIAL INTERNET BASED OFFERINGS IN A TECHNOLOGY COMPANY

Master's thesis

Examiner: Professor Miia Martinsuo
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ABSTRACT

TOMMI PARVIAINEN: Customer-oriented business models for industrial internet based offerings in a technology company
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Industrial internet has figured prominently in both academic literature and in business, but the customer viewpoint has not gained that much attention. This thesis researches how a business model of industrial internet solution can be made more customer-oriented in the context of industrial manufacturing. The premise of the study is the customer perceived value and the need. The objective of this thesis is to develop the business model of industrial internet solutions offered by the Case Company towards more customer-centric direction by understanding customers' needs and businesses.

The research was conducted as a qualitative case study. The data was collected through semi-structured interviews by interviewing persons from real customer organizations of the Case Company and also from successful benchmarking companies. The Case Company has conducted pilot projects related to industrial internet condition monitoring solution with these participated customer organizations. Therefore it was also possible to collect feedback related to current offering and success of the pilot projects.

Based on the conducted research, the most important ways to make business model more customer-oriented are to involve customers into different development phases and increase co-operation in the light of Agile development. It is important to involve customers versatilely in different phases, like in offering development but also in business model innovation and development. It is also reasonable to do both offering development and business model innovation simultaneously. In that way it is possible to maximize the customer value. Especially industrial internet solutions are offering great platform for that kind of co-operation as these solutions support network thinking very well.

The most important sources of customer value recognized in this study are safety, efficiency improvements, securing operational reliability and intelligence. On more detailed industrial internet -based condition monitoring solutions -level, the most important factors are connectivity with customer's own system, predictability, prescriptive advisor analytics and easy integration with operative processes. There seems to be increasing interested towards value based pricing models which are enabled by industrial internet. Additionally, combining industrial internet solutions with traditional offerings into more comprehensive services proved to be interesting option for many companies. Finally, action plan for the Case Company was compiled based on the results of the study. More research related to participative business models and value based pricing models is needed to enable the real utilization of industrial internet enabled networks and business models.

TIIVISTELMÄ

TOMMI PARVIAINEN: Teollisen internetin tarjoomien asiakaslähtöiset liiketoimintamallit teknologiayrityksessä
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Avainsanat: liiketoimintamalli, asiakasarvo, asiakaslähtöisyys, teolliset palvelut, teollinen internet, esineiden internet, kunnonvalvonta, asiakkaan osallistaminen

Teollinen internet on ollut paljon esillä viime aikoina niin tutkimuksessa kuin liike-elämässäkin, mutta asiakasnäkökulma on usein jäänyt vähemmälle huomiolle. Tämä diplomityö tarkastelee teollisen internetin ratkaisujen liiketoimintamallin asiakaslähtöistämistä teollisen tuotannon ympäristössä. Lähtökohtana on asiakkaan kokema arvo, ja keskeistä on selvittää, millaiset asiat asiakkaat oikeasti kokevat arvokkaina. Tarkoitus on asiakkaan liiketoiminnan ja tarpeiden ymmärtämisen kautta tarkastella ja kehittää kohdeyrityksen teollisen internetin kunnonvalvontaratkaisujen liiketoimintamalleja ja niiden kehitystä enemmän asiakasarvoa tuottavampaan suuntaan.

Tutkimus toteutettiin laadullisena tapaustutkimuksena. Aineisto kerättiin puolistrukturoiduilla haastatteluilla kahdessa vaiheessa rikkaan aineiston saamiseksi. Tutkimuksessa haastateltiin henkilöitä sekä teollisen internetin ratkaisuissa menestyneistä vertailuyrityksistä että kohdeyrityksen asiakasyrityksistä. Kohdeyritys on toteuttanut pilottiprojekteja liittyen teollisen internetin kunnonvalvontaratkaisuun, ja näin ollen tutkimuksella pystyttiin myös keräämään palautetta nykyisestä ratkaisusta sekä itse projektin onnistumisesta.

Tutkimuksen perusteella tärkeimmiksi keinoiksi lisätä liiketoimintamallin asiakaslähtöisyyttä havaittiin asiakkaiden osallistaminen kehitykseen ja yhteistyön lisääminen ohjelmistotekniikasta tutun ketterän kehityksen hengessä. Asiakkaita voidaan osallistaa monipuolisesti eri vaiheissa niin tarjooman kuin liiketoimintamallin kehityksessä. Lisäksi järkevää on kehittää tarjoomaa ja liiketoimintamallia samanaikaisesti asiakkaita osallistaen, jotta asiakasarvo pystytään maksimoimaan. Erityisesti teollisen internetin sovellutukset tarjoavat tähän hyvän alustan, sillä verkostomainen ajattelutapa sopii niihin hyvin.

Keskeisimmät asiakasarvon lähteet teollisen internetin ratkaisuissa ovat turvallisuus, toiminnan tehostaminen, käyttövarmuuden lisääminen ja älykkyys. Teollisen internetin kunnonvalvontaratkaisuissa tärkeää puolestaan on yhdistettävyys asiakkaan omiin järjestelmiin, ennustettavuuden aikajänne, ohjaava neuvoa-antava analytiikka sekä integroinnin helppous asiakkaan prosesseihin. Tutkimuksessa havaittiin, että asiakkaat ovat erityisen kiinnostuneita arvopohjaisista hinnoittelumalleista, jotka teollinen internet mahdollistaa. Nämä mallit sekä ratkaisuiden yhdistäminen kokonaisvaltaisemmiksi palveluiksi osoittautuivat monille yrityksille potentiaalisiksi mahdollisuuksiksi. Tutkimuksen lopuksi kohdeyritykselle laadittiin toimintasuunnitelma perustuen tutkimuksen tuloksiin. Jotta teollisen internetin mahdollistamia verkosto- ja liiketoimintamalleja voidaan todella hyödyntää käytännössä, tarvitaan lisää tieteellistä tutkimusta liittyen arvopohjaisiin hinnoittelumalleihin sekä asiakkaita osallistaviin liiketoimintamalleihin ja niiden innovointiin.

PREFACE

Half a year ago this day seemed to be very distant, but now my Master's thesis is ready and I am ready to graduate. There are several people who deserves special thanks for their efforts to support me during this journey.

Firstly, I want thank the examiner of my thesis, Miia, for the great support. Through her comments I have been able to develop my thesis and my own thinking. I have been able to contact her whenever I have needed and asked some silly questions too. From the Case Company of the study, I want to thank my thesis' supervisor Antti and whole other team I have had a pleasure to work with. Also Ilpo and my mentor Minna deserve special acknowledgement from the support during my years at the Case Company. Special thanks goes also to everyone who attended to interviews and gave great input for this thesis. Lastly, I want to thank Katja, who has supported me during all long days and temporary moments of desperation.

Even though, the journey with this thesis is ending, there are several new journeys waiting to be discovered.

Helsinki, 31.7.2018

Tommi Parviainen

CONTENTS

ABBREVIATIONS

API	Application Programming Interface
B2B	Business to Business
B2B2C	Business to Business to Consumer
B2C	Business to Consumer
BM	Business Model
BMC	Business Model Canvas
BMI	Business Model Innovation
CBM	Condition-Based Maintenance
CD	Customer-Dominant
GD	Goods-Dominant
I40	Industry 4.0, Industrie 4.0
IIoT	Industrial Internet of Things
IoT	Internet of Things
MVP	Minimum Viable Product
PaaS	Product as a Service
PSS	Product-Service Systems
RQ	Research Question
SaaS	Software as a Service
SD	Service-Dominant
TCO	Total Cost of Ownership

1. INTRODUCTION

Industrial internet and Internet of Things (IoT) are still quite commonly used buzzwords. Earlier the talk has mainly been on a concept level. Now the solutions that industrial internet provides and enables are starting to realize and many companies have something concrete to offer, but reaching the full potential is still far away. As the main hype has moved forward towards machine learning and artificial intelligence, it is a good time to concentrate on concrete benefits and business that can be achieved with industrial internet and IoT.

1.1 Background

There has been increasing amount of research regarding industrial internet and IoT solutions during recent years. Consultants and innovators have presented different scenarios how this technology is going to change the world and the hype has been enormous. It is predicted that industrial internet and IoT will bring noteworthy productivity gains and savings in operational costs in many fields (Manyika et al. 2013). Report of McKinsey & Company has stated that the IoT offers a potential economic impact of $4 to $11 trillion a year in 2025 (Manyika et al. 2015). Many companies and other institutions have understood that and have developed new digital products and services with huge drive because it is possible and everyone wants to be part of the fourth industrial revolution. Still business uncertainty is a real challenge (Ehret & Wirtz 2017). It is said that digital solutions will heavily change the way how companies are creating the value to the customers (Iansiti & Lakhani 2014). However, the most important thing has not got enough attention in this massive drive and hype. That thing is the customer. This thesis tries to take customer point of view into account better and find out how business models of industrial internet solutions could be more customer-orientated.

The main subjects of this thesis are business model and innovation of it, customer value and industrial internet -based service offering. Shortly, business model is defined as a way a company creates value, delivers it to customers, attracts customers to pay for that value and turns this whole palette into profit (Teece 2010). Customer value has several definitions. Basically, customer value can mean value for customer or customer's value to company (Smith & Colgate 2007). In this thesis we will focus on value for customer. On the other hand, of course if a supplier company is delivering superior value to its customer it is likely that also the supplier company is getting more value from that certain customer.

1.2 Context and research problem

In this study, concentration is on value added digital industrial services that are made possible by development of industrial internet. The context of the study is industrial manufacturing where industrial services have increasing role. The main focus is on customer-orientated business model for industrial internet based service offerings. The point is to understand how to form a customer-centric business model for digital services which supports complete offering of the company and offers real value to the customers. Business model can be observed on various levels, but in this thesis the observed level of business model is offering level, not company level. The concentration of this thesis is on economical point of view of industrial internet solution, not on technical perspective.

The Case Company of the study is a global technology company offering wide range of different automation and energy solutions for different industries. The Case Company has invested heavily in the development of industrial internet solutions during recent years. The more specific focus of thesis is on business model of industrial internet based condition monitoring solutions. Current work in the observed department of the Case Company has mainly dealt with condition monitoring of electric motors. This thesis examines condition monitoring on a higher level including more applications under the same research. The ambition is on future, but the results of the study should be exploitable also with the existing condition monitoring solutions. Condition monitoring solutions make predictive maintenance and optimization of machine base possible more easily. Some of the main advantages of these solutions are reduced downtime, extended lifetime of production equipment and increased energy efficiency (Wang 2016).

New thing is that earlier it has not been profitable to monitor those parts of the processes like motors and pumps that are not highly critical for processes. Technological development and increase of processing power have changed the arrangement during the recent years. At the same time when technology has developed, price of the technology has lowered. Also cloud computing has impacted to that by offering virtually limitless computing power at very low cost (Iansiti & Lakhani 2014). It is nowadays possible and worthwhile to monitor these more comprehensive parts of the processes, but the question is: How should a company form its business model regarding such an offering to offer real added value to customers?

The addition of industrial internet components to the company's complete offering must be carefully planned. Unsystematic approach where intelligent industrial internet components like connected sensors are added to the present product or service offering does not absolutely lead any market success (Gerpott & May 2016). Business model must be designed or adapted to the special characteristics of new elements to ensure the real customer value (Burmeister et al. 2015; Dijkman et al. 2015). In addition to that industrial internet requires new business models, on the other hand it also enables companies to apply some new approach regarding business model and develop their business in many

ways. With new products and services customers accept new ways of conducting the business.

During recent years, these subjects have gained a lot of attraction and many researches are conducted to increase the understanding over these topics. Prior research has mainly concentrated on technological aspects, and research of business viewpoint of industrial internet is still lacking compared to technical literature (Kiel et al. 2016). This thesis concentrates on business model of industrial internet solution through customer value and combining previous offering with new solutions. Especially customer perspective has not earlier got enough attention (Kiel et al. 2016) and this thesis tries to fill that research gap. The study takes a look to the Case Company's business case through customers' business cases. Real customers of the Case Company are interviewed to build the understanding of real customer value. Also professionals from successfully benchmarking companies from other industries are interviewed to combine good practicalities with real customer needs. As the subject is relatively new and the idea is to form new knowledge for the Case Company, it is more valuable to conduct interviews with customers and benchmarking companies instead of internal interviews.

Universal transition behind these topics is the transition from product-thinking to service-thinking in many industries. New technologies like industrial internet and its development are accelerating this change even more (Gerpott & May 2016; Rymaszewska et al. 2017). It is clear that the business cannot be done in the same way as earlier, but companies must change their point of views in order to integrate into this new scheme of thinking. Service-orientated business requires new arrangements and rethinking of business model. When the focus is on digital solutions enabled by industrial internet, it is important that both sides, the supplier and the customer, understand that offering is a service, not a product. Industrial internet is promoting the shift from product thinking to service thinking.

One of the most important parts regarding the service-orientation is the customer-orientation. It cannot be ever forgotten why the business is done. The customer must be in the center. A company exists because it is creating value to its customers. There is quite a long history in many companies to develop products and services by assuming what customers want and not finding out what they really want and need.

1.3 Objectives and research questions

The objective of this study is to promote real business utilization of industrial internet solutions and realization of the value from the customer-centric viewpoint. There are many obstacles that current literature have not yet observed in sufficient level. There are relatively little research on business models of industrial internet solutions and customer has not got the attention it deserves. Intention is to build a picture of relationship between business model and real customer value related to industrial internet based services. From the managerial viewpoint the objective of this study is to create an action plan with the

steps, which the Case Company should take in order to achieve its goals of creating more value to customers through customer-oriented business model. Action plan has to take into account what kind of services and functions are needed to support the customer-centric business model. In addition to action plan, the goal is to create a framework regarding customer value and business model innovation of industrial internet based solution. Secondly, the target is to find out how to combine and integrate value added digital services with complete offering of the company to maximize the customer value. The research questions (RQ) of this thesis are following:

RQ1: What are the sources of customer value in an industrial internet -based solution?

RQ2: How can a technology company make its business model of value added industrial internet -based solutions more customer-orientated?

This study tries to combine the business case of the Case Company with the business cases of the customers to create value to all parties and achieve a real win-win situation. To be able to understand the business case of the customer, it is highly important to understand their business and for which operations and processes they need value added digital solutions and how those solutions should be offered to customers. Do they for example want to own the production equipment or monitoring sensors that are offered to them by the Case Company or should the whole offering be servitizated?

Also profiling the customers and segmentation will take place in this study to understand needs of different customers. Customer value and perceiving it are not universal conceptions: Every customer has own understanding and experience over the value. Taking also these things into account in the study, creates a solid base to answer to the research questions. In an ideal situation, the target segment will also be found or at least discussed.

In this study, industrial services are observed in manufacturing industry context. The focus is on *B2B* (business-to-business) environment. Consumer applications differ from industrial solutions in many ways so they are not included in this research. Some of the results may be exploitable and applied with *B2C* (business-to-consumer) solutions, but the focus is on industrial services and applications. It is estimated that B2B applications will cover approximately 70 percent of the value from Internet of Things solutions (Manyika et al. 2015). In addition to that, the Case Company operates mainly on B2B environment. The main focus is on industrial internet based condition monitoring solutions, but industrial internet based services are observed also more generally.

1.4 Structure

This thesis is divided into six chapters, which are introduction, literature review, methodology, results, discussion and conclusions. At the beginning of the literature review, central concepts like industrial services, industrial internet, condition monitoring, customer

value and business model are introduced. In this literature review, concepts are defined and research questions are observed through existing literature of the topics. Theoretical foundation of the study is built in the literature review and later empirical results are analyzed in the light of this review. There is not much existing literature related to business models of industrial internet solutions especially from customer viewpoint. Overall picture of the customer-oriented business model of industrial internet solution is created by combining literature related to industrial internet, customer value and business models. Finally, learnings of the literature review are synthesized and framework for customer orientation by involving customers in different phases of development is formed. It is worth to notice that some topics like business model and its innovation have quite much research which all cannot be covered in one literature review which has many topics and tries to connect different subjects with each other to form an overall picture over the research themes.

After literature review, it is time to move to the empirical part of the study and take a closer look to the research methodology. In this thesis, case study was selected as a research approach to get insights to the real-life events. Data was collected through semi-structured interviews and totally eleven interviews were conducted. Interviewees were selected from both customer companies and successful benchmarking companies to get deep understanding to customer needs but also to good practices of other companies. Nature of the collected data is qualitative, as it enables different and rich viewpoints to the phenomena. In data analysis, data was firstly coded based on the different research themes. After that coded data was analyzed by using inductive reasoning as the intention was to create new knowledge.

In chapter 4, results of the interviews are presented. Interesting results were found related to real customer needs and feedback, business models of industrial internet solutions and its innovation and increasing customer value through customer involvement. Deeper analysis is conducted in chapter 5, where results are discussed and reflected in the light of the literature review. Customer value and involvement framework synthetized in literature review is further developed based on the empirical results. Also, action plan for the Case Company is formed based on the discussion and reflection of the literature review and empirical results. Finally, chapter 6 concludes the key findings of this thesis. Also, the whole study is reviewed and need for further research is discussed.

2. LITERATURE REVIEW

In this chapter, central concepts of the thesis are defined and existing literature over the topics is reviewed. Also, theoretical foundation of this study is built in this chapter and research questions are observed in the light of existing literature. Firstly, central concepts are shortly introduced. Industrial services are observed little deeper than other concepts because other concepts have their own chapters later. After that, the focus is on industrial services which are based on the industrial internet. Next, the focus is on customer value in the context of industrial internet services. Last but not least topic is the business model of industrial internet -based service. Linkages between industrial internet services, customer value and business model are discussed throughout the literature review.

2.1 Central concepts

Industrial services can be defined as services which are offered for the needs of organizations with industrial production. Services mean activities or performance that are provided to fulfill customer needs. Service business differs from product business in many ways. Unlike the products services are intangible. (Brax 2005) In addition to intangible nature, services tend to be heterogeneous, simultaneously produced and consumed and perishable (De Brentani 1995; Johne & Storey 1998; De Jong & Vermeulen 2003). Industrial services require often customer participation. Also, relationships between customer and supplier tend to be long-lasting and complex. (De Brentani 1995)

Services are becoming more and more important in industrial sector (Brax 2005; Meier et al. 2010). Companies are moving more and more towards service business instead of traditional products. Services can for example increase the sales of physical goods, lengthen customer relationships and balance the economic cycles. (Brax 2005) Many companies are putting on a great effort to develop services in addition to more traditional product business. Also customers are demanding services more than earlier (Oliva & Kallenberg 2003). Service business can be seen as a way to secure a long-term growth and also to remain and achieve competitiveness (Jacob & Ulaga 2008). Services are harder to imitate than products which makes them beneficial way to differentiate on the market (Raddats & Easingwood 2010).

Industrial services have very fundamental and central role in this research as the context of the study is industrial manufacturing where services have increasing role. Development of industrial internet enables new industrial services whose business models are researched in this thesis. Industrial services emphasizes business models to be changed from transaction-based towards relationship-based (Oliva & Kallenberg 2003). As service business is requiring stronger connections between different parties (Meier et al. 2010) it

is interesting that existing literature has not covered customer-orientation regarding industrial internet based services and their business models.

Many fields of industry are currently living the age of servitization. Firms are competing in an uncertain environment where competition is tough. Services have been seen as a solution to differentiate their offering (Neely 2008). Basic reasons behind servitization are seasonal or fluctuating demand of technology-based products, different and changing customer needs and new technologies which are enabling the services (Neely 2008; Baines et al. 2009). It is said that servitization is moving industrial value creation toward the customer interface. Added value increases when the company is going toward end-customer services. It is also worth to notice that also risks increases when company's strategy is moving more and more towards services: If company is adding some service components to its products risks are low, but if company is trying to be purely service provider, risks are greater (Raddats & Easingwood 2010). In servitization when companies are changing the focus from product to services, common difficulty is the business model and especially understanding what customers view as value (Neely 2008). That is one fundamental motivation of this thesis and also reason, why this thesis is soon focusing on customer value and business model.

Servitization is not only about to offer services instead of products. In many cases, products and services are combined and offered as *Product-Service Systems* (PSS) (Zancul et al. 2016). In other words, PSS is an integrated bundle of products and services which main purpose is to generate value and utility for customer (Boehm & Thomas 2013). Many applications of industrial internet or IoT are actually product-service systems, because there is often physical hardware side and some service elements combined. In PSS value is often co-created with different partners (Zancul et al. 2016).

Industrial internet can be defined as applying Internet of Things (IoT) for the use of companies and other organizations in B2B markets (Juhanko et al. 2015; Jeschke et al. 2017). Term Internet of Things refers to the sensor and actuator based interconnection between physical objects, things, in order to connect them to the internet (Dijkman et al. 2015). IoT-technology is well suited for industrial purposes and it can be used for example in condition monitoring and material flow optimization purposes (Burmeister et al. 2015). The main logic is that network of interconnected things harvest information from the environment, interacts with physical world and uses existing internet standards to transferring and analyzing the information (Gubbi et al. 2013). Term industrial internet is used in this thesis to emphasize the context of industrial manufacturing where industrial services have increasing importance. Industrial internet -based services are observed deeper in chapter 2.2.

Condition monitoring can be defined as the continuous or periodic measurement and interpretation of data to indicate the condition of asset and need for its maintenance (Williams et al. 1994, p. 11). The fundamental purpose of condition monitoring is to guarantee

functionalities of an asset so that possible faults can be detected as early as possible (Widodo & Yang 2007). Very close term to the condition monitoring is *Condition-based maintenance* (CBM). It is a management philosophy which assumes that current or future condition of assets defines repair or replacement decisions (Rymaszewska et al. 2017). In other words, CBM can also be defined as a maintenance program that recommends maintenance decisions based on information that is gathered through condition monitoring (Jardine et al. 2006). Condition monitoring is enabling predictive maintenance. Condition monitoring is one type of industrial service. Oliva & Kallenberg (2003) have defined that condition monitoring is relationship-based product-oriented industrial service. The challenge in condition monitoring services is that they are not directly adding value to the end customer. The value comes from higher equipment availability. (Oliva & Kallenberg 2003) Industrial internet based condition monitoring is observed in more detailed level in chapter 2.2.3.

Customer value has many definitions but most of them shares the aspect that value is based on customer's experience of the obtained benefits (Woodruff 1997). Common aspect is also that customer value consists of the two parts: benefits and costs which both can be divided in more detailed parts (Lindgreen & Wynstra 2005). Customer value is depended on perceiver which means that different customers can experience the value differently than others (Woodruff 1997). Value in business markets can be defined as the worth in monetary terms including technical, economic, service and social benefits that a customer company receives in exchange for the price and other costs (Anderson & Narus 1998). Value in B2B markets differs from the value in B2C markets: In business markets emotional matters and things like appearance are not as important as in consumer markets. Things like performance and functionality gain more importance in B2B markets (Mencarelli & Riviere 2015). In value proposition which is part of the business model, company describes the promised customer value and promises to deliver certain features to customer in order to fulfil customer's needs (Keller & Kotler 2006; Osterwalder & Pigneur 2010; Zott et al. 2011). Concept of customer value is analysed more carefully in chapter 2.3.

Business model (BM) is defined as a way a company creates value, delivers it to customers, attracts customers to pay for that value and turns this whole palette into profit (Teece 2010). Business model can also be described as a holistic overview of manner how company does its business (Zott et al. 2011; Dijkman et al. 2015). These definitions of BM are not unambiguous and there is a lack of exact business model definition in the literature. Many researchers have pointed out this problem and have proposed definitions and one of the most cited business model article is Teece's article from year 2010. Well defined and suitable business model is essential factor in the success of company (Bucherer & Uckelmann 2011). BM can be seen as a layer between strategy and business processes

(Rajala & Westerlund 2007). More about business model and its relationship with industrial internet applications is discussed in chapter 2.4. Central concepts of this thesis and their relationships are illustrated in Figure 1.

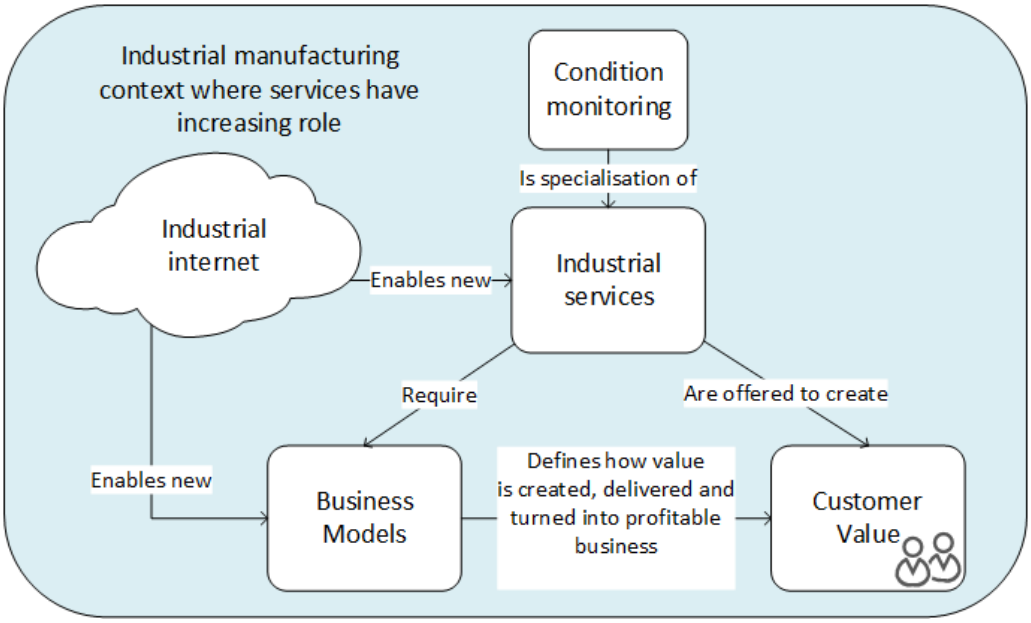

Figure 1: Central concepts and their interconnection.

As it can be noticed from Figure 1, industrial internet is a driving force which is enabling new industrial services. Industrial internet offers great opportunity to develop for example efficient condition monitoring solutions which require less manual labour than earlier. At the same time, these new industrial services made possible by industrial internet are requiring new business models to conduct profitable business. On the other hand, industrial internet is also enabling new kinds of business models for both new services but also for more traditional services and products. The fundamental objective of industrial service is to create value for customers and business model defines the value proposition and how the value is created to customers and finally turned into profits.

2.2 Industrial internet -based services

Industrial internet based services are becoming more and more important part of industrial services. Because this thesis focuses on business point of view of industrial internet, the focus of this literature review is also mainly on literature related to the business models of industrial internet solutions. There is a huge amount of literature which deals with technological aspects, but they are mainly left out from this study.

2.2.1 Overview of industrial internet and Internet of Things

There is huge variety of different terms related to Internet of Things. During recent years terms have been used quite inconsistently and many companies have even formed their

own terms. Little by little, terms are starting to become established. In many cases, terms *Internet of Things, industrial internet* and *Industry 4.0* are used with a similar connotation (Burmeister et al. 2015). More precisely, Internet of Things refers to the sensor and actuator based interconnection between physical objects in order to connect to the internet (Dijkman et al. 2015). In other words, IoT can be seen as a general concept for all things that are connected to the internet. The main logic is that network of interconnected things harvest information from the environment, interacts with physical world and uses existing internet standards to transfer and analyze the information (Gubbi et al. 2013). Term IoT is usually understood to include both industrial and consumer applications but also in some definitions term IoT refers mainly to consumer markets (Juhanko et al. 2015). Most known consumer applications are probably fitness monitors and smart homes. Term Internet of Things was firstly introduced as early as year 1999 by Kevin Ashton in the context of supply chain management, but it gained more attraction and become hot topic much later (Ashton 2009; Gubbi et al. 2013).

Industrial internet is very close concept to IoT. Industrial internet is companies' business to business viewpoint to the digitalization and Internet of Things (Juhanko et al. 2015). In other words, industrial internet means applying Internet of Things for the use of industries and companies (Jeschke et al. 2017). Originally, term is launched by General Electric (Iansiti & Lakhani 2014) but it has gained more ground broadly. Some researchers and other experts have also used term *Industrial Internet of Things* (IIoT) for the same purpose. Term industrial internet is used in this thesis to clearly point out that focus is on industrial applications and services, even though significant part of the literature uses term Internet of Things also in industrial context.

Term Industry 4.0 comes originally from Germany and has quite similar meaning than industrial internet (Burmeister et al. 2015). In some cases, original German term *Industrie 4.0* is also used in English and that is abbreviated into form *I40*. Term Industry 4.0 refers to the fourth industrial revolution which is supposed to increase productivity through digital development and cyberphysical systems (Lasi et al. 2014; Drath & Horch 2014). Industry 4.0 can be understood as broader view to the digitalization than mere industrial internet (Lasi et al. 2014; Rymaszewska et al. 2017), but internet technologies in the industry use are the major technical background of it (Drath & Horch 2014). Figure 2 illustrates the interconnection between different IoT-related terms. Also potential applications and fields of industrial internet and consumer IoT are presented.

