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# **COMMUNICATING VALUE OF PRODUCT AS A SERVICE OFFERING**

Customizable value proposition

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# ABSTRACT

Maria Marek: Communicating value of product as a service offering - Customizable value proposition  
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To meet the needs of contemporary customers, companies focus on selling solutions that offer performance and functionality rather than offering simple products or services. Also, new possibilities unveiled by XaaS models in the IT industry have attracted the attention of both companies and customers in other sectors. Thus, companies increasingly more often decide to sell their products as a service. Even though product-as-a-service (PaaS) offerings have become more common, the existent definitions of a PaaS offering and discussions on how to analyse and communicate the customer value of a PaaS offering are rather vague. Then, customer value is discussed as context-specific and evolving over time, which means that customers customize the perceived value during the use of an offering. Nevertheless, customer value propositions are usually constructed at the beginning of the provider-customer relationship, and hence do not consider the impact of the evolving use situation on the value creation process and thus also the customer value proposition itself.

The objective of this thesis is to introduce a concept of a customizable value proposition and to study how to create a customizable value proposition for the product as a service offering. To reach the objective of the study, service and customer value literature is reviewed, and a conceptual framework is created. The framework is then applied in the case of a company that operates in the domain of medical laboratory diagnostics. As value statement is one of the elements of a compelling value proposition and quantification of value in monetary terms is crucial in any market sector, a value assessment tool is developed for the case company. The tool is built based on the observations in a laboratory, interviews with the case company, laboratory, and hospital representatives, and existing materials on value assessment in healthcare. The developed tool is also used to test how the change in the case company's offering use situation influences the initially estimated value potential and possibly other elements of a customer value proposition.

The study shows that when attempting to communicate the value of a PaaS offering, a company must thoroughly analyse the impact their offering makes not only on the company's direct customers but also on the customer's customers. The understanding of how the direct customer creates value for its own customers can help the supplier to identify how its offering can help the customer to create value. Moreover, it has been found that value assessment and, in particular, value assessment tools may have other applications besides measuring and quantification of customer value. Value assessment tools can be used to analyse the offering's use situation better and build a clear picture of the customer's role in the value creation process. Then, value assessment tools can also serve as a platform enabling tracking the changes in the offering's use situation or even help the customer to note potential issues that the customer has not been aware of. Hence, such tools can become an excellent platform for building a customizable value proposition. Finally, it has also been concluded that a customizable value proposition seems to be a suitable platform for communication of the value of a PaaS offering as it not only allows to reflect the changes in an offering's use situation but also may help the customer and the provider to understand the impact of these changes on the value creation process and address potential issues.

Keywords: customer value, customer value proposition, servitization, product as a service, customization, customizable value, customizable value proposition

The originality of this thesis has been checked using the Turnitin OriginalityCheck service.

## PREFACE

The time of my master's studies at Tampere University has been a time of many personal and professional realizations. Personally, it has been the time of big decisions and facing all their better and less desirable consequences. I have learnt that words have great power and may either lift you up and help to do great things or bring you down and destroy your self-confidence needed to go forward. I have been fortunate enough to experience more of the first kind of words, and I am grateful for that. Professionally, I have expanded my knowledge and improved critical thinking skills beyond what I hoped for when starting my master's studies. Also, as a student and a teaching and research assistant, I got invaluable experience of working within an international environment, which taught me different approaches to work, life, and communication. This thesis is an excellent example of the things I have learned through my master's studies.

There are two people to whom I am especially grateful, who helped me to become my own person and patiently served with motivational 'speeches' throughout my master studies. The first person I would like to thank is my husband, who has been my rock, pride, and my best friend who would always find the brighter side. The second person that made a difference and gave me a lot of freedom and possibilities to develop the way I wished while always bringing in interesting and valuable discussions is Dr. Jouni Lylly-Yrjänäinen. Furthermore, I would like to thank Professor Teemu Laine not only for his excellent supervision and guidance along this research process but also for his trust and patience. Next, big thanks to Dr. Tuomas Korhonen for his mentoring, the help on the case, and being always available to answer any questions. I am also grateful to the representatives of the case company for pleasant co-operation and providing a compelling case to work on. Finally, I would also like to thank my family - my parents for all the life lessons, and my sisters for unconditional love and support.

Tampere, 17 August 2020

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## LIST OF SYMBOLS AND ABBREVIATIONS

AST	antibiotic susceptibility testing
CRE	carbapenems resistant Enterobacteriaceae
CVP	customer value proposition
<i>ECDC</i>	European Centre for Disease Prevention and Control
GDL	goods-dominant logic
HCW	healthcare worker
IB	installed base
ICP	infection control and prevention
IVR	interventionist research
PaaS	product as a service
PCR	polymerase chain reaction
PS	product-service
PSS	product service system
SaaS	software as a service
SDL	service-dominant logic
SL	service logic
SLA	service level agreement
XaaS	anything as service

# 1. INTRODUCTION

## 1.1 Motivation for the study

The era of selling solely traditional physical goods is long over for manufacturers, and the market for pure physical offerings is steadily shrinking (Bustinza et al., 2017). As Levitt used to say, *“People don’t want a quarter-inch drill. They want a quarter-inch hole!”* (Ali et al., 2018). Lacy and Rutqvist (2016) also point that an office manager does not care what exact bulbs are installed in the office space, but he is concerned with providing cost-efficient lighting for his workers. Hence, customers increasingly expect solutions to their problems and fulfillment of their wants, not just mere product or service offerings. Moreover, customers aim to appear increasingly more agile and are less interested in making heavy investments into assets. Customers nowadays want to buy functionality and performance rather than pre-defined products (Lacy and Rutqvist, 2016).

Delivering performance and functionality is associated with advanced service offerings (e.g., Baines and Lightfoot, 2013; Kowalkowski et al., 2015) that are composed of varying degrees of products and services. Thus, to address changing customer needs, create and capture new business opportunities, many companies have turned to offer services and customer solutions rather than simple products (Ulaga & Reinartz 2011). Furthermore, inspired by the popularity of anything as a service models (XaaS) in the IT industry, various businesses have started to build as-a-service offerings (Classen et al., 2019). Especially, product-as-a-service (PaaS) model has gained popularity among companies that have shifted towards offering customer solutions. Nevertheless, despite the vivid discussions on the meaning of service, service infusion (e.g., Brax, 2005; Edvardsson et al., 2005; Gebauer, 2008), and transition from goods-dominant logic to service-dominant logic (e.g., Vargo and Lusch, 2004b) and service logic (Grönroos and Voima, 2013), PaaS offerings are underexamined.

Inclusion of a PaaS offering in the business portfolio requires that companies well understand the impact the offering makes on customers and their businesses. The business impact of an offering is often measured in a form of customer perceived value in the process of value assessment (Anderson et al., 2009; Keränen and Jalkala, 2013). To be effective, the customer perceived value should be expressed in a quantifiable form (Storbacka, 2011; Wouters and Kirchberger, 2015) and show how the offering impacts the

customer's revenues and costs (Anderson et al., 2006). Customer perceived value is communicated using a customer value proposition (CVP).

There is no agreement on what constitutes a CVP (Anderson et al., 2006), and different authors propose varying definitions (e.g., Lanning and Michaels, 1988; Ballantyne and Varey, 2006; Payne et al., 2017) and frameworks (e.g., Anderson et al., 2006; Skålén et al., 2015; Leroi-Werelds et al., 2017) to describe the phenomena of a CVP and to guide how to build a compelling CVP. Nevertheless, there is little discussion on how to communicate the value of a PaaS type of an offering. As a PaaS offering can be seen as an advanced combination of products and services under a single service offering (Classen et al., 2019), this combination of various product and service elements creates challenges in analyzing and communicating the value of a PaaS offering to potential customers. Hence, it would seem that studying how to assess and communicate the value of a PaaS offering could help to understand the nature of PaaS offerings better and help companies to build attractive customer value propositions answering to the needs of contemporary customers.

## 1.2 Objective

With the transition towards service-dominant logic and increasing customer-centricity, customer value propositions are more often mutually defined by a selling company and its customers (Payne et al., 2017). These mutually defined customer value propositions include a monetarily quantified value statement, role of the customer, and capabilities needed to derive the promised value (Skålén et al., 2015; Leroi-Werelds et al., 2017). Also, the interactions between the selling company and the customer allow to co-build customized solutions and value propositions based on the customer's needs, and account for differences between customers and competing offerings (Anderson et al., 2006; Heikka et al., 2018).

Nevertheless, such customization of value and customer value proposition is still mainly discussed from the provider's point of view (Heikka et al., 2018). What is more, customer value is not static, but it tends to evolve over time (Vargo, 2009; Grönroos and Voima, 2013). The customer value is also contextual, i.e., the customer's use situation may impact the value derived from an offering (Grönroos and Voima, 2013). This means that the same PaaS offering may impact two seemingly similar customers in different ways and result in different customer perceived values. Thus, customers customize the perceived value during the use of the offering, which makes the customer value customizable (analogy to a 'customizable offering' - Gilmore and Pine, 1997). The contextuality

and dynamism of customer value suggest that, once created, a customer value proposition is likely to be perishable and, hence, it should also evolve based on changes in customer's use situation. Thus, the objective of this thesis is...

*... to introduce a concept of a customizable value proposition and to study how to create a customizable value proposition for product as a service offering.*

To reach the objective of the thesis, an in-depth study of service and customer value literature is performed. Based on the revision of service literature and XaaS concepts, the definition of product-as-a-service (PaaS) offering is refined. The review of the customer value literature leads to a summary of how to create a compelling value proposition, and the role of the monetary value assessment in the communication of customer value is also discussed. Furthermore, the theory related to customization is reviewed to define customizable customer value and customizable customer value proposition. Finally, a framework showcasing the idea of the creation of a customizable value proposition for a PaaS offering is proposed, and some practical examples are given.

The research in this thesis is done as a part of a research project belonging to the research portfolio of the Cost Management Center, a research group at Tampere University. In the research project, the researcher works on the case of a medical laboratory diagnostics provider and studies the impact that the automation of a laboratory screening protocol has on customer value. The researcher builds a customizable value assessment model that allows assessing the difference between the customer value of traditional and automated screening solutions in different healthcare settings. As the case company's solution is also sold as a service, the case study serves as a testing platform for the developed theoretical framework.

### 1.3 Research methodology

Research is a systematic collection and interpretation of information with a clear purpose to find things out and increase the knowledge (Saunders et al., 2019, p. 5). According to Saunders et al. (2019, pp. 6), business and management field is a distinctive area for research because it requires bringing some practical consequence as the managers, who participate in the research, are often busy people unlikely to allow the study unless some personal or commercial advantages can be seen. Furthermore, Adams et al. (2014, p.3) say that research in business areas is usually undertaken to fulfil specific business objectives such as gaining a competitive advantage, testing new products and services, solving management or organizational problem, reducing costs, or enhancing

profitability. Thus, business and management research requires engagement not only in the world of theory but also in the world of practice (Saunders et al., 2019, p. 6).

To address the purpose of the business and management research to bring theoretically and practically appealing results and answer the objective of the thesis, this study follows an interventionist case study approach. Having the traits of qualitative multi-method research (Saunders et al., 2019, pp. 179-180), this study utilizes action science, participant observation, qualitative interviews and existing materials as main data gathering methods. The case study is conducted with a company operating in the industry of medical laboratory diagnostics that seeks an efficient and effective way to communicate the value of their offering to medical laboratory and hospital decision-makers.

Despite some variations across philosophical worldviews expressed by different authors (e.g., Merriam, Yin and Stake, cited in Harrison et al., 2017), case studies are described as an approach suitable for an in-depth investigation of complex phenomena in their real-life contexts (Harrison et al., 2017). Furthermore, case studies are frequently divided into different types based on a number of cases included in the study and the aim of the study (Harrison et al., 2017). Based on the number of cases, a case study can be considered as a single-case or a multiple-case study, while based on the purpose of the study, case studies can be divided into exploratory, explanatory, or descriptive case studies (Yin, 2014). The objective of this thesis is to answer to a 'how' question to enable gaining insights into the studied phenomena. Moreover, to answer the objective, a single case organization within its context is studied. Besides the case company, different actors within the network are investigated which results in the multiple units of analysis. Hence, this thesis can be deemed as embedded single-case study research that is exploratory in its nature (Yin, 2014).

Single case studies enable more detailed descriptions and analysis of the phenomena and enhance a researcher's understanding of 'how' and 'why' things happen (Ridder, 2017). Also, the strength of a single-case study lies in its potential to theory creation through the expansion of existing constructs and relations within specific settings (Ridder, 2017). The use of the single-case study approach in this thesis enables the researcher to study the communication of the value of product-as-a-service offerings and the meaning of the customer value customizability within a context of a specific industry. The use of a single-case study approach and such context specificity are sometimes considered a drawback as it limits the generalizability of the findings made (Voss et al., 2002). However, since the studied industry belongs to the healthcare sector, the applicability of the findings is likely to be rather broad within its domain as the healthcare sector

is one of the most important and fastest-growing industries worldwide. Also, the researcher, having a background in business and management field, besides increasing the knowledge on value- and service-related concepts and theories, must study the case-specific industry to build a deep understanding of the case context. The choice of a single case study approach supports such a quest as it allows to narrow down the focus of the study. Nevertheless, Gummesson (2017) argues that even the cases whose original purpose is to stay single might be eventually compared to other cases to draw more general conclusions.

'Traditional' case studies use interviews, observations, focus groups, or questionnaires as the main methods of data gathering (Harrison et al., 2017) and, hence, these studies relay mainly on what a researcher reads, sees, and hears while not being personally involved in the phenomena studied. However, Gummesson (2017) claims that while such conventional research methodology may bring interesting results, to truly understand the theory and contribute to the theory development, a more practical and interactive involvement of a researcher in the case study might be required. Furthermore, Gummesson (2017) calls for more practical application of business and management theory. Hence, in this thesis, the interventionist research strategy (Suomala et al., 2014) is utilized as the researcher is personally involved in the case under study and intentionally seeks to be able to study the phenomena from 'the inside'. Jönsson and Lukka (2007) define interventionist research (IVR) as a cluster of research approaches using more intrusive research methods where the researcher plays an active role in the real-time flow of events in the researched field. During the IVR process, the researcher aims to become a competent and trustworthy member of the researched community not only to be able to have a chance to gain a better understanding of the study context but also to be able to communicate and act together with other actors (Jönsson and Lukka, 2007).

Following IVR strategy, the researcher brings practical inputs that also serve as a means to gain better access to the case organization and its network to collect quality research materials that support reaching the objective of this thesis (Suomala et al., 2014). Based on existing materials, qualitative interviews and participant observation (Gummesson, 1993), the researcher builds a comprehensive Excel value assessment tool that is to be used by the case organization in their sales negotiation process. Thus, the model creation utilizes the action science approach (Gummesson, 1993), and constitutes the main research intervention of the thesis. Furthermore, the model serves as the practical outcome of the research work for the case company while the researcher constructing the model gets access to interview several employees of the case company and the company's network actors such as hospital and laboratory staff. Also, while building the

model the researcher gains practical experience and forms better a understanding of how different customer variables affect the value potential offered by the case company's solution and how that influences the communication of customer value.

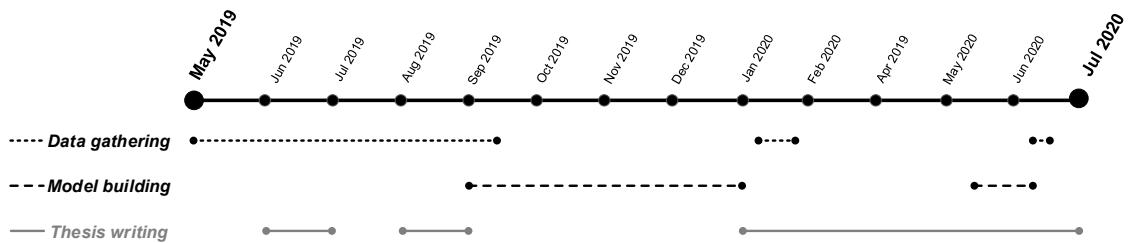
As Suomala et al. (2014) mention, sometimes to facilitate the project continuation and building of trust between the researcher and the actors involved in the study, the researcher needs to invest time in tasks somewhat secondary to the research objective studied. It means that some of the interventions may not directly contribute to reaching the studied objective but may be indispensable to gain access to more valuable data. In the case of this thesis, the researcher makes an additional data analysis to provide insights to the local medical laboratory on the topic of their interest. In return, the laboratory allows the researcher to spend a few days in one of the laboratory units and observe the real-life context in which the case company's solution could be used. Moreover, the researcher is able to interview several laboratory employees and ask the questions that guide not only building of the practical model for the case company but also provide insights helping to answer the objective of the thesis.

Based on the followed research methodology, this study uses both an inductive and deductive approach to theory development. When following deductive approach, a researcher first develops theory and then collects data to test the theory, while in the case of the inductive approach, the researcher first explores the phenomena by collecting data to generate and build the theory (Saunders et al., 2019, p. 153). Saunders et al. (2019, p. 155) state that, in fact, business and management research often combines both approaches. At the beginning of the work on this thesis, the researcher performs initial theory screening and forms the theoretical objective of the study that, in some way, guides her data collection. However, the resulting research questions evolve along the process of data collection and the phenomena exploration. Hence, going back and forth between the inductive and deductive approaches is apparent in this thesis.

## 1.4 Research process

The research process unofficially started in March 2019 when the researcher was introduced to the case in order to support the work of students on a research intervention that was a part of their coursework at Tampere University. At that point the researcher was not actively involved in the casework. However, based on the inputs from the senior researcher working on the case and own online-based research on the case company and case-related concepts, the researcher consulted students working one the interventionist task and eventually facilitated the student's meetings with the case company. At the same time, these meetings were the first researcher-case company encounters that,

looking from the current perspective, were invaluable for the researcher as they facilitated the researcher's understanding of the laboratory solutions offered by the case company as well as the challenges the company faced. Hence, this time could be labeled as the pre-understanding phase of the study. The entire research process is illustrated in a simplified form in the figure below.



**Figure 1.** Research process.

The research timeline in Figure 1 starts in May 2019 as at that point, the researcher got actively involved in the casework and started gathering data needed to answer the objective of the study and build the value assessment model. Most of the data were collected between May 2019 and mid-September 2019, when the researcher run a series of interviews and teleconferences with the case company, a laboratory, and a hospital's representatives. Moreover, during this time, the researcher also run two-day observations in a medical laboratory. Some more information was also inquired in January 2020 when representatives of another hospital were interviewed and in mid-June 2020, when the researcher discussed outcomes of the study with the case company's representatives.

The value assessment model was built mainly between September 2019 and January 2020. During that time, the main model inputs, the relations between different data, and the user interface were built. Furthermore, the assumptions for the model building were introduced to the case company, and modifications to the model were done several times. While the full version of the model was ready in January 2020, due to the coronavirus pandemic, the final check-up of the model by the case company could only happen in May 2020. Based on the final model check-up, the last modifications to the model were made, and hence the value assessment model was completed. The final model check-up resulted in interesting discussions and new data collection. Despite the completion of the model, the researcher might still have a role supporting the case company's trial uses of the model with customers. Table 1 includes main research interactions along the research process.

**Table 1.** Research interactions along the research process.

Type of interaction	Theme of the interaction	Attendants' roles	Date	Role of the researcher
Meeting	Defining co-operation	Key account manager (KAM), Laboratory chief physician (LCP)	13.5.2019	Active participant
Teleconference	Data gathering and refining further plans	Marketing manager (MM), R&D manager (R&DM)	21.5.2019	Active participant
Interview	Information gathering	LCP	18.6.2019	Active participant
Interview	Data gathering	Microbiologist	18.6.2019	Active participant
Interview	Data gathering	Laboratory technician	18.6.2019	Active participant
Interview	Data gathering	Laboratory technician	20.6.2019	Active participant
Observation	Data gathering	Laboratory technicians	18.6.2019	Observer
Observation	Data gathering	Laboratory technicians	20.6.2019	Observer
Interview	Data gathering	Nurse	1.7.2019	Active participant
Interview	Data gathering	Infectious diseases specialists	19.8.2019	Active participant
Interview	Data gathering	Nurse	8.9.2019	Active participant
Teleconference	Assumptions for model and data gathering	MM, KAM, R&DM	12.9.2019	Active participant
Interview	Data gathering	Nurse	4.10.2019	Active participant
Teleconference	Model check-up and data gathering	MM, Chief commercial officer (CCO)	20.11.2019	Active participant
Teleconference	Model check-up and data gathering	MM, CCO	29.11.2019	Active participant
Interview	Data gathering	Nurse	24.1.2020	Active participant
Teleconference	Model check-up and data gathering	MM, CCO, Product Manager (PM)	7.05.2020	Active participant
Teleconference	Data gathering	MM, PM	16.06.2020	Active participant
Teleconference	Model check-up	PM	27.07.2020	Active participant
Emails – 75 sent & 62 received	Information gathering, scheduling	All stakeholders mentioned in the table	1.05.2019 - 30.06.2020	Initiator

As Table 1 shows, many interactions with different stakeholders took place during the course of study and the researcher took an active part in all the interviews, teleconferences and observations. The researcher was in constant touch with the case company's marketing manager who was responsible for the project delivery. By the end of the study, a new product manager was introduced as a key contact person that is responsible for the value assessment model implementation. The product manager became the main contact person and the person with whom the model was finalized.

Besides the research interactions listed in Table 1, the researcher gave several presentations on the studied case. As the case studied in this thesis is a part of the broader project consortium, the researcher presented the outcomes of the study at a couple of steering group meetings and during a few internal research group meetings. Moreover, the researcher presented the case during management accounting seminars as well as prepared an online lecture presentation for students of one of the university courses as due to coronavirus pandemic all the classes were moved to the online space.

All the different interactions and presentations brought many interesting inputs to the study and supported the reporting of the study outcomes in the form of this thesis. The thesis writing process lasted from June 2019 to July 2020; however, as Figure 1 depicts, most of the thesis was written between January 2020 and July 2020.

## 1.5 Structure of the thesis

One of the most critical phases of any research is its documentation. While the qualitative research process might not always be smooth, the research report should be constructed logically. It does not mean that the researcher is not allowed to describe the reality of the research process, but that should be done in a well-structured and easy to follow manner. Thus, this thesis is logically divided into seven chapters in the following way:

**Chapter 1** comprises the introduction to the thesis. The chapter presents a brief theoretical background of the study that aims to present the key theoretical concepts and point at the research gaps leading to the objective of this thesis. Next, the research methodology and research process are described.

**Chapter 2** deals with the phenomena of service and servitization. The chapter presents the characteristics of service, how different authors understand the meaning of the concept service, and the meaning of service changes across different marketing perspectives. Furthermore, servitization and its main objectives are described as well as the most famous service classifications are presented, and one generic service strategy presented. Lastly, in this chapter, the concept of anything as a service and various service revenue models are described, and product as a service offering is defined.

**Chapter 3** dives into the customer value literature review. Firstly, value and customer value are defined, and the evolution of these concepts is described. Then, the importance of quantifiable value assessment is emphasized, the process of the value assessment and value elements to be included in value assessment are reviewed. Thereafter, definitions of customer value proposition and various value proposition frameworks

are presented. The chapter ends with a framework illustrating how to build a compelling value proposition.

**Chapter 4** aims to link service and value concepts described in the previous chapters by discussing value in different service perspectives. Also, the product-a-as-a-service offering is placed on the servitization continuum together with different marketing perspectives. This chapter also introduces concepts of customization and modularity, which are then used to discuss the communication of customer value of product-as-a-service offerings. In this chapter, a framework that presents a potential theoretical contribution of this thesis is created.

**Chapter 5** introduces the case company and its challenges as well as describes the case context and related concepts. In this chapter, also the key value elements impacted by the case company's solution are identified, value assessment logic established, and an exemplary value assessment is performed. Moreover, a value assessment tool is introduced, and the role of the tool in the creation of a customizable value proposition for the case company's offering is discussed.

**Chapter 6** draws back to the research objectives and research questions, which are analyzed based on the main findings. The case findings are also reflected back to the framework, and the results are discussed. Furthermore, the limitations of the study are summed-up and suggestions for further research made.

**Chapter 7** is the final chapter of the thesis and brings all the main findings together to conclude the outcomes of the thesis.

## 2. PRODUCT AS A SERVICE

### 2.1 Services

#### 2.1.1 Service definition

As far as it has been always easy to define and understand the meaning of a physical good, not the same can be said about the concept of service (Rathmell, 1966; Johns, 1999). The richness and variety of the meanings of the word ‘service’ may cause confusion and the use of the right service denotation is crucial to perceive the right context (Johns, 1999; Edvardsson et al., 2005). Based on the Johns’ (1999) review, at least three different main meanings of service can be distinguished:

- An industry
- An output
- A process.

Firstly, service can refer to an industrial sector encompassing economic activities that do not result in made goods but focus on doing ‘things’ for a customer. Second, denoting of service as an output or offering draws towards the discussion on the difference between physical goods and services. While many authors distinguish between products and services, they also see a complete offering as a combination of physical goods and service components (e.g., Rathmell, 1966; Gummesson, 1995; Edvardsson 1997; Johns, 1999) in which proportion between the physical components and service components may vary upon specific offering or customer. Finally, Johns (1999) also distinguishes a process perspective to defining a service. According to his research, this notion of service was built on the perception of services as activities, and so similarly as in manufacturing process, inputs, outputs, and substrates upon which service process operates can be defined.

Furthermore, according to the latter review of Edvardsson et al. (2005), many researchers deem services to be processes, activities, deeds or interactions, and they focus their definitions on customer and services as solutions to customer problems. This view on services is well represented by Grönroos (2000) defining the service as

*“... an activity or series of activities of a more or less intangible nature that normally, but not necessarily, take place in the interaction between the customer and*

*service employees and/or physical resources of goods and/or systems of the service provider, which are provided as solutions to customer problems”.*

In their review, Edvardsson et al. (2005) also point that most of the service definitions have various interpretations as only being so abstract these definitions may cope with encompassing the phenomenon of service. Furthermore, they state that diversity of meanings of service definitions may rely upon viewing those definitions solely as a mean to portray services or on the other end as a mean of describing services in terms of value-creation. Hence, in the first case, services are prospected as activities that are the subject of a transaction, whereas the second approach denotes service as a value-creation element. Nevertheless, as noted by Edvardsson et al. (2005), all the service definitions focus on the role of customer and increasingly show the customer as a value co-creator in the service notion of value-in-use.