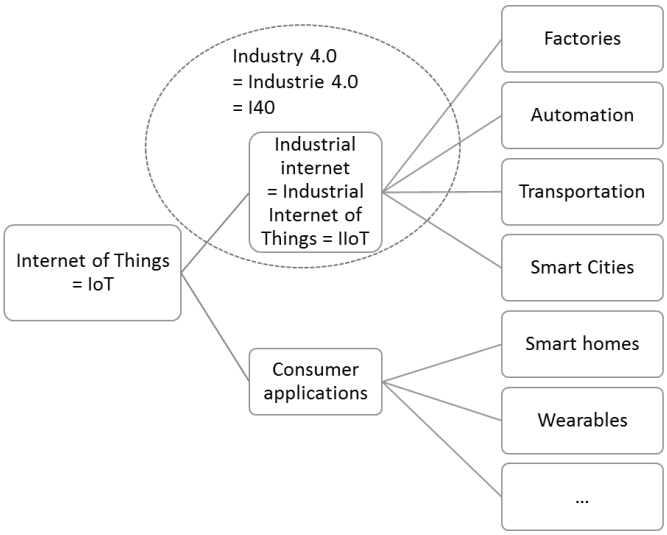

Figure 2: Internet of Things related terms and their connections

General digital transformation of businesses and processes can be seen behind all of these terms (Iansiti & Lakhani 2014). Digitalization means transforming of socio-technical non-digital structures into digital things and relationships (Yoo et al. 2010). The thing that really is revolutionary, is that IoT is offering enormous potential to consumers, companies and public sector by enabling many innovative applications almost in every field of economy (Pang et al. 2015). It is also worth to notice that technology is constantly transforming the ways how companies operate (Porter & Heppelmann 2014). Even though this is significant transformation, this is not so unique situation when the angle of view is on a longer term, and there can be seen some connections to the earlier industrial revolutions.

2.2.2 Special characteristics of industrial internet business

Internet of things and industrial internet connect machines and other things through internet like internet did first for the people. Goal of the industrial internet is to develop new applications and improve existing applications in many fields (Dijkman et al. 2015). Smart connected products are currently reshaping industries and transforming the competition in many ways (Porter & Heppelmann 2014). Industrial internet has provided huge opportunities to achieve efficiency. As computing power is coming more efficient and sensors cheaper and smaller, the use of sensor technology is becoming more attractive (Da Xu et al. 2014). One way to utilize industrial internet in competition is to form product-service system bundles to gain competitive advantage compared to competitors (Zancul et al. 2016). Product-service systems require better and more sophisticated understanding of customer needs than traditional products, which require shortening the distance to customers and understanding how the products are used (Walters 2008). Internet of Things technologies offer many benefits for companies and those can refer to both internal operations and final solutions for end users (Manyika et al. 2015).

Industrial internet applications can be divided into three categories which are (1) monitoring and control, (2) big data and business analytics and (3) information sharing and collaboration (Lee & Lee 2015). Interestingly, Lee & Lee (2015) see these categories as separate applications. To criticize their point of view, these three categories can also be seen as components of industrial internet application, not as separate applications. Customer value can be built as a combination of these three categories in a way which is the most suitable for the customer's business. Of course, some solutions can be based on only one of those but more comprehensive solution should have all these elements to fully exploit the possibilities of industrial internet. Some other researchers stand up for this combination viewpoint from little different perspective. They are talking about three IoT components which basically are (1) hardware with sensors and actuators, (2) middleware which means computing tools for data analytics and storage, and (3) presentation which means visualization of the information designed for different applications (Atzori et al. 2010; Gubbi et al. 2013).

Development of IoT has brought new hybrid solutions that combines physical products and digital services (Fleisch et al. 2015). In other words, solutions are not usually pure products or pure services, but they might be weighted more on one or the other side. This point of view differentiates IoT applications from both products and services and that is one reason why IoT solutions deserves to be researched separately. Currently, many companies are trying to achieve competitive advantage by adding industrial internet components into their current offering (Gerpott & May 2016). The addition of industrial internet components to the company's complete offering must be carefully planned. Unsystematic approach where IoT components like connected sensors are added to the present product or service offering is not necessarily the best way to jump on the industrial internet bandwagon and does not absolutely lead any market success (Gerpott & May 2016).

Barriers to adopt IoT solutions are lowering which can make early bird competitive edge only temporary (Gubbi et al. 2013). Through strategic partnership with companies like IBM and Microsoft many companies are able to adopt needed technologies and develop own solutions. On the other hand, it is possible that first players who are able to create simple combining platform can rule the market. After that, market penetration might be hard if a new company does not have any radical new innovation.

It has been stated that IoT will revolutionize the ways of how humankind lives and works, but the development of Internet of Things has not yet realized as fast or widely as it was predicted (Palattella et al. 2016). Maturity of technologies is currently still quite low. The majority of potential users is still not using any applications. Controversially it is also stated that IoT technologies are already widely available and mature (Zancul et al. 2016). Both studies are from the same year but the researchers see maturity quite differently. The fact that industrial internet applications are based on old technology like internet protocols supports Zancul et al.'s (2016) point of view, but real life valuable applications are still quite rare as Palattella et al. (2016) states.

Industrial internet technologies are combinations of many different technologies. For example, following technologies are needed from technical point of view: identification, architecture, communication, network and software technology, services and algorithms, cloud computing, hardware design, data and signal processing technology, search engines, relationship network management, power and energy storage, security and privacy technologies. These technology aspects are only one part of the industrial internet solution: They are just enablers, not the solutions. The most essential thing is to understand when, how, where and why to use these technologies. After that it is truly possible to implement industrial internet in the real business processes. (Zancul et al. 2016)

In future it is likely that technology disappears from the consciousness of the users (Gubbi et al. 2013). In other words, connectivity to the internet becomes so normal that user does not even think that the used solution is somehow special. She or he does not either need to have any special knowledge to be able to use the product or whatever the solution is. Connectivity and advanced IoT-based features may become standard in future. From other perspective the special features may be hidden and they are used on the background.

2.2.3 Condition monitoring and industrial internet

As this thesis concentrates mainly on business models of condition monitoring solutions, industrial internet -based condition monitoring deserves deeper observation. As defined earlier in chapter 2.1, condition monitoring means continuous or periodic measurement and interpretation of data to indicate the condition of asset and need for its maintenance (Williams et al. 1994, p. 11). The purpose of condition monitoring is to guarantee functionalities of an asset so that possible faults can be detected as early as possible (Widodo & Yang 2007). Condition monitoring is a common industrial service. Its nature is relationship-based product-oriented service (Oliva & Kallenberg 2003). In industrial manufacturing context, there is huge amount of different assets and production equipment that are worth be monitored to ensure better availability and efficiency. The special challenge in condition monitoring services is that monitoring is not directly adding any value to the end customer. The value comes from higher equipment availability which can be achieved if some failures or maintenance needs can be detected before severe failure.

Industrial internet enables machine-to-machine communication which can be utilized in the predictive maintenance through condition monitoring with sensor technology. Predictive maintenance allows optimizing maintenance frequency which can directly lead to the decrease in maintenance costs. Condition-based maintenance (CBM) is a management philosophy which assumes that current or future condition of assets defines repair or replacement decisions. (Rymaszewska et al. 2017) Condition-based maintenance is based on real-time diagnosis of impending failures and prognosticating of future health of monitored assets or equipment (Peng et al. 2010). It can also be defined as a maintenance program that recommends maintenance decisions based on information that is gathered through condition monitoring (Jardine et al. 2006). The difficulty in condition-based

maintenance has been to find optimum time for maintenance operations (Rymaszewska et al. 2017). This can be solved with the systematic condition monitoring as monitoring systems becomes more and more intelligent which is made possible by development of industrial internet.

Condition based maintenance can be presented in three generic steps: data acquisition, data processing and maintenance decision making (Jardine et al. 2006). With little inspection it can be noticed why industrial internet can be exploited in the means of condition-based maintenance: In Figure 3 is presented components of industrial internet application recognized by Lee & Lee (2015) and their connection to three steps of condition-based maintenance presented by Jardine et al. (2006). These two concepts support relatively well each other's. First step of condition-based maintenance is data acquisition and first part of industrial internet application, monitoring, is the way to acquire the data. Next, data can be processed with big data and analytics to get more refined information for the decision making which is based on the information sharing.

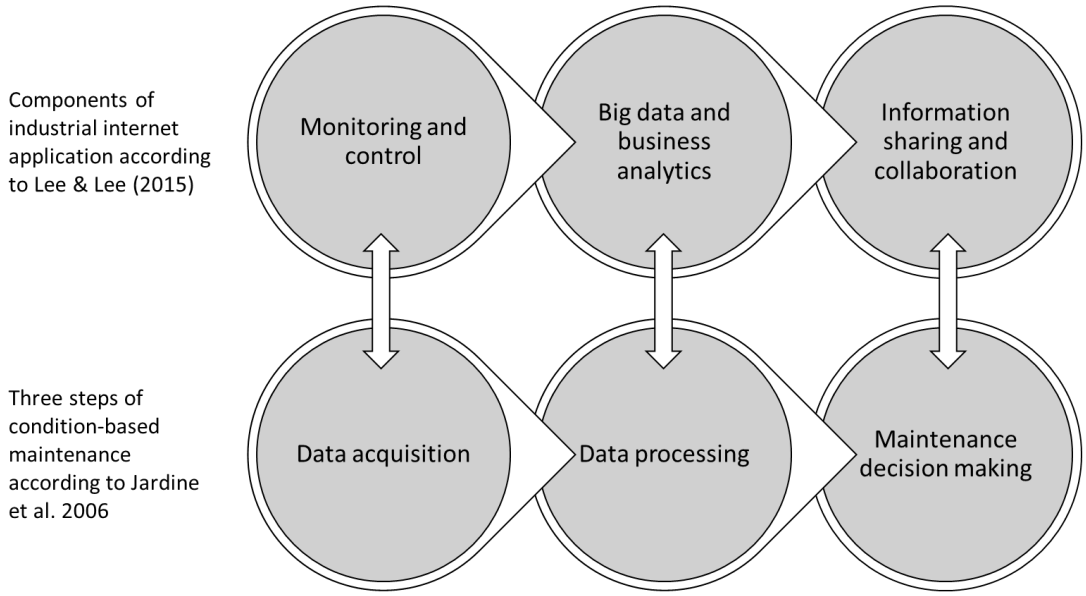

Figure 3: Components of industrial internet application support three steps of condition-based maintenance.

The modern industry is increasingly demanding reliable operations, low environmental risks and human safety while operating processes at maximum yield (Peng et al. 2010). Operational reliability of production equipment is crucial element of conducting business in a successful way. With effective monitoring and control better operational reliability can be achieved, which at the same time can enable companies to operate more profitable by maximizing the value addition and availability of producing assets. (Rymaszewska et al. 2017) Industrial internet based solutions are answering to this need by making condition based maintenance possible through real-time monitoring and communications.

2.3 Customer value in industrial services

Value propositions and business models of industrial internet solutions are expected to become more customer-centric than in traditional businesses (Burmeister et al. 2015). This means that the meaning of customer value and value proposition is going to be even more important part of the business and success. This thesis is focusing on exactly same thing: to find out how where the real customer value of digital value added services is coming from and how company can change its business models to increase that customer value. To be able to find answers to these questions, concept of customer value has to be understood especially in the context of industrial internet based services. Customer value has strong connection to the business model: Customer value and value proposition are one of the most essential parts of the business model and they form the foundation of the business model (Zott et al. 2011).

2.3.1 Concept of customer value

Customer value is extremely central in business. Customer value and its creation have been central concepts of marketing for long (Woodruff 1997), but marketing is not the only field related to it. It is suggested that companies exist to create value for customers (Slater 1997; Smith & Colgate 2007). Maximization of customer value is the goal of companies in addition to fundamental target of shareholder value maximization (Bolton et al. 2007). As a concept, customer value has been quite popular research subject during recent decades, but at the same time it is also stated that customer value creation is underinvestigated (Hunt 1999). It has been researched from many different viewpoints, but results are not unambiguous. The main classification that can be distinguished from researches has been the division to B2B and B2C customer value. As this thesis is focusing on industrial services, the main perspective is naturally B2B viewpoint. There is at least not yet that much literature regarding customer value in industrial internet based applications. Many researchers touch the topic in their researches but only very few directly deals with the subject. At the beginning, it is also worth to notice that fundamentally customer value can mean both value for customer or customer's value to company (Lindgreen & Wynstra 2005; Smith & Colgate 2007). In this thesis, the focus is on perceived value by customer.

Even though concept of customer value is researched already on several decades, there is still no unambiguous definition for it. Not until year 1997, it was proposed that customer value and value proposition are good sources of competitive advantage and observation of customer value is going to revolutionize many fields of business (Woodruff 1997). It is surprising how new thing customer orientation through customer value thinking actually is in the academic literature. Of course, some companies have applied the customer orientation in practice, but there has not been much research about it. Woodruff (1997) does not give explicit definition for customer value, but he states out that customer value

is value perceived by a customer, not a supplier company, and value is based on customer's experience of the obtained benefits (Woodruff 1997). In a company, customer value has to be understood as a higher-level concept, not a low level operational measure (Tzokas & Saren 1999).

As mentioned earlier, there is no unambiguous definition for customer value, but there are still same shared viewpoints between researchers and other professionals. The shared aspect of many researchers is that customer value consists of the two parts: benefits and costs (Lindgreen & Wynstra 2005). Components of customer perceived value recognized by Keller & Kotler (2016) are presented in Figure 4. Customer perceived value can be divided into total customer benefits and total customer costs. Total customer benefit includes product benefits, service benefits, personnel benefits and image benefits. As for total customer cost contains monetary costs, time costs, energy costs and psychological costs. (Keller & Kotler 2006) It is important to understand that purchase price is not the only cost that is related to some product or service. Total customer cost has close connection to term *Total Cost of Ownership* which means all the life-cycle costs of observed subject, not only the purchase price (Ellram & Siferd 1998). If benefits are greater than costs, customer perceived value is positive. It is also worth to notice that costs can be greater than benefits, which makes customer perceived value negative. Even though model can be presented in a very simple format, putting the model into practice is not that easy. Many questions can rise. One of the most important ones is that how can we actually measure and compare benefits and costs. It is not definitely easy task to compare for example service benefits with psychological costs.

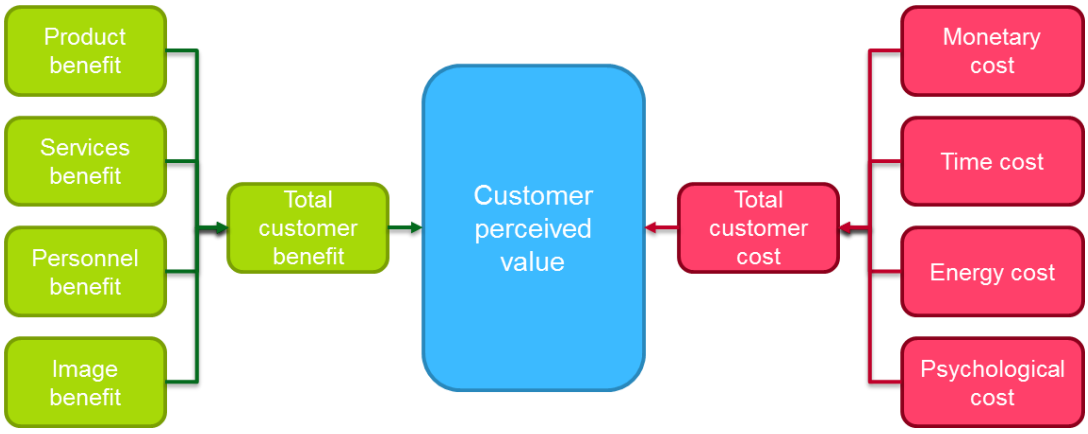

Figure 4: Customer perceived value and its components (Keller & Kotler 2006; Martinsuo et al. 2016)

Another close term to the customer value is customer satisfaction. Customer value can lead to the customer satisfaction, which on the other hand can lead to the customer loyalty (Lam et al. 2004). If customer value is not understood concept, it is hard to understand customer satisfaction deeper, not to mention achieving the customer satisfaction and loyalty. Regarding customer loyalty, it is not self-evident that customer satisfaction leads to long-term customer loyalty (Woodruff 1997), but satisfied customers are more likely to

be also loyal customers (Lam et al. 2004). In literature, there is often mentions about superior customer value. Superior customer value is achieved when company offers more value to the customers than competitors can offer. The comparison is often conducted by using a net present value analysis. (Slater & Narver 2000)

Traditionally, value has been seen as a central topic of marketing, but this is not the entire truth. Value as a concept is surprisingly hard to research because it has connections to the many other fields like strategy and strategic management, psychology and customer behaviour, accounting and finance (Tzokas & Saren 1999). It is not only hard to research, but also to control the value creation in companies. Customer value is central concept which should concern every parts of the organization. As discussed earlier, one viewpoint to the existence of companies is that they exist to create value to the customers (Slater 1997; Smith & Colgate 2007).

Value expectations of the customers are different and highly dependable on different factors. In addition to that, customers might perceive and experience value differently. Also, customer needs differ noteworthy depending on the industry field but also on company level. (Zeithaml 1988) Perceived value refers to customer's experience of the company's offering (Heinonen et al. 2010). It is also notable that customer's experience depends on time and place (Lindgreen & Wynstra 2005). It is extremely essential to understand these factors that effect on customer value experience to be able to offer real value to the different customers. It is not possible to create offerings and suitable business models for them which both fulfil needs of every customer. Because of that companies must segment their offerings for certain target groups. It is not possible to offer everything for every customer, but as a result of segmentation it is possible to tailor offerings for the needs of main target groups (Keller & Kotler 2006). In service business, it is highly important to understand the needs of different customers, because basically customers have more participative role in the production of services than in traditional manufacturing (Alam 2002). Even though we can form a mathematical-like formula of the perceived customer value, it is hard to define the value exactly. Perceived value always depends on customers' experiences. Customer experience is packed full of all the past and current activities and other inputs which can be both cognitive and emotional (Heinonen et al. 2010). In B2B environment cognitive facts affect more and customer behaviour is not as emotion based than in B2C markets. Things like performance and functionality gain more importance in B2B markets. (Mencarelli & Riviere 2015)

It is very important to understand that even the customer itself does not necessarily have uniform idea of the value internally. In some cases, this fact makes it hard to understand the real customer value. Literature does not take this side into account in many cases, but it is worth to be considered at least on some level. Company can be considered as a group of individuals who can experience the value differently. The idea of the value might be quite different depending on who it is asked from. The directors of the company or business owners might have different viewpoint to perceived value than operative employees.

To sum this up, it is crucial to understand interests of different parties to be able to fully deliver superior value to customer. It is also worth to figure out who are the most important individuals inside the customer's organization. In the empirical part this thing is taken into account by interviewing persons from different levels of the same customer organization. In this way it is possible to have broader view to the value understanding and increase the value by taking multiple viewpoints into account.

It is not enough that offering provides value to customer. The value has to be demonstrated to customer. (Anderson et al. 2006) Firms can better manage their customer value delivery if they understand the components of customer value (Menon et al. 2005). In addition to that, companies must develop their ability to build relationships with customers and their ability to visualize the value of their service offering to customers, the service offering portfolio must be made adaptive for changing customer needs (Kindström 2010).

In today's competitive environment many companies have focused to lower their own costs and increase productivity. Other way to gain competitive advantage is to concentrate on customer value and increase of it. One way to increase customer value is service business (Bolton et al. 2007) and that is one reason why servitization has been remarkably emerging trend during recent years.

2.3.2 Customer value in the context of industrial internet

One fundamental reason to develop industrial internet solutions is to offer even more value to customers than ever before. Naturally, companies are not developing solutions for such an altruistic reason. Producing more value to customers means more business which hopefully makes growth possible and finally generates more profits. The fundamental goal of a service should be to facilitate value for the customer (Grönroos 2008) and it is said that digital solutions will heavily change the way how companies are creating the value to the customers (Iansiti & Lakhani 2014).

Industrial internet offers many possibilities to companies to increase created value or change the value creation radically. Many companies have realized this possibility to utilize industrial internet by generating incremental value to the customers (Wortmann & Flüchter 2015). That kind of value creation is based on adding some digital software elements to the existing products. That kind of solutions can be considered as one product based solution. In that kind of solutions that are tied only on one product most of the value of industrial internet is thrown away. More value can be achieved if the products are connected together into a system and even ecosystem (Wortmann & Flüchter 2015).

According to research conducted by McKinsey & Company, industrial internet and its applications have promised noteworthy savings in operational costs in almost every industry (Manyika et al. 2013). Are these cost saving percentages enough to customers to end up to purchase decision or do they want to know or achieve something more about

the value of the solutions? To take more out from the development of industrial internet, it is proposed that cost-centric approach has to be replaced with value focused viewpoint (Bucherer & Uckelmann 2011). Long-lasting benefits are typically more valuable to customers than cost reduction which effects diminishes when competitors acquire the same technology (Openshaw et al. 2014). Solution must offer improvements into customers' business performance and those performance improvements have to be sustainable over time, not just in short term.

As discussed earlier, industrial internet is boosting the servitization and makes completely new approaches possible. All this makes it possible to companies to extend their value chain and through that serve customers better which might lead to the increased profitability (Rymaszewska et al. 2017). Rymaszewska et al. (2017) present that industrial internet-based solutions are good and cost-effective ways to craft a value proposition which takes companies closer to their end customers. Through industrial internet offering companies can also change their position in value chains (Rymaszewska et al. 2017). This has significant effect on delivered customer value. Research made by Rymaszewska et al. (2017) is one of the few studies which is researched in the industrial manufacturing context. Most of the researches observes Internet of Things more generally.

It is critical to understand that industrial internet or IoT technologies are not values themselves. They are just tools and enablers to achieve real customer value. Gathering data and taking the readings and measurements are not new things. Real value of the industrial internet comes from possibility to deal with huge amount of data with advanced analytics to make reasonable business decisions (Openshaw et al. 2014). Industrial internet itself is not able to generate value and increasing data amounts must be transformed into useful knowledge (Zancul et al. 2016). As technology is not an end itself, it is important to focus on user experience to increase the customer value. It is said that user experience is better to customer if the sensing and processing works in the background hidden from the user, both in the industrial and consumer contexts (Gubbi et al. 2013).

One interesting thing is that industrial internet offers good opportunity to companies to understand their customers better and to understand how they are using their products (Rymaszewska et al. 2017). When customer behavior is understood, companies can reshape their business models and value chains to better meet customer needs. When company gets customer data through industrial internet applications, company can gain new insights into their business for example into customer segmentation (Porter & Heppelmann 2015). With more accurate segmentation company can offer tailored offerings for certain segments.

In case of adding industrial internet components into the existing products, the difficulty might be to convince the customer to purchase these new solutions instead of the traditional offering. Industrial internet related offering must give perceivable and significant

advantage to customers in order that they change permanently to industrial internet boosted offering. (Gerpott & May 2016)

One interesting point of view which has not got much attention is that smart connected products can be updated over the air which makes them more sustainable solutions. It is possible to add new features through software updates. (Hui 2014) Of course that requires that additional features are somehow taken into account during development phase for example through adding enough memory and processing power to add new features. That can be considered valuable to customer: Customer does not need to anymore throw away old products and acquire new ones. Instead of that customer just can download updates into old product and get new valuable features.

2.3.3 Customer value of condition monitoring solution

Generally, customer value of condition monitoring solution can be considered to come from reducing total costs of ownership of the monitored product. Additional value creation starts when some of these life-cycle costs can be decreased. In condition monitoring value creation comes exactly from that point of view. Industrial internet based solution for condition monitoring is not value itself. The value comes from decreasing the total costs of ownership. For example: if customer owns a motor and condition monitoring system tells that bearing is going to break within two months, company can maintenance the motor before it fails and company saves huge amount of money.

The purpose of condition monitoring is to guarantee functionalities of an asset so that possible faults can be detected as early as possible (Widodo & Yang 2007). Industrial internet enables machine-to-machine communication which can be utilized in the predictive maintenance through condition monitoring with sensor technology. Through industrial internet solutions condition can be monitored continuously and need of manual labor can be decreased. Predictive maintenance allows decreasing maintenance frequency which can directly lead to the decrease in maintenance costs. In addition to refining monitoring data into valuable condition information, data acquisition can also be used for finding out some patterns of customer behavior (Rymaszewska et al. 2017).

Another possible value comes from risk management point of view which can be exploited in fleet management purposes. Through preventive and predictive maintenance that are made possible by industrial internet condition monitoring solution, customer can lower risks at the same time when costs are reduced (Openshaw et al. 2014). Condition monitoring solutions should be marketed also with risk management point of view, not only with cost reduction. The value of the information can increase if information is combined with some other information (Bucherer & Uckelmann 2011). In this way condition monitoring solutions can be refined even more valuable if the information can be combined with some other useful information. Together this new combined information can provide totally new point of views and increase the customer value significantly.

2.4 Business model of industrial services

The special focus on business models in this chapter is on industrial services and especially on business models of industrial internet solutions. There is a huge amount of literature available focusing on business models. All that cannot be covered or is not even appropriate to cover in this literature review. The fundamental researches and industrial internet context researches are covered. Ambition is to find ways for customer-orientated business model of industrial internet based digital service offering. Bucherer & Uckelmann (2011) have stated that business model is a major element to be able to unite technological developments of industrial internet with economical business perspective.

2.4.1 Business model definition and components

Business model is relatively new concept and it has even been misunderstood in many occasions (Al-Debei & Avison 2010). Term has many definitions that differs from one another and literature is developing in silos (Zott et al. 2011). One of the most cited definition for the business model is Teece's (2010) definition. Business model describes the ways company creates and delivers value to customer, entices customers to pay for that value and converts this whole palette to profits. This definition includes also management's hypothesis on what customers want and way how customers' needs can be fulfilled. (Teece 2010) Business model can also be shortly defined as an architecture of the revenue (Chesbrough & Rosenbloom 2002). In other words, it is a holistic overview of manner how company does its business (Zott et al. 2011; Dijkman et al. 2015). These three definitions give short picture what the business model is all about.

Business model connects technical potential with realization of economic value (Chesbrough & Rosenbloom 2002). With suitable and innovative business model a company can increase its competitiveness. The approach to business model must be logical and consistent to be able to execute the business successfully. (Bucherer & Uckelmann 2011)

There is often misleading confusion between terms business model and business strategy (Casadesus-Masanell & Ricart 2011). Business model has strong link to the strategy and it is often related to the strategy but it is important to remember that they do not mean the same thing. Business strategy and business model are not substitutes, they are rather complements. (Zott & Amit 2008; Zott et al. 2011) Business model can be seen as layer between strategy and business processes (Rajala & Westerlund 2007).

Business model usually starts with differentiating the value proposition, value creation activities and value capturing models. This process and components are presented in Figure 5. The value proposition is used to describe the drivers of the customer value and unique features of the company's offering. The value creation instead includes the resources and processes that are required to deliver the value through company's offering.

Last but not least value capture describes profitability and economic matters including revenue logic and cost structure. (Zott et al. 2011; Burmeister et al. 2015)

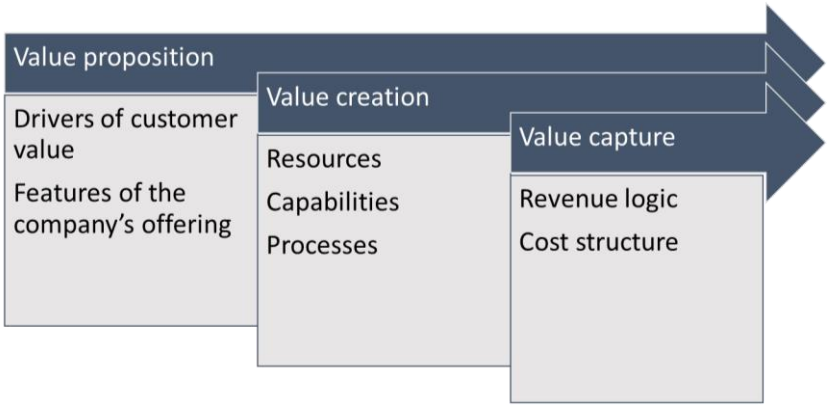

Figure 5: Fundamental structure of a business model

One of the most popular frameworks for business model generation is *business model canvas* (BMC) presented by Osterwalder & Pigneur (2010). Also, those few frameworks for business model of IoT solution are based mainly on business model canvas (Dijkman et al. 2015). Business model canvas itself is based on a meta-analysis of business model framework literature (Dijkman et al. 2015). Business model canvas divides business model into four pillars which are value, customer, infrastructure and financial aspects. These pillars can be further divided into nine building blocks which are value proposition, customer channels, distribution channels, customer segments, key activities, key resources, key partners, cost structure and revenue streams. (Osterwalder & Pigneur 2010) Business model canvas and its components are presented in Figure 6. The pillars of the model are highlighted with different colors.