### **2.1.2 Service characteristics**

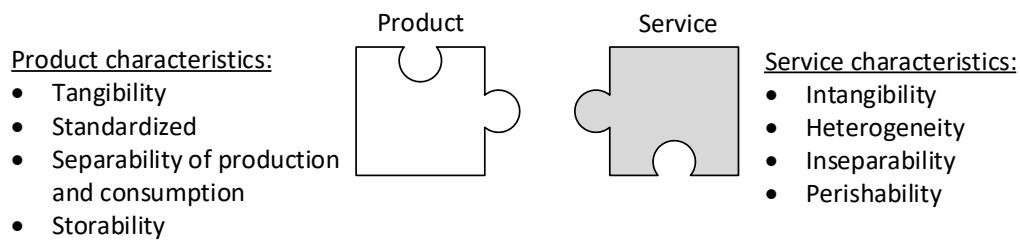
Rathmell (1966) points at a few characteristics distinguishing between physical goods and services. According to him, a good can be thought of as a noun and a service as a verb, and thus the good should be considered as a thing, an object, a device, or an article whereas the service should be rather considered as an act, an effort or a performance. He also continues that a buyer obtains an asset while buying a good and seems to only incur expenses when buying services; thus, the service can be thought of as a transaction where object sold is different than transferring the ownership of a tangible commodity. Nevertheless, Rathmell (1966) also noted that there are rather few examples of pure products or pure services as most products, both consumer and industrial, need to be supported with services to be useful and, on the other hand, most of services need supporting goods to be useful.

Many authors proposed different service features differentiating services from goods (e.g., Zeithmal et al., 1985; Edgett and Parkinson, 1993). However, there are four main features describing services that are commonly used by most scholars. Those service characteristics are denoted by IHIP abbreviation standing for intangibility, heterogeneity, inseparability and perishability.

First, intangibility, considered to be the main good-service distinction (McDougall and Snetsinger, 1990), means that a service is not palpable nor material as, according to many definitions, services are rather performances or acts and cannot be sensed the same way as goods that are tangible objects. Gummesson's (1987) statement that “*services are something that can bought and sold but which cannot drop on your foot*” well presents the most traditional feature of services. Second, heterogeneity of services aims

to portray the difficulty in standardizing the output of a service. The heterogeneity of the services, in that sense, comes either from the fact that there exist multiple service providers and service processes may differ among them, or from the service production variances within certain company which is caused by different employees and varying customer needs and expectations (Edvardsson et al., 2005).

Third, inseparability means that services are produced and consumed simultaneously while goods are produced, sold, and only then consumed (Regan, 1963). Inseparability of services, traditionally, also means that the producer and the seller of the service are the one entity, which allows for more interactive marketing and production of services (Zeithmal et al., 1985). Last, perishability of services relates to the inability to store services as opposed to goods that can be stocked. Thus, perishability of services may result in difficulties in synchronizing the supply and demand for the services (Wolak et al., 1998). Figure 2 shows the difference between goods and services according to their varying characteristics as described above.



**Figure 2.** Product and service differentiation.

Some authors do not see the IHIP characteristics unique to services or argue their validity in terms of value creation through services as they do not apprehend the process and interactive nature of services (Vargo and Lusch, 2004a; Lovelock and Gummesson, 2004). However, Edvardsson et al. (2005) argue that the IHIP characteristics should not be generalized but rather used when relevant and possibly useful. A similar view is shared by Moeller (2010) who aims to show that each of the IHIP features is still valid and can be helpful if related to specific aspects of services rather than being granted to services as an entire package.

Vargo and Lusch (2004b) argue that IHIP service characteristics are not accurate and may give a misleading perception of the nature of market offerings. They also point at each of the service characteristics and criticize their fundamental meanings. On the contrary, Moeller (2010) points at each of the IHIP features and argues their validity against opposing opinions. Table 2 compares different views on the service characteristics including their traditional meanings and the arguments against and pro their validity.

**Table 2.** Service characteristics (Vargo and Lusch, 2004b; Moeller 2010).

	<b>Traditional understanding</b>	<b>Critics</b>	<b>Validation</b>
<b>Main theme</b>	<b>All characteristics apply to services as an entity</b>	<b>IHIP characteristics are not unique for services</b>	<b>Specific characteristics applied to specific aspects of services</b>
Intangibility	Services lack the palpable quality of goods	Tangible goods are often part of the service offering	The provider's promise of performance offered is always intangible
Heterogeneity	Services cannot be standardized unlike products	Many services are relatively standardized	Resources belonging to customer are heterogeneous
Inseparability	Opposed to goods services are produced and consumed simultaneously	Not all activities associated with service are inseparable	Customer resources are necessary for service provision
Perishability	Services are impossible to store	Both tangible and intangible 'things' can be stored	Capacity of the services perishes if not activated by customer resources

Comparison of opinions presented in Table 2 shows that service and its characteristics have been studied for a long time and, hence, various conceptions have emerged. These varying conceptions might be the result of evolving marketing view on the role of the service in a market offering and perception of which elements of the offering, i.e., physical product or service part, play the most important role in the customer purchase decision making process, in other words, what constitutes the key selling points.

### 2.1.3 Service in GD, SD, S-logics

Johns (1999) states that it is rather difficult to differentiate between manufacturing and service industries in terms of outputs and processes. According to him, however, there can be both manufacturing and service paradigm recognized. The first one focuses on input, products and processes to provide tangible goods to satisfy market needs whereas the second one focuses more on customer relationships and satisfying customers through actions.

Another view on the product versus service paradigm was voiced by Gummesson (1995, p. 250) who stated that customers buy offerings rendering services that bring value instead of purchasing just goods or services. According to him, the common differentiation between goods and services is not valid anymore as both activities as well as things render services and it is only the matter of seeing services from customer perspective rather than the provider perspective. Furthermore, Vargo and Lusch (2004b) added that instead of trying to distinguish between the goods and services it should be understood how they

are related. Also, as argued before by Grönroos (2000), the physical goods rather become one of the elements of service offering rather than entity on its own.

Vargo and Lusch (2004a; 2004b; 2008b) point that marketing, as well as other business disciplines, have moved from goods-dominant (GDL) towards service-dominant (SDL) logic where GDL sees the physical goods as the focus of the economic exchange whereas the SDL recognizes the services as the foundation of the exchange activity. According to them, it should be noted that meaning of the 'service' is not equal in both GDL and SDL perspectives.

GDL views services as (1) a form of an intangible good, (2) something that is offered to just to boost the physical good offering, thus seen only as value-added to the physical good, or (3) what is known as service industries like education or health care. Furthermore, the nature of economic exchange in GDL is primarily focused on units of outputs, that are embedded in value during the production process that ideally happens in isolation from the customer and as the result yields standardized and storable goods.

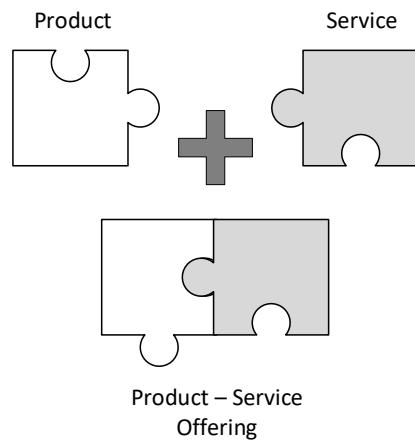
On the contrary, in SDL service is seen as a process of application of knowledge and skills for the benefit of another party (Vargo and Lusch, 2008b). SDL assumes that service can be provided for or in collaboration with the customer and the value is reciprocally co-created between the two parties. Moreover, SDL applies to all offerings, also those involving tangible goods in process of service provision. However, goods in SDL serve as the provider's competencies conveyor and are not the primary mean for value creation.

Grönroos (2011) challenged the phrase 'service-dominant' initiated by Vargo and Lusch (2004a) as the name referring to the new marketing perspective. Grönroos (2011) argues that, based on the fundamental premises, proposed by Vargo and Lusch (2004a), any kind of a resource, also a good, is thought of as delivering service to customers. Hence, according to Grönroos (2011), the new marketing perspective shall be rather called 'service logic' as it is a logic of service, not just a logic dominated by service. In service logic (SL), there are no goods-centric aspects but, as Grönroos (2011) - pointing back at work of Gumesson (1995) - argues, SL views service as supporting customer's everyday practices in a manner that renders services and facilitates the customer's value creation while goods play an enabling role in the execution of this logic. Nevertheless, as Grönroos (2011) points, SL is not considered as an alternative perspective to the one proposed by Vargo and Lusch (2004a) but rather the next stage in that logic and the name 'service logic' just better encompasses the service-based view on business and marketing.

## 2.2 Servitization

### 2.2.1 Definition

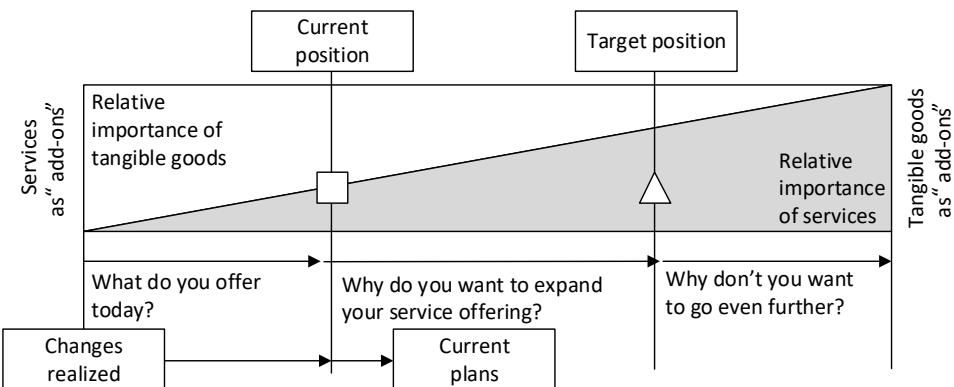
The limited nature of manufacturing, ever evolving customer needs and expectations, fierce competition, and eroding products' profit margins led manufacturing companies to seek competitive advantage and operational gains outside manufacturing paradigm (Mathieu, 2001a; Oliva and Kallenberg, 2003; Brax, 2005; Neely, 2008). Manufacturers have started to offer solutions aiming at capturing more market share and increasing customer satisfaction (Beuren et al., 2013). One of the natural ways of building those offerings was the extension of traditional business through services and offering product-service (PS) bundles (Gaiardelli et al., 2014). This bundling of products and services was termed as servitization by Vandermerwe and Rada (1988). They defined servitization as "*market packages or bundles of customer-focused combinations of goods, services, support, self-service and knowledge*". Figure 3 shows the basic idea behind product-service bundling.



**Figure 3.** Product-service bundle (Based on Vandermerwe and Rada, 1988).

Since Vandermerwe and Rada defined servitization, there have appeared different definitions of servitization. However, according to Baines et al. (2009) the delivery of product-based services remains central and, on general level, most definitions seem to agree with the one of Vandermerwe and Rada. Furthermore, there have been many researchers working within different communities to contribute to servitization topic by adding distinctive as well as complementary perspectives to the servitization phenomenon (Lightfoot et al., 2013). Even though those communities seem to discuss the same phenomenon of combining product and services, many different terms have appeared to describe the product-service bundling such as integrated solutions, service infusion, systems selling or product-service-systems (PSS) (Brax and Visintin, 2017).

Furthermore, publications that refer to servitization phenomenon oftentimes discuss service strategies in terms of transition during which manufacturers follow servitization path starting from providing a simpler type of the PS offering, going up towards more infused one, and ending-up with the most sophisticated form of the PS offering (Raddats and Kowalkowski, 2014). For instance, Oliva and Kallenberg (2003) conceived the expansion of service offerings among manufacturers as the transition line, known also as product-service continuum. Product-service continuum has been already referred to by Rathmell in 1966 as he stated that *“Economic products lie along a good-service continuum, with pure goods at one extreme and pure services at the other, but with most of them falling between these two extremes”*. Yet, according to Brax (2005), the study of Oliva and Kallenberg (2003) is the only one that yields a clear model of transforming process from manufacturing only to being in service business. Figure 4 presents the PS continuum proposed by Oliva and Kallenberg (2003).



**Figure 4.** Product-service continuum (Oliva and Kallenberg, 2003).

As shown in the figure above, the product-service continuum has two distinctive ends. In one of the ends, the left part of the figure, companies obtain competitive advantage while being product manufacturers providing services as add-ons only. The main source of revenue and profits comes from the product sales while services, being mainly a differentiating element in product's marketing strategy, contribute to revenue or customer satisfaction on minimal level. Whereas, the companies that can be placed on the opposite side of the PS continuum, sell products only as add-ons to their offerings. Services play the major role and are the source of the major part of the value created.

Oliva and Kallenbeg (2003), based on the framework shown in Figure 4, also presented a four-stage model that helps manufacturers to move along the continuum while offering services to the installed base (IB). Each of the stages presented in the model includes triggers, goals and actions related to the specific stage in which the company needs to

develop specific capabilities to address set of issues restraining the company from moving along the continuum. The model includes four following stages:

- Consolidating product-related services
- Entering the installed base (IB) service market
- Expanding to relationship-based or process-centered services
- Taking over the end user's operation.

In the first stage, companies consolidate their product-related services and bring them under one organizational unit mostly being driven by the desire to sell more products. Consolidation of the service offering is often combined with the plan to gain higher efficiency, improve service quality and delivery time as well as design of the new services. This stage usually yields the mechanism monitoring service effectiveness and delivery, which is highly useful when entering the next stage. In the second stage, companies enter the IB services market to tap the potential profit identified in this market by building the structures and processes enabling for profit exploitation. This stage requires that the company well analyses the IB market and creates the infrastructure needed to deliver demanded services.

In the third stage the company has to choose between expanding to relationship-based services and process-centered services. Expanding towards relationship-based services, the company aims to increase the utilization of service infrastructure through assuming operational risks and gaining costs advantage utilizing learning curve or economies of scale. While expanding to process-centered services aims to exploit the product-development skills to increase their usability and system integration capabilities through developing consulting capabilities, creating 'new' distribution network and possibly including other manufacturers. The final stage is taking over the end-users' operation which yields a pure service organization. In this stage the company takes over the operating risk and the responsibility for the customer's processes.

### **2.2.2 Servitization drivers**

As service has become an important element of any offering, manufacturers increasingly decide for adding services to their core offerings (Oliva and Kallenberg, 2003; Brax, 2005). The motivation to include services in the portfolio mostly stem from the manufacturers wishing to improve their financial performance, either through increased sales of product-service bundles or services themselves (Raddats et al., 2019). However, according to Oliva and Kallenberg (2003), servitization drivers can be grasped into three broader categories: economic, demand-based and competitive. Similarly to Oliva and

Kallenberg, Baines et al. (2009) gathered servitization drivers under three corresponding categories: financial, marketing and strategic.

First, the most frequently cited economic (financial) drivers include higher profit margins as compared to selling product alone, new sources of revenue coming from services, implying also higher revenues, and decreased volatility and vulnerability of the cash flows as service provision may help to balance the impacts of the economic cycles (Wise and Baumgartner, 1999; Mathieu, 2001; Malleret, 2006; Oliva and Kallenberg, 2003; Raddats et al., 2016). As services oftentimes complement products and increase customers' confidence to make the buying decision, they also may boost the sales of traditional products, thus, also increasing the manufacture's revenues (Cusumano et al., 2015). Moreover, according to Malleret (2006), servitized offerings are seen as being less sensitive if it comes to price-based competition which may be the reason behind higher profit margins.

Second, as it comes to demand-based (marketing) drivers, those are based on the customers increasingly requiring more specialized services (Oliva and Kallenberg, 2003), and the trend towards long-lasting customized rather than transactional customer-supplier interactions (Mathieu, 2001). According to Baines et al. (2009), marketing benefits, motivating to follow the servitization trend, are most of all seen as using of the services as a trading-card to sell more products. Furthermore, while offering services, the manufacturer tends to come closer to the customer (Wise and Baumgartner, 1999), and therefore is able to better recognize the problems and wishes of the customer and, thus, build more appealing customer-specific offerings. That in turn, may increase customer's loyalty and is likely to result in customer becoming more dependent on the manufacturer, yielding in the repeat-sales and cross-selling opportunities (Mathieu, 2001; Malleret, 2006).

Finally, one of the most important competitive (strategic) drivers enabled through services is product differentiation. Technological differentiation and low prices are increasingly more difficult to remain lasting strategies (Mathieu, 2001), and thus adding services to accompany product offerings is nowadays seen as a mean to achieve market differentiation and competitive advantage (Raddats et al., 2016). Product-related service provision may also enable the manufacturer to see and understand how the product works in real-life setting and thus consider the findings in the future product designs (Goffin and New, 2001). Moreover, as stated by Oliva & Kallenberg (2003), services are more human dependent and less visible from outside, and hence more difficult to copy by competitors and may pose as a market entry barrier (Anderson and Narus, 1995).

### 2.2.3 Service offerings and service strategy

Already in 1972 Levitt made an assumption that everybody is in some way in the service business. Following that, Berry and Parasuraman (1991) stated that manufacturing companies are also service companies as most of the manufactures offer services to some extent. Hence, many authors proposed various classifications of services provided by manufacturers and Table 3 gathers examples of well-known service offering categories found in the existent literature.

**Table 3.** Categories of service offerings.

Author(s)	Service classification	Classification logic
La Londe and Zinszer (1976)	services offered before, during and after sale	point of delivery
Frambach et al. (1997)	transaction or relationship related services	nature of supplier-customer interaction
Mathieu (2001a)	services supporting products (SSP), and services supporting customer's actions (SSC)	recipient of the service
Mathieu (2001b)	customer service, product service, service as a product	nature of the offering
Davies et al. (2006)	own product, and multi-vendor services	recipient of the service
Raddats and Easingwood, (2010)	product-attached services and operational services on own or vendor-independent services	recipient of the service
Witell and Löfgren (2013)	free and chargeable services	cost vs revenue generation
Baines and Lightfoot (2013)	base, intermediate, and advanced services	service output
Cusumano et al. (2015)	smoothing, adapting, and substituting services	complementing or replacing the product purchase

Table 3 provides a summary of different service classifications presented by several authors. This summary shows that there exists vast amount of views on how service offerings can be categorized. La Londe and Zinszer (1976) divided services based on the point at which the service is provided to customers. They have distinguished services as offered before, during and after the sale of the product. Then, Frambach et al. (1997) classifies services based on the nature of supplier-customer interactions. They distinguish between services related only to the product sale (transactional services), and services that help building and maintaining closer relations with customers, i.e., relationship-based services.

There are two different classifications that can be found in Mathieu's publications. First classification (Mathieu, 2001a) divides service offerings based on the nature of the offering into customer service, product service and service as a product. Customer service refers to the seller-customer interaction quality, product service relates to services supporting the supplier's product, whereas service as a product refers to services independent from the seller's product. The second classification proposed by Mathieu (2001b) distinguishes services, based on the service recipient, between services supporting the product (SSP), and services supporting customer (SSC). SSP fits the traditional view on service offering as the direct recipient of the service is a product, the intensity of the relationship and the service customization are low. SSC, on the other hand, focuses on services supporting the customer's action in relation to the supplier's product. Thus, while SSC is considered, a person is seen as a direct recipient of the service and both intensity of the relationship and service customization are high.

Davies et al. (2006) divide services according to whether the manufacturer offers services only to own products or also offers the service for installed base of competing manufacturers. Following the considerations of Davies's et al. (2006), Raddats and Easingwood (2010) went a step forward and connected Davies's et al. (2006) service offering categories with those of Mathieu (2001b) to create a two-dimensional matrix of different service categories. Figure 5 illustrates the matrix by Raddats and Easingwood (2010) .

		Orientation of services	
		Products	Customers
Multi-vendor orientation of services	Own and third party products	2. 'Product-attached' services on own and third party products	4. Vendor-agnostic 'operations services'
	Own products	1. 'Product-attached' services on own products	3. 'Operations services' on own products

**Figure 5.** Service categories by Raddats and Easingwood (2010).

As Figure 5 shows, the matrix includes four services categories. First, product-attached services on own products are services such as installation or training that are offered only for own products. Second, in the case of product-attached services on own and

third-party products, a manufacturer decides to offer services also to competing manufacturers' products for example in case the manufacturer holds the majority of the customer's products and plans to eventually swap the competitors' products to their own. Third, operations services on own products are the ones that support the operations related to the product provided by the manufacturer. Finally, vendor-agnostic operations services require more consultative-based sales approach as in this case the manufacturer tries to achieve the operational efficiencies of the whole customer's system including not only the manufacturer's but also other suppliers' products.

On the other hand, Witell and Löfgren (2013) broadly discussed the matter of companies transiting from offering services for free to charging for those services when realizing that services should not be only the cost generating part of the offering. Thus, they divide the services into two categories, services provided for free as part of the product sale, and chargeable services that are billed separately.

Baines and Lightfoot (2013) propose a classification of services based on the final output of a service. They divide services into the base, intermediate, and advanced. Base services show production competence, and their outcome is focused on product provision. Inter-mediate services are focused on maintaining the product's condition, whereas advanced services show the ability to manage the product's performance and are focused on delivering capability.

The last classification provided in the table belongs to Cusumano et al. (2015), who classify services as the ones that complement and replace products. Complementary services include smoothing and adapting services, and product replacing services are called substituting services. Smoothing services are the ones that make the product's sale flawless while they do not alter the product's functionality. Adapting services aim to expand the functionality of the product or aid the customer to explore new uses or to adjust the product to unconventional conditions. In contrast, substituting services challenge the view that services always complement products. Cusumano et al. (2015) argue that in the case of substituting services, a service replaces the purchase of the product.

As it can be noticed, even though different classifications are build based on a different logic, they still contain some common elements. One of the most striking similarities in the fact is that, usually, the second or third category in each of the classifications tends to show a more advanced approach to services and servitization. On the other note, as stated by Raddats and Kowalkowski (2014), manufacturers often offer a vast pool of services that do not fall exactly into one category of any given typology or combine various paths of service expansion. Furthermore, ever-increasing market competitiveness

and complexity, as well as more comprehensive customer needs, force product-manufacturing firms to develop increasingly more compelling offerings, and thus extend their business along product-service continuum (Oliva and Kallenberg, 2003; Gebauer, 2008; Raddats and Kowalkowski, 2014; Nudurupati et al., 2016). Nevertheless, to move along the continuum a manufacturer should seek an organized way to achieve the expected progress, i.e., follow a specific service strategy. According to Raddats and Kowalkowski (2014), service strategy is a method of defining service offering categories that a manufacturer will put forward in a certain market to achieve differentiation.

Unlike Oliva and Kallenberg (2003), Raddats and Kowalkowski (2014), instead of taking PS continuum and gradual transition through different stages, took more pragmatic approach by adapting Raddats and Easingwood's (2010) framework of services categories to build service strategy theory. Also, Oliva and Kallenberg focused their work on servitization strategy of the capital equipment manufacturers whereas the study of Raddats and Kowalkowski (2014) aimed to deliver a service strategy typology that would suit 'a wide cross-section of manufacturers'. Furthermore, according to study of Raddats and Kowalkowski (2014), manufacturers stepping into service business expand their service portfolio rather than move from offering one category of services to the another.

As a result, Raddats and Kowalkowski (2014) identified three categories of service offerings which are product-attached services, operations services on own products, and vendor independent operations services. They decided to combine, proposed by Raddats and Easingwood (2010), product-attached services on own products and product-attached services on own and third-party products into one category as it is very likely that on customer's request the manufacturer would also provide the service to the products of some other OEMs. Moreover, using those categories Raddats and Kowalkowski (2014) specified three generic service strategies, posing also as different types/groups of manufacturers and their attitudes towards servitization: service doubters, service pragmatist, and service enthusiasts. Combining the categories of service offerings and the generic strategies, Raddats and Kowalkowski (2014) created the service strategy typology as shown in Figure 6.

Category of service offerings	Service strategy		
	Service Doubters	Service Pragmatists	Service Enthusiasts
Vendor independent operations services	Low	Low	High
Operations services on own products	Low	Low	High
Product-attached services	Low	High	High

**Figure 6.** Service strategy typology (Raddats and Kowalkowski, 2014).

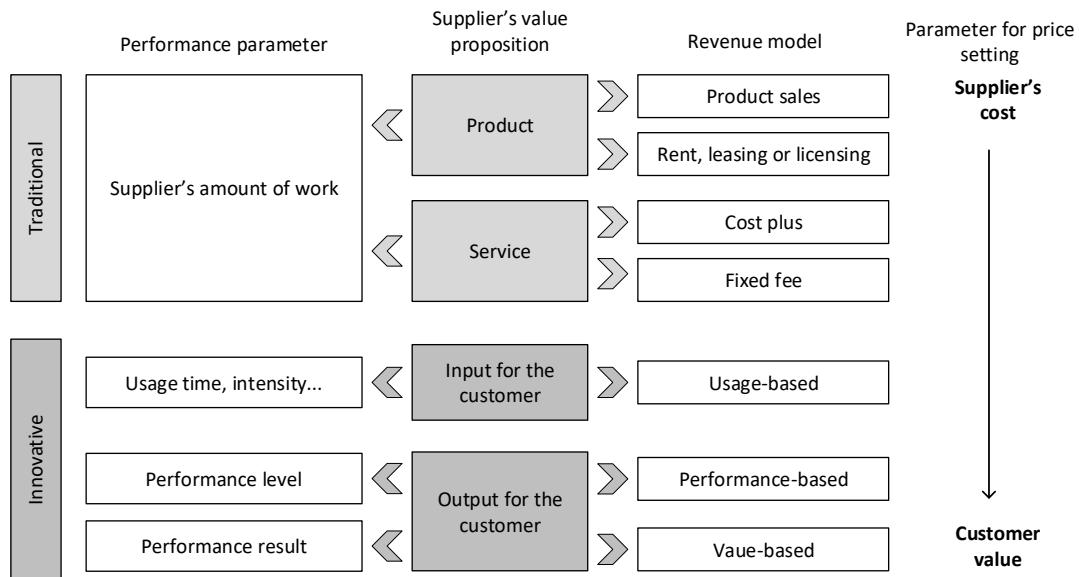
'Low/High' in each square in Figure 6, indicates how likely a company following a particular strategy would include a particular category of the offering in their portfolio. Service doubters are the companies for which nonservice factors are source of differentiation and thus service opportunities may be limited for them as they do not aim to undergo servitization. Service pragmatists represent a group that uses services to differentiate their products and can be perceived as having rather traditional product-centric view on the business. Service pragmatists are also likely to provide the services to other OEM's product but to a limited extent. Lastly, service enthusiasts see services not only as a product differentiating factor but also a growth possibility. Thus, service enthusiasts are likely to offer each of the service offering categories not focusing solely on one of the categories.

## 2.3 Defining product as a service

### 2.3.1 Revenue models of servitized offerings

Solution selling differs from selling products as the final configuration of the solution differs due to the varying amounts of product/service elements represented in the value proposition (Tukker, 2004). Also, according to Bonnemeier et al. (2010), selling servitized solutions usually leads to longer supplier-customer relationships and, thus, that requires adapting pricing practices not only to the duration but also to the intensity of the relationship.

Bonnemeier et al. (2010) have proposed a framework, illustrated in Figure 7, representing traditional and innovative revenue models that could suit integrated (servitized) offerings. They argue that the main difference between the traditional and the innovative revenue models, related to solution offerings, lies in pricing measures taken while setting the price. In case of traditional revenue models, the value proposition is based on conventional product or service provided by the supplier while, in more innovative revenue models, the focus is directed on the actual input or output of the customer, i.e., the value-added.



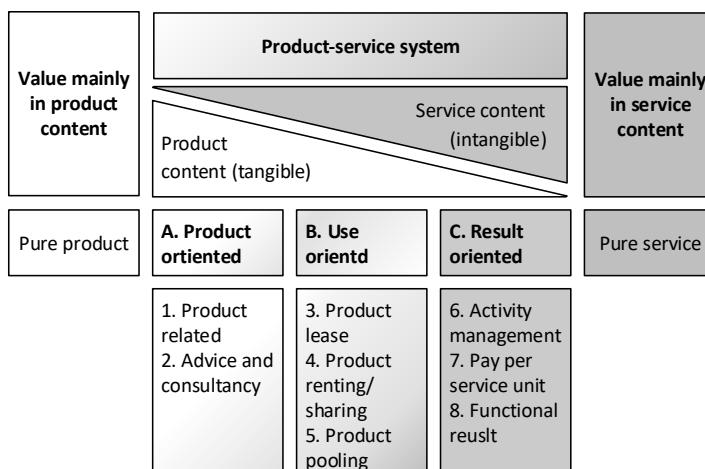
**Figure 7.** Traditional and innovative revenue models (Bonnemeier et al., 2010).

Considering product sales only, Bonnemeier et al. (2010) divide traditional revenue models into 'product sales' and 'rent, leasing or licensing model'. Product sales revenue model simply stands for revenue being generated through property transfer whereas rent, leasing or licensing revenue model is used when only the possession rights are transferred. In case service component is included within traditional offering, the revenue models include 'cost-plus model' and 'fixed-fee model'. Cost-plus model implies that a supplier charges for specific amount of work and adds a mark-up to secure profitability. In case of the fixed-fee model, a supplier and a customer agree on a certain amount of money to be paid regardless of whether the actual service is fully used by the customer or not.

As in the case of traditional revenue models the base for price setting is the supplier's amount of work, in the case of innovative revenue models prices are not related to variables internal to supplier but rather to the solution's performance. Thus, the innovative revenue models are divided into 'usage-based', 'performance-based', and 'value-based'.

First, the usage-based model reflects a situation when a customer pays for utilization of the solution within the certain time period and the supplier's solution contributes as an input within customer operations. Second, in the performance-based model a certain level of performance is promised to the customer and supplier is paid a pre-arranged fee for keeping the service promise or can be penalized for underperforming. Finally, in the case of the value-based model, the supplier aims to improve customer's internal processes and benefits from the value that the supplier generated for the customer. The costs that the supplier bears are also important when the innovative revenue models are considered but they are not the only price-setting parameter anymore.

While Bonnemeier et al. (2010) distinguish between traditional and innovative revenue models, Tukker (2004) proposes eight archetypical PSS business models, some of which are closely related to the revenue models described above. Tukker (2004) gathers those eight business models under three main categories of PSS, and pictures them using the PS continuum model, similar to the one presented by Oliva and Kallenberg (2003). Figure 8 illustrates the PSS business models proposed by Tukker (2004).



**Figure 8.** Eight PSS business models on PS continuum (Tukker, 2004).

As the figure above shows, the upper part of the figure is a representation of PS continuum while in the bottom part Tukker (2004) divides product-service offerings into three broad categories. First, product-oriented offerings, where the supplier focuses on the product sale and services, are provided to support product business; those services are usually transactional and standardized. In this category, there are two PSS types distinguished: (1) product-related services, where the supplier not only sells the product but also provides services required over the product's life time, and (2) advice and consultancy in which case the supplier apart from the product provides the customer with the advices related to the most efficient use of the product.

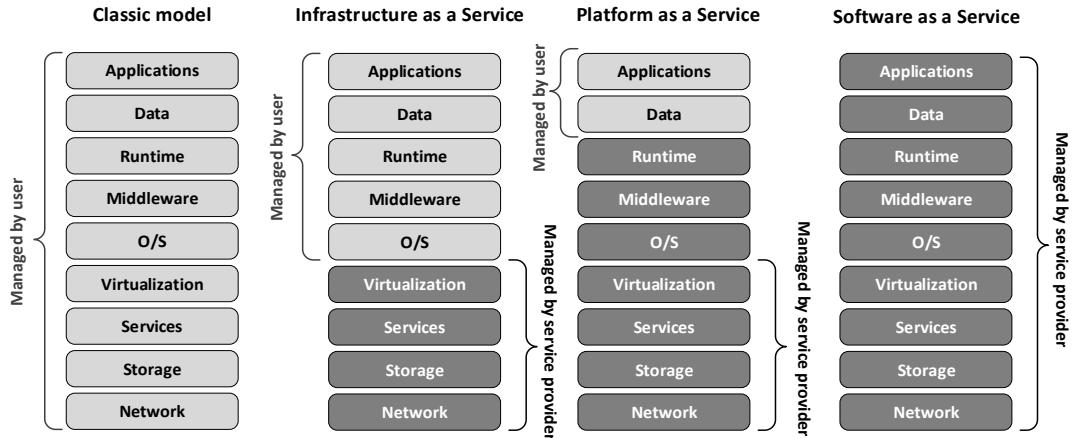
Second, use-oriented offerings aim to achieve the availability of the entire system, and the use of the product is sold accompanied with value-adding services while the product stays under a supplier's ownership. The three types of business models included in this category are product lease, product renting or product sharing, and product pooling. When product is leased, the customer pays regular fee and has unlimited and individual access to the product. Then, in the case of product renting or product sharing the customer pays for the use of the product but does not have unlimited and individual access to the product as it is sequentially used by different customers. Finally, product pooling is similar to renting or sharing with the difference being the simultaneous use of the product by various customers.

Last, result-oriented represents a set of offerings in which a supplier and a customer agree on a certain result to be achieved, the supplier sells its competency and there is no pre-determined product involved. In this category there are three archetypes involved which are activity management, pay per service unit, and functional result. First, in case of activity management, the client outsources certain activities and as the outsourcing contracts usually include performance indicators this archetype can be grouped under result-oriented category. Second, in pay per service unit model the client pays for the output of the product but not for the product and other related activities. Finally, in case of functional result, supplier and customer agree on the result to be delivered and the supplier has the freedom of how to deliver the promised result.

Bonnemeier et al. (2010) focus on revenue models which greatly simplifies the understanding of different revenue models applied for any kind of offering. On the other hand, Tukker (2004) connects business and revenue models and, hence, also encompasses the change of ownership and responsibilities of the customer and the provider while progressing across the servitization continuum.

### **2.3.2 XaaS**

For several years researchers have been proposing various models for defining anything as a service (aaS) concepts, and these attempts included discussions on software, processes, data, information and many others as a service (Duan et al., 2015). The trend has been especially strong in information technology (IT) industry that in the recent years has focused on cloud computing solutions that aim to deliver everything as a service (XaaS) (Banerjee et al. 2011). Many examples of XaaS models have evolved in the IT industry, and these models usually differ based on the division of roles of the user and the provider of the offering that the use of the offering implies. Figure 9 shows the basic division of XaaS models in IT industry.



**Figure 9.** XaaS models (Sekhar and Rao, 2014).

Not that long ago, the only possibility of using the software was buying a license or a copy of the software which would then be installed on the company's computers. The most left stack in Figure 9 depicts such a model and is called a classic model. The classic model implies that the customer company needs to possess many resources and capabilities in-house as the customer is fully responsible for managing and maintaining the software and all related processes (Goran et al., 2014). This kind of model entails significant upfront investments as well as high operational costs. The company has to firstly invest in the entire hardware and software infrastructure and then create capabilities within the company to integrate and run the software over time, which requires the employment of a number of skilled IT professionals (Bibi et al., 2012). Then the three other models, represented in Figure 9, imply a gradual decrease in the customer's responsibility as well as upfront investment into assets and capabilities.

First, infrastructure as a service model allows for outsourcing part of the responsibility for managing and maintaining the software on the software provider. Typically, in this model, hardware, data storage, servers, and other network components are provided and managed by the provider. The advantage of the infrastructure as a service model is that the customer company does not need to invest in its physical servers or any data center infrastructure. Infrastructure as a service allows the customer to adjust to the use of a provider's services to their current needs while being billed only for used resources flexibly. However, customers remain largely responsible for managing and maintaining their specific resources making sure that their companies' technologies are secure, and all run correctly. Furthermore, customers develop the entire code using their own enterprise platform and available tools.

Second, the platform as a service model allows for offloading even more responsibilities of software development on the service provider. In this model, the service provider offers and manages a platform and environment for building applications and services over the internet while the customer can use the ready-made tools while building applications (Goyal, 2013). The customer does not have to own any physical infrastructure or employ specialists to manage it. The service provider also takes responsibility for security and software updates, while developers may focus on more creative tasks. This approach significantly reduces the work of developers who can use ready parts of code while building their software, hence saves time and money. Furthermore, platform as a service provider can also offer consultation and assisting services starting from the conception of ideas, the creation of applications to application deployment (Goyal, 2013). As this solution is also highly scalable, customers either pay based on pay as you go or subscription model, which allows the customer to adjust its costs based on actual needs (Goran et al., 2014).

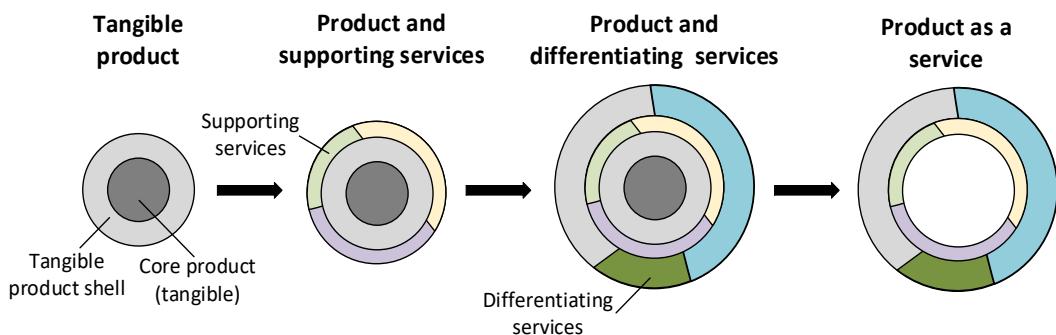
Last, there is the software as a service model, which is by far the most popular and advanced cloud-based service model and often referred to as SaaS (Bibi et al., 2012). When the SaaS model is utilized, the service provider takes over all the responsibilities related to building, managing, securing, and maintaining the software. At the same time, the customer can access and use applications over the internet (Goyal, 2013). The customer does not even have to download nor install anything locally. Hence, customers, instead of investing in all the required resources to build, run, and manage applications in-house, can use applications offered by SaaS providers. As in the case of infrastructure as a service and platform as a service, the customer pays for access to and use of services over time, and the monthly subscription fee is a common billing model (Goyal, 2013). Thus, SaaS does not require that the user develops new capabilities, but the user company can focus on its core competencies while sourcing the solutions from SaaS providers. SaaS also enables the customer to control their costs better and spread the software related expenses over time while being able to utilize the ready software for the benefit of the company (Goyal, 2013). Moreover, if the users do not need to use a particular application anymore or want to change to other services, they can simply stop using it, and the service provider will disable their account (Goran et al., 2014).

### **2.3.3 Product as s service**

The popularity of XaaS models in the IT industry, and the new possibilities unveiled by restructuring ownership of the software, shifting of responsibilities, and focus on outputs resulted in many manufacturing companies becoming interested in offering outcomes

rather than tangible products (Bibi et al., 2012). The already existent trend of servitization in manufacturing (Baines et al., 2009) and the XaaS movement in IT industry have inspired manufacturers to also start developing as-a-service offerings (Classen et al., 2019). However, as noted by Classen et al. (2019), manufacturing companies usually operate in more complex environments which are likely to influence their path towards XaaS offerings.

One of the commonly used denotations of XaaS models in manufacturing is the product as a service model. The term product-as-a-service (PaaS) is discussed in non-academic publications relatively often while most of the academic sources do not discuss the term in much detail. Nonetheless, product-as-a-service model appears mainly in circular economy context (e.g., Lacy and Rutqvist, 2016, p. 99-114) as a circular business model in which products are provided through lease or pay-for-use agreements and the provider ensures durability and upgradability while seeking benefits through long-term use, reuse and sharing. Then, in engineering and manufacturing domains, products as a service appears in context of servitization as the highest degree of an extended product offering that belongs to the category of PSS (Ducq et al., 2012) as Figure 10 illustrates.



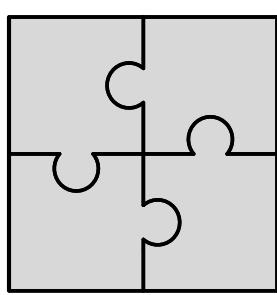
**Figure 10.** *Product as a service representation by Ducq et al. (2012).*

Figure 10 resembles the product-service continuum with the domination of products on the product side of the PS continuum and service orientation on the service side of the continuum (Rathmell, 1966; Oliva and Kallenberg, 2003). PaaS offering, as presented in Figure 10, emphasizes the intangible qualities of the offering as the tangible product remains in the ownership of a manufacturer, and revenues come uniquely from services (Ducq et al., 2012). Following that, Classen et al. (2019) state that “as a service” offerings in manufacturing stem from renting and leasing business models, and they define a PaaS offering as a single service offering comprised of the bundles of products and services. They also continue that, in case of such a service offering, customers may use products while the suppliers ensure the product’s functionality. Otherwise, the notion of the PaaS

offering is barely mentioned. When this notion appears, it usually applies to those manufacturers who utilized their product sale potential and could expand their portfolio by offering their standard products as a service, i.e., manufacturers can ‘sell’ their products using service revenue models (Cusumano et al., 2015). Rolls Royce’s “power by the hour” service is one of the most commonly used examples of a product sold as a service.

Despite the scarce academic discussion on PaaS offerings, the existence and the meaning of the concept are fairly well acknowledged. It is rather the matter of naming of concepts and phenomena within the servitization domain. It is also notable that the PaaS offering in many ways resembles the software industry SaaS model, and hence, the product-as-a-service offerings constitute the group of most servitized manufacturing solutions. Figure 11 aims to define main qualities of product-as-a-service offerings.

### Product as a service



#### Basic characteristics of the offering:

- Most advanced forms of PPS offerings  
(e.g., Mathieu, 2001a; Oliva and Kallenberg, 2003; Baines and Lightfoot, 2013)
- Intangible, heterogenous, perishable, inseparable... (e.g., Edvardsson et al., 2005)
- Focus on use, functionality and performance rather than a tangible product  
(e.g., Tukker, 2004; Classen et al., 2019)
- Responsibility and costs of product remain with service provider (Sekhar and Rao, 2014)

**Service strategy:** service enthusiasts (Raddats and Kowalkowski, 2014)

**Applicable business models:** use and result oriented (Tukker, 2004)

**Revenue models:** innovative (Bonnemeier et al., 2010)

**Drivers:** financial, strategic, marketing (Baines et al., 2009)

**Figure 11.** Product as a service (PaaS) definition.

As Figure 11 presents, PaaS entails the group of most advanced forms of product-service offerings. Those offerings include, for example, the advanced services (Baines and Lightfoot, 2013) focused on customer processes (Mathieu, 2001a), enhancing supplier-customer relationships and manufacturer taking over some of the customer’s operations (Oliva and Kallenberg, 2003). PaaS offerings bring high level of intangibility and heterogeneity (Edvardsson et al., 2005) as use, achieved functionality and performance may differ among customers served by the same manufacturer. Moreover, while a PaaS offering is promoted by promise of certain benefits, functionality or performance (Classen et al., 2019), there might be no pre-determined product involved (Tukker, 2004). Similar, to SaaS model (Sekhar and Rao, 2014), with PaaS offering the costs of product ownership and responsibility for product management during its lifecycle remain with the manufacturer (Lacy and Rutqvist, 2016).

Hence, offering product as a service requires the strategy of a service enthusiast that expands its service portfolio to not only to differentiate its product but to grow its business (Raddats and Kowalkowski, 2014). Furthermore, not all the business models are appli-

cable for PaaS offerings as mechanisms of value creation, delivery, and capture significantly differ from the mechanisms relevant to most product or service business models. However, use- and performance-based business models (Tukker, 2004) employing innovative revenue models (Bonnemeier et al., 2015) enable building attractive PaaS offerings. While manufacturers are motivated to expand towards PaaS offerings attracted by strategic, marketing, and financial benefits (Baines et al., 2009), customers have similar reasons to pick this kind of offerings. Shifting of the costs and responsibilities for product on the manufacturer allows the customer to slim down their capital expenses making the organization look less capital extensive and enable various maneuvers based on more operational cost structure. Furthermore, customers can adapt extensiveness of the offering to their own customer demand, and hence they are more flexible and less likely to be impacted by changes in economic cycles.

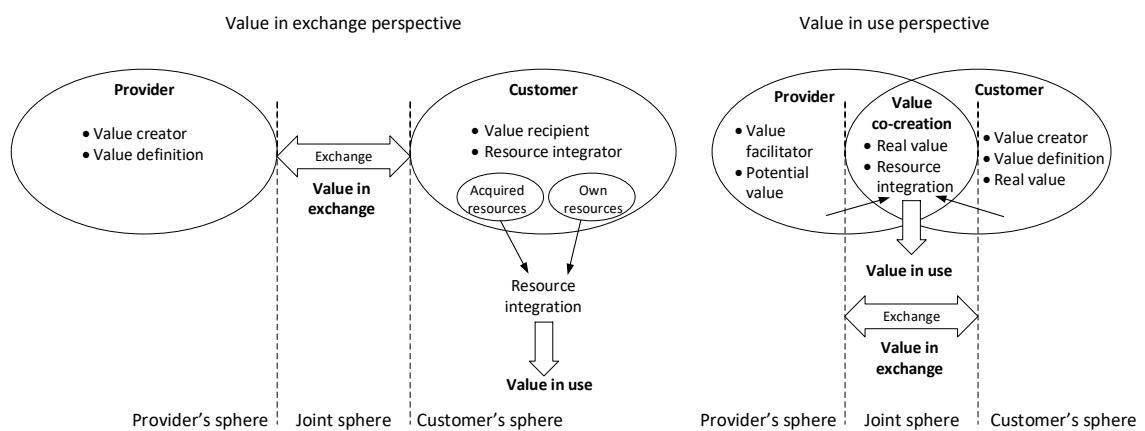
However, to achieve the benefits of inclusion of PaaS offerings in the business portfolio, manufacturers must also convince their customers of the superiority of their offerings. The superiority of the manufacturer's offering can be discussed in terms of the customer value the offering provides to customer. Hence, customer value and communication of the customer value are discussed next.

### 3. ANALYZING AND COMMUNICATING CUSTOMER VALUE

#### 3.1 Customer value in business markets

##### 3.1.1 From value in exchange to value in use

Value is a concept that has been drawing the attention of philosophers and scholars since ancient times. Already Aristotle brought up the famous value paradox while differentiating between two manners in which a product can be used as, for example, a piece of clothing can be used for wearing or for exchange (Eggert et al., 2018). Hence, he initiated the discussion on the value in exchange and value in use which has continued since. Later there has also emerged discussion on value creation and co-creation leading to the division of the value in exchange perspective and value in use perspective into two main logics, one based on goods and the other based on service (Vargo and Lusch, 2004a; 2008a; Grönroos, 2008). Figure 12 presents the most cotemporary view on difference between value in exchange and value in use perspectives.



**Figure 12.** Value in exchange vs value in use (Based on Grönroos and Voima, 2013 and Eggert et al., 2018).

As Figure 12 illustrates, within value in exchange perspective the provider company is the one that defines and creates value through the manufacturing and distribution of products and services that are embedded with value (Vargo and Lusch, 2004; Eggert et al., 2018). This value can be then exchanged which happens during a brief encounter of the provider and the customer. Also, according to the value in exchange perspective value in use is created in the customer's sphere only after the exchange process through customer integrating exchange elements and own resources (Grönroos and Voima,

2013) and, thus, the customer is the only one capturing the value created in the use situation.

On the other hand, within value in use perspective value cannot be just delivered to the customer (Vargo and Lusch, 2004). Value is perceived and determined by the customer and the provider does not create value but proposes potential value and facilitates the value creation process (Grönroos and Voima, 2013; Eggert et al., 2018). Through the integration of provider's and customer's resources, the value is co-created in the joint sphere and, hence, both the provider and the customer are accountable for value creation, and both have the right to capture part of that value (Grönroos and Voima, 2013; Eggert et al., 2018).

Similarly to perspectives on value, how and by whom value is created has undergone changes, also the customer value definitions have evolved over time (Khalifa, 2004; Lindgreen et al., 2012; Eggert et al., 2018). This evolving and subjective nature of the value concept may have resulted in difficulties in understanding the concept of customer value (Jaworski and Kohli, 1993) while, according to Woodruff (1997), creation of successful strategies based on customer value requires that the concept of customer value is firstly well understood.

### **3.1.2 Defining customer value**

The motivation to study the concept of customer value has been explicitly stated by many scholars. Holbrook (1994, p. 22) stated that customer value is the fundamental basis for all marketing activities. Furthermore, Keith (1960) said that the long-term success of the company depends on the providing customer the highest value for the price paid while Huber et al. (2001) and Kotler & Keller (2008) generalized that the creation of superior customer value has been claimed to be a key to business success. Kumar and Reinartz (2016) added that the aim of any enduring business is, first, to create value for customers, and, second, draw some part of this customer value as the profit for the company. Summarizing, customer value has become the indispensable concept in any area of business (Lindgreen et al., 2012) which has led many companies to become increasingly interested in value-based strategies, and thus focused on understanding how to create, communicate and deliver value to differentiate from competitors and gain competitive advantage (Woodruff, 1997).

There can be three subsequent stages of how the definitions of customer value have evolved (Eggert et al., 2018):

- Stage 1: early customer value definitions
- Stage 2: broadening the scope of customer value definitions
- Stage 3: increased depth of understanding customer value.

In the first stage, scholars tried to transposition existing consumer definitions of customer value into the business context (Eggert et al., 2018). These definitions built on the trade-offs between what consumers get in exchange for what they give. When translated into business context, the get and give elements are related to the value embedded in the goods. Hence, also reflecting the value in exchange perspective. Scholars used various terms while defining customer value such as utilities, perceived quality (Zeithaml, 1988), customer's willingness to pay (Porter, 1985, p. 3), monetary units (Anderson et al., 1993), worth, benefits, and quality (Woodruff, 1997), economic and social gains (Gassenheimer et al., 1998) or benefits and costs (Ulaga and Chacour, 2001).

In the second stage, the customer value definition gains broader spectrum while the most goods-dominant view on customer value is complemented with the value potential stemming from business relationships (Eggert et al., 2018). In this view, the customer value is the trade-off between benefits and sacrifices gained over the provider-customer relationship (Ravald and Grönroos, 1996; Ulaga and Eggert, 2006). The relationship between the provider and the customer gained the facilitating role in the exchange of goods and services. Hence, it can be implied that the second stage is a transitional perspective between value in exchange and value in use paradigms.

Finally, in the third and most contemporary stage, value definitions reflect the most in-depth understanding of customer value. Unlike in the first two stages, reflecting the view on the value being created by the supplier, the last stage recognizes the role of customers in the value creation process clearly showing the influence of SD-logic and moving from the value in exchange to value in use perspective (Grönroos, 2008). Definitions of customer value in this stage point at value co-creation within provider-customer spectrum as well as recognize wider network of actors co-creating value (Frow & Payne, 2011). Moreover, value is not seen any longer as embedded in goods but as the effect of collaboration between and integration of resources of the parties involved (Eggert et al., 2018). Table 4 gathers several examples of customer value definitions grouped by the three stages as proposed by Eggert et al. (2018).