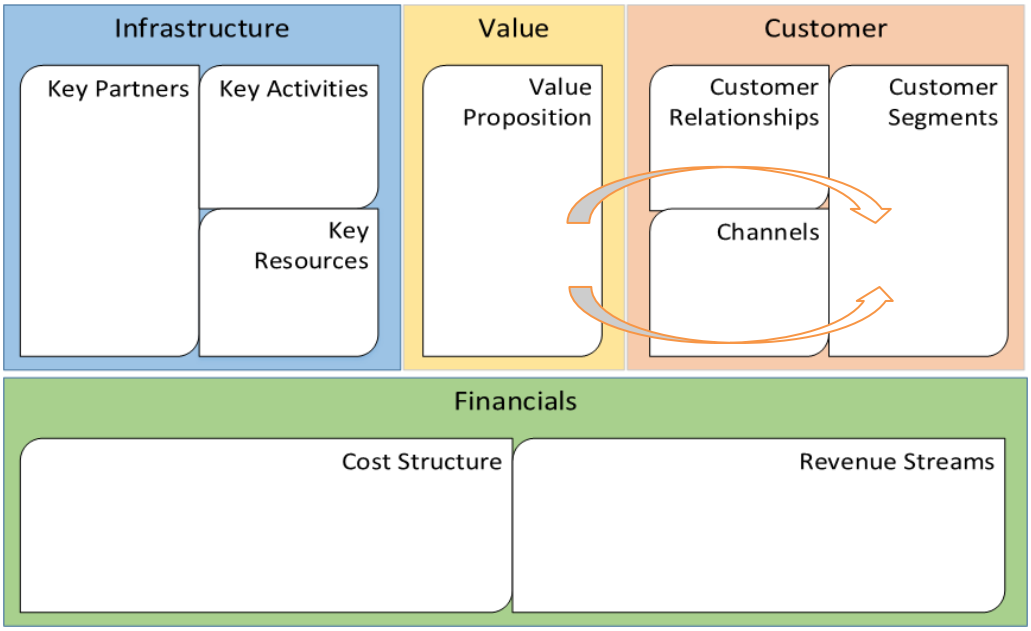

Figure 6: Business model canvas, adapted from Osterwalder & Pigneur (2010).

The *value proposition* is in the center of the canvas and it defines what is actually delivered to the customer (Osterwalder & Pigneur 2010). In other words, it describes what customer needs are fulfilled with the offered product or service and how (Bucherer & Uckelmann 2011). Next is the customer perspective, which includes three different parts. First there is the *customer segment* which means the certain groups of customers that are served with this offering. Second, there is *channels* component which defines the ways how these selected customer segments are reached and how the value is delivered to them. Third part of the customer perspective is *customer relationships* which defines the relationship between company and the customers. Relationship can be for example very loose like self-service or highly engaged like value co-creation. (Osterwalder & Pigneur 2010; Bucherer & Uckelmann 2011)

Bucherer & Uckelmann (2011) have categorized *key activities, key resources* and *key partners* building blocks as an infrastructure components of business model. Key activities mean the most important actions that company performs in order to create, offer and market the value proposition. Key resources are the most important assets that are required to make the business model work. They can be physical, intellectual, financial and human. Last one of the infrastructure components is key partners which means the network of suppliers and other collaboration partners that business model requires. (Osterwalder & Pigneur 2010; Bucherer & Uckelmann 2011)

At the bottom of the business model canvas, there is the financial perspective of business model. The *revenue streams* define the sources of revenue and ways of revenue generation. There can be different revenue streams in one business model. The *cost structure* describes the most significant costs that are linked to the business model. (Osterwalder & Pigneur 2010; Bucherer & Uckelmann 2011)

Basically, business model canvas is a tool for *business model innovation* (BMI) which allows user to describe and manipulate business model when new decisions are made (Osterwalder & Pigneur 2010). Teece (2010) defines business model innovation as *"sensing, seizing, and reconfiguring skills that the business enterprise needs if it is to stay in synch with changing markets"* and changing business environment. In other words, business model innovation is a systematic process for developing new business models. Business model innovation is a way to analyze new forms of value creation. With business model innovation companies can differentiate themselves from competitors and achieve competitive advantage (Bucherer & Uckelmann 2011). Business model innovation must be proactive work and companies must look steadily forward. During recent years, business model innovation has become quite important tool to recognize new opportunities for value creation from both company's and customer's perspective (Zott et al. 2011). Typical problem in business model innovation is that it is done in isolation without thinking about the competition and real customer needs (Casadesus-Masanell & Ricart 2011).

New innovations can require new business models (Chesbrough & Rosenbloom 2002). It is extremely important to understand the meaning of the business model to complete business. Even though one has wonderful innovation which is revolutionizing the field, but one does not have suitable business model for that, one's business might be ruined. Companies must expand their perspectives to find the right business model for the innovation to capture the value from it (Chesbrough & Rosenbloom 2002).

2.4.2 Business model of industrial internet solution

As technology develops, companies must be ready to reshape and innovate their business models in addition to developing products and services (Chesbrough & Rosenbloom 2002; Teece 2010; Zott et al. 2011; Burmeister et al. 2015; Dijkman et al. 2015). Only flexible and reactive players have a real chance to take the benefits of technological development (Rymaszewska et al. 2017). It is not enough if company is able to adopt new technologies. The company must also be flexible and reactive with business models and their innovation. (Leminen et al. 2012) New business models must be developed to exploit the industrial internet applications (Dijkman et al. 2015). Bucherer and Uckelmann (2011) have stated that internet of things provides an infrastructure for both incremental and radical business changes. Configuring the combination of technology, suitable business model and customer acceptability are forming the actual business case (Leminen et al. 2012).

Earlier business model innovation (BMI) was seen as a task of startups, but technological development has also made it necessary for companies that already have long successful history (Burmeister et al. 2015). In addition to this technological progress and digitalization, also increasing cooperation and ecosystems of different companies are forcing these companies to reconsider their business models (Bucherer & Uckelmann 2011). For very long researchers have been silent of the challenges of monetizing the IoT and industrial internet (Westerlund et al. 2014). It is highly important to be able to do profitable business with industrial internet. Companies are not doing charity work when they are developing industrial internet applications. They want to take out the profits from that situation. To be able to do that business model is highly important concept to understand.

Even though the digitalization is not a totally new research topic any more, digital aspects still might deserve some additional viewpoints in business model generation. No matter how good product or service one has, the future market position and profitability lies heavily on whether the business model of digital solution is suitable in that specific case or not (Burmeister et al. 2015). There is still lack of research that concentrates especially on business models of Internet of Things or industrial internet solution. During few recent years some articles are published (Rymaszewska et al. 2017). It is also little controversial whether these solutions deserve own specific models or frameworks for business model and its innovation. On the one hand basic business model frameworks can be exploited,

but on the other hand, it is highly critical to understand that these new solutions are reshaping business in many ways (Dijkman et al. 2015). Those new aspects should definitely be taken into account, but there is no denying the fact that digital parts of the solutions are becoming more and more commonplace and may be later integrated in the traditional business model thinking.

When implementing industrial internet in the real-life business processes the first key element is to understand when, how, why and where to use the technology (Zancul et al. 2016). It is easy starting point to start with such question words. With this kind of little analysis, it is possible to determine which alternatives are the most suitable ones to continue with industrial internet aspect. It is important to understand that industrial internet itself is not the customer need. Industrial internet only comes into the picture when value is created. It is a tool to fulfill customer need and offer additional value to customer.

Industrial internet will change the value propositions of the companies and through that complete business model is worth to be reconsidered (Iansiti & Lakhani 2014; Burmeister et al. 2015). Most of the research regarding business models of IoT or industrial internet solution tend to focus on determining which building blocks of the business model are the most important ones. One of the most cited research regarding business model generation for internet of things application is conducted by Dijkman et al. (2015). They have started their work from ordinary business model canvas and observed that there are some additional components that should be taken into account. They have recognized that the most important factor in the business model of IoT application is the value proposition. Next comes customer relationships and then key partners. In value proposition the types convenience, performance, getting job done and possibility for upgrades were the most important things. Their research context was relatively broad containing different sectors from both B2B and B2C contexts and also for that reason the results are not very practical. (Dijkman et al. 2015)

According the study conducted by Metallo et al. (2018), most important parts of the business model of IoT solution are value proposition and key resources and activities. This interpretation is quite technology focused. Of course, it is extremely important that company is doing technologically right things, but from business point of view the customer cannot be forgotten. Financial aspects and customer are not seen as important (Metallo et al. 2018). To be able to operate successfully, the whole palette must be taken into account. In many cases, especially customer is forgotten. It is true that key resources and activities are important to be able to build some product or service which can offer some value to customer, but business model must be considered as an entity where all building blocks must be in the balance. In addition to entity point-of-view Metallo et al. (2018) tend to forget the interplay and interaction between different business model components. With separate blocks it is not possible to conduct business successfully. All the components must interact with each other and also support each other. Many researches of IoT business models tend to only focus on recognizing which elements are the most important

ones. There is clearly need for further study which tackles this area much deeper. Customer perspective is mostly ignored in the existing literature.

Key partnerships were also considered as one of the most important elements of the business model in IoT-related business (Dijkman et al. 2015; Metallo et al. 2018). In the IoT-based business most important partners are usually software developers and data analyst partners. (Dijkman et al. 2015) That kind of partnerships are required because only few companies have capabilities to do all by themselves and often it is not even cost-effective to do so. This might be repulsive idea to some traditional companies who have been used to that the most important parts of the offering are produced self. According to the very basic principles of business, a company should focus on its core competences and outsource other elements (Prahalad & Hamel 2000). Only few companies that could gain benefits by adding IoT components to their offering are able to produce software or analyze data in a meaningful way. Interesting question is how companies should react to the fact that someone else is taking care of the most core components of their IoT-based offering. Companies must open their central operations to others so they are definitely taking risks, but it might be profitable to do it. In that kind of partnerships, it is important to understand how other parties make money to secure long term success (Dijkman et al. 2015).

It makes sense that some elements of business model can be considered as more important than others, but what does this information gives to us? Managerial implications are mainly that managers know which parts deserve extra attention. Some key elements of the service-orientated business model is that companies should focus on every aspect of their business model in holistic way, not only analyze parts separately (Kindström 2010). After all, complete business model deserves extra attention. Business model is more than the sum of its parts.

2.4.3 Effects of industrial internet on business model

As found earlier, industrial internet changes and requires changes in business models (Dijkman et al. 2015; Burmeister et al. 2015). Critical changes in business model might even shift company's place between industry boundaries (Burmeister et al. 2015). Through industrial internet solutions, traditional companies are offering and even producing software. This change requires much from companies and employees. There is no room for change resistance. Fleisch et al. (2014) have even stated that the separation between physical and digital industries is now past. That might be put little too bluntly because there are still many industries which are based purely on physical products. It is definitely true that key transformation of IoT are hybrid solutions which combine physical product with digital service (Fleisch et al. 2015) and development of IoT might enable hybrid solutions in products that cannot yet be even imagined.

Many researchers state that companies must change their business models to take into account aspects of the industrial internet (Leminen et al. 2012; Burmeister et al. 2015; Rymaszewska et al. 2017). Only few of them see the other side: At the same time company has possibility to form their business models again. It is not necessarily the compulsory evil, but it can be huge opportunity to company. If industry is not in the change it is very hard to change the logic of the business, but if customers also understand that the environment is living in the transformation, customers are more approving.

The digital transition might be dangerous for some more traditional companies. These traditional companies have got new competitors which are revolutionizing the business with digital solutions (Rymaszewska et al. 2017). These solutions might promise value through advanced algorithms and analytics. At least this fact should wake up the traditional companies to react to this changing environment. Also, customer demands are changing. Digital transition towards servitization welcomes new entrants to the traditional markets in different contexts (Rymaszewska et al. 2017).

Research of Deloitte conducted by Openshaw et al. (2014) states that companies tend to offer cost reduction through industrial internet as a customer value. They criticize that point of view to customer value of industrial internet solution, because the returns that are achieved through cost reduction are diminishing over time when competitors implement similar efficiency improvements. They still admit that this kind of cost reduction approach can be valuable to customer companies but they state that industrial internet solution providers should offer something more. More customer value can be obtained from some critical innovation than from incremental innovation. Industrial internet solutions can also enable revenue growth which might be more valuable to customers than cost savings. (Openshaw et al. 2014) At the same time when cost reduction is offered to a customer company, provider can get new insights to customers business though data and offer better services to customers.

Industrial internet is also changing distribution channels and customer relations (Burmeister et al. 2015). In customer relationship element of business model, the IoT special thing is co-creation of the value (Dijkman et al. 2015). It is good to involve customer in different phases of the product or service cycle because it can also make relationship deeper which can lead to customer loyalty and even strategic partnerships where both parties benefit. Also if company has access to customer data that can enable quicker contact and personalized relationships (Dijkman et al. 2015). Through IoT offering companies can also change their position in value chains (Rymaszewska et al. 2017). It is for example possible that companies can directly reach their end customers through B2B2C chains (Burmeister et al. 2015). In this way some players on the market may face difficult times.

There has even been some research regarding IoT strategy. IoT strategies can for example be divided into four different basic strategy: get-ahead strategy in market, catch-up strategy in market, get-ahead strategy in technology and catch-up strategy (Li et al. 2012). If

company has some kind of IoT strategy, of course business model must support that chosen strategy. After all, it is still quite controversial if a company needs such a thing as IoT strategy. Company's overall or digital strategy may be enough. It is necessary that company's strategy takes such an important transformation into account, but own IoT strategy might be exaggerated. At the beginning of the company's IoT path, it might be useful to have such a strategy, but later on IoT point of view should be integrated into the company's overall strategy.

Bucherer & Uckelmann (2011) have presented few example business models for IoT solution. They have mainly conducted their research in B2C context which is significantly different than industrial services context. However their findings are supporting other researches and there seems to be correspondence between contexts. First scenario relates to *Product as a Service* (PaaS) model where customer does not need any longer own products. If applied into industrial context, it might mean for example production equipment like motors. Company can offer equipment on contract basis for example based on monthly fee. Contract can also include additional services like repairs. Customer benefits because investments are lower and there are no repair and maintenance costs. (Bucherer & Uckelmann 2011) In that way there is also risk management point of view. In PaaS model industrial internet works as an enabler and with sensors it is possible to track the usage of product and its condition (Bucherer & Uckelmann 2011). Second scenario by Bucherer & Uckelmann (2011) focuses on providing information as a service. As information collection is getting cheaper it is possible to turn information processing profitable.

Third one of the scenarios presented by Bucherer & Uckelmann (2011) is customer involvement. Bucherer & Uckelmann presents this only as a consumer involvement and does not try to apply it in the industrial context. Also, industrial internet can provide new level of customer integration into value co-creation process. Customers can be exploited for example in the purpose of developing condition estimating algorithms. Customer can tell the company that now machine is really broken and this is what condition monitoring solution said. As a return customer can get some discounts from the licence fees. Last scenario presented by Bucherer & Uckelmann (2011) focuses on right-time business analysis and decision making where industrial internet is the enabler.

Chan (2015) has little different view to the successful business model of IoT solution. He proposes "who, where, and why" framework (Chan 2015). Basically, his model includes same basic components than other frameworks, but it concentrates more on technical aspects. Turber et al. (2014) has divided business model of IoT-based solution into parts what, who, how and why. This point of view can be criticized because it is more like business idea or concept not the business model. (Turber et al. 2014)

Ecosystemic perspective can be recognized as a rising trend in the IoT-oriented business model research. Westerlund et al. (2014) have argued that instead of viewing IoT as a

technology platform it should be viewed as a business ecosystem. They are also promoting a change from focusing the business model of a company to designing ecosystem business models. (Westerlund et al. 2014). This ecosystemic perspective is observed deeper in the next chapter which discusses how to make business model more customer-oriented. Westerlund et al. 2014 have proposed that managers should use business model designing tool which takes into account the ecosystemic nature of the Internet of Things (Westerlund et al. 2014). There still seems to be very little empirical evidences of success of such business models.

In addition to all opportunities that industrial internet is offering, there are also new threats that should be considered at the strategic level of the company (Wortmann & Flüchter 2015). In addition to new technology it is worth to notice that new business models and ways of doing the business also create new risks (Iansiti & Lakhani 2014). In order to understand new risks it is definitely worth to conduct an in-depth risk analysis. There also has to be a plan how to react if these risks realize.

It might be more profitable to sell less physical products and concentrate on long lasting partnerships. For example, it is stated that General Electric has succeeded in that and they have generated noteworthy extra revenues with such a strategic choice in non-traditional business model (Iansiti & Lakhani 2014). Later on, it has been noticed that the truth is not that simple, and it is even said that GE Digital failed (Scott 2017; Moazed 2018). GE had lot of technical problems and delays with its platform (Scott 2017). Also reported $1 billion additional revenue was internal revenue, not from external customers which is criticized to be sugar-coated (Moazed 2018). As this example shows the expectations, public image and reality are not necessarily confronting.

Essential parts of the business model are also pricing and monetarizing models. While traditional products concentrates on generating revenue by always selling new products, industrial internet can help companies to enable recurring revenue (Hui 2014; Metallo et al. 2018). This might also be the hidden motive to enter into IoT-business. Recurring revenue is tempting option to companies because it can balance seasonal fluctuation in demand. When creating a business model of servitizated offering it is also worth to notice that Neely (2008) has observed that companies that are servizating are achieving higher revenues, but lower profit percentages compared to traditional manufacturing companies.

Bucherer & Uckelmann (2011) have noticed that pricing of the information is problematic when information is the offered as a value. Value of the information is hard to determine and value of the information may even change over time (Bucherer & Uckelmann 2011). This makes pricing complicated. Laurila (2017) has researched deeper the linkage between customer value and revenue logic in the context of industrial internet -based services in her master's thesis. Her study revealed that non-traditional revenue logics like benefit-based pricing are a growing trend in industrial internet context. The problem in benefit-based pricing is that benefits should be measurable easily, and often in practice it

is not easy to determine how much value customer has received in monetary terms. Classic subscription model is exploitable with many industrial internet applications. (Laurila 2017) Even though pricing scheme is important part in market expansion (Chun & Choi 2014), it cannot be fully included in this thesis. Different pricing models are observed lightly in the empirical part of the study, and theoretical background is mainly based on Laurila's (2017) research.

The most significant cost factors of the IoT solution are closely related to the data collection, storage and maintenance. Costs of using are considerably small. (Bucherer & Uckelmann 2011) Development of course can be long and expensive process. For that reason it is important to understand that profits are not realizing immediately and lot of work is required before operating profitability.

As a conclusion from the review of existing industrial internet and IoT business model literature, it can be noticed that customer point of view has not gained the attention it deserves. Most of the existing literature focuses on recognizing which business model components are the most important ones. Key resources and activities have gained interest, but the customer is forgotten. There is clearly need to give more attention to customer and operate in customer-oriented way.

2.4.4 Making a business model more customer-oriented

Throughout the history companies have focused too much on their own processes instead of customers. It is really worth and even highly critical to understand what customers really want (Levitt 1960). It is interesting that existing literature of business models hardly concentrates on customer orientation. Value proposition is central part of the business model but the customer itself is not necessarily involved in the process. There is clearly a research gap which needs to be fulfilled. As we now understand the concept of business model and special characteristics how industrial internet effect on it, it is time to have a look how this whole palette can be made more customer-oriented. Existing literature deals quite incidentally the ways to customer-oriented business model. In Table 1, ways to increase customer orientation collected from the existing literature are presented. Firstly, discovered ways are divided into categories which are presented in first column. In final column references and research contexts are presented. If some way has several references, contexts are presented in similar order. It is important to notice that there are only little research in the context of industrial services. For that reason, research from other contexts were reviewed and discussed whether it is exploitable also in the context of industrial services.

Table 1: Ways to make business model more customer-oriented.

Category	Ways to customer orientation	Reference and context
Strategic choices:	Applying Service-dominant logic.	(Vargo & Lusch 2008; Turber et al. 2014), service business generally (mainly consumer services).
	Applying Customer-dominant logic.	(Heinonen et al. 2010), service business (mainly consumer services).
	Achieving customer proximity by changing the position in value chain through industrial internet -based services.	(Rymaszewska et al. 2017), industrial manufacturing.
Offering related:	Creating long-term customer relationships by offering complete solutions instead of simple aftersales services.	(Johansson & Olhager 2004), industrial services.
	Offering revenue growth to customers instead of cost reduction.	(Openshaw et al. 2014), Internet of Things ecosystems.
Building understanding:	To find out what kind of support and other services customers need to get even more value, company must understand customer's context, activities and experiences related to different tasks and how the service supports the customer.	(Heinonen et al. 2010), service business (mainly consumer services).
	Building mind-set of what customer want to achieve and how company can support them to do that.	(Heinonen et al. 2010), service business (mainly consumer services).
	Instead of basing services purely on product, service strategy must be aligned with customers' environment.	(Raddats & Easingwood 2010), industrial services.
Involvement:	Including customers into value creation.	(Turber et al. 2014), service business generally.
	Involve customer into development phase.	(Tuominen et al. 2015), service productization.
	Involving customers into business model innovation.	(Lukkaroinen 2014), industrial manufacturing.
	Involving users and getting input from users.	(Alam 2002), financial services.
	Interaction between customer and company. Interactive perspective in value creation.	(Tzokas & Saren 1999; Ulaga & Chacour 2001; Grönroos 2008; Gummerus 2013), consumer marketing, industrial, marketing, service business, service business.
	Ecosystemic point of view in the business model design.	(Westerlund et al. 2014), industrial internet ecosystems.
	Building open business model.	(Burmeister et al. 2015), industrial manufacturing.

One way to take customers into account more comprehensively is *Service-dominant logic* (SD-logic). Service-dominant logic emphasizes the power of services and how they should be managed. In service business, relationships become more and more important and the co-creation of value is necessary to ensure the best results. (Vargo & Lusch 2008) Vargo & Lusch (2008) determines that *"a service-centered view is inherently customer oriented and relational"* because services are defined in terms of customer benefit and value co-creation. It has to be understood that this Service-Dominant logic is a mind-set like lenses through which to look the whole phenomena. In theory, viewpoint to services should be customer orientated, but in practice there is a danger that company that offers services acts like traditional product manufacturer and customer orientation lacks. The article of Vargo & Lusch (2008) does not comment how company can achieve such a cooperative relationship with customer. They just content themselves to mention that it should be so.

Role of the customer is extremely important to understand. Customers can be better taken into account if customers become part of the value creation processes. With service-dominant logic company can solve some traditional problems which are often decreasing the customer orientation. SD-logic is more network-centric rather than firm-centric. Customers are included in value creation. Company cannot alone create value for the customer in digital context. (Turber et al. 2014) This is a good starting point to increase customer-orientation. In addition, it also takes monetary and non-monetary benefits into account. (Turber et al. 2014)

Even though SD logic focuses on cooperation and interaction, it is still quite provider-dominant logic (Heinonen et al. 2010). As a response to this particular problem concept of *Customer-Dominant logic* (CD logic) is introduced. Customer-dominant logic is a strategic mind-set and mental model which positions the customer in the center. It still can focus on services but it concentrates on different perspective. Instead of focusing what company can do to provide the service that customer prefers, the focus should be on what customers are doing with the services to reach their goals. (Heinonen et al. 2010) When customers business and logic is understood, companies can even find new business opportunities to support their customers better. With service-dominant logic the concentration is on what the company is currently doing, but if eyes are kept open, new opportunities and businesses can be noticed. It is also easier to form long lasting partnerships with the customer if their business case is really understood. Even though research conducted by Heinonen et al. (2014), Vargo & Lusch (2008) and Turber et al. (2014) are mainly observing consumer business context from marketing viewpoint, they seem to support well also industrial services context. It is worth to research deeper whether their principles suit for the industrial services context.

Value has also relational dimension, which means that value can be created in relationship with suppliers, through alliances partnering or even in the relationship with the customers (Ulaga & Chacour 2001). Value creation has traditionally been firm-centric activity

where firms add value to the outcome in a value chain. Later it has been understood that interaction between customer and company can actually increase the value for every party (Gummerus 2013). Customer's interests can be fully understood only in interaction between customer and company (Tzokas & Saren 1999). Alternative point of view to delivering value is, that suppliers only create and offer resources to customers and then customers create value by themselves (Grönroos 2006). Task of the service company is to support the customer's own value creation (Grönroos 2008). This viewpoint emphasizes the interaction perspective of the value creation process (Grönroos 2008). Even though research context is consumer business, same principles seem to suit also on industrial context. Especially industrial internet and IoT have emphasized the network thinking where no one can succeed alone and also customers are involved.

To be able to understand the customer's use or value of the service, the supplier company must first understand customer's context, activities and experiences related to different tasks and how the service supports the customer (Heinonen et al. 2010). When these things are understood it is easier to find out what kind of support and other services customers need to get even more value. The mind-set must not be what the offering can do to customer. It must be about what the customer wants to achieve. Companies need to achieve deeper insights of their potential role into customer's activities and business (Heinonen et al. 2010). Firstly, it is highly important to understand the basic regularities of service business. Secondly, company should understand the meaning of customer centricity. It is better if services that company offers are not only based on the company's products but the service strategy must be closely aligned with customer's environment (Raddats & Easingwood 2010). It is highly essential that companies listen to their customers and become disciplined about understanding their needs. In this way company can make smarter decisions how to allocate scarce resources in developing offerings that really generates value to the customers. (Anderson et al. 2006)

All things considered, it is necessary to offer services that responds to the actual needs of the customers to create real value to customers. One way to find out the customer needs is to involve the customer into development phase (Smith & Colgate 2007). Involving the customer can be done in many ways. Customers can be interviewed, observed, involved into shared development or common pilot projects. It is proposed that customer participation bring many benefits such as improved services (Alam 2002). Usually customers know what they need even at some level. When totally new services or products are developed customers do not know anymore exactly what they want, but it is possible to get valuable information how customers determine the value. Customer proximity is very important to truly understand customer needs and to be able to deliver real value to customers (Rymaszewska et al. 2017). Customer proximity can also be achieved by changing company's position in a value chain. There is also servitization aspect in customer proximity and it is stated that the best way to productize a service is to include customers into development phase (Tuominen et al. 2015). If long lasting customer relationships want to

be established companies should concentrate on offering complete solutions instead of simple aftersales services (Johansson & Olhager 2004). Existing literature of customer involvement is from various contexts. For example, Alam's (2002) research context were financial services, but Rymaszewska et al. (2017) have got quite similar results also from industrial manufacturing context. This motivates to research more how involvement can be utilized in industrial services context.

It is also possible to involve customers into business model innovation. Lukkaroinen (2014) has researched that in her master's thesis. She has noticed that customers can be involved for example through interviews, surveys and observation. Also Burmeister et al. (2015) have proposed that there is need for future research about involving customers in different phases of innovation. The main benefit of customer involvement in business model innovation is that it is possible to get insights of customer needs and wants (Magnusson et al. 2003; Lukkaroinen 2014). Basically, customer involvement in business model innovation and its benefits are similar than customer involvement in solution development more generally.

Westerlund et al. (2014) have pointed out that some challenges related to the IoT business can be overcome if the ecosystemic nature of the IoT is taken into account. This can be seen as a one way to increase customer orientation in the business model of industrial internet solution. Instead of focusing on individual company's self-centred goals, managers should focus on designing business model by considering complete ecosystem. This can be done by using business model tools that take ecosystemic nature into account. (Westerlund et al. 2014). Westerlund et al. (2014) has proposed simple tool for that purpose but it is not very practical. It is more about the concepts that should be taken into account. Basic starting point to understand IoT business model is to look at the value for all parties in the IoT business ecosystem. They also underline integrated value drivers which are shared for entire IoT ecosystem. (Westerlund et al. 2014) This kind of thinking suits quite well with other customer focusing points of views, because customer can be seen as a very central part of the ecosystem in the IoT business.

Westerlund et al. (2014) also criticizes business model canvas presented by Osterwalder & Pigneur (2010) because it is only providing an exploded view to the parts of the business model and is not explaining the dynamics between the components. Westerlund et al. (2014) are not presenting any competing tool for business model generation. They are only presenting key pillars of a business model design tool for IoT ecosystems. These pillars are presented in Figure 7. First one of the pillars is *value drivers* which mean the motivation of different parties of the ecosystem. To build long-term relationships there should be shared value drivers. Second is *value nodes* which are different actors like sensors, machines, processes, individuals and organizations which are linked to other nodes to create value. As can be noticed, nodes are very heterogenetic which means that many different actors affect to the value creation. Third part is *value exchanges* that refers to an

exchange of value by different means, knowledge, resources and information which specify how revenues are generated and divided in the ecosystem. Fourth, *value extract* shows what the meaningful value which should be monetarized is. Finally, *value design* should be sum of these other pillars and it should illustrate how value is collaboratively captured. (Westerlund et al. 2014) As it can be noticed this is not a ready tool and it is very abstract level concept. It is more or less a framework telling what should be considered when tool for business model generation and innovation is created. By combining these pillars with business model canvas better results might be achieved.

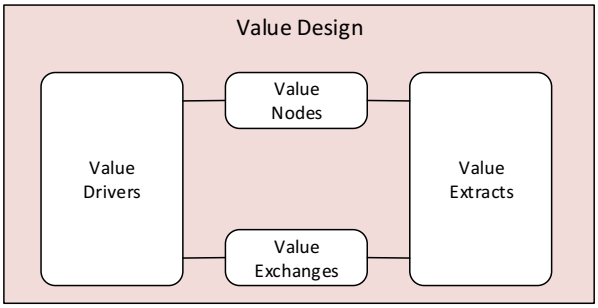

Figure 7: Key pillars of business model for IoT ecosystem (Westerlund et al. 2014).

Totally new approaches are needed and for example Burmeister et al. (2015) have proposed that open company boundaries might be required and *open business model* could be one way to do that. Basically, open business model is more or less similar than the ecosystemic business model presented by Westerlund et al. (2014). Open business model might be quite radical choice and many traditional companies might not be ready for that or at least it might require relatively long time. It is worth to figure out whether companies are ready for it or not in practice.

Operational linkages between company and customer increase which requires better managed customer relations than before (Zancul et al. 2016). Also risk management point of view has to be taken into account and contracts should be managed. It is highly important to define the responsibilities between different parties (Zancul et al. 2016). When something goes wrong for example with information security, effects might be huge and catastrophic. Also, division of intellectual property rights must be carefully agreed before joint development or other co-operation.

Contexts of existing research presented in Table 1 are relatively broad. Only few of the researches deals with industrial services in the context of industrial manufacturing. For that reason it is extremely important to analyze ways of customer orientation in this study to find out which of them suits for industrial manufacturing context where services has important role.

2.5 Synthesis

Industrial internet offers a good place to update business model towards much more customer-oriented direction. Main ideas of the industrial internet support customer focus well: Network thinking and value co-creation are very strong fundamental pillars behind industrial internet (Westerlund et al. 2014; Burmeister et al. 2015). Also, more radical changes in business models are possible because of radical changes in offering and whole environment.

Based on the reviewed literature, it can be stated that customer-oriented business model is not a simple concept. The most fundamental thing in customer orientation is to offer real value to the customer. There is a strong connection between business model and customer value. Customer viewpoints must be taken into account in every occasions and according to many researches value proposition can be considered as the most central part of the business model. In addition, value proposition cannot necessarily be static for different customers and it might be beneficial to have somehow modular offering to react to different needs of customers. Difficulty is that customers experience the value differently and they have different needs. This can be solved by tailoring the offering for needs of different customers or by segmenting the offering more precisely for certain customer group. It was also noticed that other parts of the business model like for example revenue logic and pricing model can have significant effect on customer perceived value.

Industrial internet based services are still quite new thing and business models of those solutions need additional research. Existing literature tends to focus on recognizing which components of the business model are the most important ones. This is not necessarily giving much managerial implications. There is definitely need for research which focuses on specialities of business models of industrial internet -based solutions especially from customers' and customer value point of view. Teece's (2010) definition for business model states that value proposition is based on management's hypothesis on what customers want and how they want it. Real customer involvement is needed to build more customer-oriented and valuable offerings and business models.

In this thesis customer orientation mainly means increasing value experienced by the customers. Hypothetical framework for customer orientation by involving customers is presented in Figure 8. Framework is based on the different observations related to increasing customer orientation from the existing literature.

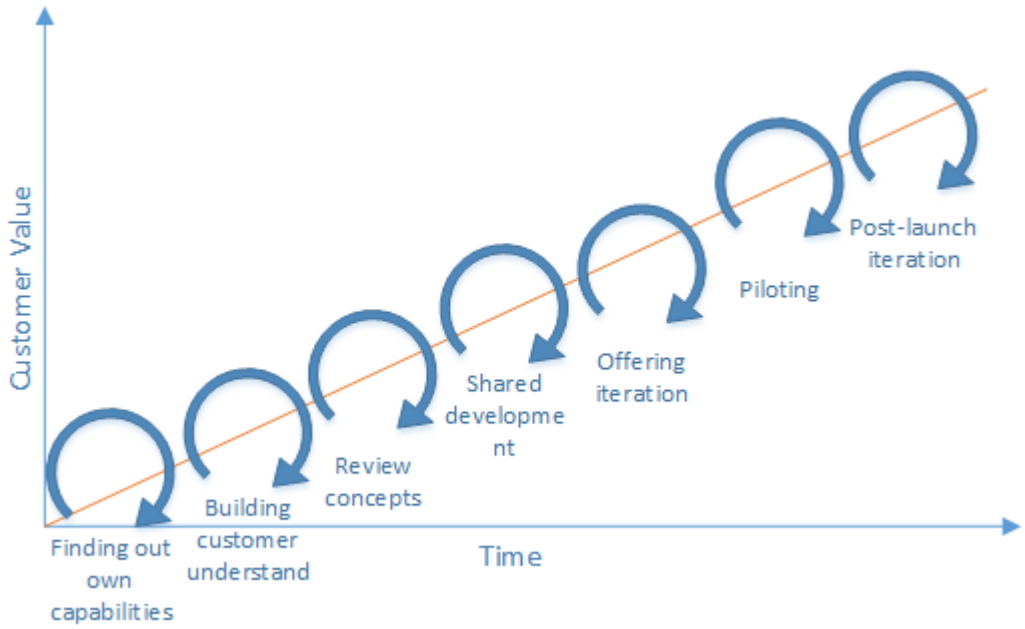

Figure 8: Increasing customer value by involving customer into different development phases.

The fundamental idea of the framework is to increase customer value in every iterative steps by involving customers in them. First two iterative steps in the figure are understanding the customer needs, value and own capabilities. These two steps can naturally be simultaneous, and the point is to mirror customer needs to own capabilities. Heinonen et al. (2010) have summed this up nicely and basically the idea is to build mind-set of what customers want to achieve, and how company can support them to do that. Based on the reflection supplier company can draft concepts and then review them together with the customer or customers. After that it is possible to start shared development project where customer is involved as Tuominen et al. (2015) have proposed. It is not necessary to apply all the steps of the model. It is possible to leave out some steps and for example shared development is not always possible or reasonable. This can be substituted with offering iteration and shared pilot projects, where customers are testing the offering and giving feedback. After the offering is launched it is still useful to iteratively update the offering based on the customer feedback. It is worth to notice that different steps are not necessarily linearly increasing the customer value. In empirical part, it is observed whether the framework suits for industrial manufacturing context.

Noteworthy is that presented framework is relatively generic. It might also be suitable for other application development than only in the development of industrial internet solutions. Industrial internet enables co-operation that has not been possible earlier or at least have not been easy to conduct. Industrial internet is integrating companies and different offerings efficiently and for that reason it is offering huge possibilities to different companies.

3. METHODOLOGY

In this chapter the research design and process are described. Empirical part of this thesis focuses on developing the real business case of the Case Company through interviews where business cases of pilot customer companies and benchmarking companies are contemplated. The main purpose of this study is to find out where the real customer value comes from in the terms of industrial internet -based services and how to shape the business model of such an offering more customer-oriented. Interviews are divided into two separate categories: Research starts with benchmarking interviews where managers of successfully companies are interviewed to learn some good practices. Another part focuses more on customer point of view. In that second part, several employees of real customer companies are interviewed to find out real needs and value expectations. All interviews are semi-structured and conducted in a collaboration with other companies.

3.1 Research design

Due to the nature of research questions and topics of the thesis, this research is qualitative. Business model and customer value are concepts which are hard to measure quantitatively. It is more important to perceive concepts and bigger picture to be able to answer to the research questions. Nature of the qualitative research is non-numeric and results are hard or impossible to measure exactly (Saunders 2011, p.151). Qualitative research has also ability to reveal new and surprising findings. With qualitative research, researcher can observe different viewpoints to the phenomena (Saunders 2011, p.151). In this research it is important to understand interpretivism philosophy. Interpretivism emphasizes understanding the differences between human as social actors (Saunders 2011, p. 115). This means that data includes interpretations of different professionals which are based on their individual experiences and opinions. It is also worth to notice that personal interpretation of the researcher might affect the results because researcher is a part of the research process in the qualitative case study.

Case study was selected as a research approach in this study, because case study allows researcher to acquire holistic and meaningful insights to the real-life events. According to Yin (2009, p. 18) “a case study is an empirical inquiry, that investigates a contemporary phenomenon in depth and within its real-life context, especially when the boundaries between phenomenon and context are not clearly evident”. The case study is suitable when research questions require many variables and there are not necessarily unambiguous results which can be generalized (Yin 2009). Qualitative research can be conducted by using methods like using existing data, questionnaires, interviews, observation and action science (Saunders 2011). In this particular research, interviews were selected as a research method to collect rich, deep and multidimensional qualitative data (Yin 2009). As non-

probability sampling is used in this study, results cannot be used for statistical conclusions (Saunders 2011).

3.2 The Case Company

The Case Company of this study is a global multi-industry technology and engineering company offering wide range of automation and energy solutions for different industries. Some functionaries of the company have strong roots in Finland. The company has invested heavily in the development to be the market leader and pioneer of digitalizing industry during recent years. In this thesis, term "the Case Company" is used to refer to this company.

The Case Company is developing different industrial internet solutions for many purposes and for many industry fields. This thesis relates to the industrial internet based -condition monitoring solutions. The Case Company has already launched offerings, but idea of the thesis is to find out what customers really want and how to make business model of such solutions more customer-oriented. Ambition of the study is in the future and company is looking for new business opportunities. The idea is also to collect honest feedback from the customers about existing offering and pilot projects.

3.3 Data collection

Data is collected through semi-structured interviews. Interviews are divided into two parts: pilot customer company interviews and benchmarking interviews. These interviews are presented in more detailed level in their own subchapters. Altogether, 11 interviews were conducted in five companies. Average length of the interviews was 48 minutes. Summary of interviewees and their roles is presented in Table 2.

Table 2: Interviewees and their roles in their companies.

	Target company	Interviewee	Duration (min)	Role in the company		Job description		
				Expert	Management	Development	Maintenance	Sourcing
Pilot company interviews	A	A1	61	x		x		
		A2	38	x			x	
		A3	35	x		x		
		A4	74		x	x		
	B	B1	45		x			x
		B2	48		x	x		
	C	C1	40		x	x		
		C2	40	x		x		
		C3	52	x			x	
Benchmarking interviews	D	D1	46		x	x		
	E	E1	45		x	x		

As industrial internet solutions are relatively new subjects, there is not yet necessarily enough knowledge in the Case Company. It is more useful to conduct interviews with external companies than interviewing employees of the Case Company. The idea is to

build new understanding for the Case Company, and for that reason employees from external companies are interviewed. Also customer centricity is the fundamental theme of this thesis which makes it explicit to get knowledge directly from the customers. In addition to customers, benchmarking company interviewees are interviewed to deeper the knowledge by understanding what others have done and learning from them. In other words, thesis combines real customer needs with existing practices that has proved to work in other industries. General information about companies that participated in the study is presented in Table 3. Exact information is not presented in the table, to protect the privacies of participated companies.

Table 3: Participated companies.

	Company	**Personnel**	**Revenue**	**Industry**
	The Case Company	100 000 - 150 000	30 000 - 40 000M€	Automation
Pilot customer company	**A**	500 - 1000	100 - 500 M€	Maintenance
	B	15 000 - 30 000	5 000 - 15 000 M€	Pulp & Paper
	C	15 000 - 30 000	5 000 - 15 000 M€	Pulp & Paper
Benchmarking company	**D**	50 000 - 60 000	5 000 - 15 000 M€	Technology
	E	15 000 - 30 000	1 000 - 5 000 M€	Technology

Even internally in one company the value can be experienced in many ways depending on who it is asked from. This has been taken into account by interviewing persons from different roles and levels of the same customer organization. This ensures better understanding to the real customer needs and enables broader view to the customer value. Different functions of the company might have different motivators.

3.3.1 Benchmarking interviews

The basic idea of benchmarking interviews is to find out good practices from successfully companies from different industries. First benchmarking company (D) is an international technology and metal industry company focusing on solutions that are improving people movement. This benchmarking company has invested in research and development and has succeeded with its digital offerings. Second benchmarking company (E) is also global company focusing on marine and energy solutions. Company has devoted heavily to smart solutions that are supporting its business comprehensively. It has focused on smart technologies during recent years and it is already offering a wide range of digital solutions.

Both benchmarking companies are somehow similar than the Case Company of the study. All of them are global companies offering high quality solutions on their own fields and they are also one of the most significant companies on their own industries. Companies are not direct competitors with each other, but they might have common customers. They can all learn much from each other even though they are not operating on exactly the same industry. They are all pioneers on developing new solutions on their field of industry and regarding the industrial internet.

The nature of the interviews was semi-structured which means that interview follows beforehand prepared structure but discussion is allowed to branch of the topic. The interviewees were found by contacting individual persons from the companies. After that companies internally decided who would be the best person to be interviewed based on their experiences related to the topics of interview. Questioning frame for benchmarking company interviews is presented in appendix A.

3.3.2 Pilot customer company interviews

The Case Company of the thesis has ongoing pilot projects with several pilot customers. Interviews are conducted in three of these pilot customer companies. All of these three pilot customer companies are real and significant customers of the Case Company. Totally nine employees from these companies were interviewed. Pilot projects with these customer companies relate into existing industrial internet -based condition monitoring solutions for electric motors. Through interviews it was also possible to get valuable feedback from the past projects and existing piloted offering. Eight of nine pilot company interviewees were familiar with the existing solution offered by the Case Company. Six of those have tried or used the solution by themselves.

The customer company A is a Finnish maintenance company which is investing in development and digitalization of maintenance. The customer company B is a forest industry enterprise offering renewable solutions in biomaterials and paper. The customer company C is also a forest industry enterprise. Interesting difference between customer companies B and C from the viewpoint of the Case Company is that with customer company C common pilot project was stopped prematurely. For that reason, it is possible to get valuable information from customer company C why they ended up in the ending decision.

In this research non-probability sampling was used. A snowball sampling method was used to select the interviewees with every pilot customer company. The basic idea of snowball method is that previous interviewee proposes the next interviewee or interviewees (Saunders 2011, p. 240). By using such a method, the most suitable and relevant candidates could be found. Firstly, one contact person were contacted who proposed the person who was the responsible for the common pilot project. After the first interviewee was found, snowball method was used to select other interviewees from the organization. Questioning frame for pilot customer company interviews is presented in appendix B.

3.3.3 Common aspects of the interviews

In both of the interview types, both face-to-face and Skype interviews were used. Customer companies have diffused locations across Finland which made it hard to arrange face-to-face interviews with every interviewee. Also scheduling difficulties favored Skype interviews. After all, there were no significant differences noticed whichever technique was used. Naturally, face-to-face interview makes it possible to read impressions and other non-verbal communication, but meaning of those can be considered relatively insignificant in this study.

All of the interviews were semi-structured. In semi-structured interview the researcher has list of themes and questions. Semi-structured interview allows to branch of the topic and makes it possible to pose a follow-up questions. Order of the questions may vary in different interviews and it is possible to leave certain questions out in some interviews if needed. (Saunders 2011) Benchmarking company question frame is presented in appendix A and pilot customer company question frame in appendix B. Process of forming the used questioning frames is presented in Figure 9:

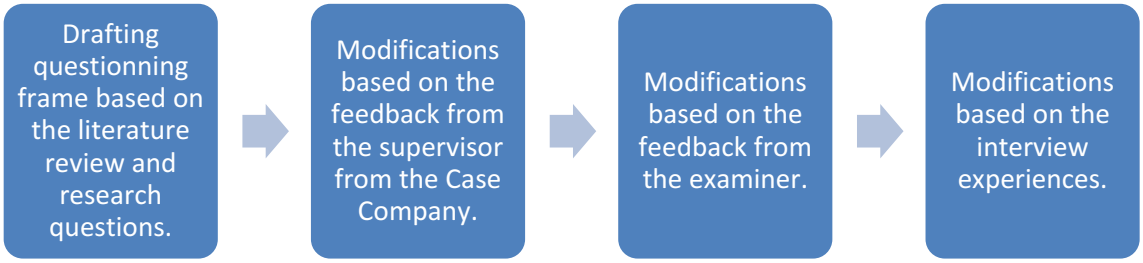

Figure 9: Questioning frame process.

One of the interviews was not recorded by interviewee's request. In this interview researcher had to focus more accurately on making the notes to enable the use of this interview similarly than others. All other interviews were recorded and transcribed for the data analysis.

3.4 Data analysis

After interviews and transcriptions were conducted, data analysis started by coding the data. Research data were coded based on different themes. Microsoft Excel was used as a tool in data coding. The codes used to classify the research data are presented in Table 4.

Table 4: Used themes in data coding.

Themes
1. Industrial internet 1.1 Current status in company 1.2 Future 1.3 Challenges
2. Ambition and motivation 2.1 Motivation 2.2 Potential
3. Customer value 3.1 Customer needs 3.2 Sources of customer value 3.3 Success factors in business
4. Existing offering 4.1 Existing solution feedback 4.2 Existing solution development 4.3 Common pilot project
5. Condition monitoring solutions 5.1 Subject of the monitoring 5.2 Predictability 5.3 User experience 5.4 Connectivity 5.5 Additional features 5.6 Supportive services
6. Networks and partners 6.1 Meaning of partners 6.2 Role of the Case Company 6.3 Value co-creation
7. Business model 7.1 Industrial internet aspects in business model 7.2 Business model innovation 7.3 Revenue logic and pricing models 7.4 Integration with the complete offering
8. Towards customer orientation 8.1 Finding out and understanding the customer needs 8.2 Different customer needs 8.3 Integration into own processes 8.4 Implementation into customer's processes 8.5 Needed Capabilities 8.6 Customer involvement

Themes were selected based on the research questions and objectives of the study to build a comprehensive picture of the researched subjects. Also, interviews were already conducted, so researcher's experiences from interviews could be utilized to highlight central

themes that were recurring. Theme structure was modified during data coding. Themes are forming a path which is reasoning viewpoints and proceeding logically. The idea is firstly to find out interviewees' outlooks to the industrial internet: What do they know and what they have already done? After that their ambition and motivation is observed to be able to analyze the fundamental reasons why they are interested to adopt industrial internet solutions and what kind of problems they are expecting to be solved. After that it is easier to drill down to more practical needs and value drivers. It is important to mirror these value drivers also with success factors of their businesses to truly understand their environment and needs. Next, it is reflected how existing solution provided by the Case Company has succeeded to create value for customers and also how common pilot projects have succeeded. After that condition monitoring solutions are observed in more general level to understand what the real value drivers of them are. Next theme is networks and partnerships that are related to industrial internet. After that when there is value understanding, it is possible to move towards business model through value proposition. Finally, ways to customer-oriented business model are discovered. Results of the study are mainly following this theme structure.

Mainly, inductive reasoning is used in this study, as intention is to create new knowledge about research subjects and even build new theory (Saunders 2011, p. 125). There is not yet much existing research about research subjects, which encourages to select inductive approach. Naturally, thesis has also some characteristics of deductive reasoning as existing literature is reviewed first before data collection and analysis. For that reason, the study can be seen as a dialogue between theory and practice and it is possible to use term abductive reasoning which is a combination of inductive and deductive approach.

It is obvious that every view and thought that were presented during the interviews cannot be considered as truth because they are based on viewpoints of individuals. Also, because of that same reason, results of the interviews are inconsistent in some occasions. In such situations viewpoints were prioritized based on the roles and positions of the interviewees in their organization. This does not mean that the higher the person is in the organization the better her or his opinions were listened to. Results were considered as more reliable if many interviewees shared the same opinion. When the results were written down, comments were translated from Finnish to English. This may have caused slight differences and nuances to the comments.

4. RESULTS

In this chapter the results of the empirical study are presented. Results are analyzed and discussed deeper in chapter 5, discussion. Citations presented in this chapter originate from conducted interviews. Citations are translated from Finnish to English and that may have caused slight differences and nuances, but those have been tried to take into account as well as possible. Citations are presented in *italics*.

4.1 Current adoption and motivation in target companies

As it was noticed from the existing literature, many companies are willing to adopt new technologies and are taking steps to be a part of the digital revolution. This fact is also accurate according to this study. Every one of the five interviewed companies have invested in development of industrial internet heavily during recent years. Some of them are further than others but all of them have an ambition to apply digital solutions in their businesses and develop their functions through digital possibilities.

4.1.1 Differences of companies regarding industrial internet adoption

Before results are started to observe, it is worthwhile to take a look into the differences between the target companies. It is important to understand that companies differ from each other and they have different needs based on their current status and other factors. The most notable observed differences and their explanations are presented in Table 5.

Table 5: Differences between the companies related to industrial internet adoption.

Differentiator	Explanation	Scale
Industrial internet market role	Company can be seen as a supplier, customer or both of an industrial internet solution.	Supplier / customer / customer & supplier
Attitude towards industrial internet	Companies have different attitudes towards industrial internet based on their interests and experiences.	Positive / neutral / negative
Industrial internet adoption	All of the companies are investing in industrial internet, but adoption level differs.	Beginning / middle-phase / advanced
Industry	Industry affects broadly to the needs and value expectations of the company.	Pulp & paper / maintenance / technology

Differences presented in Table 5 were pointed out during the interviews. Interviewees were for example asked to describe their current industrial internet adoption which also revealed their role on industrial internet markets. There were also several questions which revealed their attitude towards industrial internet solutions.

The first differentiator is the role of the company in the industrial internet solutions market. Company can act as a supplier, as a customer or as both, supplier and customer. Most notable difference between companies is the difference between benchmarking companies and pilot customer companies. Benchmarking companies are offering wide range of industrial internet -based solutions to their customers. Basically, benchmarking companies are solution suppliers and pilot customer companies are customers and service users. Although, industrial internet is mixing the value chains and roles of companies are not that clear anymore. As noticed in literature review, a company can change its position in value chain through IoT offering (Rymaszewska et al. 2017). This can be also noticed in this study. One of the companies has become both supplier and customer during digitalization. It is also important to take further look and notice that from the perspective of a software or platformer supplier like for example Microsoft, all the companies are also customers.

Second differentiator is the attitude toward industrial internet. Overall attitude towards industrial internet solutions is positive. Every one of the interviewees strongly believed that industrial internet solutions will change the way of life and working. Naturally there were differences how soon and fast they expect the change happen. Benchmarking company interviewees, who already have industrial internet -based offerings, were the most optimistic and hopeful, but also pilot customer interviewees strongly believed in development. According to certain pilot customer company interviewees:

> *Development is proceeding so fast. In one year things change significantly. After ten years we are living in totally different world. – A4, Reliability Process Owner*

> *IoT is involving our everyday lives and will change our lives permanently. – B2, Smart Operations Director*

It is not surprising that naturally there were also some personal differences and even some frustration, because development has not been as fast as technical hype has suggested. Pessimism and healthy scepticism also occurred:

> *We have been waiting for that. There are always some buzzwords which change in every few years, but I have to admit that this time the drumming has been so loud that I have to believe in IoT and hope for the best. – B1, Sourcing Director*

> *You cannot jump on the hype. Let see after ten years if there are some real and useful solutions. – C3, Maintenance Engineer*

There seemed to be a connection between attitude towards industrial internet and attitude towards service purchases. If company is interested in industrial internet it tends to be also more interested to purchase services instead of pure products.

Current adoption of industrial internet solutions is significant divider. Some companies are already on more advanced level and have invested into development and been part of the development longer than others. Some companies have had slower start and they have been more careful in decision making. They have wanted to first see how others are reacting. Both benchmarking companies are on advanced level, but pilot customer companies have more differences. Two of the customer companies have even highlighted the digitalization and industrial internet as the central themes of their current strategy periods. All of the companies have chosen quite ambitious viewpoint to the industrial internet: The starting point in every pilot customer company has been to start to develop their own centralized industrial internet system. They do not need or want one industrial internet partner with which to co-operate. They all have several ongoing projects with several partners and they want to have control over their position in industrial internet adoption and implementation. Currently companies have ongoing projects related to process optimization through data visualization and predictive analytics, condition monitoring visualization and algorithms. Even though benchmarking companies are on more advanced level on industrial internet compared to the pilot customer companies, they still understand the need to keep up in the development and that work must be done constantly. It is not possible to stop and there are still many possibilities while technology develops all the time:

> *Even though we already have highly developed and intelligent solutions, there is still much to do. I believe that we still are only at the beginning of this path. – D1, Development Director*

The digitalization focus in two of the customer companies is mainly on process and operations optimization. Maintenance related condition monitoring solutions have not yet gained that much attention. As one of the customer companies is purely a maintenance company, they have naturally focused on maintenance and condition monitoring solutions more than other companies. Other two pilot customer companies have familiarized themselves with the market offerings and have even tested many of available solution, but they are not yet as advanced, and there is clear demand for ready applications:

> *We have increasing amount of process optimization projects. Maintenance projects we have to a lesser degree. We have some, but less. There is a lot of talk regarding predictive maintenance, but in our environment greater benefits come from process optimization. Of course, both are needed but at the beginning processes are more interesting. – B2, Smart Operations Director*

I think that all of them (IoT based condition monitoring solutions) are in a pilot phase. Concrete solutions are still missing. There are lot of promises but not enough concreteness and concreteness is what we are missing. –B1, Sourcing Director

There are also internal differences in adoption level inside one company. It can be noticed that adoption is in early phase and solutions are piloted only at some factories. Customers do not yet have much solutions in everyday use which are integrated into real-life processes in every factory. Some of the factories and business units are still waiting for practical solutions and applications. There is a clear demand for the solutions which does not require huge investments in infrastructure. Solutions which are basically plug-and-play type can be utilized in that kind of old production environments where infrastructure is not on today's level.

Currently we do not have any intelligent solutions in this factory. It is too hard to implement them in the old factory like this. – C3, Maintenance Engineer

It is more or less testing. Currently everything is still quite operator based, not data-analysis based. – B1, Sourcing Director

It would have been interesting to observe also geographical and cultural differences, but in this study all the companies are Finnish companies. All of them except one company have also global operations but organization culture is based on Finnish values and principles. Geographical differences between markets could be an interesting subject for further study.

Based on these differentiated factors companies have different needs and for that reason it could be beneficial to build different offerings or tailor offering based on these differences. The companies who are not yet that far on development are missing ready simple solutions, but more advanced companies are waiting much more.

4.1.2 Industrial internet adoption motivators

There are many different motivators to jump on the industrial internet bandwagon. The most important motivators recognized in this study are presented in Table 6. Motivators are based on answers of every interviewee from all of the five companies that participated in the study. After interviewees had listed motivators they were asked to prioritize these motivators. Naturally, all the interviewees did not have similar opinions. Final order in Table 6 is based on combination of how many interviewee pointed out the motivator and how high he or she prioritized it.

Table 6: Motivators to industrial internet.

Motivator	Explanation	Importance
Financial aspects	The main target behind investments and development is to get more money as a return.	Very important
Increase customer value	Through industrial internet companies are trying to obtain increased value to their customers.	Important
Competitive advantage	Companies try to gain competitive advantage to perform better than their competitors.	Important
Will to be forerunner	Companies want to be pioneers and gain image of a forerunner.	Somewhat important

Financial aspects were recognized as the most central motivator to come along into the industrial internet world. All of the interviewees pointed out the financial aspect. Investments must be profitable and companies are hoping to decrease costs or increase revenue with industrial internet based solutions. Customer companies are mainly chasing to obtain cost savings. Two of the pilot customer companies are operating in process industry, where cost pressure is extremely hard. Interviewees stated that especially in their paper divisions costs are the main thing that matters, because market has intensive price competition. Some of the interviewees are also hoping to increase revenue, but mainly focus is on cost savings through efficiency improvements.

> *Basically, the reason is money. Of course, that is the motivator. We would like to make our whole system running more efficiently. – B2, Smart Operations Director*

There are differences between the companies regarding the attitude towards financial aspects. Some companies see that they should immediately be able to calculate how much solution will save costs or increase revenue. Some of the companies are more interested to take a part into the development of totally new things. Of course, they also want to justify the decision with the obtained benefits, but they are more interested to be technological forerunners.

> *In principle, every activity should be worthwhile. But when you participate in projects like this shared pilot project you cannot expect that you will receive benefits till the first day. If you want to be part of something like that, you have to be ready to try with open mind what kind of great things this can bring in the long run. – A1, Reliability Engineer*

> *Personally, from the viewpoint of sourcing, I am interested what the payoff versus the price is. Of course, in the bigger picture we are also interested what we can achieve. – B1, Sourcing Director*

Second motivator is to increase customer value experienced by their own customers. Especially the maintenance company is interested to offer more value to its own customers and through that perform better. They are hoping to improve reliability of the production equipment through intelligent and predictive solutions. Other two pilot customer companies are looking for better quality through which they are able to offer more value to their own customers. It is very fundamental principle that in B2B environment a company can create most value to its customer if it helps the customer company to create superior value to its own customers.

Companies are also willing to increase their competitive advantage. Competitive advantage means something that differs company from its competitors. To gain competitive advantage companies have started to invest in development of industrial internet to perform better in their business than their competitors.

> *Competitiveness and competitive advantage are the things we are looking for. – A4, Reliability Process Owner*

Will to be a forerunner is quite similar reason than will to gain competitive advantage. In this particular case will to be forerunner relates more to visibility and public image of the company, whereas will to gain competitive advantage relates to performing better than competitors. Visibility and public image are important things to companies and can have significant effect on customer relations and market position. Even that a company can say that it is part of the fourth industrial revolution and digitalization, can be beneficial to it at least on early phase of the adoption.