**Table 4.** Customer value definitions.

<b>Stage</b>	<b>Definition of customer value</b>	<b>Author</b>
Stage 1	"... overall assessment of the utility of a product based on a perception of what is received and what is given."	Zeithaml, 1988
	"...the perceived worth in monetary units set of economic, technical, service and social benefits received by a customer firm in exchange for the price paid for a product offering, taking into consideration the available alternative suppliers' offerings and process."	Anderson et al., 1993
	"A value judgement is the customer's assessment of the value that has been created for them by a supplier given the trade-offs between all relevant benefits and sacrifices in a specific-use situation."	Ulaga and Chacour, 2001
	"...the sum of tangible and intangible benefits and costs."	Kotler and Keller, 2016, p. 33
Stage 2	"... a business customer's overall assessment of the utility of a relationship with a vendor based on perceptions of benefits received and sacrifices made."	Menon et al., 2005
	"Customer value in B2B contexts is defined as the customer's perceived trade-off between benefits and sacrifices within relationships."	Blocker, 2011
Stage 3	"The customer is always a co-creator of value. There is no value until an offering is used - experience and perception are essential to value determination."	Lusch and Vargo, 2007
	"...we define value-in-use in terms of the customer's goals, purposes or objectives, it arises from a variety of resources within the customer's network, or the system within which the customer resides, including not just those directly provided by the provider and the customer but also those provided by other actors in a configuration which the provider-customer relationship may influence."	Macdonald et al., 2011

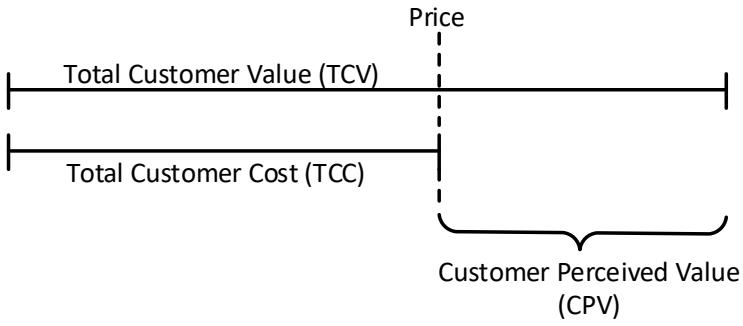
The definitions gathered in Table 4 well represent each of the stages, and while comparing between definitions from different stages, the difference in focus of the scholars is evident. The most significant differences between the early definitions and the more contemporary definitions of customer value are the emphasis on value in use and the recognition of the customers' and broader network's roles in the value co-creation process. Nevertheless, it does not mean that the tradeoff between the give and get elements does not have any more place in understanding the concept of value as value co-creation requires that knowledge, various skills, competencies, and resources are being exchanged and integrated within the provider-customer network (Cambra-Fierro et al., 2017), and ex-change implies that something is given in order to receive something. Hence, to encompass both the early and the contemporary views on the customer value, it can be said that:

*Customer value of an offering is a sum of tangible and intangible benefits and costs a customer perceives while creating and co-creating value within specific use situation.*

The customer value definition, as presented above, points that there are various benefits and costs customers may perceive while integrating their resources to co-create value and that the value is created in use which is reflected by the specific use situation. Furthermore, value perception may depend on the specific use situation. Different customers might decide for the same offering to achieve different goals (Woodruff and Gardial, 1996) or circumstances, i.e., environment and person/company variables, (Fennell, 1978; Grönroos and Voima, 2013) in which the offering is used alter the value perception. Ulaga and Chacour (2001) linked specific use situation to different customer segments that show differences in type of offering's criteria to be assessed, relative significance of each criterion and pool of competitors to be compared to. Furthermore, if the use situation changes, the connections between specific offerings' attributes, purpose, and consequences of its purchase, as well as goals to be achieved change too (Woodruff, 1997). This also means that different use situations may require different sets of knowledge, skills or resources to be integrated within the value co-creation process which in turn may require the inclusion of different actors, hence influencing the net value the customers perceive (Leroi-Werelds et al., 2017).

### **3.1.3 Customer perceived value**

All the benefits a customer receives can be seen as total customer value while all the costs born by the customer constitute total customer cost (Lylly-Yrjänäinen et al., 2019). Total customer value, according to Anderson et al. (1993), consists of economic, technical, service and social benefits. However, those benefits do not come without different kinds of sacrifices, and thus total customer costs can be also divided into sub-elements such as purchase cost, usage costs and disposal costs (Lylly-Yrjänäinen et al., 2019). Thus, the benefits and costs are heterogeneous and can be expressed in monetary terms, as cost savings or increased profits, or non-monetarily as decreased risk or increased trust (Grönroos, 2011). Furthermore, the sum of total customer value and total customer costs or, differently said, the difference between the TCV and TCC, creates the customer perceived value (Day, 1999; Kotler and Keller, 2008; Lylly-Yrjänäinen et al., 2019). Figure 13 illustrates the concept of customer perceived value.



**Figure 13.** Customer value framework (Lylly-Yrjänäinen et al., 2019).

As the figure above shows, price marks total customer costs that then based on the total customer value allows calculating or at least estimating the customer perceived value. However, price is here not understood as the purchase price a customer pays to obtain the offering but rather the total tangible and intangible costs to the customer, expressed in monetary value. Kumar and Reinartz (2016) defined customer perceived value as the customer's net valuation of perceived benefits gained from an offering which costs they are willing to bear to satisfy their needs. Moreover, they also stated that both, benefits and costs, are created through the offering's attributes; however, customer's perception regarding the offering might not comprehend all the attributes objectively and various customers may perceive the importance of various attributes differently. Nevertheless, for customer to perceive the positive value of the offering the perceived benefits must at least outweigh all the perceived costs (Kumar and Reinartz, 2016). The discussion regarding what the perceived customer value is, can be summarized as a concept build out of three elements which are all the perceived benefits of the offering minus the purchase price and all the cost incurred during offering's life cycle (Lindgreen et al., 2012).

Furthermore, customers are likely not only to investigate give and get elements of an offering but also compare different offerings available in the market. Thus, customers try to find the offering that brings the highest perceived value or utility (Kumar and Reinartz, 2016). According to Anderson and Narus (1998) a market offering has two main determinants, its value and its price, and changing the price does not affect the value of the offering but rather the customer's incentive to buy the offering. Even in case no comparable offering exists in the market, customers still may choose to make a product themselves or think of another competitive alternative to satisfy their needs. Thus, Anderson and Narus (1998) proposed an equation that illustrates the comparable trade-offs a customer considers while choosing between various market offerings:

$$(Value_S - Price_S) > (Value_a - Price_a)$$

$Value_S$  and  $Price_S$  stand for the value and price of the supplier's offering whereas  $Value_a$  and  $Price_a$  represent the value and the price of the next best alternative. The difference between the value and the price represents customer's incentive to purchase the offering. In other words, the customer will purchase the offering that provides with the highest customer perceived value as compared to alternative offerings in the market.

Nevertheless, as already pointed in the customer value definition defined in this thesis, the consideration of the highest customer perceived value should not be solely based on the temporary value and purchase price of the offering but should take into account the use situation, thus all the benefits and costs to come over the offering's lifetime. Also, Kotler and Keller (2016, pp. 150-153) stated that, even though the customer value can be seen as the difference between give and get elements, customers do not always pick the offering that shows the relatively higher perceived customer value. They say that buyers in the customer company may have their own agenda and thus, the buyer will always choose the lowest price offering, the offering that increases their personal benefits or the offering that comes from the trusted partner no matter what the value offered is. Hence, to be able to better estimate customer perceived value, various value elements and methods of assessing customer value should be investigated. Then, the method that allows for assessing the life-time value of the offering needs to be chosen or created. Moreover, the elements that might be driving the customers' purchase decisions, other than perceived customer value, need to be factored-in as those elements are likely to influence the final customers' purchase decisions.

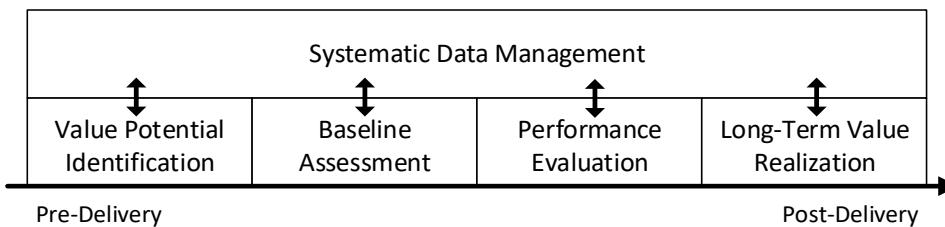
## 3.2 Customer value assessment

### 3.2.1 Customer value assessment

Already in ancient Rome Publilius Syrus saying '*Everything is worth what its purchaser will pay for it*' raised the importance of the customer value assessment in making a deal. Nevertheless, even business customers often cannot accurately understand and, thus, also estimate what the certain offering could be worth for them. Customer value is a complex phenomenon and, thus, it might be challenging also for a supplier to measure how a specific customer perceives the value of an offering at specific point in time (Smith and Colgate, 2007). Despite those challenges, customers want to be increasingly assured of the results delivered by suppliers. Hence, to meet that customers' requirement of educated value proposals, suppliers have to perform value assessment (Anderson et al., 1993).

Value assessment is the process of evaluation and monetary quantification of the impact the supplier's offering has on the customer's costs and returns and then communication of value created (Anderson et al., 2009; Keränen & Jalkala, 2014). Except from providing customers with more accurate perceived value estimations, value assessment allows for gaining superior knowledge about the market and better understanding of the customer's business to both the customer and the supplier (Anderson et al., 2009).

Many tools and methods for value assessment exist such as focus groups, internal engineering, field value-in-use assessment methods (Anderson et al., 1993), total cost of ownership method or life-cycle costing method (Keränen and Jalkala, 2013). However, most of those methods are rather product-oriented or focus on the costs only whereas today's B2B offerings are more complex. Value tends to unfold over the time and is delivered not only through products and services but also through supplier-customer resource sharing and integration, enabling the customer to reach its business goal (Keränen and Jalkala, 2013). Hence, Keränen and Jalkala (2013) examined the key processes and activities involved in customer value assessment in B2B markets. Based on qualitative interviews with several managers they identified activities associated with customer value assessment shown in Figure 14.



**Figure 14.** Customer value assessment process (Keränen and Jalkala, 2013).

The first key process, presented in Figure 14, is value potential identification which deals with understanding of how a supplier can add value to the customer's business. This process focuses on explicit identification of a customer's needs and understanding customer processes to be able to understand the financial impacts for customer business as supplier eventually adds value to the customer's business through bringing cost reductions or potential for increased revenues. Baseline assessment is the second key process in customer value assessment and focuses on assessing the customer current state prior to implementation of supplier's offering. This assessment serves then as reference point and enables for benchmarking of the before and after offering's implementation situations pointing at improvements achieved and possibly also at the goals to be still achieved.

During the third key process, performance evaluation, the actual impact of the supplier's offering on customer's business is evaluated. Oftentimes trial runs are conducted at the

customer to enable specifying the value impact on the customer's performance. Trial runs enhance the supplier's own understanding on the value that is delivered by its offering within different applications or business setups. The fourth key process in value assessment is long-term value realization that aims to verify that customers received the value promised. The verification process might be challenging as the offering's value-in-use accumulates over time and sometimes even increases over time as customers learn to use the offering more efficiently. Thus, verification of the value realized and, in general, value assessment should be an ongoing process that is also well-documented. The final, fifth process is the systematic data management that is essential to manage all the other processes included in the value assessment. The final process includes collection of relevant customer data and sharing the data across different organizational functions.

As Figure 14 shows, four of the processes seem to follow one after another while one of them is more of a supportive process utilized in each of the phases. However, Keränen and Jalkala (2013) point out that those processes do not necessarily follow a linear pattern but may overlap or be iterative prior and after the offering's implementation, and hence implies that customer value assessment should be an iterative and on-going process.

The ultimate value potential that customers might achieve might be still difficult to assess as value often unfolds over time and it is dependent on both customers' and suppliers' inputs (Keränen, 2014). Value potential estimations might be especially difficult if supplier's offering is complex or/and innovative. In the case of a complex offering there might be almost too many variables to consider when trying to measure customer value while in the case of an innovative solution the challenge lays in learning what the real impact of the solution that has not been implemented before is. Thus, having a more comprehensive understanding of potential value elements an offering consists of is of utmost importance to proceed in the successful customer value assessment.

### **3.2.2 Value elements**

According to Anderson et al. (2009, p. 347), to be able to truly asses the value the offering has for a particular customer, a supplier must not only evaluate the fit between the supplier's skills and the given market opportunity but also build a thorough understanding of their offering's value in the specific use situation. Anything that affects the benefits or costs of an offering in a customer's business is seen as a value element; value elements may have varying nature and level of tangibility (Anderson and Narus, 1998). Unambiguous evaluation of all the value elements might be challenging as some of the value

elements are easy to be expressed in monetary terms as they are clearly linked to customer's cost savings or revenue generation, while others, being more strategic in nature, are difficult to quantify (Anderson et al. 2009, p. 347).

Anderson et al. (2009, p. 348) presented the typology of customer benefits. However, while assessing customer value, both benefits and costs should be evaluated in the same way as the costs assumed by the customer also do not have to be purely economic. Thus, the framework of the typology of customer benefits is here modified and named as the typology of the customer value elements as presented in Figure 15.

	High	Economic, tangible value elements	Economic, intangible value elements
Economic value elements	High	Focus on comparing with current alternatives available to customer – show the superior price to performance.	Burden of proof is on supplier. Typical approaches: <ul style="list-style-type: none"><li>• benchmark studies</li><li>• pilot tests</li><li>• guarantees</li></ul> to offset customer risk.
Non-economic value elements	High	Non-economic, tangible value elements  Focus on building market reputation and image.	Non-economic, intangible value elements  Not a viable option for acquiring customers, but the glue that holds buyer-seller relationships together over time.
	High      Supplier's ability to communicate the value of the offering to the customer      Low		

**Figure 15.** *Typology of customer value elements (Modified from Anderson et al. 2009, p. 348).*

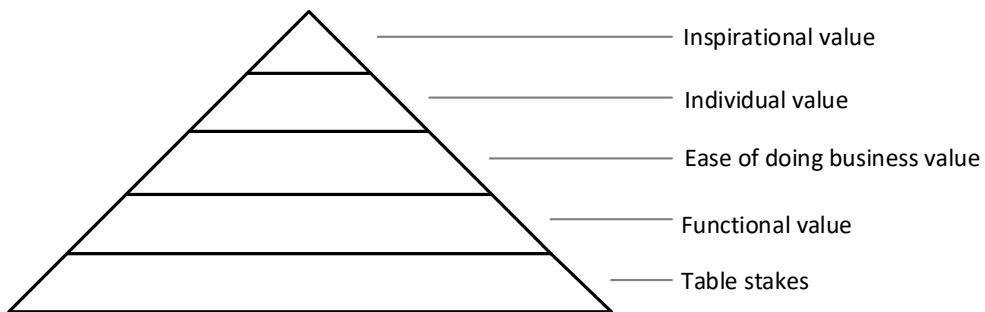
As Figure 15 shows, the difficulties in assessing customer value of an offering are not only caused by value elements being either economic or non-economic but also a value element's level of tangibility plays an important role. Based on the framework in Figure 15, it can be said that, if an offering has mainly economic and tangible value elements, the supplier should have the highest ability to communicate the value of the offering while the difficulty in communication raises while the offering starts to have more of the non-economic and intangible value elements.

Also, several authors have tried to categorize and distinguish between various value elements. The matrix in Figure 16 showcases value categories, including the typology provided by Anderson et al. (2009), and value elements relevant to business markets.

CATEGORIES		Anderson et al. (2009)	Almquist et al. (2018)	Anderson et al. (1998)	Menon et al. (2005)	Smith and Colgate (2007)	
							BENEFITS
							SACRIFICES
1. Economic, tangible	1. Table stakes			• Technical	• Core benefits	• Functional	
2. Economic, intangible	2. Functional			• Economic	• Add-on benefits	• Experiential	
3. Non-economic, tangible	3. Ease of doing business			• Service		• Symbolic	
4. Non-economic, intangible	4. Individual value			• Social			
	5. Inspirational value						
				• Price	• Purchase price	• Economic	
				• Technical	• Acquisition costs	• Psychological	
				• Economic	• Operations costs	• Investment	
				• Service		• Risk	
				• Social			

**Figure 16.** Value categories and value elements in B2B.

The figure above, besides the categorization of value elements by Anderson et al. (2009), includes the categorization proposed by Almquist et al. (2018) who divide value elements into five main categories and map them in the form of pyramid with the more objective value elements at the bottom and more subjective elements at the top of the pyramid. As Almquist et al. (2018) argue, avoiding the commodity trap requires that not only the rational but also the emotional value elements are recognized, hence value categories are placed onto the pyramid as presented in Figure 17.



**Figure 17.** B2B value categories (based on Almquist et al., 2018).

As the figure shows, at the bottom of the pyramid Almquist et al. (2018) placed table stakes. Table stakes are considered to be the value elements that are necessary to be in the business and are not used by companies as a differentiating factor. Table stake value elements stand behind ensuring that the offering meets the specifications promised within the acceptable price while being compliant with regulations and ethical standards. Above the table stakes are functional value elements ensuring that the offering meets customer's economic and performance needs such as cost reductions, product quality or potential scalability. On the third level are the value elements that make it easier to do the business. On this level, are still mainly objective types of value such as boosting the customer's productivity through time savings on increased transparency or bringing

operational efficiencies through simplification and integration. However, on this level are also some subjective value elements related to relationship quality such as cultural fit or commitment. Value elements at the next level are more subjective and aim at meeting an individual buyer's priorities being either personal such as reducing anxiety and having appealing design or carrier driven allowing the buyer for network expansion. Those value elements address sometimes very emotional concerns as the buyers making expensive purchases are often under pressure as their actions may influence the companies' business in the long term. Finally, at the top of the pyramid lay inspirational value elements. Those elements aim to enhance customer's social responsibility and provide the vision of the future and hope for the future. Suppliers oftentimes can help the customer to predict the changes happening in the market or ensure that their customer can start using new generation technologies easily and affordably.

Furthermore, the matrix in Figure 16 covers value elements gathered from three publications. First, Anderson and Narus (1998) point at several value elements that are also included the customer value definition they adopted from Anderson et al. (1993). They distinguished between technical, economic, service and social benefits a customer gains in exchange for the price paid. Thus, the price paid seems to be the only sacrifice element claimed by those authors. However, Anderson and Narus (1998), also said that a company can manage an offering successfully only if they understand all the benefits the offering, as well as parts of the offering, bring and all the underlying costs. Thus, it might be argued that, even though Anderson and Narus (1998) clearly recognize the price as the major cost element, they in fact presented many other cost elements that might be technical, economic, service and social, and vary in their tangibility such as cost caused by a bottle that exploded during the filling process including not only downtime cost but also costs related to the service check and maintenance, cleaning, scrap or disposal.

Second, Menon et al. (2005) divide the benefits customer receives into core and add-on benefits, and the sacrifices made by the customer they split into purchase price, acquisition costs and operation costs. The core benefits represent the minimum level of attributes required by the customer; those are the basic features without which the offering will not meet the expectations of the customer. Add-on benefits, on the other hand, are additional elements that may give the supplier an edge over its competitors. Add-on benefits can be seen as differentiating factor that generate added value and attract customers. According to Menon et al. (2005), the greater the perceived core benefits and add-on benefits, the greater the customer perceived value. As many authors recognize the purchase price, the amount of money paid by customer at the time of transaction, as the

only major sacrifice considered by the customers (e.g., Anderson and Narus, 1998; Ulaga and Chacour, 2001), Menon et al. (2005) included also two other types of costs associated with the entire supplier-customer relationship. First, acquisition costs consist of the efforts and expenses required to obtain and store the product such establishing and maintaining customer-supplier relations, ordering, delivering or warehousing. Second, costs related to customer operational costs such as internal coordination, manufacturing, and R&D.

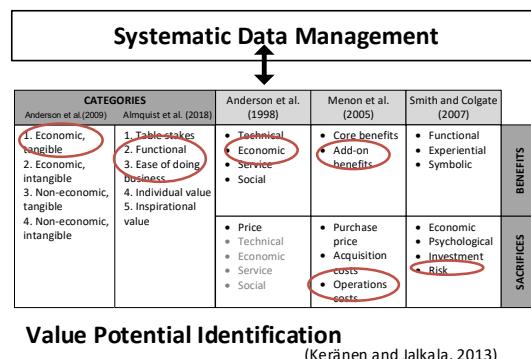
Finally, Smith and Colgate (2007) identified five main sources of value. According to them, information, products, interactions, environment and ownership are linked to the variety of value-chain processes and activates on intra- and interorganizational level. Consequently, Smith and Colgate (2007) proposed benefits built on functional, experiential and symbolic value elements. First, functional value elements, such as adequate attributes, performances or consequences, address the extent to which the offering complies with wanted characteristics or carries out desired functions. Second, experiential value elements, for example sensory, emotional, social or epistemic benefits, focus on the degree to which the offering triggers the right emotions and creates appropriate experiences. In B2B, experiential value concentrates on the social-relational value such as developing the trust between the business partners. Last, symbolic value elements, such as self-identity, personal meaning, self-expression, social or conditional meanings, concentrates on the level of the customer's psychological attachment created by the offering. Moreover, Smith and Colgate (2007) presented several sacrifice value elements which are concerned with all the costs and sacrifices that are or may be involved in the offering's purchase, use of the offering or simply its ownership. Economic costs, psychological costs, personal investment and risk belong to cost/sacrifice value elements.

Figure 16 outlined the variety of the elements and their interpretations. Interestingly some of the value elements have been easily measured for a long time already, and thus competing based on those elements is quite straightforward. However, the more emotional the elements, such as these that could be placed at the higher levels of the Almquist's et al. (2018) pyramid, the more difficult it is to measure and quantify them. Thus, according to Almquist et al. (2018), emphasizing the intangible elements of total customer value is seen as a differentiating factor. However, the ability to properly assess and quantify all the elements of the customer value should be mastered by companies as it is shown to positively impact the business performance (Hinterhuber et al., 2017).

### 3.2.3 Monetary value assessment

Value quantification has become a routine task for B2B purchasing managers who compare offerings available in the market; these purchasing managers use various valuation schemas and methods (Plank & Ferrin, 2002). However, nowadays it is expected that suppliers provide their customers with offerings that include value quantification (Hinterhuber et al., 2017). According to Plank & Ferrin (2002), a selling organization has to know how to identify and solve customer problems, and also be able to understand the customer valuation system to build offerings in a way that they either follows the customer's valuation system or improve the overall value so that the customer's usual valuation system changes. Also, due to a variety of market offerings, it is often difficult to compare the value of those offerings unless expressed in the commensurable units (Wouters and Kirchberger, 2015). Hence, it is important to express business impacts of various offerings in a quantifiable form (Storbacka, 2011), and quantification of value in monetary terms provides a meaningful unit of measurement as well as makes the process of value assessment more specific and compelling (Wouters and Kirchberger, 2015).

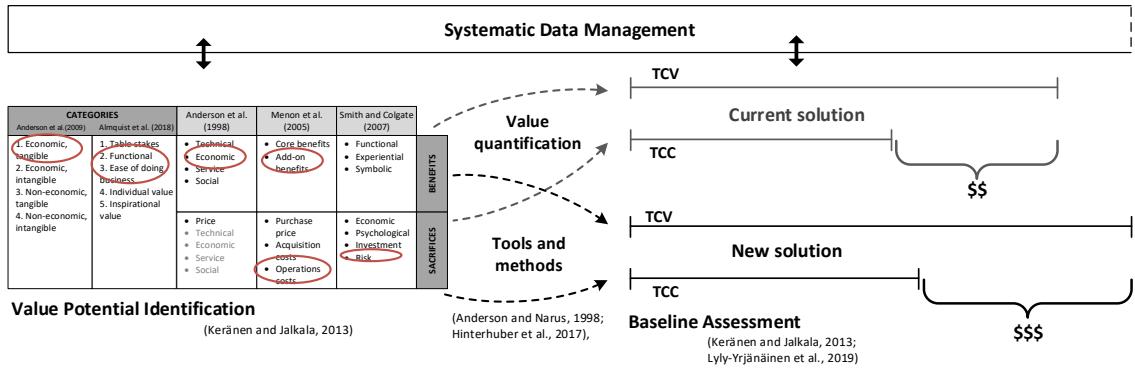
While understanding value should be a key driver of managerial activities (Plank & Ferrin, 2002), quantification of value and value visualization, especially in monetary terms (Wouters and Kirchberger, 2015), are crucial capabilities in B2B markets (Kindström et al., 2012). Moreover, based on the value assessment framework of Keränen and Jalkala, (2013), the selling company firstly must identify the value potential. It means that the company must thoroughly understand customer's needs and processes, and what is the most significant source of value customer gets and, hence, how the company can add value to the customer's business (Keränen and Jalkala, 2013). This understanding might be visualized by identification of all the value elements impacted by the supplier's solution (Anderson et al., 2006) as Figure 18 illustrates.



**Figure 18.** Value elements in value potential identification.

As Figure 18 shows, value potential identification should focus on verification of the relevant value elements that can be used to quantify value in monetary terms as, according to Keränen and Jalka (2013), understanding the offering's financial impact on the customer business is imperative. Customers do not seek to acquire products, but they continuously seek to perceive value that is realized as incremental revenue generation or quantifiable cost savings (Anderson et al., 2006; Grönroos, 2011). Hence, customers are increasingly more interested in understanding the value-in-use of an offering prior to the purchase. To achieve that, suppliers should adopt proactive, value facilitator and co-creator roles (Grönroos, 2011), and provide customers reliable, monetarily expressed value potential, i.e., customer perceived value, estimation. According to Anderson and Narus (1998) and Hinterhuber et al. (2017), the customer-specific value calculations help to convey the company's competitive advantage into quantifiable, monetary benefits. These authors also propose various value quantifications tools such as spreadsheets or virtual simulators, and methods like value calculators, return on investment assessments, value studies or comparative total cost of ownership calculations. Hence, the identified value elements can be assessed in monetary terms using mentioned tools and methods.

Moreover, according to Hinterhuber et al. (2017), value assessment and monetary quantification should also account for the difference in performance between competitive solutions and, thus, also the currently utilized solutions. This kind of comparative value quantification is usually performed after running pilot projects to ground the comparative assessment on the sample data (Keränen and Jalkala, 2013). However, many companies, especially those offering new technologically advanced solutions, could benefit if they provide such comparative value assessment early on during an offering development or sales negotiation process (Wouters and Kirchberger, 2015). Bringing new solutions, these companies must be able to showcase the impact they can make to help the customers understand their offerings better and earn themselves the possibility to run the trial tests or implement the solution even on a small scale. Figure 19 pictures the process of monetary comparative value assessment.



**Figure 19.** Monetary value assessment.

Figure 19 illustrates that the quantification of value should happen just after the identification of the relevant value elements. Companies should use the tools and methods applicable to the business case. Also, while assessing the customer's current situation, companies should present the outcomes of the value assessment in monetary form as well as well systematically document all the outcomes. Moreover, companies should also signify how the estimation of customer perceived value, based on the same value elements, changes with the implementation of the new solution. However, this kind of monetary value assessment is only one of the factors in building successful cooperation as this monetarily expressed customer perceived value shall also be well communicated and understood by the customer.

### 3.3 Value proposition

#### 3.3.1 Definition

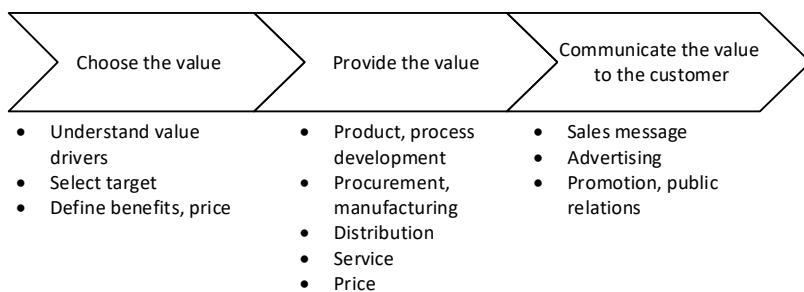
After assessing the customer value of a company's offering, the company should find a way to clearly communicate this value to the customers. One of the strategic tools used to communicate how the company's offering will provide value to customers is a customer value proposition (Payne et al., 2017). However, like the concept of value, the concept of customer value propositions (CVP) tends to be understood and used poorly (Skålén et al., 2015), and according to Anderson et al. (2006) there is no agreement on what constitutes a customer value proposition and especially what makes a customer value proposition a compelling one.