> *We want to invest in visibility and deliver a message to our customers. That is one reason for our ambition. – A1, Reliability Engineer*

In addition to these recognized important motivators, readiness of the technology acts as significant enabler that recurred in several discussions. It is classified more as enabler than motivator. Simultaneously when technology has developed, price of the sensor and analyzing technologies and other needed technologies has decreased significantly. This has caused that it is useful to place sensors all over and collect huge amounts of data even though it is not yet even known how to utilize it. One of the target companies had this kind of situation that they have lots of data but it is not yet utilized as efficiently as it could. Also, other needed technologies like cloud computing have become more affordable

After all, almost all the motivators and reasons are connected to the financial aspects. There is no denying the fact that money talks and that is of course the fundamental reason to conduct a business after all. All other motivators can be considered as ways to achieve financial benefits. Through increased customer value it is possible to conduct new business and increase revenue. Also, will to be technical forerunner through competitive advantage is a way to decrease costs or increase revenue. Similarly, as technology is more

mature and prices lower it is more probable to achieve costs savings or revenue increases through it.

4.2 Sources of customer value

Even though there were differences between companies, the sources of customer value and value drivers were relatively common for every participated company. Naturally there were some differences but mainly all interviewees had quite similar value outlook.

4.2.1 Different value drivers

Recognized sources of customer value are presented in Table 7. Interviewees from customer companies were first asked to describe what the most important value sources for them are. After that they were asked to prioritize them. Based on their findings and priority orders, the most important value sources are presented in Table 7. Importance is based on the prioritizing made by interviewees and number of interviewees pointing out the certain value. Also, benchmarking companies had recognized quite similar value drivers when they had co-operated with their customers. Basically, recognized sources of customer value are very fundamental. More practical value needs are described later when condition monitoring solutions are observed deeper in chapter 4.5.

Table 7: Value drivers and their importance regarding industrial internet solutions.

Value	Importance
Safety	Very important
Efficiency improvements	Very important
Securing operating reliability	Very important
Intelligence	Important
Risk management	Important
Quality improvement	Somewhat important
Sustainability	Somewhat important

Industrial internet -based offerings should be built on these values. At the beginning of the life-cycle of technology early adopters might jump on the bandwagon because of the technology and hype. As technology is becoming more mature, solutions have to be able to give real benefits to customers. Novelty value of industrial internet is not enough anymore at this point. Value must be able to be justified before purchasing decision. If there

are no adequate evidences of the profitability, investment is not done even though speculative value might be ten times the investment. At the end, all or at least most of these sources of value have connection to financial aspects and cost savings or revenue increases are the most fundamental value drivers.

Safety emerged in several discussions. Academic literature gives less attention to safety when value of the industrial internet and IoT services are observed. All of the companies pointed out that safety is the most important factor. In a western country like Finland, safety at work is a central focus point and many companies have safety first attitude. Fundamental principle is that working must be safe and all safety risks have to be minimized. Employees are more satisfied when they do not have any safety threats. Safety problems and occupational injuries have also very negative effect on company's public image which might have effect on the whole business. If safety can be increased somehow, companies are willing to listen the options and make investments. For example, with industrial internet -based condition monitoring solution safety can be increased if need of maintenance personnel to go to the production facilities can be decreased.

> *When solution is able to tell the condition of monitored machine or any other asset without need to go to machine or asset, safety is increased and simultaneously risks are decreased. – A3, Project Manager*

After safety, ***efficiency improvements*** were considered as the most important value source. If solution can improve actual working time, it is valuable to customers. Through reducing unnecessary work efficiency can be improved. Industrial internet based solutions offer possibility to that by for example automating condition monitoring. There is no need that someone goes to the machine and checks whether it is working properly or not. When machines can tell their own statuses personnel can concentrate on more productive work. One interviewee summarized the idea well:

> *Currently preventive maintenance is static. Someone goes to machine and checks that everything is ok every second week year after year. When machine starts to malfunction, it is a good thing that someone has done it. But if you have done it for five years every second week and everything is working, it is kind a wasted work. If machine starts to tell us its own condition, no one needs to go and monitor it every second week. Resource efficiency increases significantly. It does not mean that we will lay off our workers, but those persons can do something more productive and profitable work. – A4, Reliability Process Owner*

Efficiency can also be improved when need of work can be forecasted. This improves orderliness of work which enables better work balancing and scheduling. Naturally condition monitoring is not the only field where efficiency improvements can be achieved. In production environment increase of production can be achieved and material flows can be optimized. Two of the customer companies which operated on pulp and paper industry

saw the most possibilities of industrial internet in process optimization. On the other hand, they had much on-going development projects regarding that. Maintenance side and condition monitoring had not yet gained that much attention in those companies, so it might be interesting market and opportunity for the Case Company.

Next, ***securing operational reliability*** were also seen as very important source of value. Any kind of predictability is valuable to customer companies to decrease failures and breakdowns and through that secure operational reliability. Basically, securing operational reliability is more or less subcategory of efficiency improvement but it is separated here to highlight its meaning from the special point of view of condition monitoring. According to the pilot customer company interviewees, functionality of maintenance is measured by unexpected shutdowns. That can be connected to the efficiency by trying to keep the level of these unexpected shutdowns as low as possible with as low costs as possible. This is exactly the thing where industrial internet -based condition monitoring solutions can give the best possible benefits as unexpected shutdowns can be decreased with continuous automatic monitoring and analysing. Simultaneously costs can be decreased as there is no need for manual labour.

Regarding industrial internet solutions, ***intelligence*** was considered as a one of most central value sources. Intelligence is different than other recognized sources as is can be considered as a way to achieve those other sources of customer value. For example, efficiency can be increased through intelligent usage of data. Through intelligence it is possible to achieve predictability which can lead to better operating reliability and efficiency improvements. Companies are looking forward to machine learning and artificial intelligence which could make solutions even more intelligent and valuable.

Risk management point of view relates strongly to the securing operating reliability. They have many common factors. Fundamentally securing operating reliability is more or less risk management. Also, safety improvements relates strongly to risk management. Of course, risks can be managed and minimized also from other viewpoints. A couple of interviewees highlighted also ***sustainability***. On the other hand, if resources and materials can be used efficiently it leads to more sustainable production.

Two of these three pilot customer companies' strategy is based on ***quality***: They are offering high-quality products and services to their customers. They are aware that they do not have the most affordable offering. Similarly, the Case Company should utilize this knowledge and offer these companies solutions that help them to offer high-quality to their own customers.

One interviewee captured the sources of customer value with sectors of OEE. It is an abbreviation from term *Overall Equipment Effectiveness* and it evaluates how effectively a manufacturing operation is utilized. If supplier can help them to improve parts of OEE which are availability, performance and quality, then supplier offers value to them. They

have already been able to improve all of this with industrial internet solutions in process optimization, but they strongly believe that there is still much to do.

4.2.2 Value through responding to customers' challenges

The biggest challenge that interviewed employees from participated companies have is the unawareness. It cannot be directly known what should be done. As one interviewee phrased, they are on something like a journey of exploration. They are on relatively foreign land and they have to familiarize themselves with new things and do decisions with only little information. In addition to unawareness, resources like time and money are limited. It is possible that on its journey company spends much resources and after two years notices that this is not what they should have done. For example, during these years someone might have developed much better solution. There are naturally risks in investing in the industrial internet development, but it is also risky to not to invest. If the company is not part of the development competitors can overtake it. It would be valuable to customer if the Case Company can offer ready solutions which respond to their needs without needs to invest in uncertain development. On the other hand, one interviewee has also stated that if you are waiting for ready solutions to come to the market you have already lost the track. In that kind of situations common development might be a good solution, because companies do not need to invest as much as they should if they would do everything alone. In other words, it might be easier to be part of a development network than do everything by yourself. The complexity of the solutions is also other part. There are no right and wrong solutions to question in which order things should be done. Before company can for example control its processes through data visualization, company needs to have many different systems and overall architecture.

In addition to helping companies to achieve the success in their business, responding to these challenges might be valuable to customers. The Case Company can for example offer ready solutions to companies who are not ready to take risks and start own development. Then with other customers who are willing to be technological forerunners the Case Company can conduct shared development projects to develop better solutions.

4.3 Meaning of partners and networks

Partners and networks have significant importance in the development and adoption of industrial internet solutions. The Case Company is already operating with pilot customer companies but it is interested to increase co-operation. Firstly current use and need of partners are presented in this chapter. After that interviewees' opinions about the role of the Case Company and possible co-operation is described.

4.3.1 Current use and need of partners in target companies

Generally, all participated companies are using partners in the development of their industrial internet solutions or applications. Applications are so complex that there is no sense to do everything alone. All of the companies have only little resources for software development and analytics, so they mainly need partners for that. Academic literature discusses on meaning of partnerships, value co-creation and ecosystem level thinking. Ecosystem models are not yet utilized but companies are aware of strong network thinking that relates to industrial internet and IoT.

> *IoT is linked to the partnership thinking and networks are build. There is no sense to do all by yourself. At the beginning we started to do too much by ourselves, but after all we are a maintenance company. We are not a software company. It is worth to pay for helping hands, but we still want to participate strongly into development. – A4, Reliability Process Owner*

> *Increasingly we are developing together with someone. – D1, Development Director*

There are many kinds of partners that companies are using. One company favours cooperation with educational establishments. Those projects are easier to conduct because they do not require big investments. One interviewee stated that significant results can be achieved by giving only facilities for the use of student group. Whereas if a project is started with a supplier, starting investment is often tens of thousands of euros. This makes it easier to start a project with educational establishment because there is no need to determine net present value and other factors that relates to investments. Also, start-up companies are increasingly utilized because they are agile and still they might have strong knowhow on some very specific field of industrial internet. Co-operation with a start-up company can be much easier than with a global corporation whose resources are divided geographically. Company can also manage more easily network of start-up companies than network of global enterprises.

The challenge is that there are coming all the time more and more digital technologies that relates to the development of industrial internet. No one can keep up with all the new technologies and master them. That is the one fundamental reason why partners are needed and utilized. Core competence and knowledge must be inside the organization but different capabilities can be sourced from partners. Partners can also give different outlooks in which directions the world and technology are going and how these things should be taken into account related to the company's offering.

4.3.2 Role of the Case Company

Pilot customer companies and individual employees see the role of the Case Company very differently. Nevertheless, everyone thinks that there is a place and position for the Case Company in their own businesses and operations. As smallest, the role is considered to be an application supplier. For example, electric motor condition monitoring is considered as an application which customer company is willing to include into its own common industrial internet system or platform that they are currently developing. None of the interviewed pilot customer companies do not want to have one central industrial internet partner. They want to keep control in their own hands.

> *Role is an application provider. The basic idea is that the application works in our own cloud system. We do not want to have data from supplier's system to be transferred into our system. The whole application preferably runs in our own cloud system. At the application level we cooperate with different partners. – B2, Smart Operations Director*

> *Currently, there is no need for one main partner, whose complete system we should use. We have our own cloud-system. – A4, Reliability Process Owner*

Some of the interviewees sees only broader cooperation possible and they are interested in service contracts where for example motor power is offered as a service. Currently problem is that overall picture is relatively unclear: Different departments of the Case Company are offering separate solutions even though it would be possible to combine solutions into broader complete offering. This has caused little confusion according to some interviewees. They are hoping that the Case Company could introduce more comprehensive solutions and that also future directions are clarified.

Customer companies have machine base provided by the Case Company, and at least cooperation related to those machines is considered necessary. Anyone is not shutting out other possibilities. Mind-set is quite rational and any kind of cooperation can be considered if it is valuable. Some companies are ready to outsource anything if the value can be showed and demonstrated.

> *If some company can offer additional value to us with competitive price, then of course we should buy that. After all, these are very fundamental make-or-buy decisions. – A4, Reliability Process Owner*

As the Case Company is massive global company offering wide range of solutions, it is also stated out that role is different depending on which part of the Case Company is observed. As a hardware provider, the Case Company is wished to add intelligence to the hardware with competitive price. The Case Company acts also as a service provider offering wide range of services. Some of the companies are more willing to operate with hardware provider than with service or application provider and the other way around. As

a service provider, the Case Company can even be a competitor for some of the customers. For example, through service contracts the Case Company can compete with the customer company A, which is a maintenance company. Depending on the customer, the Case Company should be able to select a role which suits best for that specific case. The Case Company should bravely exploit these different role possibilities to maximize the business potential. On the other hand, it is mentioned that the Case Company's different departments are separately offering different solutions which could maybe be somehow combined into bigger entirety.

Most of the interviewees mentioned that sensors can be purchased anywhere. The main thing is the intelligence that the solution should offer. According to few interviewees there is no sense that the Case Company positions itself as a sensor supplier. To be able to compete there have to be something more to offer. Complete applications with hardware, analytics and connection to the customer's own systems are wanted. It would be even better if applications are modular and could be combined differently for the needs of different customers.

> *Important thing is to position what is the additional value. You can get sensors from everywhere. It is essential that your analytics are more advanced than your competitors. One option is to offer the full package so that customer does not need to get sensors somewhere, motors from there, and then analytics from different supplier. – B1, Sourcing Director*

More about possibilities to extend the role by combining different offerings are discussed later in chapter 4.6.

4.3.3 Value co-creation

In literature review customer involvement were seen as the best way to increase customer orientation in offering development and business model development (Alam 2002; Lukkaroinen 2014; Turber et al. 2014; Tuominen et al. 2015). Generally, all the pilot customer companies are interested to participate in shared development projects. At minimum level companies are willing to get their voice to be listened and opinions taken into account when offerings are developed.

> *It would definitely be great if we could get our voice to be listened and have possibility to effect on offerings already in development phase. – A3, Project Manager*

However, available resources are a question mark. Even though companies are interested to participate in development in earlier phase, there is lack of time and other resources. If there is not enough time, contribution might remain too low which can lead to the situation where no one is getting benefits from the co-operation.

I cannot directly say how we would have resources available. There is always lack of time, so we could not necessarily contribute as much as we should or would like to. – A2, Maintenance Engineer

Another problem is to define how to share the benefits. The target companies are not yet utilizing modern network thinking. To fully utilize co-creation, ecosystemic nature of industrial internet business should be taken into account as Westerlund et al. (2014) have proposed. There has to be specific contracts which describes how the benefits are divided and what are the responsibilities of each party. If these are not discussed carefully, it might cause troubles in relationships between companies. At worst whole partnership and relationship might get ruined if unclear terms of contracts cause conflicts. If networks are wanted to be fully utilized, it requires changes in outlooks. Whole network should be taken into account. A company cannot only push its own agenda. Real win-win situations must be the target.

There are always commercial discussions and contracts which might be problematic. If we for example give resources to the development where your company gets the commercial benefits. If our data is for example utilized, our competitors might get benefits from our data. Of course, there are non-disclosure agreements, but then your commercial potential might decrease if terms of contracts are too strict. There are some barriers, but absolutely that kind of cooperative operation should be developed and increased. – A4, Reliability Process Owner

Due to scarce resources, common piloting projects were seen as the best functional practice to participate in the development especially in the short run. Companies are willing to test different offerings to find the best possible solutions for their needs. Piloting does not require any significant investments. Customers get the latest technology in test use and supplier gets real environment for testing and gets feedback and development ideas from customer. It can be considered as a win-win situation. If supplier wants to get the best results from piloting, it must pay attention to it and customer.

Companies are willing to participate deeper if pilots are successful and a customer company perceives that offering is useful and suitable for their needs. They do not want to test or participate into development of too incomplete solutions. Customers expect that a supplier has relatively ready and functioning concept before piloting. Before piloting it could be possible to have discussion sessions about the concept and get feedback in that phase. In those discussion sessions they would like to give their view to the subject and tell their needs. The end users, customer's technical experts and sourcing experts could participate in those discussion sessions and give their viewpoints and knowhow.

All of the interviewees agree that there have started to be many different solutions on the market, but there are only little solutions whose value can be demonstrated. Everyone is yearning for more concrete solutions and reference stories. Co-creation of the offering is

a good way to get those long-awaited reference success stories. Even though companies say that they are pioneers and forerunners, they are still yearning for that someone has done it before them.

4.4 Existing solution pilot projects

To be able to make offering and business model more customer-oriented it is important to understand what the starting point is and what could be improved. The Case Company conducted shared pilot projects with these three pilot customer companies introduced in methodology chapter. In these projects, the Case Company provided the existing solution to the pilot customer companies for the real life use. The idea was to test solution in real production environment where the solution is meant to be used. Every project was conducted similarly and every customer company received needed devices from the Case Company. Representative of the Case Company delivered the devices to the customer company sites and gave little presentation of the offering.

Interviews conducted for this thesis were a great opportunity to get honest feedback from the pilot customer companies. Especially discussions with customer company C employees were interesting from this viewpoint because pilot project were stopped by the customer company C. It was possible to collect valuable information from interviews and figure out why project ended and how the Case Company could act better in future.

4.4.1 Feedback of the existing solution

Eight of nine pilot company interviewees were familiar with the existing solution offered by the Case Company. Six of those have tried or used the solution by themselves. Altogether, the feedback was both positive and negative. All of the interviewees liked the idea and concept of the solution, but those interviewees who had practical experience on the existing solution were not completely happy with the practical functionalities of the solution. The concept of the intelligent condition monitoring for the electric motors were considered very interesting and valuable. All of the interviewees agreed that solution could be valuable to them if it would work as it was communicated to them.

Even though the idea were considered interesting, in practice the solution had many problems which interviewees pointed out. First significant problem was that companies were not able to use the solution with the devices they would like to. The solution had many limitations and it was meant for certain type of electric motors, which were not that interesting for pilot customer companies.

> *We were not able to monitor those motors which would have been the most important and interesting ones. There were limitations related to the voltage, drives and other things. That limited the target group. The motors which this solution were*

able to monitor ranked to the places five of six in our order of priority which was based on fault statistics. – A1, Reliability Engineer

One of the most significant problems was that pilot customer companies felt that they were not able to get any new valuable information. Probably this problem exists due to communicational issues. Interviewees stated that they already had the same information that the solution could offer to them from other old-fashioned condition monitoring systems. They thought that the idea is good, but in practice the wanted data was not available when they got the systems. For customer company C winding condition monitoring was the most important factor which tempted them to participate into the pilot project. Winding condition information was promised to them, but it was not yet available. It was on the pipeline of the development. Probably due to communicational issues the solution was expected to be much readier than it was when the pilot project started. This caused much frustration and disappointed customers.

This is quite a bit like testing. These machines are already monitored by our own condition monitoring solutions which can give much more detailed information about the condition of the assets. – A2, Maintenance Engineer

We were aiming to decrease the need of human powered continuous monitoring. We had great expectations on this solution, but it was not able to do that. – C1, Maintenance Development Manager

Quality and accuracy of the data that solution provides were also big issues. Especially customer company C pointed out that data that solution offered was not correct. Again, better communication would have been needed. The idea of the existing solution is to monitor trends and changes in them, not absolute values. Pilot customer companies had also significant difficulties regarding reading the measurement data and sending it to the cloud system.

First, when we got the sensors, it took few months before we were able to use the system, because the mobile app was updated all the time and it did not work. We had to acquire new smart phones which support the app. It took four months, which actually was the first agreed pilot timeframe, to be able to get any data from the system. After we finally got the data, we started to notice that the data is little questionable. Vibration values were not same than we measured with our own measuring systems. Also, temperature was ambient temperature, not the motors temperature. And then there were not winding condition data at all even though we requested it. – C2, Development Engineer

Any of the companies has not yet caught any motor failure with the solution during the pilot phase as there were not any failures. One of the pilot customer companies had noticed that system had started to recognize some changes in bearing condition, but they were not able to read whether the changes were significant or not. From that customer

company one central feedback was that system were not very user friendly. User can for example see some values of the bearing condition but user do not know what those values mean and whether the value is low or high. The user experience of the solution was not as intuitive as it could be and customer has not got enough support with their troubles.

Positive things in solution were the easy data collection. It does not require skills to use any special measuring instruments. Anyone can use it and read the measurements with simple mobile application. On the other, hand data collection were also criticized by several interviewees: Data upload failed often and system is not able to send the measurement automatically to the cloud service. Someone has to go machine and take the readings with smart phone. One company did not see that as a problem and they stated that they were easily able to integrate measurements readings in their other processes. In other customer company, they experienced that it was too slow to read measurements. It caused frustration and they stated that it would take same time to take readings with their manual measurement devices than try to connect smart phone with the sensor. Later on these issues were solved with gateway solution which collects the data automatically. Wireless connection was also considered as a valuable factor. There is no need to invest in network. Old production facilities do not necessarily have connection possibilities and it would be extensive to build new network. More practical feedback is presented in Table 8. Many of the problems that are presented in table are already fixed after the interviews were conducted. After these fixes feedback would not probably be that negative.

Table 8: Existing solution feedback.

COMPONENT / FEATURE	PROS +	CONS -
CONCEPT	+ Competitive price. + Intelligence. + No need for infrastructure investments. + Simplicity. + Supports also old machines. + Suitable with motors from other manufacturers.	- Only support for 400V or 690V motors. - No support for motors connected to drive. - Does not utilize the full power of IoT as readings must be taken manually. - Requires specific sensor which makes solution like a product instead of service.
USER EXPERIENCE	+ Easy to install. + Easy to follow instruction manual.	- Commissioning the device is hard and takes time. Asset information has to be filled manually. - Manual reading of the measurements. - Reading takes as much time as taking measurements with existing measurement instruments. - No self-evident way to present condition. - Mobile application is not reliable. It crashes and fails connection with solution.
MEASUREMENTS	+ Magnet field measurements were happy surprise.	- No possibility to take detailed level measurements. - Values are not accurate enough. - No absolute measurements. - No winding condition yet.
CONNECTIVITY	+ Wireless connection. + No necessary need for network investment.	- No automated data upload to cloud system. - Only Bluetooth, no support for sim-card. - No possibility to get data into other systems. - No possibility to get raw data.

Customer companies A and B were more satisfied with the solution than the customer company C. Customer companies A and B tend to understand better that the piloted solution is not ready yet. With customer company C, meaning of the project was lost because of the communicational issues. Customer expected to get a ready solution. Pilot project and roles of different parties were not defined properly.

4.4.2 Feedback of the common pilot project

The Case Company conducted shared pilot projects with these three pilot customer companies. With customer companies A and B projects went better than with customer company C. Also, customer companies A and B have faced problems with the solution and they are not fully satisfied, but they are more contented with the solution and the project. Lack of the communication were considered as main problem in the projects. Many interviewees mentioned that it was hard to get answers from the representatives of the Case Company if they had something to ask for.

> *At the beginning everything went well. We got answers quickly and everything was ok. Now my colleague has tried to get answers to certain question, but she has not got any answers. She would probably give much more negative feedback than I do. – A1, Reliability Engineer*

> *There has not been that much communication, but with quite positive mind-set we have done our part. – A2, Maintenance Engineer*

As communication has not work as good as it should, it has caused some additional problems and there might have been some kind of miscommunication. At the beginning of the project, the Case Company may have stepped on the wrong trail. Some of the customers had understood that solution is much readier than it actually was. They were roped into the pilot project with the sales pitch and future scenarios, not with the fact that we have a concept and together we can make it better. Idea of the pilot project were maybe not understood right at first by both parties.

Other significant problem was that the Case Company was not active enough. Interviewees felt that anything was not proceeding. If they for example needed some help or had some questions, they did not get answers or at least the process was very slow. Some interviewees also pointed out that it seemed that solution responsibility was not in Finland and all the decisions were made some elsewhere.

> *It took so long to get any answers and activity from the Case Company seemed to be very low. – C2, Development Engineer*

As mentioned earlier, the pilot project with customer company C was stopped by the will of the customer company. Customer company C were not that happy with the project than other customer companies. They wanted to stop the project in midstream because they were so unsatisfied with the solution and involvement of the Case Company. Main reason to stop the project was that they felt that project is not proceeding at all.

> *One reason why we stopped the project is that project proceeded so slowly. It felt like that there were no support for the project on behalf of the Case Company. Then we frustrated on that, because we offered environment for testing purposes, but the*

Case Company was not motivated to drive the project forward or our contact persons did not have enough authority to do anything. – C1, Maintenance Development Manager

Other significant factor which drove customer company C into ending decision was that they felt to be only party in the project who is doing their part. Shared project requires naturally deep cooperation and good communication. Even though the Case Company worked hard to meet the wishes of the target customer company, customer company representatives were not able to see that. There was not enough visibility in the shared project. It is definitely better if there are open communication and visible actions in the co-operative project.

Anyway, all feedback was not that negative. Generally, every company saw that common pilots are good way to co-operate and there should be more common projects. Improvements are definitely needed to enhance the communication and ensure that every party knows what is going on and why.

I think that we probably need more pilot projects like this one. This is a good way to us to familiarize ourselves with new technology. We can find out what are the things that suppliers think that we need, and what they could offer to us and how we can implement those into real life use. More this kind of opening moves are needed. – B1, Sourcing Director

4.4.3 Ways in which on-going projects affected future co-operation

The fact that pilot customer companies were not fully satisfied with the offering and shared project, affected on their overall picture of the Case Company. Especially the interviewees from customer company C had negative experiences. Every one of three interviewees from customer company C mentioned that the overall picture of the Case Company decreased or remained very low. They have had similar problems also with other departments of the Case Company. It might be worth to investigate how the relationship with this certain customer could be improved generally.

Of course this influenced on the overall picture. Because the project failed, it left a bad taste in my mouth. – C1, Maintenance Development Manager

Even though the experiences were so negative in customer company C, they still might be interested to participate in shared projects in future. This requires more commitment from the Case Company and it cannot afford to fail again. After that it would be much harder to continue collaboration. Same mistakes cannot be done again and it is possible to forgive once but second time it is much harder.

We are ready to listen different options and propositions, but you have to remember that we cannot accept similar results than this time. If we are investing our own time in the project and offering environment, we have to get something as a return. – C1, Maintenance Development Manager

After that pilot I have quite negative picture, but I think that the Case Company is so significant actor on the market that we still want to co-operate. We want to be part of the development and follow what you have to offer. – C3, Maintenance Engineer

Even though there were negative feedback, all the companies saw the common piloting very useful concept. Some of the interviewees wished more this kind of co-operation and they considered them useful for both parties. For some interviewees this kind of piloting gave better picture of the Target Company.

4.5 Condition monitoring solutions

In this chapter the focus is on industrial internet -based condition monitoring solutions generally. The ideas is not anymore to observe existing solution of the Case Company. First, customer needs related to these industrial internet enabled condition monitoring solutions are observed. Secondly, it is observed how long time predictability these solutions should be able to offer to respond to customer needs. After that it is described what kind of additional features customers experience valuable. Lastly connectivity of these solutions and other systems are observed.

4.5.1 Need of industrial internet enabled condition monitoring

Generally, intelligent industrial internet -based condition monitoring solutions are wished for rotating apparatus. Motors and pumps were indicated to be the most interesting ones in factory environment. Many critical expensive devices are already monitored relatively well, but more affordable apparatus have not yet gained that much attention. Depending on current industrial internet adoption level of the company, needs differ. For example, companies which are at the beginning of their industrial internet journey are willing to have solutions for critical devices and machines. Then those companies who already are monitoring their devices relatively well are wishing to have affordable solutions for devices which are rotating auxiliary equipment and are not part of the core processes. Few of the interviewees also mentioned that drives have very similar needs. They are maintained according to schedule, not based on the real needs.

On more detailed level when condition monitoring of electric motors is examined, there are some components which are more interesting than others. Winding health condition monitoring were the most significant reason why customer company C participated in the pilot project originally. According to the representatives there are not many affordable

intelligent solutions on the market which could monitor condition of the winding of electric motor. Other interesting parts in electric motors are bearings. According to the statistics of the customer company A, bearing breakdowns are one of the most common reasons of motor failure.

> *Winding condition is the most interesting one because it is not easy to measure them. Of course, bearing fault is as bad from the viewpoint of machine functionality. – C2, Development Engineer*

> *Even the technology is very advanced nowadays, there are still too much bearing faults. For 200 years there have been this same problem but still there are too much bearings related failures. – A4, Reliability Process Owner*

One interviewee pointed out that motors that existing solution is meant to monitor are so cheap that whatever problem occurs, whole motor will be replaced. For that reason, they would like to have all critical parts of the motor monitored.

> *It does not matter what part of the motor is going to break down. It should monitor overall condition and tell if something is going to break. Whatever factor triggers that motor is breaking, the motor is going to be replaced. These motors are not repaired. – A1, Reliability Engineer*

Also energy consumption were highlighted. Energy consumption info could be utilized to find saving potentials. It was also pointed out that this information is interesting from the viewpoint of the Case Company, because it opens possibility to additional sales of energy saving solutions. Some of the interviewees would like to also have some more accurate and detailed level data than only total level measurements.

It can be noticed that need depends significantly on who it is asked from. Someone of those who were responsible for the development of intelligent solution in one customer company, stated that there is no need for that kind of solutions. On the other hand, those who were responsible for maintenance were very interested in that kind of intelligent solutions. There might be some kind of struggle in company where different departments are arguing whether to develop independently or buy ready solutions from suppliers. One interviewee also stated that it would be better to utilize existing data than put new sensors everywhere and collect new data.

> *Sensors are not the thing. Our devices are already well measured with the sensors. We have a huge amount of sensors. The thing is to utilize better the data we already have related to our machine base. – B2, Smart Operations Director*

Some of the customer interviewees pointed out that solutions should support also old machine base. If only new machines can be monitored, it is not reasonable to invest in that kind of solutions because machines might have very long life cycle and it would take

long time until all machines would have been replaced with new machines with intelligent features. Even better would be if machines from other manufacturers could also be monitored. Also, interviewees from benchmarking companies highlighted that it would not be profitable business case if solutions support only newly installed machines or devices. The Case Company has already been able to take these things into account and existing solution supports both old machines and machines from other manufacturers.

Customers are willing to have solutions which can be easily connected and integrated into their processes. If solution requires lot administrative work and has additional costs like for example manual measurement reading, customers are not that interested. In that kind of cases promise of industrial internet is only partly utilized and that kind of solutions produces only part of the potential value. In the existing solution of the Case Company, this problem was later solved with gateway solution which collects data automatically. Interviewees were highly interested to include also that in the pilot projects.

Most of the interviewees stated that it would require success stories to increase interest towards this kind of solutions. Few of them mentioned that there are not yet enough concrete evidences. Companies want that suppliers would be able to tell what they have done with other customers and what the results are.

> *It does not take wings before someone has really been able to prevent some serious failure with it. Image advertising is not enough. – A1, Reliability Engineer*

> *It feels that everyone is saying that you can do everything with IoT, but they still do not have anything concrete to offer. – B1, Sourcing Director*

Also benchmarking companies have noticed this same fact. They have mentioned that majority of the customers are not yet familiar with possibilities of industrial internet. For that reason, those companies have not yet realized that they should be part of that. Another difficulty has been that it might be hard to verify the value of solution. It is not necessarily simple to show that some benefits are related to that specific solutions. It requires lot of reasoning to show some customers that these really are things they should invest in. Basically, the problem is that users have to be convinced to do what solutions tell them to do because solutions are not yet autonomously making the decisions. It has to be possible to show that this amount of energy would have been saved if you would do what the solution tells you to do.

4.5.2 Predictability

One of the most important factors in industrial internet -based condition monitoring solutions was recognized to be the predictability. Solutions must be able to tell early enough if machine is going to break down. If customer get warning just before break down, there is probably nothing that customer can do and then the solution is useless and does not

offer any value to the customer. Solution must be able to tell in good time beforehand that there are some problems, so that it is possible to react to that notification. Generally, the earlier the solution is able to detect error and notify user the more value solution provides to customer. It is important that machine can be replaced or repaired in a controlled way. If machines stop short during the run it is much more expensive and can have serious effects, like interruption of production and loss of production.

In summary from interviews, it can be noticed that it is not possible to define unambiguous time how long the predictability should be. The needed time depends on industry and target of application. In some applications it is possible that only few days are enough to react, but in other applications much longer time can be needed. Most of the interviewees stated that few days are not enough. Predictability must be weeks, preferably several months. Some phenomena that relates to the machines condition can be noticed several months beforehand, but there are also phenomena that cannot be predicted.

Interviewees stated that it is more important that the solution can give answer to the question will this machine be able to run till the next shutdown. This information is valuable, but information must be reliable. Interviewees mentioned that it is much easier to predict and prepare for failures in a paper mill than for example in a pulp mill. In paper mill, there are regular shutdowns every third or fourth week. In pulp mill it is possible that there is maintenance shutdown only once a year. Suggestive needed timeframes for predictability are presented in Figure 10. Due to regular shutdowns needed predictability is lower in paper mill than in pulp mill.

	Process critical	Process non-critical
Pulp	Months	Weeks
Paper	Weeks	Days

Figure 10: Suggestive timeframe of predictability on pulp and paper industry in process critical and non-critical applications.

The longer the predictability is, the better the company can prepare for different consequences. From sourcing point of view predictability is also important. For example, delivery time of some machines or spare parts might be several months. If needs for machines and their spare parts can be predicted it is possible to optimize inventory and through that decrease working capital.

4.5.3 Additional features

Even though, it is a good start that a solution is able to tell that something is going to break down and when it is going to happen, it is not enough in the long run. Currently it is good, but solutions can be much more sophisticated and there is much more potential in intelligent industrial internet -based solutions. Value for the customers can be increased if solution can tell them more exactly what is going to fail or break down. In addition to that customers are missing prescriptive solutions that can advise in more detailed level what should be done to fix the issue or prevent the failure. With such a solution it would not require that maintenance person should have that much special expertize.

> *In addition to that solution tells that something is going wrong, it is important to know what is going wrong and especially what should be done to solve that problem. Certain kind of advisor prescriptive analytics is what we are aspiring. – B2, Smart Operations Director*

That kind of advisor prescriptive analytics have a clear demand on the market. All of the customers are not yet missing them but few interviewees were able to point this out. Most of the interviewees consider notifications adequate. Notifications are wished to be send also through mail or text message in addition to smart phone push notifications.

Some of the interviewees hoped that there would be service where the Case Company would take care of following the status of assets. Then when something happens, presentative of the Case Company contacts customer and tells what should be done. In this scenario pricing of the service could be relatively hard. Customer companies have pointed out that kind of need but they are not necessarily ready to pay for that. That kind of service could be included in the broader service contracts, but as a separate service it would be hard to implement.

In the long term, interviewees are interested in more automated processes. In automated process when machine is going to break, system can for example offer spare parts or machine and call maintenance person to do needed operations. According to interviewees it might be good start to be able to see details of suitable spare parts for that machine which is going to break down. Also, possibility to order spare parts or substitutive device through system were considered as a useful idea. The problem in that is that ordering and purchasing in companies is not as simple as in consumer markets. Consumer can make the purchase decision by himself or herself, but placing orders in B2B environment requires heavier process and orders may be placed through enterprise resource planning system. For that reason, benefits might not be very significant. The benefit might be that system gives details of needed parts so no one's need to find out suitable parts from somewhere else. To be able to put this kind of ordering process into practise would require

integration to the customer's ERP system and that would be challenging because of different ERP systems and willingness of customer to have such connections into their central systems.

> *If we imagine what this might be after ten years, then everything can be automatized. When system recognized possible fault, it orders right spare parts or compatible auxiliary machine automatically, and then reserves maintenance person to do needed operations. This of course requires long journey before this can be achieved but it might be the direction. – B1, Sourcing Director*

Solution is also wished to be auto-configurative. It is labour-consuming to fill in asset information when solution is commissioned first time. For example, current solution is wished to be able to get motor details based on the serial number of the machine.

Support services were considered necessarily. Most of the pilot customer company interviewees agreed that there would not be need for real time support possibility. Some of the interviewees also hoped that there would be certain contact person who can be contacted in case of any question or problem with the solution. It was stated necessary that different updates for firmware and other components should be available free of charge. Generally, it is not very tempting option, if customer should pay for every little update which fixes some bugs or brings some minor new features. Regarding the existing solution offered by the Case Company, this is not the case and updates are offered free of charge, but again it was not communicated to the customer companies.

Even though customers do not recognize yet the need for other supportive services, benchmarking companies have noticed that in many cases customers need support to control and manage the change in bigger picture. Digitalization is affecting on business in multiple ways and customers might need help for example in dealing with possible change resistance. Customers are not necessarily understanding that it is not enough just to implement solutions. The most critical part is to implement solutions into real life processes and behaviour of the end users. Otherwise the customer may experience that solution have failed in its purpose. Increasingly benchmarking companies are supporting their customers to adapt to digitalized environment. Again, it might be easier in bigger service contracts, but with separate services customers are not necessarily willing to pay for such a support. If contract is value- or performance-based then of course supplier has better motivation to help customers in these changes, because their incomes are based on the success of service.

4.5.4 Connectivity

Separate systems are problematic when companies have tens of suppliers offering solutions that all have separate systems and user interfaces. That is not sustainable situation

from the viewpoint of end user. Connectivity to the customers' own automation or condition monitoring systems is vital. No one wants to deal with multiple separate systems. It decreases the achieved efficiency if separate systems must be used. All interviewees from the pilot customer companies agreed that there has to be possibility to integrate solution into their own systems somehow. In test phase it is alright to have separate system, but if they would like to take solution in real use, connectivity is crucial.

> *You can imagine our situation. We have lots of suppliers and you are only one of them. We are going to drown in the app world. Because of that we have our own centralized cloud system and all solutions from different suppliers should be connected to it. – C1, Maintenance Development Manager*

> *It is impossible situation that our maintenance staff should keep a watch on all different systems. – B1, Sourcing Director*

> *If a system is separate, it kind a remains scattered and then it is not executing the bigger picture of IoT. – A4, Reliability Process Owner*

There are many variations how interviewees would like to integrate the data or application into their own systems. The simplest solution is to provide *Application Programming Interface*, API. It is an interface through which different programs can request and change information with each other. APIs are simple way to integrate different software and databases. Naturally, it requires some knowledge from the customer company so they could integrate the needed data into their own systems. Most of the interviewees finds that API is enough. There is also possibility that the Case Company offers integration as a separate service or included into broader contract.

Some of the interviewees would also like to have raw data collected by sensors in their own system. They do not want to get only results that solution generates. They want to control the whole palette. In that way they would be able to use the collected data in other purposes. Few of the interviewees mentioned that they would like to combine data from different sources and conduct own analyses. On the other hand, they are not willing to do device management in their own systems. When solution includes lots of sensors, it requires device management which can be quite labour and resource consuming. Because of that it would be better to use interconnection between supplier cloud and customer cloud. Easiest way to do this is to offer API to customers.

All of the interviewees were worried about the ownership of the data. As a consequence, some of them are willing to include the analysis in their own cloud platform. Companies prefer Microsoft Azure based systems. They would like to consider different systems as applications which should be integrated into their own cloud platform. Some of them also sees the problem that it might cause useless extra data transfer. Even though data storage is cheap nowadays drowning into useless data might be real risk.

Preferable option for us is that sensors directly feed the information into our own cloud system. Then your application and analytics run there. – B2, Smart Operations Director

4.6 Integration to the complete offering

As stated in the literature review, services are a good way to increase the sales of traditional offering (Brax 2005). Regarding customer need for broader offering there were slightly contradictory views. Many of the interviewees thought that there is no need for central industrial internet partner, but general opinion was that there is still room for broader bundled offerings and partnerships. Pilot customer company interviewees stated that suppliers, who have ready solution which can offer whole package from sensors to process control, are the most favourable partners.

If you offer solution which gives running information to customer, that is not yet enough. You have to think how this information affects and controls the processes. The supplier who is able to offer the whole pipeline from the sensors to the intelligent analytics and through that to process control, has the upper hand. – A4, Reliability Process Owner

As customer companies do not need one central supplier, some of them would also like to cut down the system into pieces. In this way they can keep the higher level control in their own hands. Naturally, this requires much more from the customer and might be relatively hard in practice.

In sourcing department, we like to chop everything. But of course, we have nothing against more comprehensive solutions. If the price and features are competitive then we can also take the whole package from one supplier. – B1, Sourcing Director

Mostly interviewees of pilot customer companies were relatively positive regarding integrating industrial internet -based solutions into service contracts and with other offerings.

There already are different kinds of service contracts regarding for example electric motors service. Of course this kind of solutions should be connected to those service contracts. – A1, Reliability Engineer

Related to comprehensive services, pilot customer companies are interested to hear more about possibilities to move towards usage and value based pricing. For example, instead of customer purchases electric motors from the Case Company they purchase motor power as a service. This can mean that the Case Company is committed to assure that there is certain motor power available all the time and motors are working as they should. In that kind of cases customers do not need to make investments and own equipment like motors or condition monitoring systems. Most of the interviewees are interested in that kind of comprehensive solutions.

It is very interesting concept. Of course it requires closer evaluation, but it would definitely be a step towards IoT service models. – A3, Project Manager

If lifecycle costs are smaller than now, of course we are open for that kind of services. But those real costs have to be verifiable. – C1, Maintenance Development Manager

At least one customer company has already a motor hotel contract with the Case Company. It could be also possible to connect that kind of concepts with industrial internet solutions. Data could be for example used to predict need of certain motor types and then warehouse level could be optimized.

In that concept we have many factories which are using same motors. Instead that every factory has its own spare devices in their own warehouses, the Case Company has centralized stock of motors. In this way we can decrease capital costs and secure availability of motors. – Interviewee from one pilot customer company

Another example to increase sales of traditional offering is related to the energy consumption which was shortly mentioned in chapter 4.5.1. Through energy consumption information the Case Company might be able to increase sales of drives. The Case Company could market the solution with energy saving potential. If solution notices that energy can be saved, the Case Company could be able to offer drive for that motor to save energy and through that decrease customer's costs.

Some interviewees had more sceptic attitude towards that kind of broader service contracts where industrial internet -based solutions are only one part of the offering. This kind of questions divided interviewees. It seems that those interviewees whose own position in a customer company could be endangered through this kind of services were not that interested. They strongly believe that they are doing things as efficiently as possible and that there are no possibilities that service provider could act more efficiently.

It is quite hard to believe that some service provider could do it more efficiently than we do. But if they could, we definitely would be interested. – C1, Maintenance Development Manager

Also, representatives of benchmarking companies stated that customers are increasingly interested to tie industrial internet solutions into more extensive offering entireties.

I do not believe that IoT is going to be own business. It is an enabler of new and existing businesses. IoT itself is nothing. – D1, Development Director

We have noticed that it is easier to implement these new solutions to customers' lives through bigger contracts. It is possible to achieve certain amount of customers

with standalone solutions, but bigger service contracts have definitely opened more doors. – E1, Digital Portfolio Director

Benchmarking company E has divided utilization of industrial internet solutions into three different horizons. First step is to improve company's own internal cost efficiency. Second step is to utilize existing offerings more efficiently through industrial internet components. The last and hardest step is to develop completely new value chains and revenue sources which industrial internet enables. They have started to think this whole palette over those three horizons.

4.7 Business model and its innovation

Business model for industrial internet -based solution and its innovation was mostly discussed in the benchmarking interviews. In pilot customer company interviews, there were no direct questions regarding business models, but there were lot of talk about the components of business model.

4.7.1 Industrial internet solution and different business models

Business model can be based on different factors. Both benchmarking companies offer their industrial internet solutions as a part of more comprehensive service contracts and also as a standalone value added services. Selected model depends on customers and their preferences. There are highly tailored contracts and those can differ very much depending on the customer. Target is to form win-win situation and ideally supplier's incomes are scaled on customer's perceived value. Naturally mass solutions differ from solutions that are tailored for the needs of customers. In mass solution, there might be for example three different levels on which customers select the least unsuitable option. Even though solutions can be sold separately as a value-added service, representatives of benchmarking companies admit that it is easier way to sell solutions as a part of more comprehensive service contracts. Benchmarking company E representative states that they have recognized, that binding the industrial internet offerings into bigger performance based contracts, is the most efficient way to utilize industrial internet and reach customers.

When industrial internet services are connected into more comprehensive service contracts, company can take on more responsibility in customer's business. In this way they can better ensure that value is really delivered to the customer. If customer has the responsibility to realize the benefits, supplier cannot know whether the customer really gets the promised value. Especially this is the case, if incomes are tied into value realization:

We have a strong trend to connect these industrial internet solutions into bigger solutions, so we can take more responsibility on the whole entity. If there are only spot solutions, it is depending more on customer's activities. Especially if we are utilizing value or performance based contracts. – E1, Digital Portfolio Director

Other viewpoint to business model presented by one pilot customer company interviewee is that intelligent features are compulsory factor that supplier should have in their offering to be able to compete against competitors, but customer companies are not going to pay for that. This is relatively future-oriented and radical outlook. Solutions are still at the early phase of their life cycle, and every supplier does not yet even have intelligent solutions. In future it is more likely that intelligent features become default, but now they are still possibility to differentiate offering from competitors' corresponding offerings.

> *If we are going to purchase some device, the data it produces is ours and we are not going to pay anything for the data. We are supposing that all the devices are increasingly having intelligent data capabilities. Then it is not competitive advantage to no one. If your devices do not have such capabilities, no one is going to buy your devices. That is how it goes. – B2, Smart Operations Director*

4.7.2 Value proposition - Finding out customer needs

Building value proposition is one of the most central parts of business model innovation. According to benchmarking company interviewees, to success in that company must be able to select the most central sources of customer value and build the offering on these drivers. These selected values act as a message which is communicated to customers. If there are too many selected value drivers, offering may become too confusing. Then there is no clear vision or focus. This makes the whole solution too entangled and then it does not give anything to anyone. If solution focus on few most central topics it is easier to develop and communicate the message to customers. In benchmarking company D, selected value drivers have taken their final form in co-operation with customers.

Other benchmarking company interviewee also denies that over the course of history they have too much focused on their internal development processes and development has been too engineer-oriented. Lately they have started increasingly co-operate with their customers. Their strategy is also based on close co-creation with partners from different customer segments. After solution has proved to be functional with that segment co-creation partner, solutions are started to generalize to whole segment. They are utilizing their existing customer relationships to find right partners from different customer segments. The role of the customer is to clarify what are the real customer problems and needs. Benchmarking companies encourage to go out with the concepts as early as possible. Then it is easier to take customer's outlooks into account. After all, customers understand or at least they should understand their problems and business best.

> *Go out with your solution as early as possible. It is not that good than you think it is. Customers know their needs differently than you do. – D1, Maintenance Development Director*

Companies do not have any specified BMI processes. There are some elements of organized processes but they have not consciously formed any process or framework for that. It all starts from the customer value. Business model is created during development of the product or service iteratively similarly than the product or service itself. First, it has to be understood what kind of value the solution produces to customer. Customers must be tightly integrated into the development. Methods in both benchmarking companies supports findings of the literature review of this thesis. The main thing is to involve customer as much as possible. It does not necessarily mean that everything must be done as customer requests. It is possible that customer do not even know themselves what is valuable for them. There must be different ways to find out those customer needs.

> *As close and as much as possible operating with customers and discussing about values. That is where it all starts. – D1, Maintenance Development Director*

> *It all starts from the customer value, customer needs and how we can shape our business. If we think about maintenance. The whole thing starts from there that we have to be able to serve our customers as efficiently as possible and tailor the service based on the customer needs in order to make customer's equipment to run foreseeable and reliably. IoT is the technology on the background and in a role of enabler. No one is buying IoT from us. They are buying safety, visibility and intelligence which assures that equipment are available as efficiently as possible. – D1, Maintenance Development Director*

At the beginning of the process, the benchmarking company D has gone to the customers and presented their ideas. Then together they have discussed what is good and what is not good in them. After that they have tested customer needs and thoughts and figured out how they would work in practise. All this customer co-operation is done to get enough conception what the service should do as a whole. During this kind of customer iteration, they have ended up to the three central sources of customer value on which the solution is build.

> *We have developed a lot this service together with our customers. We have been discussing with them, interviewing them and we understanding their needs and problems. – D1, Maintenance Development Director*

> *Those (business) models looked very different on our own development table. – D1, Maintenance Development Director*

Different techniques to find out customer needs and involve customers in early phase are interviews and different kinds of discussion sessions. Also, observation can be utilized. In benchmarking company E, they first form hypothesis and then test it with customers. Interviewee from benchmarking company D emphasized the importance of observations and measurements. Customers are not necessarily able to tell what they want or is something useful to them or not. If it is measured it is possible to get exact results and present

the value to customers. Customers might be supposing things and their opinions and viewpoints might be based on mental images and not necessarily on facts.

> *Interviews and prototyping are good ways to involve customer. The important thing is to measure things. It is not enough if you only ask customer's opinions, because one interesting finding we have made is that customers might suppose certain things to be something that they really are not. They do not do that because they are mean. When you measure how things really are, you might notice that for example efficiency has increased even though a customer's presentative has said something else. – D1, Maintenance Development Director*

> *There is no any magical philosopher's stone. We start from some hypothesis and then try to test it. Then we have to modify our hypothesis and test it again. Agility and capability are important. If you develop software in agile way you have to also be able to develop business model in agile way. Maybe cycles are not as fast as in traditional software development but similarly sprints and hypothesis could be utilized. – E1, Digital Portfolio Director*

Even though customers are involved in many ways it does not necessarily mean that company should do exactly as one co-creation partner customer wants. It is important to be able to interpret customers and their needs. They are not necessarily able to directly say what they want. For that reason also other methods are needed. Especially if the concept or technology is totally new, it is possible that customers are not able to point out all the important things.

> *It is good and useful to listen customers but it is not always best way to do exactly what customer states to want. You have to be able to find the right level from the customer input. To find what is the thing that creates the value after all. – E1, Digital Portfolio Director*

Role of the customer is to verify the value in benchmarking companies. They are telling to benchmarking companies which functionalities are valuable and which not. It is also important to request information how and why some features are valuable and why others are not. Benchmarking company E is applying two or three week sprints. The idea is to use customer continuously as a value verifier in the feedback loop.

> *We listen our customers. Then we have also our own vision and direction. Then we make this combination to meet each other and that is how the value is created. – D1, Maintenance Development Director*

It is important to be able to let it go if something is not working or if in some phase it is noticed that it is not suitable for its purpose. All of the ideas are not worth to proceed with. Company must be able abandon some ideas and focus on the most promising ones.

Also, academic research related to the commercial success of ideas supports these statements (Cooper 1979). For that reason, it is also important to do much to find those real successful ideas and concepts.

> *For every hundred ideas, only two of them are really good and about 18% somehow good and usable. Rest of the ideas never start to fly. For that reason we are doing much and trying to find those super high-flyers. – B2, Smart Operations Director*

Even though some customers are involved into development of offering and business models, it is important to take also different kind of customer needs into account. Benchmarking company D tailors offerings mainly through contracts. Physically solutions are quite similar for different customers, but service level might be different. Differentiating factors might be for example what happens when problems occur and how long are the response times. Customers can then choose the best option for their own needs.

4.7.3 Needed capabilities

According to the benchmarking interviewees the most important thing is to have a clear vision where the company is going with digital service offerings. According to representative of benchmarking company D, many companies have started to dabble and they are doing some kind of tests but they have no idea how that benefits customers' businesses.

> *One of the most important things is to have a clear vision. You need to have understanding of the big picture and what we want to achieve. On which direction we are going and why? The vision has to be as clear as possible when you are starting to develop digital service offering, because there are possibilities to go into different directions. You have to ensure continuously that you are going into right direction for example by measuring and communicating the vision clearly. – D1, Maintenance Development Director*

But after all, clear vision is not enough and something else is also needed. Customer collaboration is essential and cooperation models must be clearly defined. It is crucial that customer collaboration is fast and integrated into the iterative development process. Customer-oriented mind-set must be adopted in the whole organization. There must also be possibility to measure things somehow.

> *When you start your journey with industrial internet -based solutions, first you have to be able to build customer collaboration and operations model fast. You have to also be able to measure continuously, that are we doing right things and are we going towards our vision. – D1, Maintenance Development Director*

According to benchmarking company interviewees, even though it is important to have a vision, it is even more important to be able to adapt the vision if needed. It is not recommendable to nail down that these are the things we are doing next three years. In this way it is most probably going to fail. Vision must be analysed critically. If it needs to be changed, it has to be changed, but vision must be somehow stable. Without clear vision, big picture is hard to control and it is impossible to keep the pieces together.

Representative of the benchmarking company E emphasizes more the meaning of technological capabilities. When you have vision, you must know how technology can help you to proceed. You have to understand what data should be measured and collected. There is no use to just start collecting some data and hoping that maybe it can be utilized somehow in future. When it is understood what data is needed, next step is to understand how it can be collected. After that everything from analytics, data science and data engineering to cloud technology and user interface knowledge is needed. After all, to be able to turn all this into profitable business, strong business knowledge and customer understanding are needed. It is not necessary to have all technology knowledge in own company and it is reasonable to outsource some knowledge.

4.7.4 Revenue logic and pricing models

During interviews four different pricing scenarios were presented to interviewees and interviewees were asked to discuss and reflect these scenarios. They were also asked to choose the most interesting ones if possible, but the main idea was to analyse different models from their respective viewpoints. Different pricing scenarios presented to interviewees and their short explanations are presented in Figure 11. Pricing models were selected based on the results of Laurila's (2017) thesis which observed different pricing models for industrial internet solutions.

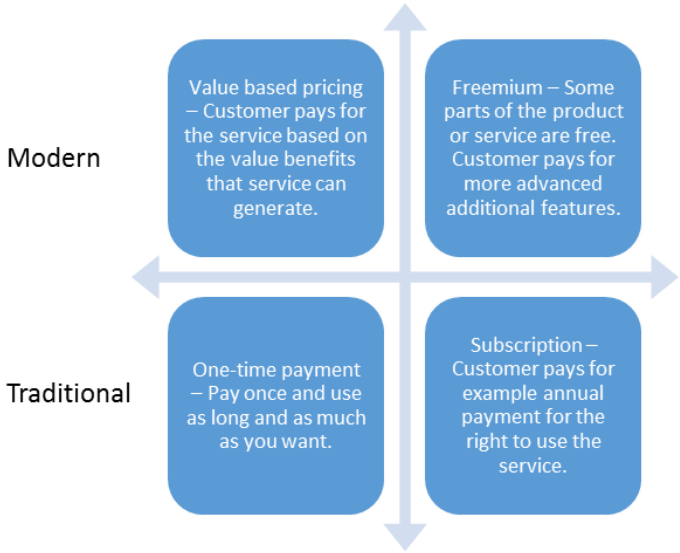

Figure 11: Example pricing scenarios for industrial internet solution.

All in all, pilot customer companies do not prefer any specific pricing model when sourcing decisions are made. All of the presented models can be utilized, but modern scenarios gained much more interest than traditional ones. In every scenario customers are willing to define life cycle costs and compere scenarios through them before final decision.

> *In principle, all of them are possible and there is no one right option. We do not favour any specific one. – A4, Reliability Process Owner*

> *You should not rule any of them out. In different cases different models are the most suitable ones. – B1, Sourcing Director*

According to interviewees, scalability of the pricing is a central factor to evaluate whether the pricing model is suitable or not. Traditional models were criticized because of their scalability. If for example the existing solution offered by the Case Company is observed, pilot customers do not consider it possible to take solution broadly in use if there is one-time payment with unit price. Price cannot be directly based on the amount of sensors.

> *If we suppose that price of one unit is 300 euros and then we scale it to our every factory which means like 1000 times investment. Cost will then jump through the roof. What I mean, if there are license fees for small units like this existing solution, the price is not competitive from scalability viewpoint. – A4, Reliability Process Owner*

There is lot of interest towards value based pricing. Most of the interviewees stated that it is the most interesting one, and that is the future direction where the pricing is going because of development of industrial internet solutions. They do not deny the problems that the model has, but they would like to try and pilot it. Some of the companies are already utilizing such models with some suppliers but it is not yet a common practise. In current utilization pricing model is seldom purely based on perceived value. There might be some kind of acquisition price paid at the beginning and then certain bonuses are paid later based on the perceived value.

> *Value based is the model where the world is going more and more. It can also include kind of network model and thinking. IoT has simplified this model which is long desired. This is definitely the direction where we are going. – A4, Reliability Process Owner*

Also, interviewees from benchmarking companies agreed that value based model is the future direction and it will be utilized increasingly. The challenge is that currently solutions are more or less decision support systems which means that after all human behaviour is the thing that matters. Solutions give only recommendation but results are based on humans' decision. Especially on little spot solutions starting might be quite hard. Interviewees believe that when level of autonomy increases, also value based pricing becomes more applicable option. Then there is no human factor anymore affecting on

whether the recommendations of solution are put into practice or not. In spot solutions it is also hard to define whether the value is achieved because of that solution or for some other reason. It might cause conflicts between the supplier and the customer, if conditions of value based pricing contracts are not explicitly defined. Other of the benchmarking companies has tried to utilize and sell spot solutions with value based pricing, but with not very good success. The difficulty is to adapt people to do things differently than they have used to do. As a conclusion value based model is considered suitable for more comprehensive solutions.

> *It is more suitable for total maintenance service contracts, where payments depend on how much tons the factory is able to produce. In case of some separate sensor, it is quite hard to build such a model or at least there should be huge amount of them. – B1, Sourcing Director*

Freemium is also considered as an interesting option. None of the interviewees has not met it in the industrial context earlier but they saw it very potential option. Especially they were interested in option where hardware like sensors of industrial internet solutions are already included into machine or equipment that is meant to be monitored. For example if customer buys an electric motor, there are sensors build into the motor and customer could then start to use industrial internet service for extra fee if they want to. Another possibility is that some basic functionalities of solution can be used for free and then customer can start to pay for more advanced features if they like to.

Traditional pricing models did not gain much interest in interviews. All of the interviewees stated that they are possible and they might suit for some solutions, but they were considered quite old-fashioned. Altogether, modern models caused more conversation and interviewees were highly interested to try them. This does not necessarily mean that those modern models are better, but it might be worth to start piloting them as customers are considering them valuable to them. It is worth to remember that in value based models there is always risk that supplier is not able to get any value out from the solution. That also means that supplier do not is not necessarily able to get any incomes from the solution.

Companies tend to be interested to purchase whole package as a service. They do not necessarily want to own the sensors and other needed devices that are related to the solution. Benchmarking company E has offered similar solutions with SaaS model which means *Software as a Service*. They have broad scale of different models from *capex* (capital expenditure) models to *opex* (operational expenditure) models, but as the most promising opportunity they see big performance based contracts. Also, other benchmarking company has ended to solution that they own the physical hardware of the industrial internet solutions. Customer purchases only service.