The concept of customer value proposition comes from strategy consultants (e.g. Lanning and Michaels, 1988) who under customer value proposition aimed to explain in a few sentences why customer should buy company's products or services. Nevertheless, the roots of the concept are told to be reaching the beginning of the 20<sup>th</sup> century when the concept of the unique selling proposition emerged in advertising domain (Payne et

al., 2017). Over the years there appeared many definitions of the customer value proposition and Payne et al. (2017) suggested that these definitions can be divided into three comprehensive perspectives:

- supplier-determined CVP perspective
- transitional CVP perspective
- mutually determined CVP perspective.

First, the supplier-determined CVP perspective reflects the early interpretation of the customer value proposition presenting the emphasis on value-in-exchange (Payne et al., 2017) where the customer value proposition is seen as a supplier-established perspective including a marketing offer describing the expected product's performance, how it relates with customer needs, and what it will cost the customer (Ballantyne et al., 2011). This perspective points also at the clear value delivery system that is a prerequisite of constructing a customer value proposition that echoes the chosen value (Lanning and Michaels, 1988). The value delivery system follows three steps as shown in Figure 20.



**Figure 20.** Value delivery system (Lanning and Michaels, 1988).

As Figure 20 shows, a value delivery system includes three customer-oriented phases. In the first phase, the company must choose the value based on the target customer needs and define benefits and price to the customer. In the second phase, the company must ensure the provision of the value through various functions in the company, and in the last phase communicate that value to the customer through sales and marketing. Value delivery system ensures that the chosen customer value proposition is diffused through all the organizational layers (Lanning and Michaels, 1988). Besides, Lanning and Michaels (1988), who define the customer value proposition as a statement including “(...) precise benefit or benefits at what price will be offered to what customer group, at what cost...”, a slightly newer definition by Rintamäki et al. (2007) well summarizes the supplier-determined perspective on customer value proposition:

*“A strategic management decision on what the company believes its customers value the most and what it is able to deliver that gives it a competitive advantage.”*

With this definition, Rintamäki et al. (2007) emphasize that, while the customer value is always defined by customers, the competitive advantage is determined by the company's use of capabilities and resources to create value. Hence, the customer value proposition presents the company's view of what is valued by customers and how the company's offering is superior delivering this value to the customers.

Second, transitional CVP perspective recognizes importance of customer experiences and perspectives related to the use of the product, hence slightly moving towards value-in-use perspective (Payne et al., 2017). Thus, in the transitional perspective the concept of CVP is seen as an extended version of Lanning and Michaels (1988) primary definition of the customer value proposition where Lanning (1998) says that:

*“A value proposition is the entire set of resulting experiences including some price, that an organization causes some customers to have.”*

Hence, the resulting experiences delivered to customers are the essence of a value proposition (Lanning, 1998, p. 4), and to recognize the elements that are valuable to customer, i.e., bring positive experience, companies need to enter into dialogue with customers (Payne et al., 2017). However, the transitional CPV perspective still sees the value as created and delivered by the company while the customer value proposition presents the company's offer through the customer's lens.

Last, the mutually determined CVP perspective reflects the most contemporary view on customer value proposition where customer value proposition is seen as co-created by a company and a customer, and emphasis is put on the value-in-use (Payne et al. 2017). Hence, value is not seen as solely embedded in a product and customers are engaged into creation of the customer value proposition through sharing of relevant resources and contributing to mutually defined goals. The last perspective on CVP is well reflected in the definition of the customer value proposition coming from Ballantyne and Varey (2006):

*“Value propositions are reciprocal promises of value, operating to and from suppliers and customers seeking an equitable exchange.”*

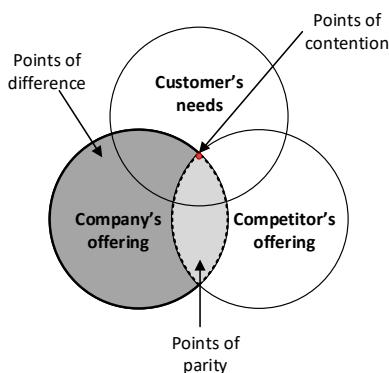
Furthermore, definition of mutually determined CVP perspective is also well complemented by Skålén et al. (2015) who argue that value propositions are promises of value creation that are based on various configurations of resources and practices. They also add that the value proposition should not only cover what value is offered by the company but also how the value is co-created by different parties based on the value proposition supported by resources that create the connection between activities and outcomes. Hence, the customer value proposition shall also acknowledge the customer's role in the

process of value creation (Leroi-Werelds et al., 2017). Moreover, according to Chandler and Lusch (2015), the customer value proposition may be treated as a kind of invitation to customer that can be either accepted or declined. Thus, based on the value proposition customers may decide whether the offering gives them clear incentives to make the deal with the supplier or not.

### 3.3.2 Review of frameworks on value proposition development

As there exist many views on what a value proposition is, there are also varied opinions on what makes a value proposition persuasive. Several scholars proposed frameworks discussing the elements and characteristics (e.g., Anderson et al., 2006) of an effective value proposition while some also included relevant practices (e.g., Skålén et al. 2015) and resources (e.g., Payne et al., 2017) required to create a compelling value proposition. Hence, this section reviews the most prominent value proposition frameworks.

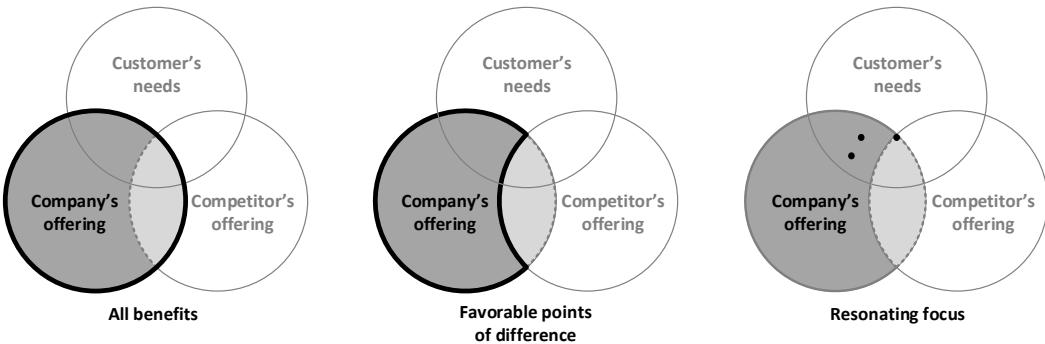
First framework comes from Anderson et al. (2006) who noticed that in business markets it is very difficult to find examples of customer value propositions that would resonate with customers. Therefore, based on their observation of the use of the term value proposition, they distinguished between different elements of a value proposition as illustrated in Figure 21.



**Figure 21.** Elements of value proposition (Anderson et al., 2006).

Figure 21 presents the main building blocks of a value proposition. The left circle of the venn diagram represents the company's offering, the right circle corresponds with the competitor's offering, which is the next best alternative in the market, while the upper circle in the diagram represents actual customer's needs. Furthermore, points of parity include value elements that provide similar functionality or performance as those of the competitor's offering. Points of difference are the value elements that are different from those offered by the competitor and either make the company's offering superior or inferior. Finally, the points of contention are the value elements about which the company and the customer disagree as to if those are points of parity or points of difference either

in favor of or disadvantage for the company. Based on these elements, Anderson et al. (2006) proposed three approaches to how value propositions can be developed as Figure 22 illustrates.



**Figure 22.** *Types of value propositions (based on Anderson et al., 2006).*

As Figure 22 shows, the first approach is called all benefits and, according to Anderson et al. (2006), it is the simplest form of the value proposition that lists all the benefits the company assumes their offering to have which is represented by the thick line around the circle with the company's offering. This form of value proposition requires that the company knows well their offering but does not demand thorough knowledge and understanding of the customers' needs nor the competitors' offerings, hence requiring a very little effort to construct. The pitfalls of this approach are that the company may be listing the benefits that have no real value to the target customers and, these benefits may largely overlap with the benefits provided by their competitors.

The middle diagram in Figure 22 presents the second approach called favorable points of difference as the company aims to include only the differentiating elements in their value proposition. This type of value proposition is seen as a bit more advanced approach to constructing a value proposition as it requires not only the good knowledge of the own offering but also of the competitors' offerings. Thus, the company must know what differentiates its offering from the next best alternative the customer can choose from. Nevertheless, this approach still does not call for a thorough customer study and, hence, the points of difference emphasized by the company in their value proposition may still not reassemble the most valued elements.

The third approach, presented in Figure 22, is called resonating focus and, according to Anderson et al. (2006), it is the most powerful type of value proposition as it is built based on the thorough knowledge of the own and competitor's offering as well as the company's deep understanding of the specific customers' priorities and the industry trends. The building blocks of the resonating focus value proposition are represented by the black dots on the most right diagram as resonating focus value propositions tend to focus on

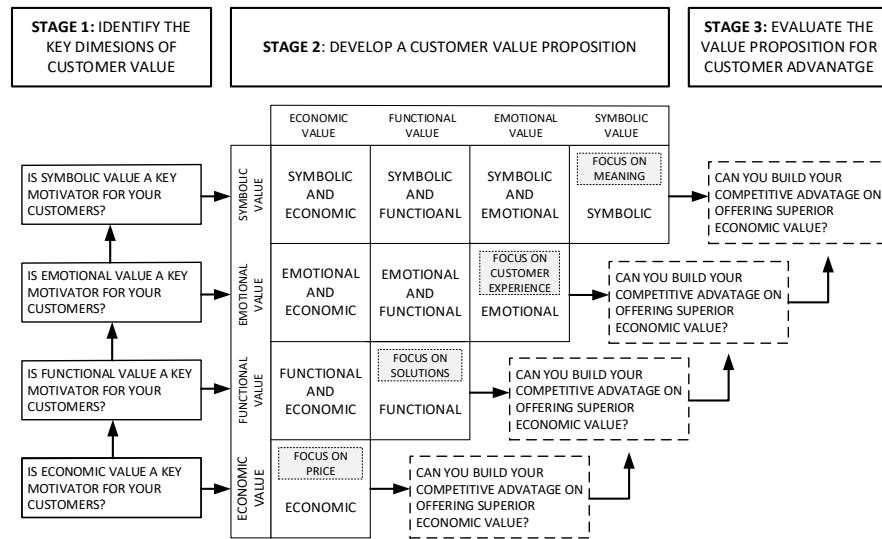
one or two points of difference between the company's offering and the closest competitor's offering and possibly one point of parity. Points of difference are meant to resemble the value elements that provide the greatest value to the customer while a point of parity is included in the value proposition if the specific value element is a must-be element or an element that otherwise may be perceived a point of contention in favor of the competitor. Hence, the resonating focus value proposition is the most time and resource consuming to create but helps the company to better focus its offering on the matters relevant to the actual customer needs.

Except of building blocks of a value proposition and three types of value proposition, based on the example of Sonoco, Anderson's et al. (2006) say that to succeed a value proposition shall be:

- Distinctive
- Measurable
- Sustainable.

First, distinctive means that the value proposition is superior to those of competitors. Second, measurable value proposition includes value elements that can be quantified in monetary terms. Finally, a sustainable value proposition is a one that is valid for a significant period of time.

Rintamäki et al. (2007) presented yet another three-stage approach to building a competitive value proposition by proposing a strategic positioning tool combining the company's resources and capabilities with customers' value needs. The three steps required to identify the suitable value proposition for target market are presented in Figure 23.



**Figure 23.** A framework for identifying customer value proposition (Rintamäki et al., 2007).

As Figure 23 shows, while identifying a competitive value proposition, the company must first identify which dimensions of customer value drive the customers. Rintamäki et al. (2007) used value dimensions as proposed by Smith and Colgate (2007) and organized them hierarchically based on several criteria such as from more tangible to more intangible, from more utilitarian to more hedonic, or from more objective to more subjective. Once the company has identified which of the dimensions or combination of dimensions drive the customers' requirements, it should aim to develop the value proposition based on the recognized dimensions. According to Rintamäki et al. (2007), companies can choose from four types of value proposition:

- Economic customer value proposition
- Functional customer value proposition
- Emotional customer value proposition
- Symbolic customer value proposition.

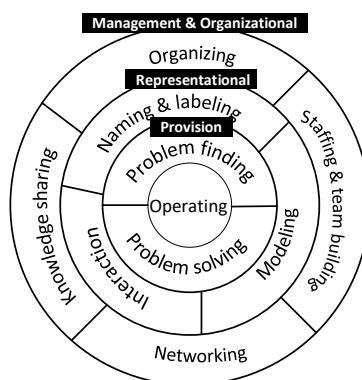
First, economic customer value proposition focuses on price of the offering as the price is one of the most tangible sacrifices customers make. However, for the company this strategy requires high competences and resources built on economy of scale. Second, functional value proposition focuses on convince for customers while choosing a specific solution. This kind of value proposition, as presented in Figure 23, might be combined with economic value proposition to offer the customer a convenient and relatively inexpensive solution. Third, the emotional customer value proposition has customers' experience at its core as it aims to target those customers who except more utilitarian aspects of an offering and seek some kind of affective state to be reached such as creation of

the state of trust. Last, the symbolic customer value propositions are created for those customers who are driven by higher means. These customers want from the company's offering something more than the obvious value it poses, which is especially true for customers for whom social and environmental aspects play the overarching role.

As Figure 23 shows, the process of identification of the value proposition ends with evaluation of the developed value proposition regarding its ability to create competitive advantage. If the value proposition passes the test, the competitive value proposition has been found, otherwise the company has to consider reformulating the value proposition to both satisfy the customers and be a source of competitive advantage. Rintamäki et al. (2007) also point out that the more utilitarian value propositions, i.e., economic and functional, reflect more the core of the offering while emotional and symbolic types of value proposition tend to complement the offering and provide the source of differentiation.

Similarly to Anderson et al. (2006), Rintamäki et al. (2007) also concluded that a successful customer value proposition should have certain characteristics. First, the customer value proposition should present the decrease in costs customer bears and/or increase of benefits that are relevant to the customer. Second, it should be constructed on the resources and competencies the company can use more effectively than its competitors. Third, the value proposition should be distinctive from the competitors' value propositions. Finally, a value proposition should provide the company with a competitive advantage.

Skålén et al. (2015) proposed another framework reflecting the anatomy of a customer value proposition that aims to fulfill the promise of value creation through re-sources and practices configuration. According to them, a value proposition is built of ten practices that can be aggregated under three main categories as Figure 24 shows.



**Figure 24.** Anatomy of a value proposition (Skålén et al., 2015).

Figure 24 shows that the three aggregate practices consist of provision practices, representational practices, and management and organizational practices. First, provision practices, being in the center of the value proposition, aim to enable the customer value creation process through ensuring that a value proposition is used so that it triggers value-in-use for customers as promised by the supplier company. Provision practices are made up of operating practices that drive integration of the resources supporting value creation, problem-finding practices that aim to recognize issues with the customer's value creation and possibly new ways of creating the value for the customer, and problem-solving practices thriving to resolve the customer problems.

Second, representational practices facilitate communication between parties involved, aim to give the value proposition structure and meaning, and are used both, internally and externally, to communicate the value proposition. Representational practices include naming and labeling practices that focus on describing specific elements of the value proposition and their fulfillment, modeling practices that aim to provide a holistic structure of the value proposition, and interaction practices that empower the communication or co-creation of the value proposition with the customers.

Finally, the last group of practices includes management and organizational practices representing how the company will organize their work and resources to enable execution of provision and representational practices. Management and organizational practices consist of organizing practices arranging the work on providing and representing value proposition, staffing and team-building practices aim to establish a team working on providing and communicating the offering, networking practices which the company uses to involve their network to enhance creation and delivery of value proposition, and lastly, knowledge-sharing practices aiming at sharing knowledge and skills enabling the value creation.

Skålén et al. (2015), in contrast to Anderson et al. (2006) and Rintamäki et al. (2007), who mainly focused on saying what a value proposition should include or focus on, introduce practices that are required in order to create a compelling value proposition. Nevertheless, besides those practices, Skålén et al. (2015) also indirectly points at elements of a value proposition. They say that the value proposition should not only be a statement of what is promised to the customer but also how this value will be co-created with the use of the resources. Thus, according to Skålén et al. (2015), a value proposition consists of a value statement, a kind recipe of how the promised value can be achieved, and what resources and competencies the specific outcome requires.

Furthermore, Leroi-Werelds et al. (2017) while examining the effect of the explicitly included role of the customer in the value proposition, they also summarized the criteria for evaluation of customer value proposition effectiveness. They pointed at the three following criteria:

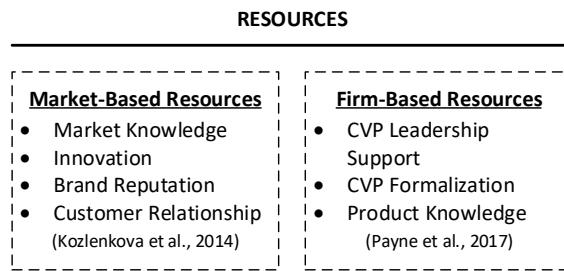
- Customer's role clarity
- Expected customer value
- Purchase intention.

First, customer's role clarity reflects the degree to which customers are aware that they need to do something to extract value from the offering (Leroi-Werelds et al., 2017). According to Leroi-Werelds et al. (2017), if customers do not know or understand that they must do something to perceive value, all the other value creation activities can be hindered. Thus, the value proposition should clearly state the customer's active role in value co-creation.

Second, the value proposition to be effective must include what is the potential customer value of the offering. Leroi-Werelds et al. (2017) stress the value-in-use of the offering rather than its attributes and thus, the net potential value of the offering shall be included in the value proposition as the difference between the expected benefits customer gets and expected efforts involved in the usage of the offering (Khalifa, 2004).

Last, purchase intention grasps the attractiveness of a value proposition as the customer is the one who, based on the value proposition, decides whether to go for an offering Leroi-Werelds et al. (2017). It means that if a customer decided to make a deal with the company, the company must have built a compelling value proposition that was not declined by a customer. Furthermore, Leroi-Werelds et al. (2017) emphasize that the combination of the three criteria composes a full and interrelated measure of the effectiveness of customer value proposition and hence a company constructing a value proposition shall consider all the elements in combination not separately. Moreover, Leroi-Werelds et al. (2017) discovered that, if the customer is aware of their role in the process of value creation, they do not necessarily perceive higher expected effort and if the customers think that expected efforts are higher it leads to an increase in expected benefits that as a result boosts the purchase intention.

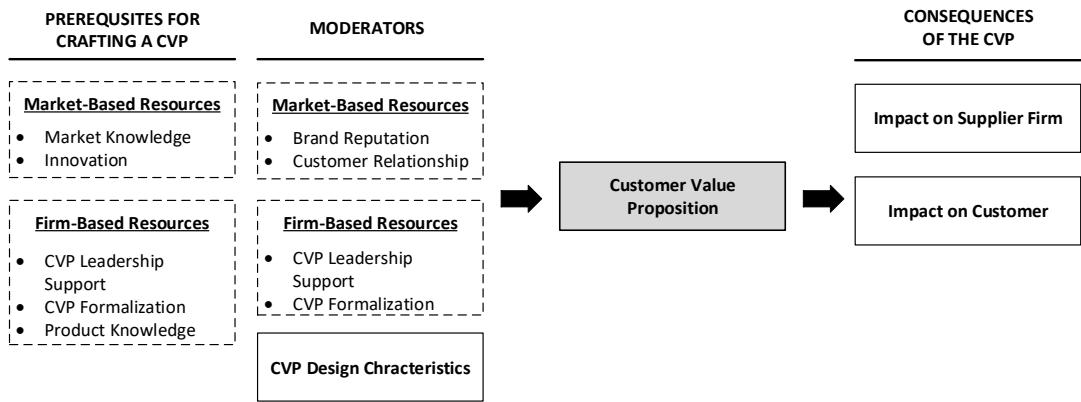
Payne et al. (2017) aimed to clarify the elements and main design characteristics of a customer value proposition to supply companies with ideas for better performance. They build their conceptual model on the resource-based theory (RBT) focusing on market- and firm-based resources presented in Figure 25.



**Figure 25.** Resources as elements shaping value propositions (Payne et al., 2017).

Payne et al. (2017) emphasized that resources are tangible and intangible assets a company can use to achieve their goals, thus resources play important role in the firm's performance. As Figure 25 shows, Payne et al. (2017) divided resources in market- and firm-based resources. They adopted market-based resources highlighted earlier in review on RBT of Kozlenkova et al. (2014) which are market knowledge, innovation, brand reputation, and customer relationship. First, market knowledge is a base for crafting a value proposition as firms must gain thorough customer knowledge to successfully recognize their needs and competitor knowledge to know if the company provides or is able to provide superior solutions (Eggert and Ulaga, 2002; Anderson et al., 2006). Second, customer value propositions should be build using innovative ways of approaching and solving customer problems. Innovation can be based on processes so the manner in which the company develops and integrates existing and new resources, and on culture meaning how the company's culture ensures that its employees are creative and innovative. Then brand reputation and customer relationship are classified as resources that moderate the impact of a customer value proposition on customers (Payne et al., 2017). Both brand reputation and customer relationship can either increase or decrease company's credibility as to if the promised value will be realized; strong brands and close customer relations tend to rule over the similar offerings offered by less-known brands.

Then, Payne et al. (2017) pointed at three main firm-based resources that shall complement the market-based resources as well as help to exploit them to the full potential. First, CVP leadership support focuses on providing the environment for development of a customer value proposition that aligns with the company's goals and values. Second, CVP formalization involves processes and organizational structures necessary for crafting and communicating of the customer value proposition. Last, the product knowledge entails the expert understanding of the own products and services technical specifications and potential applications. Building on the market- and firm-based resources Payne et al. (2017) proposed a conceptual framework representing the use of resources in creating a value proposition as Figure 26 presents.



**Figure 26.** *Creation and impact of a customer value proposition (based on Payne et al., 2017).*

As Figure 26 shows, resources are seen as ascendants to a value proposition which in consequence impacts, both, the supplier company and the customer. Market- and firm-based resources are divided into ones required for crafting a value proposition and the moderators that influence the impact of the value proposition on customers, and indirectly on the supplier company. Figure 26 presents one more type of moderators which are CVP design characteristics. Payne et al. (2017) concluded that there exist many important design elements but the four CVP design characteristics are especially important:

- the CVP perspective adopted
- explicitness
- granularity
- focus.

First, the CVP perspective adopted refers to one of the perspectives earlier described by Payne et al. (2017) being supplier-determined, transitional or mutually determined CVP perspective. Second, explicitness means that a value proposition is either clearly articulated enabling organization and prioritization of various activities or it is communicated implicitly relying on the understanding of the value proposition within the company. While explicitly communicated value propositions are claimed to be effective, implicit value propositions may be also effective if are embedded in organizational culture and supported by leaders acting as role models (Payne et al., 2017). Third, value propositions may differ by the level of granularity, such as the firm level, customer segment level, individual customer level, and thus on each level may have a different purpose (Payne et al., 2017). At the company's level value propositions aim to draw on a mission statement to explain company's existence in terms of the value created and co-created with

customers. At the segment level value propositions tends to have higher level of granularity reflecting how the value is created for and co-created with the certain segment, while at the level of individual customer the value proposition focuses on value creation and co-creation in the context of the specific customer. Finally, focus of a value proposition is related to the breadth and the number of superior value dimensions included in a value proposition which may differ significantly between value propositions (Payne et al., 2017).

### **3.3.3 Building a persuasive value proposition**

Each of the presented CVP frameworks can be also placed within one of the three perspectives proposed by Payne et al. (2017). First, Anderson et al. (2006) provide with the value proposition classification that builds upon a supplier's perspective on value as they aim to propose three kinds of value propositions that enable the supplier to focus their efforts on creating superior value. Thus, their classification clearly fits into G-D logic as it assumes the supplier to be the creator of value (Bitner et al., 1997) that through value proposition positions itself against competitors while implying potential outcomes for customers. Also, as the main way how to create the value proposition Anderson et al. (2006) suggest more traditional methods, such as market research, that require minimum involvement of the customer.

Second, according to Payne et al. (2017), the definition of value proposition proposed by Rintamäki et al. (2007) reflects supplier-determined CVP perspective. However, the literature based on which Rintamäki et al. (2007) built CVP framework is scattered between G-D logic literature and S-D logic literature. Rintamäki et al. (2007) state that value proposition is a company's decision of what the company assumes the customers value which fits the G-D logic perspective on a value proposition being constructed by the company without a customer's involvement (Ballantyne et al., 2011). However, Rintamäki et al. (2007) base their statements on the Vargo and Lusch's (2004) idea of customers being the ones deciding what is value and companies only construct value propositions that support customer's value creating activities and thus, supporting S-D logic's idea of the supplier being the facilitator of value creation not a sole value creator (Hibbert et al., 2012). Hence, Rintamäki et al. (2007) work can be rather seen as presenting the transitional view on CVP construction.

Last, frameworks proposed by Skålén et al. (2015), Leroi-Werelds et al. (2017), and Payne et al. (2017) clearly contribute to service view on value, and hence mutually defined CVP. All three frameworks assume the role of the customer in the value proposition creation process as well as the need for supplier and customer resources integration.

These authors also acknowledge that value is not only co-created between the supplier and the customer but also within a wider network of involved parties (Ballantyne et al., 2011; Bititici et al., 2004). As a result, value is not created by the offering provider, but the offering provider has co-creating and facilitating role, and customers create and co-create value while broader network may contribute to value creation and capture some of the value created within the network.

Summarizing, each of the CVP perspectives provides the set of guidelines on how to build a compelling value proposition. However, it should be noted that while the roles and involvement of the supplier and the customer change across different perspectives, the approach to what are the elements, design characteristics, criteria or processes incurred in the creation of a value proposition, tend to evolve rather than drastically change. Figure 27 presents the idea.

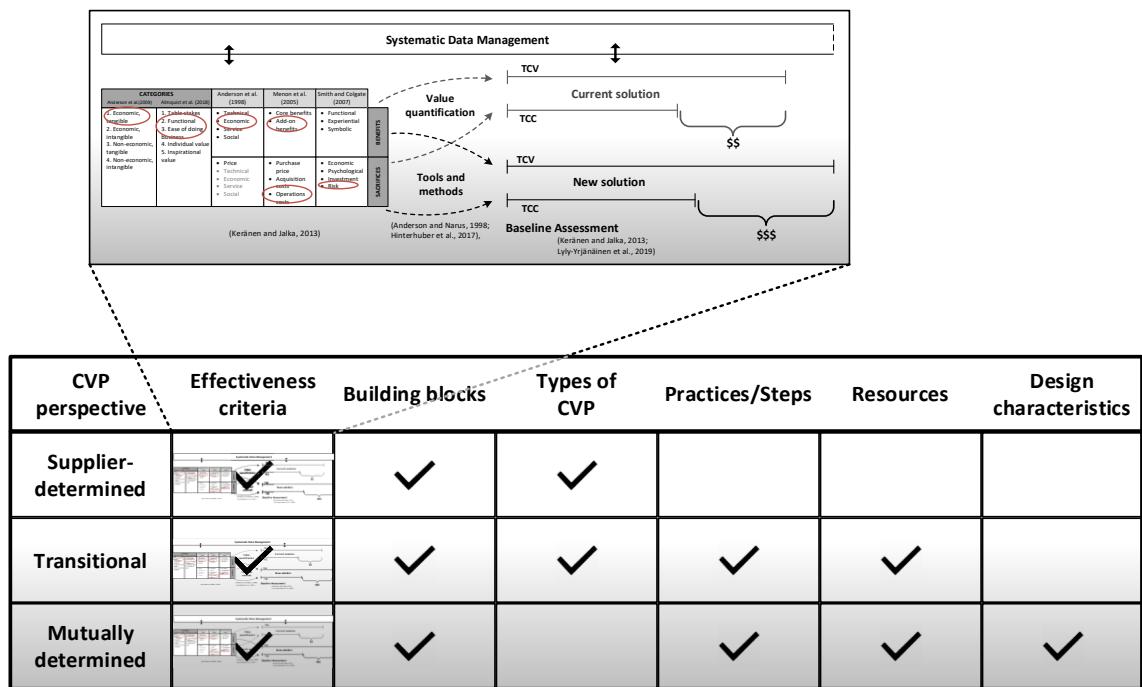
CVP perspective	Effectiveness criteria	Building blocks	Types of CVP	Practices/Steps	Resources	Design characteristics
Supplier-determined	G-D LOGIC • Distinctive • Measurable • Sustainable (Anderson et al., 2006)	Points of: • parity • difference • contention (Anderson et al., 2006)	All benefits • Favorable points of difference • Resonating focus (Anderson et al., 2006)	Steps: 1. key value dimensions identification 2. development 3. evaluation (Rintamäki et al., 2007)	Use of supplier's resources based on competitive advantage (Rintamäki et al., 2007)	
	Transitional • Showcasing business impact • Based on relevant resources and competencies (Rintamäki et al., 2007)	Key value dimensions: • economic • functional • emotional • Symbolic (Rintamäki et al., 2007)	• Economic • Functional • Emotional • Symbolic • (Rintamäki et al., 2007)	Practices: • provision • representational • management and organizational (Skålen et al., 2015)	Market-Based Resources • Firm-Based Resources (Kozlenkova et al., 2014; Payne et al., 2017)	• The CVP perspective adopted • Explicitness • Granularity • Focus (Payne et al., 2017)
	Mutually determined • Customer's role clarity • Expected customer value • Purchase intention (Leroi-Werelds et al., 2017)	• Value statement • Resources and competencies required • Method (Skålen et al., 2015)				
S-D LOGIC						

**Figure 27.** Compelling value proposition in different CVP perspectives.

Figure 27 shows the transition between the perspectives emphasized by the gradient color filling in the figure. That signifies that there is no clear line between the CVP perspectives and while building a CVP, a company does not have to be locked-in within a certain perspective but carefully consider relevant aspects that suit the business the best. Also, as Figure 27 shows, with the turn towards service perspective, more aspects in building a compelling CVP are considered important. That can be a result of more active participation of the customer in the process of a CVP creation which is assumed in service logic (Grönroos, 2011).

Two of the aspects, building elements and effectiveness criteria have been discussed from the viewpoint of each of the CVP perspectives. While the approach to building blocks in supplier-determined and transitional perspectives focuses mostly on the value

statement, the mutually determined CVP perspective expands the building blocks by what resources and competencies are required to achieve this expected value and how it can be achieved. Then, as it comes to effectiveness criteria, all the CVP frameworks presented, and hence also all the CVP perspectives, underline the importance of communication of the offering's potential impact on customer's business in a measurable form. Thus, to build a persuasive value proposition, regardless of the CVP perspective chosen, a company should firstly perform initial value assessment that yields the measurable outcomes that can serve as the element of an effective value proposition as Figure 28 illustrates.



**Figure 28.** Building an effective value proposition.

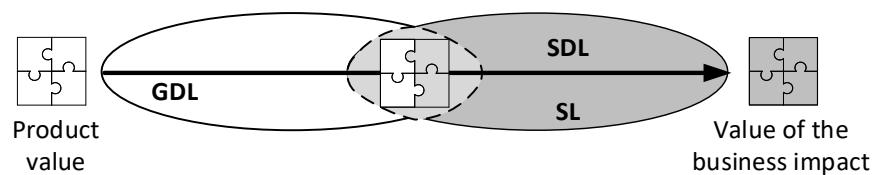
Each of the CVP perspectives is valid today and has a different emphasis; hence, companies must decide which of these perspectives is relevant to them (Payne et al., 2017). While the supplier-determined perspective sees customers solely as a recipient of value, the mutually determined perspective gives the customer a chance to participate in value proposition creation and, thus, makes the customer co-responsible for the realization of the promise stated in the customer value proposition. Thus, Figure 26 shows the aspects a company should focus one while following a particular perspective. However, the figure also highlights that regardless of the chosen perspective, a value proposition to be effective must include monetarily expressed or at least quantified estimation of customer perceived value.

## 4. CUSTOMIZABLE VALUE PROPOSITION

### 4.1 Value in servitization – synthesis through service perspectives

Servitization implies changes in the value creation, delivery, and capture processes of servitizing companies as well as their customers and related business partners (Martin et al., 2019). As it has been already shown, along the servitization path the revenue and business models of companies change and, the more the offering resembles a product as a service offering, the more emphasis is put on the offering's business impact (Tukker, 2004; Bonnemeier et al., 2010). However, challenges appear as value is not anymore related to only products or services but a newly defined offering. As a result, it is important to discuss how service and customer value are interpreted when an offering is not treated as separate service and product entities but as an offering encompassing service and product elements being sold as a single product as a service offering.

When value of servitized offerings is discussed, notions of the two well-established service perspectives, service-dominant logic (SDL) and service logic (SL), tend to appear (Lightfoot et al., 2013; Grönroos and Helle, 2010). Interestingly, as product-service (PS) offerings, also marketing and business service perspectives seem to evolve along a continuum. The importance of goods at the good's side of the continuum (Oliva and Kallenberg, 2003) well reflects the goods-dominant logic's (GDL) view while the service-side of the PS continuum mirrors the evolution towards SDL and SL views. Hence, these perspectives can be placed on a product-service (PS) continuum as Figure 29 illustrates.



**Figure 29.** Marketing perspectives on the PS continuum.

Figure 29 presents the evolution of marketing perspectives along the PS continuum. While it can be clearly stated that GDL perspective on service and value can be placed on the most left side of the PS continuum, it is rather challenging to clearly state which of the service perspectives shall be placed on the most right side of the PS continuum. Furthermore, according to Grönroos and Gummestrøm (2014) and Saarijärvi et al. (2017), while there are similarities and complementing aspects in SDL and SL, some aspects differ. Hence, that might result in complexity in service value debate.

Even though Grönroos (2011) states that the service logic is not a new marketing perspective but rather the next stage in service-dominant logic, both SL and SDL are usually discussed as individual service perspectives (Saarijärvi et al., 2017). Also, Grönroos's (2011) claim of SL 'being the next stage in SDL' should not be the sole reason for placing the SL as a more advanced perspective in terms of service and value. Importantly, both SDL and SL see the importance of service as value is discussed (Saarijärvi et al., 2017).

Hence, rather than arguing the superiority of one service perspective above another, both perspectives can be seen as useful means to discuss the value of servitized offerings and especially the most advanced forms of these offerings, such as product as a service. Also, Saarijärvi et al. (2017) state that to be able to build upon both service perspectives one needs to know how and why these perspectives differ. The table below aims to present the comparison of SDL and SL in terms of value.

**Table 5.** *SDL vs SL view on value (Based on Saarijärvi et al., 2017).*

Aspect	SDL	SL
Business objective	Service exchange	Value creation
Goods	Transmitters of service	Value-supporting resources
Services	Value-supporting processes	
Approach to value	Macro (network, system)	Micro (dyadic)
Value	Defined as value-in-context	Defined as value-in-use
Nature of value	Experiential, unfolding over time, uniquely defined by a beneficiary or customer	
Value actualization	Value is actualized during the use of a provider firm's offering	
Value creation driver	The provider	The customer
Value co-creation	Provider invites customer to co-create value	The provider might be invited to engage into customer's processes
Role of a customer	Value co-creator	Creates and experiences value
Role of a supplier	Value co-creator	Value facilitator, potentially value co-creator
	Promise of the value-in-use that can be realized using supplier's offering	
Value proposition	Firms can only offer value propositions or develop them in collaboration	Firms can not only influence design of value propositions but also value actualization

Even though Table 5 gathers only the most important differences and similarities between SDL and SL, it well showcases why there might be difficulties in discussing, analyzing, and communicating the value of servitized offerings. As Table 5 shows, SDL considers service exchange as a basis for all the business activities and SL sees value creation for all the parties as fundamental for business (Grönroos and Gummestrøm, 2014).

Thus, SDL sees goods as enablers for service provision, and SL denotes goods as resources that support customers' value creation (Saarijärvi et al., 2017). While SDL and SL provide different definitions of service, the essence of service is the same in both perspectives; service is processual in nature and aims to support value creation (Saarijärvi et al., 2017). Furthermore, SDL discusses value from macro perspective and emphasizes that neither a customer nor a supplier are self-sufficient to create value (Vargo and Akaka, 2009), and SL takes more micro level approach and discusses value within a dyadic supplier-customer relationship (Grönroos and Gummrus, 2014). Hence, SDL defines value as value-in-context which is bound to the time, place and resources available and accessible within a system while SL prefers the notion of value-in-use bound to a customer's value creation process. Thus, SL in its approach to value is more customer centric.

Both perspectives agree on the nature of value and how the value actualizes. Value is seen as being experimental, individually defined by a customer or beneficiary, actualizing during the use of the supplier's offering and accumulating over time (Saarijärvi et al., 2017). However, SDL sees the provider as the party that drives the value creation process and oversees it while SL considers that the customer drives the value creation and is in charge of it (Grönroos and Gummrus, 2014). This also results in different views on value co-creation in both perspectives. SDL sees value as always co-created, the supplier, and the customer as value co-creators and rather the supplier inviting the customer to engage in the offering creation than vice-versa (Vargo and Lusch, 2008a). On the other hand, SL argues that value-in-use is created solely by the customer, and the supplier can become a value co-creator only through interactions with the customer (Grönroos and Gummrus, 2014).

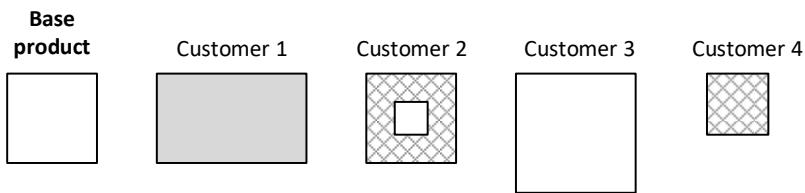
Finally, SDL and SL consider a value proposition as a supplier's promise of the value the customer can extract while using the supplier's offering (Saarijärvi et al., 2017). Nevertheless, SDL holds that the supplier can only offer value propositions (Vargo and Lusch, 2008a). At the same time, SL argues that the supplier can influence the design of the value proposition as well as the process of the promised value actualization (Grönroos, 2008). The ability to influence the customer's value creation process is possible through various kinds of interactions (Grönroos, 2011), and, according to Mathieu (2001a), service provision entails increased opportunities for interaction, hence possibilities to influence the customer's value generation process.

According to Saarijärvi et al. (2017), differences in viewpoints of SDL and SL are mainly caused by four issues. First, SDL and SL have different backgrounds. SDL originates from economics, political economics, and marketing while SL from the more empirically

based thoughts of Nordic School research traditions. Second, SDL and SL operate on different levels of analysis; SDL has a more holistic view and analyzes phenomena on macro as well as micro-level, and SL focuses on dyadic supplier-customer relationships. Third, the differences may arise because of the difference in use and vague definitions of related service concepts. Last, SDL and SL emphasize different aspects when trying to discuss and capture the fundamentals of service and marketing phenomena. For example, while SL mainly discuss customer value, SDL takes a broader perspective to value.

## 4.2 Service customization and modularity

Customization and modularity were initially associated with manufacturing, especially in the context of mass customization, but nowadays, these concepts have become increasingly more used in the context of service offerings (Bask et al., 2011). Nonetheless, the meanings of the notions of customization and modularity have largely remained the same also in the service context. Customization can be defined as opposite to standardization. While standardization assumes that all the elements of the offering are pre-defined, customization allows for case by case modifications of a product or a solution for each customer (Lampel and Mintzberg, 1996). Figure 30 illustrates the idea of customization.



**Figure 30.** *The idea of customization.*

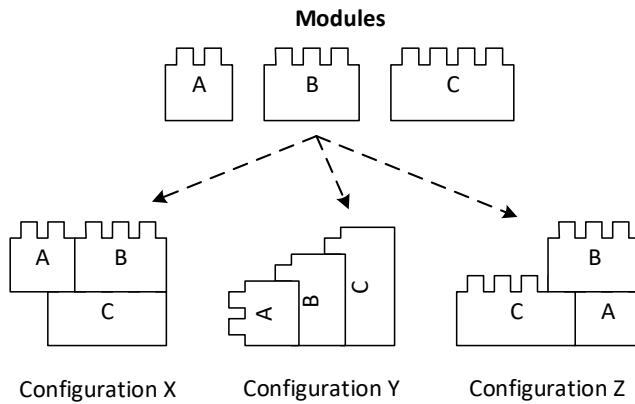
As Figure 30 shows, when a manufacturer customizes its products, each customer can get a version of a base product that best suits the needs of the customer's business. In that case, a product can be designed separately for each customer (Lampel and Mintzberg, 1996). However, while customization enables marketing of uniquely tailored customer offerings, standardization allows for gaining process and cost efficiencies. Mass customization is, hence, an idea to build on benefits of both approaches to provide offerings that externally appear to be highly variable and internally demand a rather low amount of variability (Tseng and Jiao 1996). Thus, the external appearance may reflect how the offering is perceived by the company's outsiders, for example customers, and the internal appearance should be rather understood from the company's perspective. Furthermore, Gilmore and Pine (1997) distinguished four approaches to customization:

- collaborative
- adaptive
- cosmetic
- transparent.

First, collaborative customization assumes that the supplier and the customer collaborate to find out which solution would work best for the customer, and then the supplier customizes the product based on the customer needs. Second, following the adaptive customization approach, a supplier offers a standard but customizable offering that can be altered by customers themselves. For example, a customer may want to be able to adjust the use of the offering to its business' fluctuating demand. Third, cosmetic customization focuses on presenting the same standard product in different ways to different customer. Hence, the supplier emphasizes different aspects of the offering depending on the customer's key needs and the offering's intended application. Last, in transparent customization approach the supplier offers a customer unique goods or services without explicitly informing the customers that the offering is customized for them.

Hence, it can be said that an offering can be customized, customizable or customizing. One can talk about a customized offering, when the customization happens at the provider's side, i.e., collaborative customization. A customizable offering allows for customization of the offering by the customer and a customizing offering can be a one that adjusts itself automatically, i.e., adaptive customization.

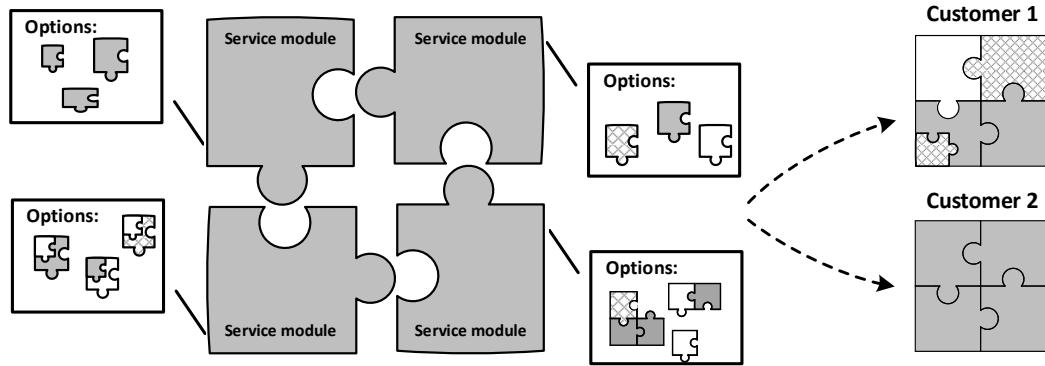
Then, modularity has been frequently defined, using the Baldwin and Clark's (1997) quote, as "*building a complex product or process from smaller subsystems that can be designed independently yet function together as a whole*". Hence, modular products or solutions are built out of separate modules that are independent, can be created and modified in separation, and put together in a number of ways (Bask et al., 2011). Figure 31 visually presents the idea of modularity.



**Figure 31.** *The idea of modularity.*

As Figure 31 presents, modularity is based on building various product configurations while using standard modules. Hence, modularity enables a greater extent of flexibility while keeping down the costs of the entire offering (Heikka et al., 2018). In that way, modularity is connected to the ability to customize offerings. Davies et al. (2006) suggest that companies should develop their offerings so that the offerings could be easily modified yet built using common elements. Moreover, according to Davies et al. (2006), as much as this is valid in goods manufacturing, the same applies to service offerings. Service offerings should also be designed as modular units that are easy to comprehend, consistent, and simple to be put together as customized solutions. Also, Nordin et al. (2011) point that service providers should balance between standardization and customization of their offerings and as a compromise, service providers should focus on creating modular systems of products and service components that can be modified based on the customer-specific needs and capabilities. Thus, modularity enables a customer to choose a service configuration or a service provider to customize the offering based on the implied needs of a customer (Voss and Hsuan, 2009).

As it comes to product-as-a-service (PaaS) offerings, belonging to the group of most servitized offerings, these offerings do not provide simple bundles of products and services but customer solutions, and according to Sawhney (2006), customer solutions involve the combination of customized and integrated goods and services that are intended to meet specific customers' business needs and create value above the sum of its parts. Furthermore, Raddats and Kowalkowski (2014) discuss that servitizing manufacturers tend to extend their service portfolio rather than changing between different service categories offered. That, hence, implies that PaaS providers can build their offerings from existing or newly created service modules to satisfy specific customers' needs. Figure 32 shows the idea of customization and modularity in the context of PaaS offering.

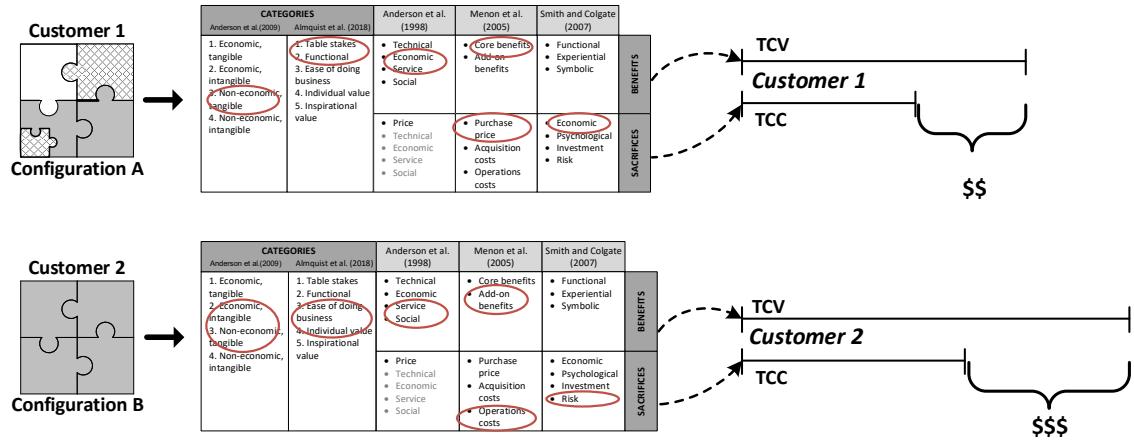


**Figure 32.** Customization and modularity in PaaS offerings.

While building PaaS offerings, the providers can try to combine the benefits of standardization and customization through building modular service systems, as Figure 32 illustrates. Those providers can build various offerings using customized modules so that they can satisfy varying customer needs. Furthermore, each service module, if considered as addressing a specific customer need, may consist of various options of how such a need could be satisfied by the service provider who uses its available and accessible resources and capabilities. This is also well captured in work of Coltman and Divnney (2013) who say that modularity aids achievement of customized service in cost-effective manner and enables offering innovative services by connecting independent capabilities and new problem-solving approaches.

### 4.3 Customizable value proposition for a PaaS offering

As stated earlier, PaaS offerings can be configured to satisfy varying customer needs through combination of relevant options within the service modules. That in turn allows for process- and cost-efficient customization of solutions provided to customers (Voss and Hsuan, 2009). However, that also implies that while a PaaS offering is customized for each customer, it is likely to impact each customer's business differently. Especially, customers that seek to satisfy varying needs cannot expect to derive the same value from the supplier's offering as illustrated in Figure 33.



**Figure 33.** Influence of customization on customer perceived value.

Figure 33 shows that a PaaS offering when customized for different customers, may have different total customer value, different total customer costs and as a result different customer perceived value. That might be the consequence of changing configurations of the PaaS offering addressing not only different customer needs but also providing different kind of benefits and resulting sacrifices. Hence, the service provider must be able to identify the value elements (Anderson et al., 2006) influenced by its PaaS offering and understand how the customization of the offering for the customer influences the type and significance of the value elements impacted. Change in both, type and significance of the impact of a value element, should then show the difference in the outcomes of value assessment, especially when the value is assessed monetarily as it is also presented in Figure 33. As the PaaS offering is customized for each customer, the potential value is also customized for the customer.

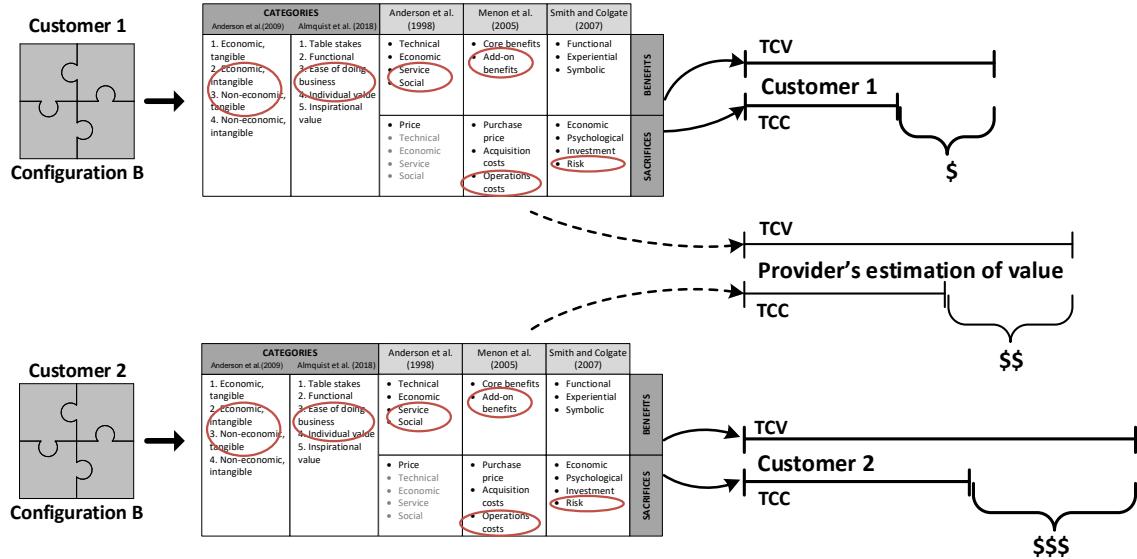
Storbacka (2011) suggests that providers should be able to make customer specific value propositions that are not only unique, but most of all answer the business-critical needs of each customer. The uniqueness of the value proposition has been also described as one of the CVP effectiveness criteria by Anderson et al. (2006). These customer specific and unique value propositions can be made using the potential value estimations customized for each customer as illustrated in Figure 33. Furthermore, as argued by Heikka et al. (2018), modular solutions should not only help to tailor the offering to the customer's needs but also enhance providers' ability to construct matching value propositions, i.e., customize value propositions. They suggest that through configuration of various internal and external provider's resources and capabilities, providers can not only deliver novel services but also deliver matching value propositions that emphasize individual customer needs. However, Heikka et al. (2018) also stresses that customization of services and value proposition is mainly done by service providers who offer these

services and value propositions based on their experience, customer sensing and customer discussions.

Hence, offering customized value and development of the customized value propositions are already apparent in the existing literature (e.g., Anderson et al., 2006; Heikka et al., 2018). However, customization of value and value proposition are rather discussed from the provider's point of view as 'customized' refers to the act that has already happened. Moreover, based on Gilmore and Pine (1997), something can be referred to as customized if the customization happens before another party is exposed to it (e.g., a value proposition) or uses it (e.g., an offering). Also, the combination of the provider's capabilities and resources to create customized service offerings is talked about (Coltman and Devinney, 2013). Thus, the role of the provider as the party that customizes both the offering and the value proposition to meet customer needs is well-discussed. However, as far as customized offerings (Gilmore and Pine, 1997), customized value propositions (Heikka et al., 2018), and customizing and customizable offerings (Gilmore and Pine, 1997) are well-acknowledged, there is no discussion on customizable value and customizable value propositions. In addition, customer solutions, to which PaaS offerings can be included, are discussed as being customized for customers. Also, despite the lengthy discussions on value and value related aspects of advanced servitized offerings through the lens of service-dominant and service logics (e.g., Vargo and Lusch, 2008a; Grönroos and Gummrus, 2014) there is no straightforward discussion on customizable value and, in effect, customizable value propositions in the context of PaaS offerings.