4.7.5 Challenges

As stated earlier, benchmarking company interviewees highlighted the need for change management. Change is needed in both own operations but also in customers' operations. They stated that they have tens of thousands of service persons who have done things in certain way for long time and now they should adapt to use totally new solutions in their work. To make all these people to adapt new things is the real challenge:

> *Technology is still relatively easy. It is just technology which engineers can solve. Challenge is to make people act differently. That is much harder. People have different motivations, thoughts, knowledge and understanding. How can you connect these solutions in the real world processes and make those processes to work? That is really the challenging part. – D1, Maintenance Development Director*

Benchmarking company E had acquired industrial internet knowledge and knowhow through acquisitions which makes integration even harder. Interviewee also stated that it must look like that whole company stands behinds these new digital offerings. There are many challenges to make business units to understand the need for these solutions. If even own personnel are not standing proudly behind new solutions how could the value be demonstrated and delivered to customers? They have had lots of continuous dialogues between business units to make them understand why changes are needed.

It is not enough to manage change only in own company. Supplier must also be able to support customers in change management. Benchmarking company D has taken more practical outlook on this change management problem with little steps. They have tried to understand users' motivations, needs and barriers. Pilot groups from own and customers' organization are utilized and then they have collected data on what is working and what is not, how they are working and what are problems. Then different communication methods are utilized to deliver the message. They have noticed that there are always influencers in different levels of company. Trying to effect on behaviour and thoughts of those powerful thought leaders is the best way to push the change. Basically, it is discussion how these things are useful for them and why. After that those thought leaders start to communicate positively in their own network.

Other essential factor that was highlighted in every interview was the ownership of data. Companies have started to be more and more conscious about the value of data and information and because of that they are also more cautious about the ownership of data. Every interviewee stated that all data that is collected from their devices must be their own. Some of the interviewees admit that during last year they have started to pay attention to this increasingly. When the Case Company develops and sells solutions, it is good to notice this change in attitudes towards data ownership.

5. DISCUSSION

In this chapter, the results of the empirical case study are discussed and reflected in the light of existing literature discovered in the literature review. The main viewpoint is to analyze how these results could be utilized in the Case Company, but also produce new academically valuable knowledge. The objective of this chapter is to answer to the research questions of this thesis:

RQ1: What are the sources of customer value in an industrial internet -based solution?

RQ2: How can a technology company make its business model of value added industrial internet -based solutions more customer-orientated?

Results of this study are supporting findings made by Palatella et al. (2016): Development of industrial internet and IoT has not realized as fast or widely as it was earlier predicted. Everyone has started to dabble with industrial internet, but ready solutions are eluding. Some of the interviewees were even little frustrated. Companies are very interested to see and try ready solutions.

In future it is likely that, industrial internet becomes integral part of the many offerings and there is no need to observe business models of industrial internet solutions separately. Smart and intelligent services related to the physical product will become mainstream and people will get used to increasing servitization. In consumer markets, music and movie streaming are good examples of people adopting the services. As it can be noticed from the results, also companies are very willing to adopt industrial internet solutions and they are seeing much potential on them. They are strongly believing that industrial internet -based solutions can create value to them. This makes it truly an interesting market for the Case Company and other companies in the industrial manufacturing context.

5.1 Sources of real customer value

The most important value sources regarding industrial internet solutions recognized in this study were presented in Table 7 in the results chapter. The most important ones were safety, efficiency improvements, securing operating reliability and intelligence. Target companies of the study raised the safety improvements as the most important value source behind industrial internet solutions implementations. Interestingly literature discusses only little about safety possibilities of industrial internet. Through industrial internet applications it is for example possible to reduce the cases when employees have to physically go to the dangerous factory zone where monitored machines operate. The Case Company of this study should also notice this point of view and start to invest in safety

possibilities of industrial internet. Safety improvements could be truly beneficial perspective in the marketing and they could be significant part of the business model through value proposition.

The most essential and fundamental thing is that to be able to deliver real value, a supplier company must be able to help a customer company to success in its business and other targets. According to the findings of this study and literature review, industrial internet adoption takes place only if real value can be achieved in monetary terms. As Manyika et al. (2013) have stated, industrial internet provides huge potential for cost savings. In literature review it was doubted whether those cost savings are enough for customers. Openshaw et al. (2014) and Bucherer & Uckelmann (2011) have presented that it is possible to reach more long-term value with value-focused approach instead of cost-centric approach, but most of the interviewees were mainly looking for cost savings with industrial internet. Customers are not yet so far on adoption, because there is still room for short-term cost savings solutions. This does not necessarily mean that the Case Company should focus only on cost saving solutions. To prepare for future and remain competitive it is important to also invest in development of solutions which could give more long-term value to customers through value-centric solutions.

On more detailed industrial internet -based condition monitoring solutions -level, the most important value sources are connectivity to other systems, long enough predictability, prescriptive advisor analytics and easy integration into operative processes. Even more practical level the most valuable applications to monitor according to the pilot customer company representatives are presented in Figure 12.

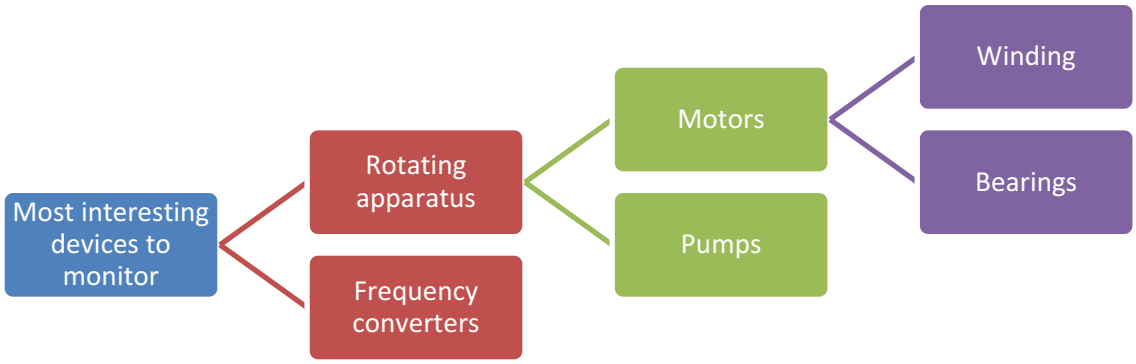

Figure 12: The most valuable applications for industrial internet condition monitoring solutions.

These different level value drivers and sources are good starting point for the Case Company to focus on real customer needs. Even more iteration might be needed to fully fulfil the needs of customers and to provide superior value to them. Instead of monitoring single machines, it might be possible to produce more value to customers by offering solutions which could monitor fleet of machines. More about connecting these industrial internet

offerings into broader offering is discussed later on the next chapter where business model in observed.

As it was predicted in chapter 3.3 where data collection was described, value can be experienced differently depending on who it is asked from. Interviewees from different roles are appreciating different factors even inside one company. Persons responsible in sourcing are more interested in purchase price and repayment periods than others. End users on the other hand are more interested in usability, whereas management is interested in profitability of an investment. Even though all this is relatively intuitive, there is not really existing literature or research regarding these differences. Companies should take these roles into account when value is communicated to customers depending on who are making the decisions. Naturally, a supplier company is in the best position if it can convince all the customer representatives who are affecting on decision-making.

5.2 Making business model more customer-oriented

The key to make business model more customer-oriented is to involve customers as much as possible and co-operate with them. Customers and their knowhow can be utilized in many different ways. After different viewpoints of business model are discussed, applying Agile methodology from software engineering is also contemplated in this chapter.

5.2.1 Customer participation

According to popular definition of business model by Teece (2010), business model is based on management's hypothesis on what customers want and how they want it. In one sense it can be said that already in this definition companies are misled, because it would be better to base business model on real customer needs instead of management's hypothesis. Then again it cannot be said that Teece's (2010) model is useless, but it could be completed with observation that management hypothesis should be based on real customer needs and contacts to be able to find out what really is valuable for the customers. In this simple way of involving customers, business model can be made much more customer-oriented.

At the end of literature review when literature was synthesized simple framework was proposed based on the findings from existing literature. That framework was presented in Figure 8. Empirical results of this study supported that framework remarkably well. Based on the empirical results, that framework is improved with few additional viewpoints. Updated framework is presented in Figure 13. Figure presents the way to increase customer value through customer involvement into different development phases.

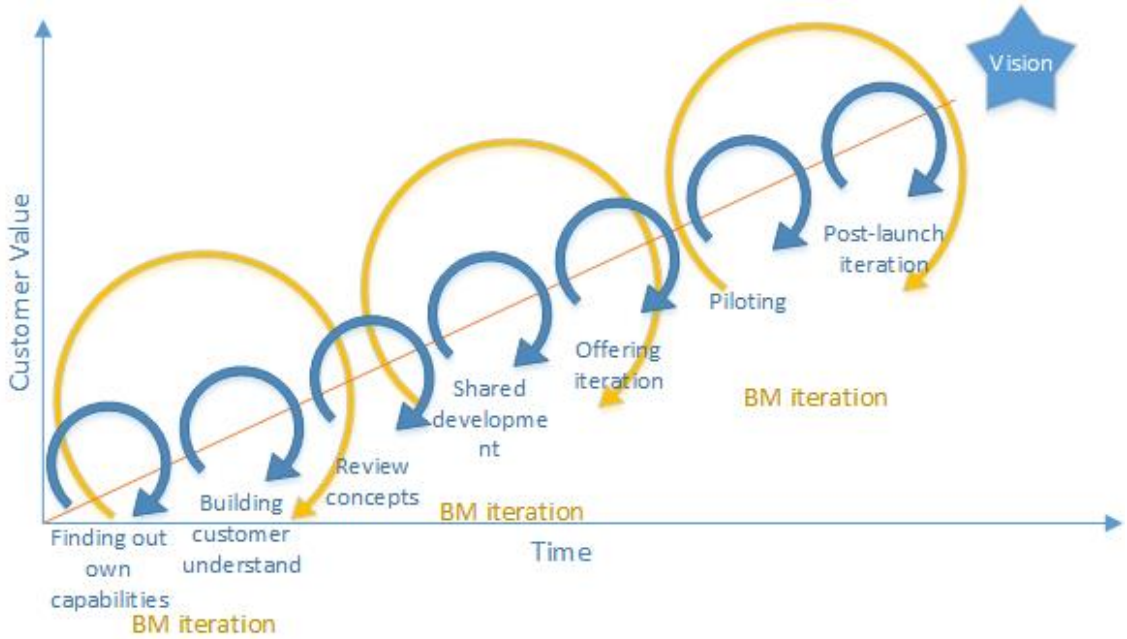

Figure 13: Increasing customer value through customer involvement in different phases of offering development and business model innovation.

The basic idea is similar than in the synthesis of literature review. Fundamental principle is to iteratively involve customer as much as possible and useful. Important addition to framework based on the empirical results is the vision. There must be clear vision which defines what is wanted to be achieved and how, and towards which the whole company is going. Vision can be modified during the whole process if needed. If vision becomes old-fashioned there is no sense to try to achieve it. The idea of whole process is to go towards vision and achieve it. Vision is defined at the beginning of whole process when own capabilities are analyzed and reflected with customer needs. Vision must be somehow static so that development is not sprawling into different directions inconclusively.

Existing literature has recognized that involving customers into business model innovation can lead to more innovative solutions (Kristensson et al. 2002; Lukkaroinen 2014). Also results of this thesis supports these findings. Benchmarking companies have noticed this in practice and they have started to utilize it as much as possible. New idea is to develop and innovate business model with agile methods simultaneously when offering is developed in co-operation with customers. Simultaneously when customer involvement and co-operation are utilized in the development of solutions, they can also be utilized in business model innovation. Business viewpoint must be taken into account during the whole process. It is natural that development and business model innovation goes hand in hand, as development decisions may effect on business model and vice versa. The most central part of the business model is the value proposition which is defined during the development of the solution. It is reasonable to start business model innovation process simultaneously because other parts of the business model are strongly connected to the value proposition. Business model can be developed similarly in sprints like the offering

itself. Sprints of business model innovation might be longer, but the idea is very similar than in offering development. Different modifications of business model can be piloted with customers. For example, different revenue logics can be applied and with different methods find the right one together with the customer. Through participating customers, it is also possible to find the most suitable target customer segments for the offering. Especially if customers from different segments are involved.

All of the steps in the model are not obligatory. For example, shared development does not necessarily suit for every solution. As noticed in results chapter, there are some difficulties in shared development which might complicate commercial viewpoint. Also finding suitable partner customers might be hard. Persons from every pilot customer company of this study were interested to participate, but it can be long path to start truly shared development project. Even though shared development is not used, it is still crucial to find out real customer needs and mirror own capabilities to these customer needs. It is important that there is also business point of view included right from the beginning.

As noticed in literature review, existing literature related to business models of industrial internet based solution mainly evaluates which business model components are the most important ones (Dijkman et al. 2015; Metallo et al. 2018). It is worth to discuss how different components relates to each other and how customer-oriented mind-set relates to business model as a whole. The ways how customer participation effects on different parts of the business model is presented in Figure 14. Model utilizes business model components defined by Osterwalder & Pigneur (2010).

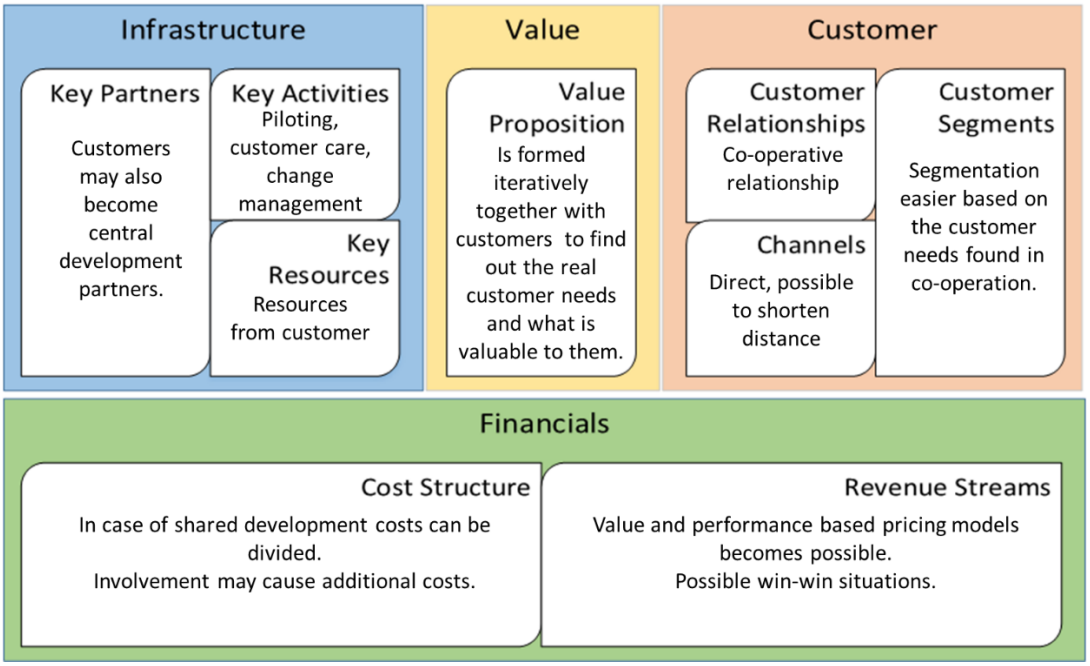

Figure 14: Ways how customer involvement effects on business model.

Based on the empirical results value proposition should be formed together with customers. Basically, everything starts from figuring out customer needs and what is valuable to them. It is possible to first form hypothesis and then modify the hypothesis based on the customer input. As noticed in results section, there are different ways to involve customers. It has turned out to be a functional way to craft concepts and introduce them to customers as early as possible. After that it should be discussed how customers experiences them. Customers can also be interviewed or observed. It is highly important to conduct also observations if possible because then it is also possible to measure things. Customers are not always able to tell what is valuable to them or what kind of problems they have. Especially when talk is about new digital solutions which are not necessarily familiar to customers.

Different customer groups can be utilized in creation of value proposition. Through that it is also possible to segment customers based on the results of involvement. It is possible to notice that certain groups are not interested or interesting ones. On the other hand, it is possible to form modular value proposition for the needs of different customer groups. Customer relationships can also become deeper and more co-operative. Simultaneously channels can become more direct which can shorten distance between customers and supplier.

From infrastructure viewpoint customers may also become central partners. Traditionally different suppliers have been central partners, but in deep co-operation customers can be considered as central partners. In addition, it is not necessarily to have all knowledge in the own organization and customer and other network partners might have some of those central resources. Customer care and support becomes central activities. Lastly, from financial viewpoint there might also be some advantageous changes. Customers are willing to move towards value based pricing models, which can lead towards steadier and increasing incomes. On the other hand, if development is shared, it might also divide costs differently if customers take on more responsibility.

Customer can be involved in the business model step by step. These different phases are presented in Figure 15. First step is to involve customer in the value proposition forming. Second step is to involve customer in value creation by involving customers into shared development project. In that way resources can be divided and there is no need to have all resources in own company. Last step is joint value capture which can mean for example open business model presented by Burmeister et al. (2015) or ecosystemic business model presented by Westerlund et al. (2014). According to this research, customers are currently ready for the first step. They do not want to form too bonded relationships at this phase. Companies are not yet ready to apply open business model presented by Burmeister et al. (2015) or ecosystemic business model presented by (Westerlund et al. (2014). Companies are increasingly interested in new value based pricing models but they do not want to tie too strong relationships with certain partners. Companies are willing to form deeper relationships with software providers like Microsoft and IBM, but they are

not willing to fully outsource digital aspects to some other provider like the Case Company.

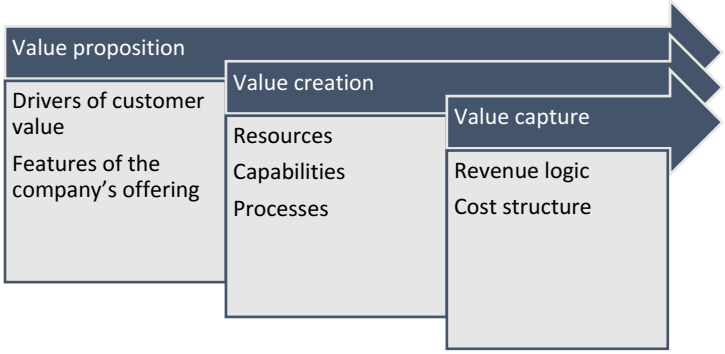

Figure 15: Different phases of business model as a steps to involve customer.

Frameworks and models presented in this chapter are not necessarily suitable only for industrial internet solutions. Customer involvement can also be utilized in other contexts to increase customer orientation. Digitalization and internet of things are enhancing the meaning of networks and partners and also encouraging companies to form closer networks for value creation (Bucherer & Uckelmann 2011; Westerlund et al. 2014; Burmeister et al. 2015). For that reason, closer co-operation with customers suits extremely well for industrial internet solutions business. Customer companies are more approving regarding new business models and pricing models when totally new solutions are offered. Customers see that industry is in change and it requires actions.

5.2.2 Building value proposition and complete offerings

To make business model more customer-oriented, it is essential that at least value proposition is developed in co-operation with the customers. A supplier company must be ready to iterate value proposition. Things that the supplier thinks to be important for the customer are not that in reality. It is essential to truly understand customer needs and build value proposition and business model through deeper understanding. Building a value proposition can be started by concentrating on the most valuable things to customers presented in chapter 5.1. Offerings should be based on few the most significant value drivers which are formed together with customers. Starting point can be the most important value drivers recognized in this study: Efficiently secure operating reliability, safety and intelligence. During development and customer iteration they might change their form.

It is important that digital services are integral part of the total solution, not just bolt-on add-ons. The real customer value is created when for example energy, time or money is saved, not on just analyzing the data. It is possible that customers do not know by themselves what they want and what is valuable to them. As noticed in this study, there is a clear gap between promises and realized solutions. Customers do not know what can be expected. They are hoping more opening moves from suppliers.

Most of the uncritical parts of the production processes are not monitored and they are only maintained when something goes wrong. As technology is getting cheaper and cheaper, also non-critical parts of the processes become profitable to monitor. This opens completely new market full of potential. The existing solution provided by the Case Company represents those new affordable and comprehensive solutions that suits for this completely new market.

Based on both literature review (Kindström 2010) and empirical results, it is important that offering is somehow modular and it can be modified for the changing customer needs and needs of different customers. In this way it is possible to reach broader target segment with the offering. At the beginning, tailoring can be also based on contractual variations. In some cases, separate applications should be part of bigger offering, but for other customers they can be offered as separate applications with different pricing model. Customers' businesses and needs should be understood better to be able to tailor the offering. In bigger service contract separate condition monitoring solution could be extra feature which is used as a selling point, not as a central part of the whole offering. For some customer companies the Case Company can be even a competitor. In these kinds of situations it is still possible to offer separate applications even though broader contracts are not desired.

IoT and industrial internet has turned products into complete connectable systems that include hardware, sensors, processors and software (Porter & Heppelmann 2014). In addition to the system view, one should also take a look to the ecosystem level. No one wants to deal with huge amount of separate systems. There has to be platforms which combine different systems under the same ecosystem. This is significant difficulty in the IoT and industrial internet business. Connectivity between different systems gain more importance as number of systems increases. Extra work which is caused by using separate systems can eat all the benefits that are obtained from the industrial internet -based application.

5.2.3 Integration into service contracts

As stated in the literature review, industrial internet is a great enabler to move from traditional product thinking towards service thinking (Gerpott & May 2016; Rymaszewska et al. 2017). Also, results of this study encourages the Case Company to utilize possibility to move even more towards service business. Customers were interested to hear more about new possibilities to purchase services instead of products. It was noticed that there is a connection between attitude towards industrial internet and attitude towards services. In other words, if company is interested in industrial internet solution, they seem to tend to be also more interested to purchase services instead of products. They are hoping easy solutions which do not require big capital investments.

In interviews, there were discussions related to concept where the Case Company offers motor power as a total service. One possibility is that from customer's viewpoint all is happening in the background and customer does not own the sensors or even the motors or other production equipment that are monitored. The Case Company is selling pure motor power to the customer and makes sure that everything is working properly as promised: The Case Company monitors motors for its own purposes to fulfil its promises to customer and offers reliable motor power for different purposes. All this requires strong partnerships with customers to take part in their businesses in such a strategic way. Other possibility is to make lighter service contracts where customer still owns motors, but every service related to them are outsourced to the Case Company.

Sensors and industrial internet technology enable totally new business models not only for industrial internet -based solutions but also for more traditional offering. For example, sensor can quite exactly follow the usage of motor. Because of that company can change its business model of motor business towards usage based model. In other words, instead of selling the motors company can sell motor power to customers and fee is based on actual time of motor used which sensor detects and both parties can get the usage data.

There are also many other possibilities where industrial internet solutions could be applied. In one interview, interviewee mentioned that they have also motor hotel service with the Case Company. In that solution the, customer do not need to have spare parts or spare motors in their own warehouse. Instead, the Case Company has centralized stock which offers service for customer's every factory. Briefly, customer can decrease capital costs and the Case Company secures availability of motors. The Case Company could for example use condition data to predict need of different motors and optimize their warehouse based on that data. Solution could also for example automatically offer new similar motor from suppliers stock if it observes that some motor is going to break down in the near future.

Fleisch et al. (2015) have stated that the key to success lays behind platforms. The one who is able to bring the most developers to its platforms will win the competition (Fleisch et al. 2015). According to results of this study, platforms are not necessarily the key to success. Companies are hoping comprehensive solutions which offer answer for some specific problem from start to finish, but they do not want to have one central industrial internet partner which offers everything from platform to different applications. They want to control the big picture by themselves. All target companies of the study have started to develop their own centralized industrial internet systems where different applications can be connected. Those systems are based on cloud platforms like Microsoft Azure and artificial intelligence tools like IBM Watson. More important is to offer connectivity to customers' own systems. The potential of IoT and industrial internet realizes when different systems are connected. All different solutions of the Case Company should be built on common platform, which has efficient and easy connection to other systems.

Little separate systems for example for motor condition monitoring are not long-term solutions. Path of digitalization has to be started somewhere and that kind of separate solutions are good starting point. On long term, these has to be extended into more comprehensive solutions. Many interviewees pointed out that the idea behind current solution is great but ambition is to have much more advanced and sophisticated solutions combined with other offerings.

Supportive services are needed to respond to customer needs. Support cannot only be helping customers in solution related technical problems. The main thing is the change management. Company must be able to change the behavior of the people. For long time, experts in the field have made the best possible decisions based on the limited information. Now it is possible to get and process nearly unlimited amount of data automatically and apply machine learning. In transitional period machines are starting to support in decision making. The challenge is to make people to adapt to the decisions of the machines. Customers need help to find out how they can utilize the solutions and what kind of changes they need in their organizations to achieve benefits. Value realizes often not until people in organization starts to act differently based on the propositions of the solutions. Autonomy of the solutions is not yet so sophisticated that industrial internet solution could directly guide automation system to change it operations. Currently many solutions require interference of human being. Solutions give decision support information but humans have to make final decisions. This is one reason why value based pricing model is not yet suitable for many solutions. As interviewees said, technology is easy and there are always engineers to solve technical problems. Real challenge is to make human beings acting differently in a totally new way.

5.2.4 Revenue logic and pricing model

Iansiti & Lakhani (2014) have proposed that digital solutions will heavily change the ways how companies are producing value to their customers. Industrial internet also makes different business models possible (Burmeister et al. 2015). According to empirical results also some customer companies are looking for those new ways. Customers are very interested in value or performance based models. That kind of models are good to customers because they can minimize their risks: If solution do not give any value to customer, they do not need to pay for that. In other words, they do not need to make risky investments.

As results showed, there is no unambiguous pricing model which could be applied in any case. Pricing should be based on customer's preferences. Of course, there are realities and supplier party is conducting business, not doing charity work. Selected model must be suitable and valuable for both parties. Customer and benchmarking companies are highly interested in value based pricing model. They see the difficulty to measure and determine the value, but they are willing to pilot such models. Also, some worries regarding this model emerged and main concern was that it might make relationship between the Case

Company and a customer company worse because determining achieved benefits might cause contradictions. One way to overcome these difficulties is to sign an agreement which defines and specifies explicitly the terms and rights of each party. From the perspective of the supplier company, value based model is a riskier choice and there has to be substantial confidence to the own product or service. If solution does not help customer, supplier is getting nothing but costs. Model must be piloted carefully to minimize the risks, if it is desired to be implemented into practice.

One interesting possibility is that the Case Company offers industrial internet solutions on its new machines and devices through freemium model. Sensors and other needed hardware could be offered free of charge or with nominal price when the motor or other device is purchased. If solution could prove its value to customers, customers are willing to purchase these offerings as a value-added service. There are certainly risks that customers are not willing to purchase it, but then it should be considered whether the offering is good or not and worth to invest in. Then it must be figured out if something new should be developed or can the offering be modified to respond better to the customer needs.

Scalability of the pricing was pointed out in several discussions. Onetime payment in which price is based on unit price which is multiplied by quantity of for example needed sensors is not preferable option if quantity of devices is high. In that kind of situations tailored contracts are preferred. If only one little factory is contemplated where amount of devices or needed licenses is low, onetime payment is a suitable solution. Subscription model on the other hand has problem that licenses must be renewed. This cause administrative work. For that reason, companies seem to be preferring centralized contracts.

Model where information is sold were rejected immediately by few interviewees. Companies are ready to purchase applications which analyses data and refines it into information, but they do not want to pay for data or information. It is important to form business model so that customer is not paying for data but a service.

The challenge in value or performance based pricing is that current solutions are still mainly decision support systems. In other words, systems give recommendation to the end user but end user is responsible to decide whether she or he follows the recommendation. Interviewee from benchmarking company stated that they should somehow be able to force end user to do as system says. Another challenge is to verify whether the value is achieved because of the solution. For example, if condition monitoring solution prevents some failure, how could supplier be able to show that device would have failed without it and it would have cost that much? For that reason contracts where payment is tied into performance are easier to put in practice than other value based contracts. Verifying the value is problematic: There are many factors effecting on it and those factors might be contradictory from the viewpoints of different parties.

One possible way to start piloting value based pricing is to take in use model where purchase price is decreased and bonuses based on perceived value are added step by step. It might be too risky for the Case Company to start straight from the pure value based model. When decisions are made it is extremely important to understand that in addition to possible benefits, there are also some downsides which are worth to consider. Industrial internet -based solutions can lead to high fixed costs because for example software development is relatively expensive (Porter & Heppelmann 2015). If solutions fail to generate real value to customers and through that to company, company can be in a situation where there are nothing but costs left.

5.2.5 Segmentation of different offerings

As noticed in the results chapter, companies differs from each other's in many ways. Their initial situations are different and so are their value needs. For that reason, offerings need proper target segments. According to the results of this study, for the offering like the existing solution of the Case Company, the best segment can be companies which are not yet on too advanced level on digitalized world. Still attitude towards development and industrial internet should be positive. Existing solution is easy way to jump on industrial internet bandwagon, but for some customers it might be too scattered solution.