The starting point to discuss customizable value or customizable value proposition is to define what is the customizable value. Following the idea of a customizable offering, i.e., adaptive customization (Gilmore and Pine, 1997), customizable value is not the effect of the provider's actions, but value being customized by the customer. While the provider may co-create the value (Vargo and Lusch, 2008a; Grönroos and Gummrus, 2014), customizability of the value steams from the customer's actions and, hence, customer's capabilities and the specific use of the PaaS offering., i.e., use situation. That is also in line with the idea of value-in-use, and generation and perceiving of value by the customer (Grönroos and Gummrus, 2014). Furthermore, as far as modularity allows for a great extent of customization (Coltman and Divnney, 2013) of PaaS offerings for various customers, not all the PaaS offerings have to be highly configurable, i.e., there might be a limited amount of possible offering configurations which, in fact, makes the offering fairly standard. Nevertheless, a fairly standard PaaS offering still may result in different customer value for different customers. Even the customers having seemingly similar needs

that can be satisfied by a certain configuration of the provider's PaaS offering may perceive the value of the offering differently as Figure 34 presents.



**Figure 34.** Customizable customer value.

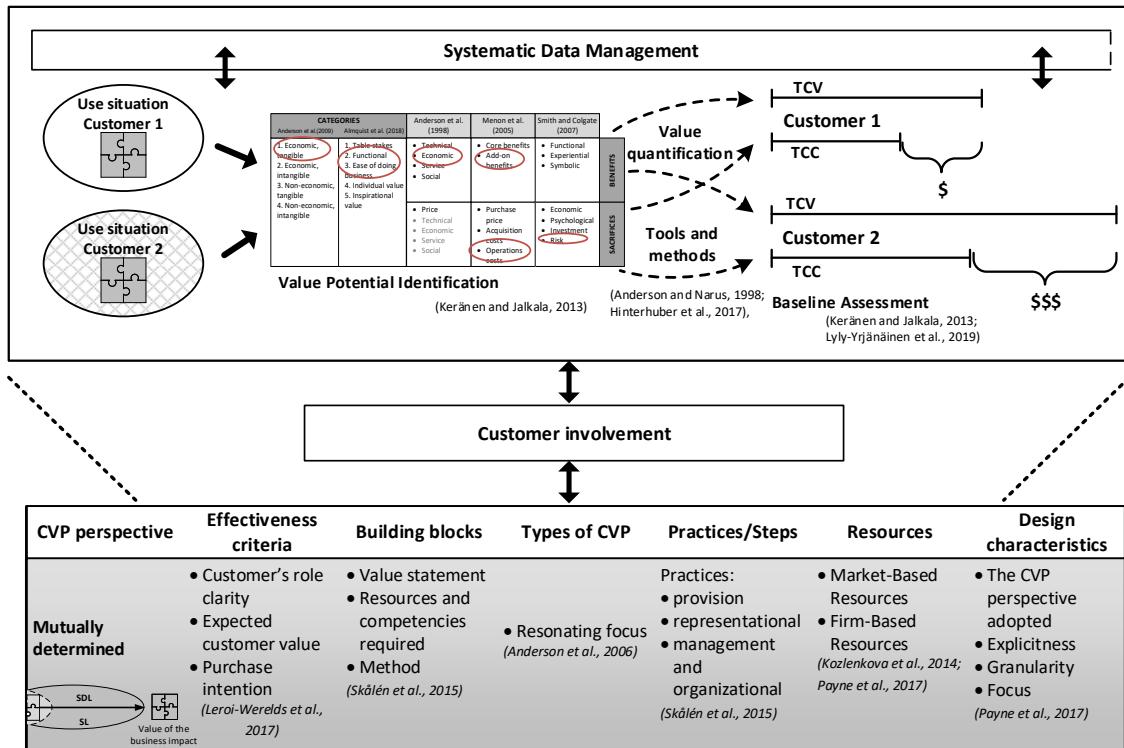
As the figure above shows, both customers are offered the same configuration of a PaaS offering that aims to satisfy similar needs and seem to impact the same areas of the customer's business. Also, the provider's early estimations of value for both customers brought similar results. However, the actual total customer value, total customer cost, and, hence, also customer perceived value differ between Customer 1 and Customer 2. Thus, the customer value has been customized by the customer during the use of the offering, and the final amount of the value perceived has been impacted by the use situation that may not have been considered by the provider while estimating the value for each of the customers. As stated before, the use situation may alter the value perception because of circumstances in which an offering is used (Fennell, 1978; Grönroos and Voima, 2013) or difference in strategic meaning of the particular offering (Woodruff and Gardial, 1996; Woodruff, 1997). The situation pictured in Figure 33 can be illustrated with the example below:

*Customer 1 and Customer 2 invest in a new cargo truck fleet that the provider offers as a service. The offering includes also access to a fleet management system (FMS) that helps to optimize the driving patterns of the truck drivers. Customers are charged by kilometer and can be offered petrol discounts for more ecologically friendly driving patterns that result in lower emissions and lower petrol consumption. As both customers have similar annual mileage and contract the same number of trucks, the provider estimated that Customer 1 and Customer 2 should*

*derive similar customer value. However, Customer 1 is a busy carrier company operating only within the domestic market. Furthermore, while the provider runs some initial training of the use of special functions of the FMS, no one in the Customer's 1 company monitors if the drivers take advantage of the FMS to improve their driving patterns. In contrast, Customer 2 focuses mainly on international transits. Also, as a smaller player in international transportation to be competitive, Customer 2 makes sure that its drivers take full advantage of the FMS functions that help to reduce the costs of petrol. Hence, both customers have not only different transport routes that may affect their driving patterns and petrol consumption but also different organizational cultures that affect how the offering is used. As a result, the customers that made similar buying decisions perceive different value from the deal made, and thus each of the customers customizes value perceived during the use of the offering, which presents that the customer value is customizable at the customer site based on the customer-specific use situation.*

Having so defined customizable customer value of PaaS offerings, it becomes clear that the provider can offer customized value estimations while the value becomes customizable at the customer. Based on that, a value proposition can be customizable only if the customer is involved in the process of crafting value proposition. It also means that a value proposition is not a fixed 'promise' but evolves, as value does (Vargo, 2009; Grönroos and Voima, 2013), along the provider-customer relation and in this way may become customizable. Hence, a customizable value proposition is a result of the provider and customer's co-operation. The provider co-creates value proposition through various processes including value potential identification, value quantification and baseline assessment (Keränen and Jalka, 2013) as well as indicating the role of the customer in the value creation process (Skålén et al., 2015; Leroi-Werelds et al., 2017). However, unless the customer is involved in the CVP generation process, value proposition is only customized but does not have potential to be customizable.

Involvement of the customer in the creation of the value proposition, and a customer creating and customizing value imply the need to follow the mutually defined customer value proposition (CVP) perspective in crafting a compelling and customizable value proposition for a PaaS offering. The approach to building a customizable value proposition for a PaaS offering is drafted in Figure 35.



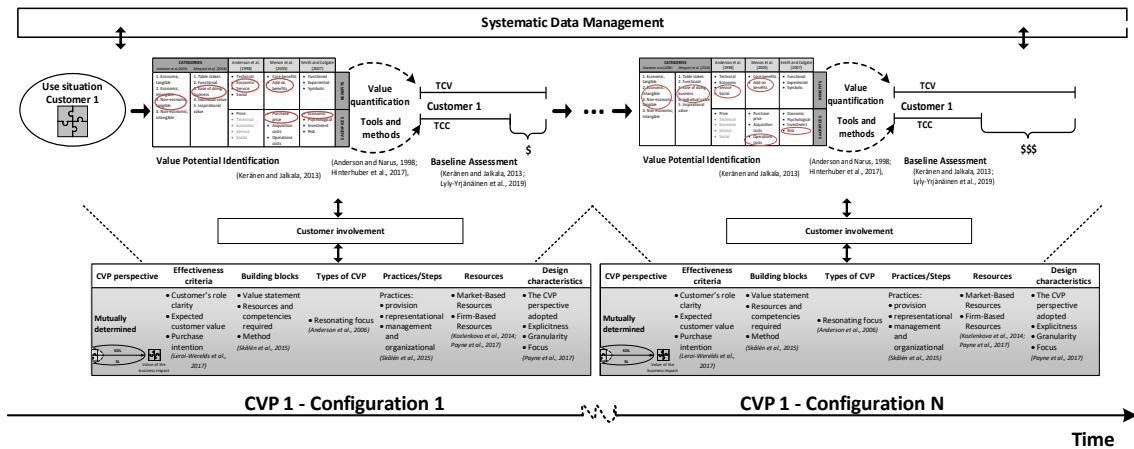
**Figure 35.** Building customizable value proposition for a PaaS offering.

As Figure 35 shows, the idea of building a customizable value proposition for a PaaS offering does not differ much from general idea of building a compelling value proposition. The approach is rather more specific as it acknowledges the type of offering and its underlying characteristics. Furthermore, the figure shows that the PaaS offering's use situation should be considered in early estimations of value potential. A better understanding of the customer's potential use situation is possible because of the service offering's potential for providing an opportunity for increased provider-customer interactions (Mathieu, 2001a). As the customer's use situation influences the value potential, the customer using the PaaS offering customizes the offering's value. At the same time, as the customer is involved in the value proposition creation process, he also customizes the value statement that is the building block of a value proposition. Thus, the customer more or less directly customizes the value proposition, which makes the value proposition customizable.

This approach to building of a customizable value proposition for a PaaS offering also emphasizes the focus on service perspectives and their main postulates such as value being generated by the use of service rather than being embedded in goods or the customer being the creator and influencer of value-in-use (Vargo and Lusch, 2008a; Grönroos and Gummesson, 2014). Hence, all aspects of mutually defined customer value proposition are valid while constructing the customizable value proposition. Mutually defined CVP perspective focuses on what value can be derived, what is needed (i.e., resources

and capabilities) to derive that value, and how this value can be derived (Skålén et al., 2015). However, this perspective seems not to discuss any specific types of value propositions. Nevertheless, implicitly this CVP perspective emphasizes the necessity to understand not only customer needs but also own ability to deliver a superior solution and hence solutions better than the one offered by competitors (Payne et al., 2017). Thus, it implies that the provider should possess a thorough knowledge of the customer and competitors, which is typical for the resonating type of a value proposition (Anderson et al., 2006). It does not mean that the CVP shall be constructed from a specific amount of points of difference and points of parity but rather provide resonance with the customer's business needs while focusing on the most important business matters.

Moreover, the approach presented in Figure 35 not only follows service perspectives but, in particular, reflects the service logic (SL) assumptions. In its core, the framework presented in Figure 35 focuses on supplier-customer interactions and roles and hence illustrates a micro-perspective to the creation of a CVP. Furthermore, not only value creation but also value customization are customer driven. Thus, the framework is rather customer-centric as also SL appears to be more customer-focused than SDL (Saarijärvi et al., 2017). Following the SL's assumptions, Figure 36 presents the customizability of a value proposition in practice.



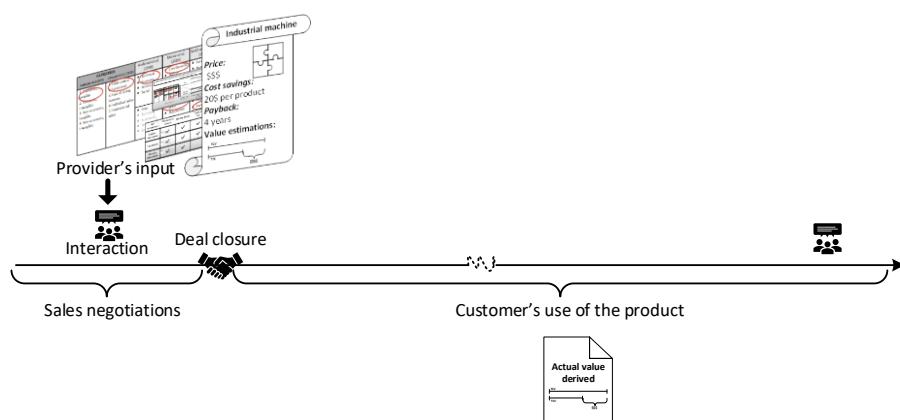
**Figure 36.** Customizable value proposition framework.

Figure 36 shows the evolution of the value proposition for a PaaS offering over time. The illustration emphasizes that various configurations of the CVP are built, and thus the initial CVP is modified to reflect the situation at the specific time-point. Along with the provider-customer relationship, the importance of some business impacts may change, and thus also different value elements may play significant roles and impact the CVP over time. The changes in the CVP may be caused by evolution in the customer's use

situation related to the PaaS offering, such as the offering gaining or losing on strategic importance.

The customer is the one who customizes the value. However, as service provision entails increased interactions between the provider and the customer, the provider may be able to influence the customer's value creation process (Grönroos, 2011). As stated before, the supplier co-creates value proposition bringing the tools and methods helping to assess the value-in-use and proposing customized CVPs for customers. Nonetheless, more frequent interactions with the customer may also allow the provider to note differences in how else the PaaS offering may contribute to the customer's value creation. The provider may suggest specific actions or adjustments in how the PaaS offering serves the customer to bring higher value potential or note that the offering influences also areas of the customer's business that have not been factored in the initial value estimations.

Customizable value proposition is a complex phenomenon, which may be better understood if explained using some examples that show the difference between a conventional CVP for a product offering and a customizable CVP for a PaaS offering. In case of a traditional product offering, following also G-D perspective, a provider would offer a customer value proposition based on own analysis of customer needs. For example, an industrial machines manufacturer may offer a customer a machine that should reduce the customer's production cost by 20 Euro per product resulting in the machine payback period of four years as Figure 37 shows.



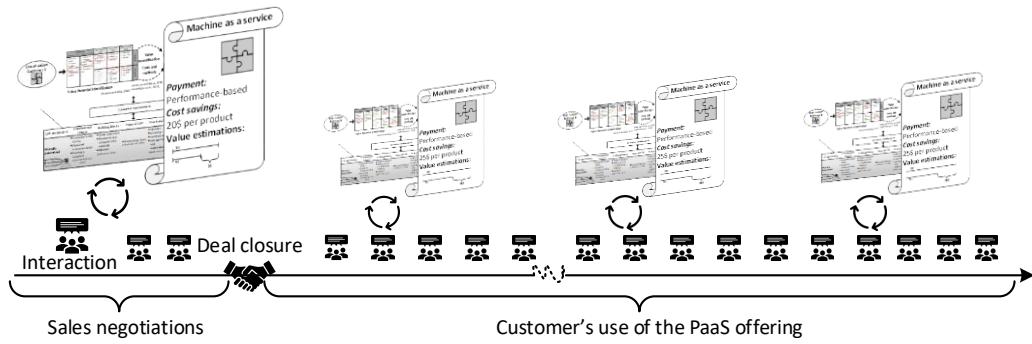
**Figure 37.** Traditional customer value proposition – a practical example.

As the figure above illustrates, the CVP is proposed at the very beginning of the sales process. The customer decides to make a deal with the provider based on the CVP created solely by the provider based on the generic customer knowledge. As the customer gained ownership of the machine and decided to do the entire equipment maintenance

in-house, the interaction between the machine manufacturer and the customer is minimal. Otherwise, the provider and the customer do not discuss as long as the machine performs more or less as promised, or the provider tries to cross-sell other products to the customer. The provider got paid and the customer runs the machine to create value for its business. The provider only interacts with the customer closer to the end of the expected life cycle of the machine to possibly sell the customer another machine to replace the old one. In that way, the value proposition proposed to the customer remained the same over time, and other potential impacts of the offering remained undiscovered.

Nevertheless, the actual value derived from the offering may have varied from the initial promise. For example, the customer might have learnt how to use the machine more efficiently and hence was able to gain more value out of the machine. On the contrary, the customer has not been able to recognize the real bottleneck in its production process and despite the perceived feel of optimal utilization of the machine, the value promised was not realized. Thus, on one hand the provider may have lost the possibility to participate in customer's success or on the other hand the possibility to act based on actual customer's situation to support the customer's value creation.

The situation described above can be avoided when a PaaS offering is proposed to a customer. As the provision of PaaS offering entails the service logic perspective, the CVP is interactively created by the provider and the customer. For example, if the machine from the previous example is offered to the customer as a service, the performance expected is likely to be analyzed in more detail as the pricing of the offering and promised benefits may appear less tangible. Also, due to a great extent of customer-centricity in such type of offerings, the value proposition would be customized based on the customer's actual needs, process, and preferences. Furthermore, as the machine remains in the ownership of the provider, the machine service would be continuously done by the provider. Hence, the interaction between both parties is likely to be more regular and may result in a situation when the value proposition is regularly revisited, as Figure 38 illustrates.



**Figure 38.** Customizable value proposition – a practical example.

As the figure shows, the CVP is not only proposed by the provider in the negotiation stage of the sales process but is rather co-operatively created by the provider and the customer at the beginning of the relationship and then revised as the time progresses. Based on the customer's use of the machine, potential new developments of the impact the offering makes on the customer's business as well as changing external factors, the value perceived by the customer might evolve over the time. Also, as the provider and customer interact often, the provider may be able to get to know the customer's use situation better and facilitate the value generation process of the customer accordingly. For example, the provider may be able to recognize the actual bottleneck in the customer's process and, as a result, improve the performance of the machine offered.

Hence, based on the evolving customer situation, interactions, and learnings, the initial value proposition evolves, too. Nevertheless, the changes in the value proposition are driven by the changes in the customer's use situation, not changes in the product offered. As a result, the customer is the one that customizes the value and its actions, and the modifications in the value proposition allow the customer and the provider to act upon these changes and understand the consequences of these changes.

## 5. CASE STUDY

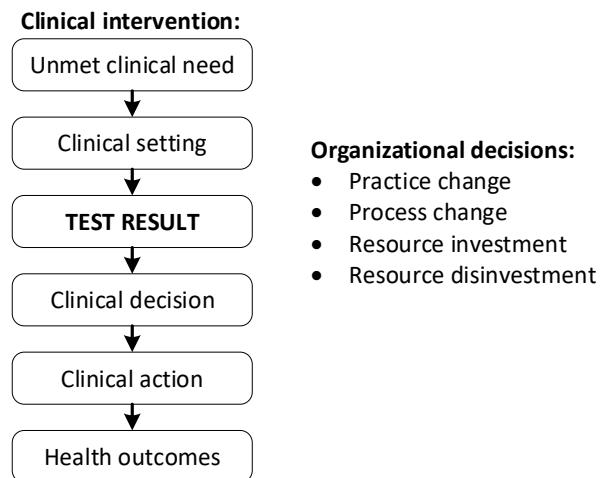
### 5.1 Case background

#### 5.1.1 The industry of medical laboratory diagnostics

The case study is conducted in co-operation with a biotechnology company that operates in the domain of medical laboratory diagnostics. The company develops and offers molecular solutions for medical laboratory diagnostics of infectious diseases and antibiotics resistances. The company has reached the commercial stage and it is growing at a fast pace in the molecular diagnostics domain. Currently, the company independently offers diagnostic instruments based on molecular technologies that enable fast and accurate laboratory diagnostics. The aim of the case company is to improve laboratory diagnostic efficiency to provide hospital wards with accurate test results faster to enable quick treatment of infected patients and reduce the spread of antimicrobial resistances.

Companies within the medical laboratory diagnostic industry provide solutions for analysis and diagnostics of body fluids and the production of images of body for medical purposes. These companies provide a wide range of instruments, consumables, software, and services to both public and private customers. Those customers are varying in size and complexity medical laboratories that are either standalone laboratories providing services to hospitals and clinics or laboratories that belong to hospitals, so called hospital laboratories. Regardless the laboratory structure and the ownership model, laboratories are staffed with qualified and trained staff capable of performing diagnostic testing using various methods and instruments.

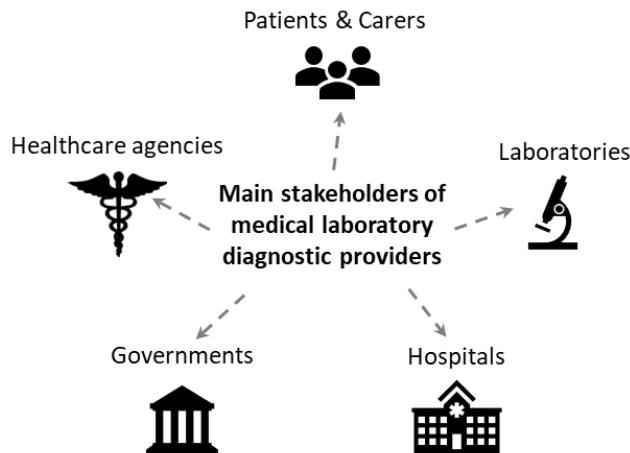
The aim of the medical diagnostic is to guide the physicians in accurate decision-making regarding a patient's treatment. In contrast to the diagnosis posed solely based on the clinical symptoms, a diagnosis given based on the laboratory testing provides objective measures (Jordan et al., 2015). Depending on a patient's underlying condition, diagnostic testing may be performed at different stages of the patient's treatment cycle and the test results influence clinical decisions and actions. Furthermore, inclusion of technological solutions in medical laboratory diagnostics may not only affect the course of treatment of a single patient and the patient's health outcomes but also impact the healthcare decisions on both clinical and organizational levels. Figure 39 illustrates main clinical interventions involving the use of a test and main organizational decisions to be made when change in testing method is considered.



**Figure 39.** Key elements in a clinical intervention involving the use of a medical test and challenging organizational decisions (Price and St John, 2014).

As the figure above presents, clinical decisions are made based on the test results and, hence changes such as the introduction of a new test or testing device influence clinical decisions and actions. It is claimed that timely and accurate diagnosis increases the chances for positive outcomes of treatment, improving the lives of patients, and saving the costs of further treatment (Jordan et al., 2015). Laboratory diagnostic enables confirmation or ruling out of a condition, guides the decisions on initiating or stopping treatment, need for additional testing or amount and frequency of medications to achieve the desired effect on the individual patient level (Jordan et al., 2015).

According to Jordan et al. (2015), the cost benefits of using laboratory diagnostics include lower numbers of patients required to treat, reduction in drug costs, improved compliance and persistence, and improved health outcomes. However, gaining benefits from the use of medical diagnostic testing requires that the results are acted upon. The introduction of new diagnostic solutions might require that some practice and process changes are made, which should also trigger decisions on investing and disinvesting in specific resources. Hence, companies offering novel diagnostic solutions have to build a clear understanding of current clinical and organizational practices and processes and how these can be influenced by their offerings. Furthermore, the companies in the industry of medical laboratory diagnostic must acknowledge a broader network of different stakeholders whose needs may influence decisions regarding the choice of diagnostic methods used in medical laboratories. The most important stakeholders are included in the figure next.



**Figure 40.** Main stakeholder groups in medical laboratory diagnostic industry.

Figure 40 presents five main stakeholder groups whose needs, requirements, and values drive the medical diagnostic industry. First, there are patients and carers; while patients are the ones whose condition is tested, they expect that right tests, of the right analytical quality, at the right time are made, and based on the tests results right decisions and actions are taken. A carer can be a family member, a friend, or any other individual supporting the patient's care. Those people expect that the patient has access to services such as laboratory testing, and if involved in any healthcare-related fee payments, they wish for the best possible outcomes within the reasonable price range.

Second, laboratories are organizations that perform diagnostic testing. Hence, laboratories directly handle patients' samples and follow various testing protocols using multiple methods, laboratory devices, and other resources. Furthermore, laboratories are responsible for delivering reliable results to hospitals, and they actively seek to improve the quality and turnaround time of the results provided. Laboratories must constantly ensure other stakeholders of the excellence of their service and provide the quality results timely but also in a cost-efficient manner. Also, while the laboratory management seeks the best diagnostic materials, devices, and solutions, they also have to ensure that the established testing protocols are within the abilities of the staff performing the test and that the protocol does not overburden the staff physically nor mentally.

Third, hospitals cover a high number of varied functions, and laboratory diagnostics can influence many of the decisions made in a hospital as described earlier. Hospital physicians order specific tests to be performed by laboratories and make treatment decisions based on the results of the tests. Hence, they are expected to pick the right tests to be performed, but physicians also require that the results of the test are reliable so that physicians have good ground for decision-making. Hospital decision-makers, besides

the test results reliability, also pay a lot of attention to the impact specific type of diagnostics may have on the hospital as a healthcare provider as well as the hospital as an organization that has to manage the available resources. For example, early detection of a specific condition, enabled by a diagnostic test, may influence a patient's recovery time and hence, the length of stay in the hospital and resources needed to treat the patient.

Fourth, governments also play various roles in the stakeholder network, and they may either enable some technologies and innovations to be utilized in medical laboratories or make it close to impossible. Governments, and especially ministries of health, develop policies and guidelines on how certain products can be used and may or may not approve certain technologies. Furthermore, public hospitals and laboratories run on the state funds and, hence all the purchases made by hospitals and laboratories must not only follow specific regulations but also fit into particular budgets.

Last, healthcare agencies such World Health Organization (WHO) or European Centre for Disease Prevention and Control (ECDC) are organizations that aim to promote general health, undertake various initiatives, including research and development, and set international guidelines and health standards. These healthcare agencies play also regulator roles which means that they also evaluate the efficacy, quality and safety of various healthcare products, including also medical laboratory devices.

As illustrated, the medical laboratory diagnostic providers such as the case company, have to satisfy a number of stakeholders. They do not only have to comply with various policies and regulations but also make sure that their offering has potential to induce changes in healthcare that would result in not only higher efficiencies of healthcare but most importantly in improved patients' health outcomes.

### **5.1.2 Case company's offering**

There are various specialty areas in medical laboratories, and the case company offers solutions for laboratory diagnostics of infectious pathogens and antimicrobial resistances. Hence, the company's offering is directed to laboratory units specialized in clinical microbiology. The company's product portfolio comprises of different test lines, and each of the test lines is paired with the compatible diagnostic instrument developed by the case company. The company also offers complementary, necessary and accessory, products for each of the test lines and a set of various services under one of the service level agreement (SLA) options.

The case company's offering is available in two forms. One the one hand, a customer can buy a diagnostic instrument, and thus the customer can make a one-time investment and become the owner of the instrument. However, for the instrument to be useful, the customer still must buy test kits that are sold separately with per test price tag. The customer can buy any number of test kits of a different kind based on the laboratory needs as there is no pre-agreed number of test kits that have to be purchased by the customer. Moreover, the customer can decide on one of the service level agreement (SLA) options, which are billed yearly. On the other hand, a customer may decide on a reagent agreement. The reagent agreement includes the instrument, test kits, and regular service of the instrument billed on price per-test basis. In that case, the instrument remains in the ownership of the case company that takes care of its constant functionality. At the same time, the customer uses the instrument and the test kits to perform sample screening.