As it can be noticed from the results, some of the companies are already collecting lots of data from their processes. Instead of purchasing new solutions which collect information, they would like to utilize the existing data better. For example, in the process industry in Finland processes seem to be well monitored and there is lots of data that is not yet utilized. At least when target companies of this study are contemplated, the trend is to start to develop own centralized cloud-based industrial internet system or platform. For that kind of customers more optimal way might be to offer application which is integrated into their own system or offer solution as a part of bigger service contract. As the Case Company has strong knowhow regarding their own machines and analyzing them, one way to utilize the knowhow is to offer analytics as a service or as an application. Sensors are not the thing: Anyone can manufacture sensors, but analytics and connecting them to broader services can be considered as an interesting business opportunity. In future ambition should be that data from any sensor or device could be applied with the intelligent analytics of the Case Company. On the other hand, own sensors are good start because they make it possible to ensure that data is in standard format and analytics are reliable.

It is essential to understand that needs of different customers and different industries can be very divergent. For example, in the light of this study it seems that at the beginning paper mills can be more tempting segment than pulp mills. There are regular maintenance shutdowns in paper mill possibly even every second or third week. As for pulp mills, there might be maintenance shutdown only once a year. In other words, predictability of the solution do not need to be that long in paper mill than in pulp mill. For that reason, it might be easier to start with solutions which suit for needs of paper mills, where need for

predictability is not necessarily that long. Then after predictability can be developed, it is possible to move towards pulp mills where predictability should be longer.

Another interesting observation is that the Case Company can have different roles depending on the customer. Some customers are willing to operate with hardware provider, others with application provider and some with service provider. By involving customers from these different segments in development phase and developing modular offering, it is possible to operate with these different segments. It is important to understand that customer can be profitable to the Case Company in many ways. Even if this specific service or product service system itself does not make profit for case company with some customer, it is possible that this service supports customer and enables other more profitable businesses. The overall profitability must be considered when different possible segments are compared.

5.2.6 Applying principles of Agile

As Leminen et al. (2012) have proposed company must be flexible and reactive to success in business model innovation. Based also on the empirical research, iterative processes are the most efficient way to develop offerings and business models to ensure the best possible customer value. Very similar and useful theory concept from software engineering supports well this ideology. This method is Agile development. Interviewees from benchmarking companies mentioned agile as an adjective to illustrate quick responds to changes. This can be taken even further by applying Agile philosophy. Agile originates to the year 2001 when Agile manifesto was published by Beck et al. (2001). Agile development originates to software engineering and development (Beck et al. 2001). Main principles of Agile are presented in Figure 16. Agile methods could also be applied in business model development: Different business models can be piloted and tested after which the best option can be selected. Business model is developed and innovated similarly during offering development in an agile way. Business model cannot necessarily be static to take into account different needs of different customers. With agile methods it is possible to react different customer needs and environmental changes. Also, Burmeister et al. (2015) have stated that business model innovation must be agile, but they have meant agile as a synonym for iterative, not Agile methodology in a broader sense. Agile methodology is more or less like a mind-set which should be implemented into normal behaviour.

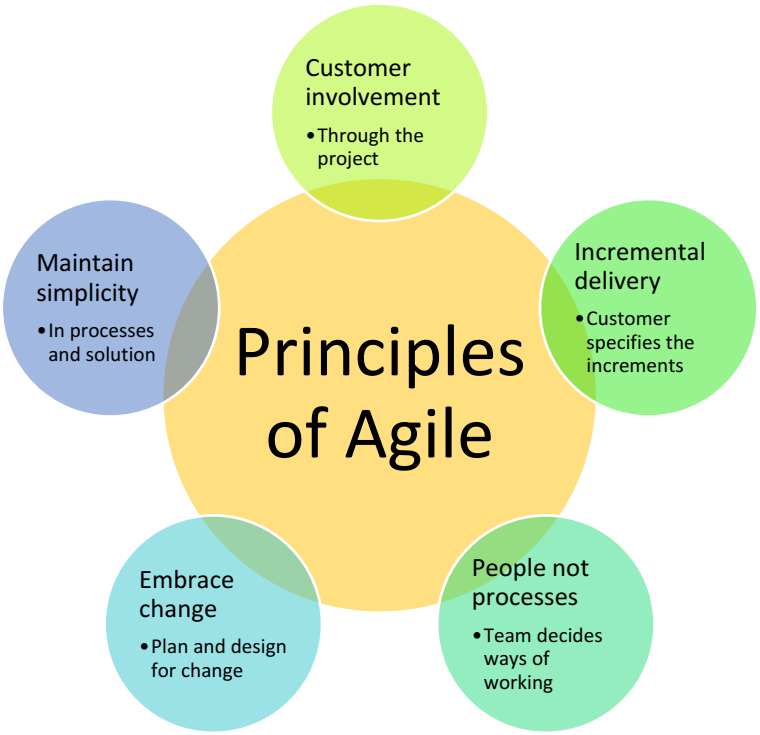

Figure 16: Principles of Agile, adapted from (Beck et al. 2001).

With Agile methodology is it possible to quickly react in different factors and modify solution if needed. In Agile development, *Minimum Viable Product* (MVP) is very used concept. Concept of Minimum Viable Product means developing product or service in agile way with minimal expenditure, which still delivers value to customers by continuously enhancing the product (Fleisch et al. 2015). This concept can be considered somehow dangerous if the idea is not communicated properly to customers. In traditional industries, customers are used to receive fully workable ready product, which can also be noticed from the common pilot project with the customer company C. MVP thinking is not familiar for many traditional companies and they might feel the product disappointing if they do not understand the concept. It is important to make sure that customers understand that product gets updates and becomes even better when time goes on.

5.3 Lessons learnt from the existing offering and its piloting

It is important to learn from conducted work so far. Results related to the existing solution and conducted pilot projects can be utilized when improvements are executed. It is easy to start with little improvements and move towards more challenging and radical changes. If company involves customers in development of the offering, it must be done carefully. If pilots and customers do not get enough attention, it is impossible to form customer-oriented product and business model for it. The Case Company has started to utilize pilots but unfortunately pilots were not that successfully as they could have been. No one was receiving the best possible value.

Customer care is important. Many of the interviewees have experienced that co-operation was not as good as it could and should have been. They have stated that the pilot project has not proceeded as they have supposed and they have not got enough support. Communication has not worked as it should, especially taking into account that pilot customers are real customers of the Case Company. The Case Company cannot afford to take a risk that customer relationships are endangered somehow. It is natural and understandable that the development team does not necessarily have enough time for customer relations and communication, but somehow this problem should be solved. One possible is that resources are allocated so that everyone can interact with the customer. Other option is to use the support of account managers and give more responsibility of the customer communication to them. This of course requires that account managers are kept up-to-dated continuously.

It was possible to interpret and read between lines that one customer company were not that interested in participating in shared pilot project. The attitude of some interviewees was that they can help the Case Company to test devices, but that is it. They were interested in the solution but they would like to purchase ready solutions. They are not that interested to cooperatively develop the solution. There is lack of resources and no time to contribute more widely.

Piloting have to be done together iteratively and co-operatively with real customers. It is crucial to listen the customers and answer to their needs. Meaning of communication cannot be underrated when company co-operates with real customers. It is important that customers truly experience that they have a meaningful role and they can effect on development. Also, management and offering responsible have to be ready to commit to common targets and they have to be ready to take customers' outlooks into account. Very fundamental things are the most important ones: It is crucial to be honest to customers. With empty promises and pure sales talks it is not possible to achieve valuable results. As it can be seen from the case of pilot customer company C: Customers will be disappointed and it can have significant effect on complete customer relationship and their image of the whole supplier company might get damaged. Company was surprised how incomplete the offering was when they received it. It is waste of time for every party to conduct pilot projects, if there is no will to learn and develop. If pilots are conducted but they are not utilized by persons who are in charge of the development and other decisions, it is really hard to success with customers. It is vital that all parties have clear a vision why pilots are conducted and what is wanted to be achieved. Also rules and responsibilities have to be defined at the beginning. Every party will become frustrated if pilot is started but nothing seems to happen or proceeding. Communication must work in every direction and it must be communicated to customers that together we are going towards the vision. The Case Company should keep conducting pilot projects in the development of industrial internet solutions, but they must be more systematic.

When co-creation of the value with the customer is considered it is worth to notice the effect of the service to customer's operation. If the service does not have huge impact on customer's business, customer might not be willing to participate in co-creation. It is also necessary that both parties understand why things are done and what the goals are. It is important to find suitable partners for co-creation. Each party must be committed to pursuing towards common goals. Partners must be somehow motivated to participate. As it can be noticed from the failed pilot project, it is no one's advantage to conduct pilot projects without specified targets and commitment. End result is only disappointed customer company and feel of failure in the own company. Pilot projects must be systematic and company must be ready to learn from them and to make changes in offerings if needed. It is important to involve persons from different levels from both organizations. To arrive into best solution, both technical and business understanding are needed.

As it was noticed in empirical study, unawareness is a central challenge in customer companies. They do not know what they should do and in which order. With co-operation and common development companies can participate in development with smaller risks compared to situation where they would do everything alone.

Even though companies are willing to adopt new technologies and be technological pioneers, from some viewpoints in some cases attitudes in the companies were still quite old-fashioned. For example in one pilot customer company, they are ready to develop new solutions and try new innovations, but mind-set is still that supplier supplies something which they see as a good thing. Co-creation and co-development are not yet common schemes of thinking. If opinion is asked, the answer might be: "This is something that your own developers should consider. Why you are asking it from us?" Clearly customers have not yet got used to participate and tell their viewpoints. First thing might be to build reliable customer relationships where things are communicated openly.

The area where the Case Company and benchmarking companies seem to have something to improve, is the networking and co-operation to the other direction. They all have started to involve customers and building certain kind of value creation network with customers, but with suppliers the thinking model tends to be more traditional. To fully utilize the power of networks as Westerlund et al. (2014) have proposed, these companies could include also suppliers into value creation ecosystem. This is probably longer path to build ecosystems and ecosystem business model but it might be noteworthy direction. In the Case Company the first step is to involve customers better and after that it might be worthwhile to contemplate supplier involvement.

Based on the conducted research the meaning of reference stories is crucial. Even though pilot company considers itself as a forerunner on its field, they are expecting to hear success stories. It is important to communicate to pilot customers that together we are creating those success stories and you are part of them in a role of technological pioneers. One important objective of the pilot projects is to create those needed success stories.

5.4 Action plan

Action plan for the Case Company to make business model of industrial internet solutions more customer-oriented is presented in Table 9. Action plan is formed based on the academic literature, results of the empiric study and their reflection. Basically action plan is summary of this discussion chapter and more detailed reasoning is presented throughout this chapter. Each action has priority after description presented in brackets. Priority is numerical value from 1 to 5. The bigger the value is the higher the priority of action is. Priority is based on the estimation of the researcher which is based on combining academic literature with the empiric results of the study. In addition, every high level action has proposal for responsible party.

Table 9: Action plan for the Case Company.

Actions (priority scaled 1-5)	Responsibility
1. Build mind-sets. **1.1 Build Agile mind-set. (4)** **1.2 Build vision which states what is wanted to be achieved, why and how. (5)** **1.3 Build service-oriented mind-set instead of traditional product thinking. (4)**	Company-level in co-operation with business units.
2. Involve customers according to process in Figure 13. **2.1 Find out customer needs by interviewing, surveying and observing. Remember to measure the value. (4)** **2.2 Present early concepts to customers and discuss with them. (4)** **2.3 If beneficial, start shared development with partner customer. (2)** **2.4 Conduct shared pilot projects and learn from them. (5)** **2.5 Measure things. Do not believe everything that customers are saying. (4)**	Product management, it would be useful to define actions on company or business unit level.
3. Improve and develop offerings. **3.1 Base the offering on the most important customer value sources. (5)** **3.2 Focus on predictability, connectivity, prescriptive advisor analytics and easy implementation into real life processes. (4)** **3.3 Focus on the most interesting devices: motors (especially winding and bearings), pumps and frequency converters. (4)** **3.4 Make offering modular so it can be tailored for the needs of different customers. Enable tailoring at least on contract level. (4)**	Product/service management, development team, R&D department, business management.

3.5 Create more comprehensive solutions. (3) **3.6 Move focus from single machines towards fleet of machines. Combine the knowledge of the whole company. The company which is able to offer the whole palette from the sensors to the process control is a pleasing partner. (3)** **3.7 Success stories are needed to convince customers. (5)** **3.8 Focus on quality. (5)**	
4. Offer additional services. **4.1 Offer API to customers, so they can connect solution into their own systems. (5)** **4.2 Offer support for the solution and also for conditioned machines. (4)** **4.3 Support customers in change management related to the digitalization. Important especially if value based pricing is utilized. (3)**	Product management, development team.
5. Develop business models and innovate new ones. **5.1 Shape value proposition in iterative co-operation with customers. Starting point can be the most important value sources recognized in this study: Safety, securing operational reliability and increasing efficiency in an intelligent way. (5)** **5.2 Pilot experimental revenue logics. There is huge interest towards value based pricing model. Start implementing step by step with certain customer partners. (2)** **5.3 Pilot servitized offerings, for example offering motor power as a service. (2)**	Product management together with business units' management.
6. Develop co-operation. **6.1 Reserve resources for customer communication & collaboration. (5)** **6.2 Invest in taking care of the customer. Take the advantage of account managers. (5)** **6.3 Enhance communication towards customers. (5)**	Product management, business management, R&D, sales department, support.

The order to conduct actions should be based on the priorities of the actions presented in the action plan. Every action has some sub-actions that can be executed in the short term, but there are also more long-term sub-actions. As there are several actions which require commitment from different parties, it will take time to fully execute this action plan into practice. Building mind-sets is a long-term mission, but it must be started immediately. It will require time to build organization-wide mind-sets and it might take one or several years. On team and department level, it is possible to build mind-sets faster.

Fortunately, different actions can be implemented simultaneously. It is relatively easy to start involving customers because the Case Company already has close relationships with different customers. In addition to that, the work is already started and different customer needs and valuable factors are found in this thesis. While involving customers, co-operation must be developed. Communication is the key to success: Before co-operation can be utilized, customer care mind-set must be adopted. It is crucial to reserve enough resources to be able to utilize the co-operation and results of it.

Timeframe for additional services and offering development might also be relatively long. However, it is possible to start developing offering and additional services based on the early results of the co-operation. Executing all the steps of those actions takes time as it requires also technical development. For example building API requires development project which might take several months. Also, building more comprehensive offerings and understanding customers' processes might take long time. Similarly, business model innovation can be time-consuming. But as it was noticed in this study, business model innovation has to be done simultaneously during offering development. They are not consecutive actions and that can shorten the total needed timeframe.

As the action plan is relatively long and there is a need for some fundamental changes, it might require several years until the whole action plan can be completed. Hard work is needed to reach the targets. It is important to understand that even though completing the list fully might take time, results might start to realize much earlier. There are many little steps which are taking the company towards its targets. Again, it has to be remembered that iterative work is the key to big results through little improvements.

Action plan is formed in the light of knowledge presented in this thesis. Nature of steps is not such that they are absolutely right and lead to success. Steps are partly based on customers' wishes and successful actions of benchmarking companies. They do not necessarily suit for the Case Company but they are worth to further study and pilot. Before implementing some of the steps like value based pricing models, it is worth to analyze possible business cases on more detailed level to find out whether they are profitable or not.

6. CONCLUSIONS

This chapter concludes the results of this thesis. At the beginning, managerial implications and contribution are summed up. Secondly, academic contribution is examined and limitations are reflected. Finally, need for future research is reviewed.

6.1 Managerial implications and contribution

Nature of the thesis is multidimensional. Used data was collected through two-phase interviews. In first phase of the interviews, representatives of two different benchmarking companies were interviewed. In those interviews the idea was to interview representatives of the companies that had succeeded with their industrial internet solution and discuss how they have overcame the challenges. In the second phase, representatives of three pilot customer companies of the Case Company were interviewed. Idea was to find out real customer needs and understand value from their viewpoint. These interviews were also great possibility to get feedback of the existing solution that the Case Company has piloted with participated companies. After interviews, all different viewpoints were combined to form the results of this study. This kind of research methodology offered a great opportunity to receive practical managerial implications.

The main objective of the study was to form an action plan for the Case Company. The action plan was presented in Table 9. From managerial point of view, the most interesting results are listed below:

1. The most important value drivers related to industrial internet solutions are safety, efficiency improvements, securing operational reliability and intelligence.
2. Valuable factors in industrial internet -based condition monitoring solutions are connectivity to other systems, long enough predictability, prescriptive advisor analytics and easy integration into operative processes.
3. On more specific level customers are interested to have condition monitoring solution for rotating apparatus like motors and pumps. Especially condition of winding and bearings of electric motors are the most interesting information.
4. The whole business model can be made more customer-oriented by involving customers through Agile mind-set as much as possible in different phases and levels of organizations. Value proposition can be formed iteratively together with customers. Piloting should be utilized more efficiently and there are many targets of development. Involve diverse knowledge, for example both development and business knowledge are needed.

5. Industrial internet -based solutions can be integrated into more comprehensive service contracts. Customers are interested to purchase services instead of products. By offering comprehensive services, business possibilities of company increases.
6. Customers are interested in value based pricing models of industrial internet solutions and broader services. Also freemium model was considered as an interesting option. These modern pricing logics are worth to be observed and piloted in co-operation with certain customer partners to find out whether they are valuable or not.
7. Framework for the agile customer involvement in offering development and business model innovation is proposed. The basic idea is to involve customers as much as possible to truly understand their needs and value drivers.
8. Communication is crucial. Many problems that occurred in conducted shared pilot projects could have been avoided if communication had been better.

In the industrial internet hype it is extremely important to keep feet firmly on the ground and ensure that the targets are realistic. Focusing on industrial internet solutions is not saving miracle which solves all the problems. Solutions has to offer real value to both customers and company itself. Everything is consuming resources and solutions must offer more benefits than they cause costs.

Altogether, modern pricing models and revenue logics caused more conversation and interviewees were highly interested to try them. This does not necessarily mean that those modern models are better, but it might be worth to start piloting them as customers are considering them valuable to them. It is worth to remember that in value based models there is always risk that supplier is not able to get any value out from the solution. That also means that supplier is not necessarily able to get any incomes from the solution.

This thesis is a starting point to find out and understand real customer needs in the Case Company, but the work must not stop here. Customer needs can change constantly which means that also working must be constant and iterative.

6.2 Academic contribution

Researched business case is relatively broad which makes also subject of thesis quite broad. In this thesis, customer value and business model are observed in different levels. Firstly, general level regarding industrial internet -based solutions is observed. In addition to that thesis tackles especially condition monitoring solutions and lastly utilizes experiences from the existing industrial internet -based condition monitoring solution offered by the Case Company. Through this multilevel outlook it is was possible to get results suitable for different industry fields with academic contribution.

As Kiel et al. (2016) have stated, the prior research has mainly concentrated on technological aspects of industrial internet, and research of business viewpoint has been lacking compared to technical literature. Especially customer perspective has not earlier got the attention it deserves (Kiel et al. 2016). This thesis takes this research gap into consideration and it concentrates on business model of industrial internet solution focusing especially on customer value and combining previous offering with new solutions. This thesis gives better understanding how business model of industrial internet solution can be made more customer-oriented. Thesis focuses especially on customer value point of view. Existing literature that relates to the business models of industrial internet or IoT solutions tends to focus only to recognize which business model components are the most important ones (Dijkman et al. 2015; Burmeister et al. 2015; Metallo et al. 2018). Customer focus has mainly forgotten and focus has been on supplier partnerships and key resources, that are needed to shape those solutions. Customer viewpoint is new viewpoint to the development of industrial internet solutions and their business models. Knowledge from different studies related to business model and customer value were combined to get broader understanding. This thesis forms overall picture, how the customer viewpoint effects on complete business model. The most efficient way to make complete business model more customer-oriented is to involve customer in business model creation as much as possible from value proposition to other business model parts like revenue logic. It was noticed in this study that companies are not yet ready to utilize ecosystemic business model proposed by Westerlund et al. (2014) or open business model proposed by Burmeister et al. (2015). As a compromise customer-oriented business model is considerable option before moving towards these more comprehensive ecosystemic business models.

It has been stated that professionalizing business model innovation process can give significant potential and advantage to a company (Burmeister et al. 2015), but there are not yet much ready frameworks which defines how to do it in practice. This thesis introduces a framework for simultaneous agile development of offering and business model where customer is involved as much as possible. From the multidisciplinary viewpoint Agile methodology from software engineering introduced by Beck et al. (2001) is combined with the industrial internet offering development and business model innovation.

To conclude, this thesis reached it objectives and answered to the research questions versatilely and comprehensively. As researched subject is relatively new, there were valuable findings from the both managerial and academic viewpoints. This thesis is one step to get closer to understanding of business models of industrial internet solutions and valuable utilization of industrial internet solutions to conduct real business.

6.3 Limitations

Results of the thesis has certain limitations and they need to be acknowledged. Two benchmarking companies and three pilot customer companies were studied in this research. Two of the pilot customer companies were operating on process industry and one

in maintenance industry. Sample selection might have significant influence on results. Conclusions are derived from qualitative data which is based on interviewees' experiences and outlooks in their own companies. Because of the nature of the case study, results cannot be generalized for all industries and environments. To be able to have more general view over these researched topics, more research is needed.

As empirical data is collected through interviews, it is almost impossible to collect data absolutely objectively. It is possible that interviewer has interpreted interviewees' answers differently than they have originally meant. On the other hand, it is also possible that interviewees have not given the best and the most truthful answers. Validity of the results was improved by interviewing several employees from every pilot customer company. In addition to that, two benchmarking interviews were conducted with employees from two different benchmarking companies. Benchmarking companies are operating on somewhat similar industries but they are not direct competitors of the Case Company. As industry is not exactly the same, similar methods cannot necessarily be applied in different industries.

In addition, there were no direct existing literature about the subject of the thesis. For that reason, literature of the different subjects and different contexts had to be combined to form an overall picture. This tried to be taken into account by combining literature of industrial internet, customer value, business models and customer orientation. As there were many subjects to cover, everything could not be fitted in literature review. The principle was to include the most important and significant researches related to subjects, but there might be some good sources that were not included.

6.4 Future research

As study was limited on certain industries, it is extremely important to research also other industries to get more generalizable results. There are many practical issues that have to be solved to enable all the benefits that industrial internet can offer. In future, agile cooperation framework developed in this study should be applied in practice and evaluated carefully. Also different research methods could be utilized when results of the studies are evaluated. It would be beneficial to be able quantitatively measure the benefits of different options.

It is also highly important to research more different pricing models and their suitability for industrial internet -based applications. As noticed in this study, companies are increasingly interested to apply these value and performance based models, but there is only little research about applying these models in practice. To be able to utilize those models, real life research is needed to compare different options.

Geographical and cultural differences in customer value would also be interesting future research subject. In this study all the target companies were Finnish companies and for

that reason cultural differences cannot be noticed. There could be big differences in customer needs and customer value experiencing geographically and culturally. Currently, in the Case Company there are big differences in the sales volumes of existing solution in different countries. This fact can implicate that there are different needs and value drivers in different countries. Based on the geographical and cultural research it would be possible to get useful information for segmentation. It would also be possible to recognize what kind of solutions and business models are suitable for different geographical and cultural customer groups, but more research is required and customers from different geographical and cultural areas should be involved.

Lastly, as noticed in this study, companies are not yet ready to implement ecosystemic or open business models presented by Westerlund et al. (2014) and Burmeister et al. (2015). To enable real life usage of these models, they need to be researched deeper. Currently customer-oriented business model might suit better for the needs of different companies, but if promises and networking of industrial internet realize, there would be need for even deeper co-operation. Also taking the whole value chain into account deserves more research. Companies have started to realize the importance of involving customers but supplier side has not get that much attention. To build truly ecosystemic business model, the whole value chain should be included and that requires lot of research to tackle all the barriers related to it.

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APPENDIX A: BENCHMARKING INTERVIEW QUESTIONS FRAME

Introduction to the company's industrial internet offering

1. Could you briefly tell about you background and your job description?
2. What kind of IoT or industrial internet based services your company is offering currently?
    a. Are some of them related to the condition monitoring?
        i. Focus on these condition monitoring offerings.
    b. Has this offering already customer base or is it still under development?

Customer value

3. What kind of value these offerings create for customer? Value viewpoint: Benefits vs. costs.
    a. Could you somehow classify these value drivers?
4. How you have ended up to this offering?
    a. Have you investigated customer needs/need for services somehow? How?
    b. Have customers participated in development somehow? (Academic literature deals with value co-creation.)
    c. Do you know, what is the exact thing for what the customer is ready to pay for in reality?
5. How do you take into account different customer needs with your offering?
    a. Do you offer tailored or generic solutions?
    b. Does the solution have different levels, from which the customer is able to select the suitable one?
        i. For example different licence options?
    c. Why you have ended up to that solution?
6. How customers have accepted and adopted these industrial internet solutions?

Skills and competition

7. What kind of skills or abilities, which enables utilization of industrial internet, your company has? Or what the company should have?
    a. Technology?
    b. Knowledge?
    c. Partners?
    d. Customer network?
    e. Operations models and methods?
    f. Something else?
8. What are the most significant factors that differs you from your competitors?
    a. Competitive assets of competitors?

Business model

9. Does the business model of these industrial internet solutions differ from the business models of your other offerings?
    a. Please describe the business model.
10. What are the essential factors that should be taken into account regarding the business model of industrial internet solution?
11. Are these offerings sold as a separate product/service or as a part of more extensive and comprehensive service agreement?
12. On what kind of factors the pricing models are based on?
    a. Customer perceived value or more traditional pricing model?
13. How you have ended up to this business model?
    a. Do you have any special models or types of actions for business model innovation?
14. What kind significance these industrial internet solutions have relative to company's complete business?
    a. How are these solutions connected to the other offerings?
    b. Are you able to support or increase the sales of your more traditional offering with these new offerings?
    c. What kind of supportive services you have around these industrial internet offerings?

Other questions

15. What kind of challenges do you see regarding industrial internet solutions?
    a. Is it easy to make customers adopting industrial internet solutions?
    b. How about own processes and backoffice?
16. What kind of opportunities relates to industrial internet solutions?
    a. How do you see the future of industrial internet solutions?
17. Free comments and feedback?
    a. Is there anything else that could or should be asked in future interviews?

APPENDIX B: PILOT COMPANY INTERVIEW QUESTIONS FRAME

Introduction

1. Could you briefly tell about you background and your job description?
2. How familiar you are with IoT or industrial internet based applications?
    a. Have you used or been in touch with such a solutions yourself?
3. What are the factors that motivate your company to jump on an industrial internet bandwagon?
    a. What kind of problems you are expecting to be solved with industrial internet solutions?
4. Where do you see the greatest potential of industrial internet in your business?
5. What are the most important sources of success in your business?
6. Do you utilize external partners regarding industrial internet solutions? Do you have own development?
    a. What is the meaning of different partners?

Customer value

7. What kind of factors creates value for you regarding industrial internet solutions?
    a. Could you somehow classify these factors based on the order of importance?
        i. Efficiency improvements?
        ii. Quality assurance?
        iii. Risk management?
    b. How could the Case Company help you in value creation?
8. Has the existing solution from the Case Company offered value for you?
9. What kind of experiences you have on the existing solution of the Case Company?
    a. What do you think about the idea of it?
    b. What kind of benefits have you got from it?
    c. What kind of costs are related to them?
    d. Is there something that could be developed? / Could it be possible to increase their value to you somehow?
10. What kind of experiences you have on common pilot project regarding that solution?
    a. Is there anything that the Case Company could develop in co-operation related to common pilot project?
        i. Communication, support, ability to respond to your needs?

Condition monitoring solutions

11. For what kind of purposes you consider industrial internet based condition monitoring solutions suitable? / For what purposes you would need them?
    a. For what processes?
    b. For which devices (electric motors, pumps, etc.…)?
12. How do you expect these solutions to help you?
    a. What information or what condition you are especially interested in? Prioritization (bearings, winding etc.)
    b. How that would help you to achieve your goals?
13. Could you describe the optimal user experience of such a solution? (Reflection to existing offering.)
14. Predictive maintenance is tightly connected to the industrial internet based condition monitoring solutions. How long time predictability such a solution should be able to offer?
    a. A week, several weeks, several months?
15. What should happen when solution notices that something is going to broke in the near future?
    a. Is pure notification enough? In application, portal, own systems?
    b. In addition to notification, possibility to order spare parts and service person?
    c. Service person directly comes and performs needed actions (Service agreement)?
    d. Any other additional features?
16. Four example pricing model scenarios are described (presented in Figure 11). How these pricing models suits for industrial internet solutions and why?
17. What kind of support services you would consider necessary?
    a. Help desk. Chat, email, phone?
    b. Commissioning and installing support?
    c. Supplier takes care of notifications and condition of assets?

Other questions

18. How would you see optimal collaboration between your company and the Case Company regarding industrial internet based solutions?
    a. Industrial internet based condition monitoring solutions as a separate entity?
    b. As part a part of deeper collaboration (service and maintenance agreements, etc.)?
    c. Deepening cooperation in development phase?
19. What kind of risks relates to industrial internet solutions?
20. What kind of opportunities relates to industrial interent solutions?
    a. How do you see the future of industrial internet solutions?

21. Free comments and feedback?
    a. Is there anything else that should be asked in future interviews?