Furthermore, each of the test kits comprises a different product as each of the tests is designed to screen for another type of pathogen or antimicrobial resistance. Even though different test lines are primarily targeted at different laboratory sizes, specific products may find their use in all kinds of laboratories. Hence, the case company can satisfy the needs of any microbiology laboratory, despite its size and the sample volume.

As some of the case company's products are fairly new in the market, the company is interested in obtaining a better understanding of cost-effectiveness and the impact of their solutions in different healthcare settings. In particular, the case company wants to investigate the cost-effectiveness of one of their products used for detection of carbapenems resistant Enterobacteriaceae (CRE). The problem of carbapenem resistance and how CRE is traditionally detected are covered in Section 5.2.

### **5.1.3 The case challenges**

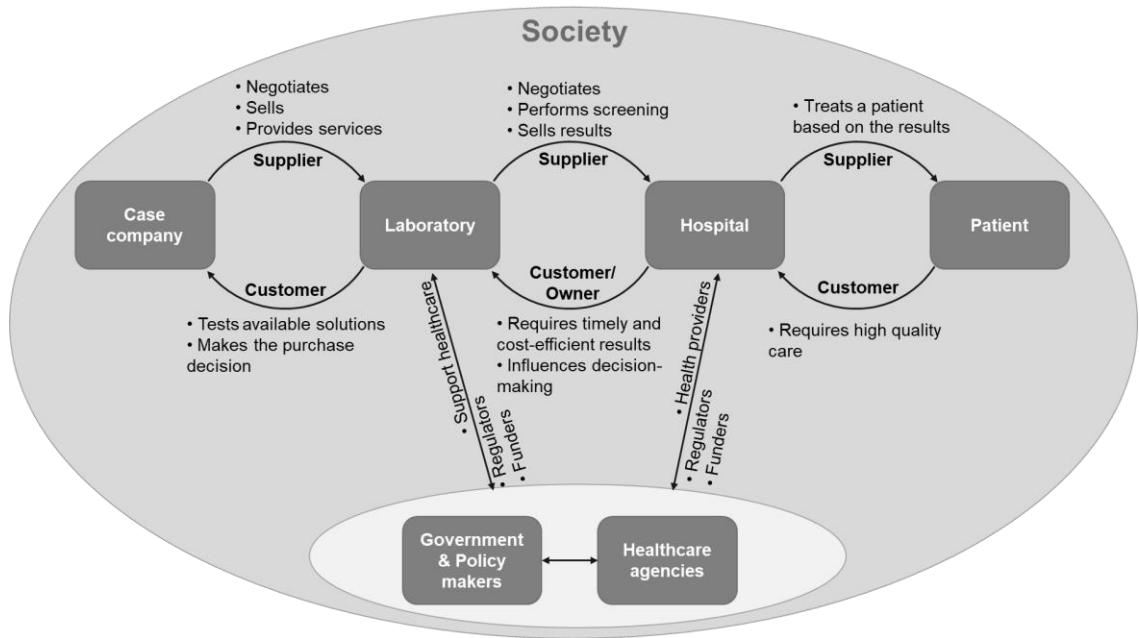
Molecular technology has been used in microbiology laboratory diagnostic already since early 2000. However, despite its ability to provide test results quickly, it has gained the fame of a costly solution the use of which needs to be justified. Therefore, the case company tries to prove that the use of the molecular diagnostic may be affordable and that access to earlier results may bring significant efficiencies not only in terms of costs but also the quality of patients' treatment. Furthermore, the case company wants to show that its solution can help to fight against the further evolution of antimicrobial resistance.

Interestingly, even though the case company provides solutions for laboratories, laboratory decision-makers, while deciding upon methods used in their laboratory, must consider their customers' needs, requirements, and abilities. Hence, laboratory decision-

makers often consult their decisions with hospital management and heads of relevant hospital units. As stated by a laboratory chief physician:

*"We [laboratory] make investment decisions ourselves. But of course, we have to consider what our customers need and how much they are willing to pay for investigations. When we make investments into new investigation methods and if those imply changes in the screening protocol and the price of an investigation goes up or turnaround time changes, then we have to discuss with the hospital and other customers whether it is ok and if they are willing to pay this extra amount of money to get for example more comprehensive or faster results."*

The statement clearly shows that the case company has to convince the laboratory decision-makers that the solution brings efficiencies not only within the laboratory settings but also enables the laboratory to provide value to the hospital. Hence, the case company must gain knowledge of the changes that take place in a laboratory while their solution is implemented. Moreover, as also stated by the company's marketing manager, the case company must be able to provide the laboratory with a set of benefits the hospitals may gain so that laboratory representatives can easily understand and convey the value of the case company's solution also to the hospital's decision-makers. That, in turn, means that the case company has to understand the impact of its solution in hospital settings and how this impact is reflected in terms of customer value a screening result might provide to the hospital and other relevant stakeholders. Based on these statements, it is clear that there are certain dependencies between various stakeholders that make the sales process of the case company's solution challenging. Figure 41 shows these dependencies between different stakeholders.



**Figure 41.** Dependencies between stakeholders and the case company.

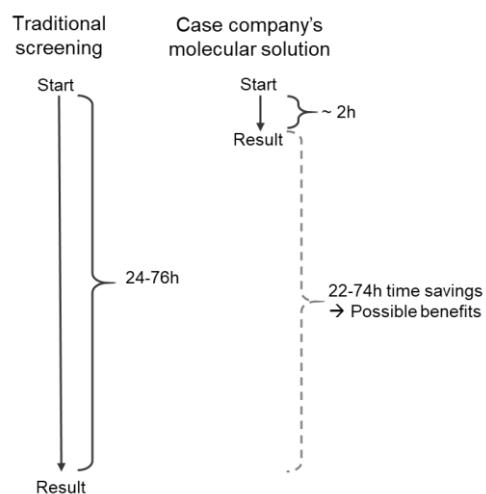
Figure 41 presents relations between stakeholders and which stakeholders are likely to interact with each other. The case company interacts mainly with the laboratory decision-makers with whom the case company's representative negotiate the deals and close the sales. However, laboratories being suppliers of tests results to hospitals negotiate some purchase decisions with hospitals. In case the hospital owns the laboratory, the case company may also directly negotiate with the hospital management responsible for the laboratory operations. While laboratories are the case company's main customers, they are also a source of information regarding current hospital needs, and labs also test many solutions available on the market. Thanks to laboratories, hospitals can make better-informed decisions and hence provide better quality care to patients.

Government and healthcare agencies affect hospitals and laboratories decisions as these organizations set standards that must be followed by hospitals and labs. Also, public hospitals and laboratories run on public money, hence investments in new solutions must also be justified to fit the public budget. Public funding also brings certain obstacles to the case company as bigger investments made by public organizations have to go through a tender process. Tender offers do not only have to fulfill special requirements but also follow a designed schedule, which often means that the negotiations and sales process are lengthy and resource intensive.

Moreover, Figure 41 places the case company and all the stakeholders in the context of society as CRE indirectly also affects the society at large, at least health- and cost-wise.

While the societal impact and regulatory influence are here acknowledged, the case focuses mainly on the impact of the case company's solution on the laboratories and hospitals, and hence indirectly also on the patients.

Furthermore, as the case company provides innovative molecular solutions for screening of common infectious diseases and antimicrobial resistances, there are already many different solutions being used by laboratories to guide physicians in their decision making. However, according to Morel et al. (2016), in the field of infectious diseases, a particular challenge to the adoption of more innovative solutions, like molecular diagnostics offered by the case company, is the well-established use of traditional diagnostic methods such as culture and drug susceptibility testing. Many laboratories nowadays still use traditional methods to screen for antimicrobial resistances as those methods are relatively reliable and cheap. Nevertheless, traditional methods may require several days to produce results while the case company's solution requires a bit over an hour to report results as Figure 42 illustrates.



**Figure 42.** Time-to-result: traditional versus case company's solution.

Figure 42 presents that the laboratory using the case company's solution can deliver screening results 22-74h earlier as compared to the use of traditional methods. This time difference in the hospital setting may bring potential changes in terms of a patient's treatment process. Moreover, access to earlier results may affect not only treatment-related decision making but may impact the whole process of handling antimicrobial resistance in hospitals. These changes may, in turn, be reflected in potential cost savings for the hospitals. Nevertheless, the case company offering their solution cannot just say that their solution has the potential to bring savings. The case company must showcase how this time efficiency positively affects work in both laboratories and hospitals. What also makes the situation more challenging is that the use of traditional methods is less costly.

It is estimated that the cost of performing the test using a molecular solution might be a few times higher for laboratories as compared to traditional methods. It means that the laboratories that want to implement molecular solutions will have to increase the price per test for hospitals. Such a price increase has to be well justified. Thus, the case company must be able to present how the time efficiency in obtaining results, brought by their solution, is translated into monetary terms. One of the representatives of the case company said:

*"Budgets in hospitals are tight, and if none can see direct savings, it is difficult, none likes to rearrange budgets. We need a way to convince the hospital management that we bring positive change. What would be helpful for us is to be able to showcase how the change from chrome agar [traditional method] to our solution impacts hospitals in terms of cost-efficiency. Benefits anyway come on a patient-level - shorter length of stay, lower mortality, and, on macro-level, less spread and correct use of antibiotics."*

Hence, to be able to showcase the potential cost-efficiencies, the case company needs to understand how their solution affects the work in laboratories and hospitals to note the main changes and analyze what these changes mean in terms of processes, practices, and resources currently utilized by hospitals and laboratories. However, there are differences in the levels of antimicrobial resistance among different countries, and hence different countries adopt different protocols for handling the CRE in their hospitals. This means that the impact of the case company's solution may vary between various hospital-settings and the case company needs to be able to address these differences while discussing the value of their offering with different laboratories and hospitals. Importantly, the case company also needs to recognize the customers for whom their offering will bring the greatest value.

Along this section, there are many challenges described that show that, despite the case company's solution's ability to provide physicians with results even up to 74 hours earlier, the deployment of this solution is not a straightforward process. These challenges can be summarized as follows:

1. Medical laboratories widely use traditional methods of screening for CRE and all the processes and practices built on these methods.
2. There is a complex network of actors whose needs have to be satisfied.
3. The approach to investments in healthcare is still rather cost-based than value-based and immediate cost reductions are strived for.
4. There are no unified procedures related to screening for CRE.

Despite these challenges, the case company needs to find a way how to efficiently and effectively discuss the value of their molecular screening device. Most of all, the company must be able to recognize what are the most important decision-making factors for its customers while not making complex analyses for each customer from scratch. Therefore, the case company needs a tool that would help to analyze the value of the company's offering using pre-defined modules, i.e., value categories and variables to be analyzed, which can be filled in with an individual customer data. Such a tool could then support the creation of customized value propositions together with the customer and serve as a platform to discuss potential new options for the customer's actions, hence stimulating the customer's value creation process.

The topic of antimicrobial resistance and laboratory screening methods are not common knowledge within the business and management fields. Thus, the next chapter will briefly review the meaning of carbapenem resistance and the importance of early recognition of patients with CRE, and also compare the traditional screening method to the method proposed by the case company. Moreover, discussion of these topics builds the ground for analysis of hospital and laboratory processes, practices, and resources that play a key role in the recognition and handling of a patient at-risk of carbapenem resistance. That, in turn, allows recognizing main value categories and value elements to be further analyzed.

## **5.2 Carbapenem resistance**

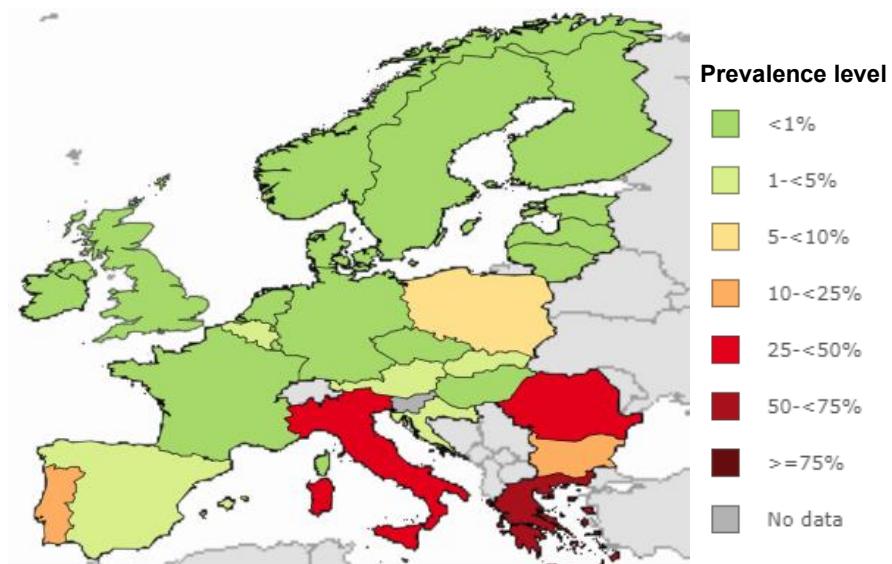
### **5.2.1 Definition and significance of antibiotic resistances**

Since the first antibiotic, penicillin, was invented in 1928 and then successfully applied in 1942, many lives have been saved due to antibiotics transforming modern medicine (Sengupta et al., 2013). Antibiotics have not only helped to save lives but had a major role in medical and surgical advances as well as in extending the expected life spans by reducing the severity of bacterial infections outcomes. Nevertheless, resistance to antibiotics has become a prominent clinical problem. The resistance to penicillin became apparent already during the work on finalizing the drug and by 1950 became the threat to many prior medical advances. Many new antibiotics have been introduced over the years to fight the resistance problem, however, by now resistance has been seen in almost all discovered antibiotics. It is claimed that the main reasons for antibiotic resistance are the overuse and misuse of antibiotics, and the shortage/failure of new antibiotics development due to low economic incentives and demanding regulations (Ventola, 2015). According to the European Centre for Disease Prevention and Control

(ECDC), around 33 000 people die each year in Europe due to infections caused by antibiotic-resistant bacteria (THL, 2018).

The evolution of bacterial resistance to antibiotics poses a major threat to global health as infectious diseases that have long been considered curable have become dangerous again (Morel et al., 2016). Currently, one of the major clinical threats, and the interest of this thesis, is carbapenemase resistant enterobacteriaceae (CRE) which is a group of bacteria that became resistant to ‘all or nearly all’ antibiotics, including carbapenems that are seen as the ‘treatment of last resort’ against the drug-resistant pathogens (Ventola, 2015). As carbapenems are seen as the most reliable drugs in treatment of bacterial infections, the emergence and highly increasing spread of resistance to these antibiotics is a major public health concern (Meletis, 2016).

Carbapenem resistance restricts treatment options and is associated with adverse clinical and economic outcomes including delay in administration of effective therapy, increased patient morbidity, attributable mortality, increased length of stay, and increased costs of health care (Mariappan et al., 2017; Moloney et al., 2019). Since the first report on a carbapenem-resistant isolate in 1996, CRE has already spread globally and some countries, like Greece or Italy, are already considered endemic for some CRE strains (Magiorakos et al., 2017). Figure 43 presents the most current situation regarding carbapenem resistance in Europe.



**Figure 43.** Carbapenem resistance in Europe (ECDC, 2019).

As Figure 43 shows, carbapenem resistance is already a major problem in some of the European countries where CRE prevalence levels reach above 10%. Simplifying, if CRE prevalence in a country is 10%, it means that on average 10% of the patients that are admitted to the hospital are likely to be CRE carriers. There are still many countries in

which prevalence of CRE is relatively low. However, as the cross-border transmission of bacteria is possible (people travel abroad and are treated in hospitals abroad), the hospitals in countries with low prevalence are also cautious about the CRE. Also, the case company's representative said:

*"In the low prevalence countries, they want to keep it low. They want to ensure that there are no patients released that would spread the CRE in the community and in result increase the prevalence. Also, the antibiotics to treat those with resistances are much more expensive. This is why these countries have incentive to screen patients, too."*

CRE is readily transmissible in healthcare as well as community settings (Nordmann et al., 2016), especially elderly and people with many comorbidities, i.e., having another disease or suffering due to other health conditions, are at risk of CRE acquisition. Hence, CRE poses extreme risk especially in healthcare facilities such as hospital and long-term care facilities, for example elderly nursing homes. There are several modes of CRE transmission in the hospital environment such as:

- patient-to-patient transmission
- healthcare worker-to-patient transmission
- medical devices-to-patient transmission
- hospital environment-to-patient transmission

First, patients might be either colonized or infected by CRE. In the case of colonization, CRE bacteria live harmlessly in the parts of the human ingestion system or on the skin, and the person does not display any symptoms of CRE bacteria carriage (Moloney et al., 2019). However, if the bacteria enter different areas such as bladder or bloodstream, they can cause illness that may result in severe morbidities leading even to death (Moloney et al., 2019). Furthermore, both infected and colonized patients are seen as the main reservoirs for CRE transmission to other patients resulting in the wider-spread carriage, further infections, and possible outbreaks (Magiorakos et al., 2017). Especially asymptomatic patients are a significant threat to the transmission of bacteria from patient to patient, as well as to healthcare workers and the environment; hence active screening of patients, potentially at risk of CRE carriage, is of utmost importance.

Second, CRE can be transmitted through contaminated hands of healthcare workers (HCWs). Being in contact with colonized patients, HCWs may pick up bacteria on their hands during various activities such as touching a patient or patient's clothing, bedmak-

ing, toileting activities, or even while administering medications to the patients (Sanderson and Weissler, 1992). Despite strict work hygiene policies in healthcare, the average compliance with proper hand hygiene of HWCs remains at around 40% (Tacconelli et al., 2014). Then bacteria being present on hands and as a result, also on the clothing of HWCs can be cross transmitted to other patients.

Third, inadequately decontaminated medical devices and tools that were used for examination of colonized patients or were touched by contaminated hands of HWCs pose yet another mode for transmission of infectious diseases, and antimicrobial resistance (Tacconelli et al., 2014). According to study of Epstein et al. (2014), 39 patients who were exposed to duodenoscope, a medical device that is inserted into human's small intestine to perform for example biopsy, were later found colonized with the same CRE strain found also on the device.

Last, the transmission of CRE may happen via a broadly understood hospital environment. Surfaces, sinks, drains, and toilets in patient rooms may be contaminated and bacteria are able to survive in these places for a significant amount of time. The latest study by van Beek et al. (2019) confirmed epidemiological links between patients who were staying in the same rooms but whose stays were not overlapping. Environmental screening of surfaces, sinks, drains, and toilets in those rooms proved positive for CRE despite proper terminal cleaning and decontamination of the patient's rooms and bathrooms.

Beside different transmission modes, there exists a positive correlation between certain factors that increase the risk of colonization followed by an infection. Those factors are so-called risk factors, and in the case of CRE, those risk factors are prolonged hospitalization, severe underlying hospitalization, presence of invasive medical devices and antibiotics use (Mariappan et al., 2017; Magiorakos et al., 2017). There is an overall 16,5% risk that a colonized patient will become infected (Tischendorf et al., 2016), that risk varies between 7,6 to 89% depending on the severity of the patient's illness (McConville et al. 2017; Ambretti et al. 2019) and between those patients, 10-75% are likely to die due to CRE (Tischendorf et al., 2016).

### **5.2.2 Guidelines for testing**

To address the emergent global threat of carbapenem resistance, many national and international bodies developed guidelines that help to identify the potential carriers and apply relevant infection prevention measures to avoid further CRE transmissions. Based on a systematic review on the prevention of the spread of CRE and expert opinions, European Centre for Disease Prevention and Control (ECDC) built a comprehensive guideline that offers suggestions for best practices related to the identification of patients

'at-risk' for CRE carriage already at admission to the healthcare setting and effective infection prevention and control measures to avert the entry and spread of CRE (Magiorakos et al., 2017). ECDC distinguishes between three groups of measures applied in a healthcare setting, which are standard precautions, so-called 'contact precautions', and additional precautions. First, standard precautions are the core measures that should be applied to any patient admitted to a hospital throughout their stay regardless of their CRE status. Second, contact precautions are the preliminary supplemental measures that should be applied to all the patients who are at-risk for CRE carriage, while additional precautions are additional supplemental measures applied to patients with confirmed CRE positive status.

Based on the ECDC guideline, the identification of patients 'at-risk' of CRE carriage should be done by the frontline HCW admitting the patient. During admission interview, the HCW has to inquire information regarding the patient's exposures and situations that would qualify the patients as 'at-risk' for carriage of CRE. Hence, acquiring detailed medical and travel history is a must. Fulfilling any of the criteria presented in Table 6, according to ECDC, defines a patient as a possible carrier of CRE.

**Table 6. Patients at-risk for CRE carriage (Magiorakos et al., 2017).**

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**Any patient who has one of following risk factors is 'at-risk' for carriage of CRE:**

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- a. A history of an overnight stay in a healthcare setting in the last 12 months
  - b. Has been either dialysis-dependent or received cancer chemotherapy in the last 12 months
  - c. Known history of previous carriage of CPE in the last 12 months
  - d. Has been previously epidemiologically linked to a patient known to be a carrier of CPE
- 

If the patient fulfils any of the criteria stated in Table 6, he is qualified as a patient at-risk of CPE carriage and supplementary measures should be applied in case of such a patient. Those measures include:

- pre-emptive isolation
- active screening for CRE
- contact precautions.

First, pre-emptive isolation means that a patient is directly placed in a room alone, either in a standard single room or in a special isolation room, instead of being included in the general patient flow. Second, active screening for CRE happens by obtaining rectal samples or samples from any other body side that is already actively infected or can be considered as colonized. Last, contact precautions mean that anyone who enters the

patient's room should follow specific contact rules, such as wearing personal protective clothing or performing proper hand hygiene.

If a result of screening for CRE is positive, supplementary precautions are continued and additional precautions measures, like active screening of contact patients or enhanced environmental screening, are advised. If the screening result is negative and there are no other reasons, such as colonization with another multidrug-resistant organism or transmissible infection, to continue supplemental measures, isolation and contact precautions discontinuation may be considered. The decision of discontinuation of the contact precautions based on screening results must be followed by risk assessment, especially in the case of a patient that has a history of CRE carriage. In practice this means, that a patient who is screened at admission, has no history of CRE carriage and obtains negative result(s), can be released from supplemental precautions and join general patient flow.

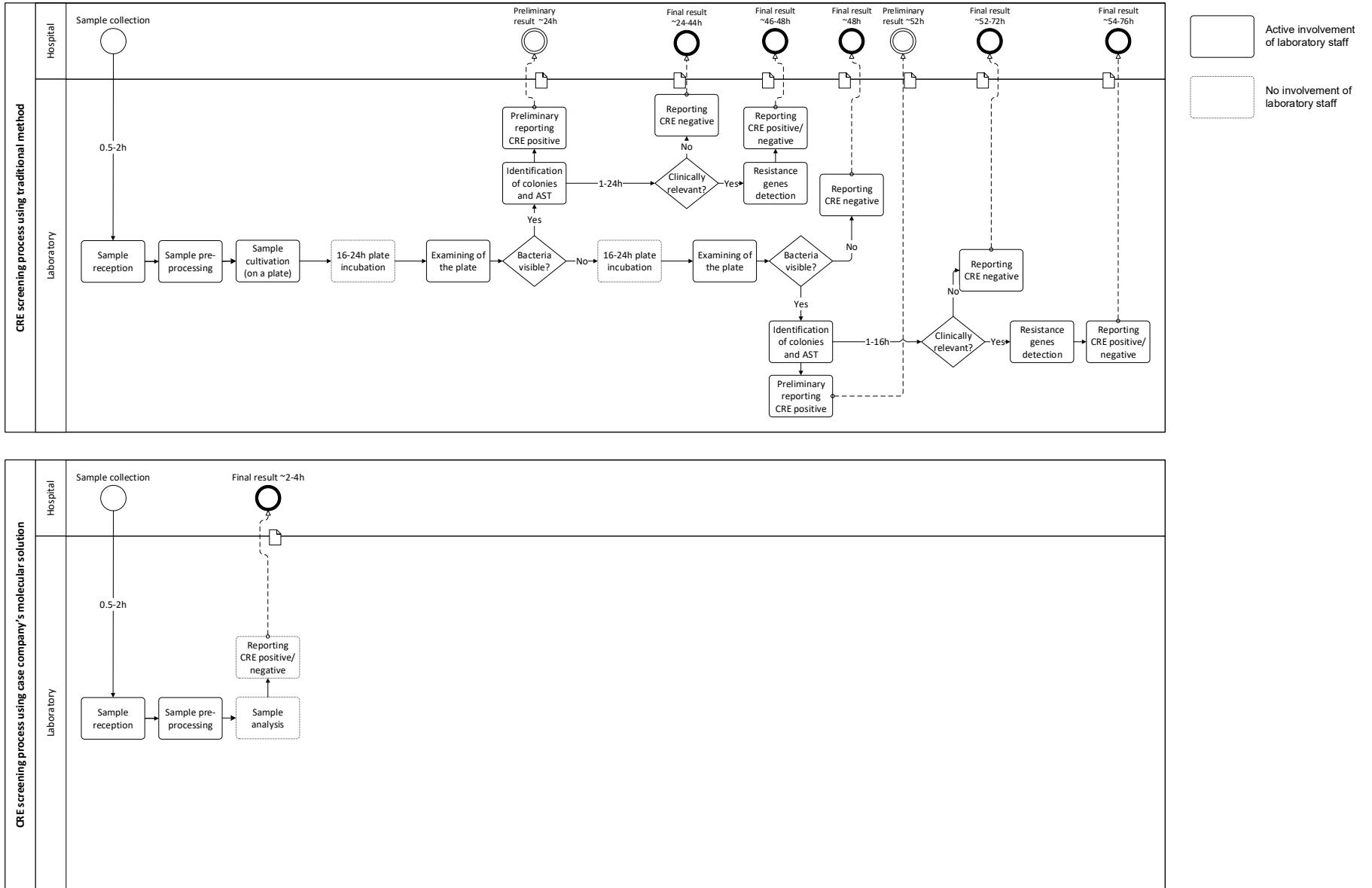
The guidelines proposed by ECDC are not compulsory for each European hospital but rather present a set of best practices to fight the spread of carbapenem resistance. As stated in the document (Magiorakos et al, 2017), hospitals may adapt or adopt proposed practices to the local CRE epidemiological needs, and financial and structural resources availability. Therefore, decisions regarding when and how to screen, type and quality of precaution measures taken vary greatly between hospitals in different countries and may even vary between different regions within one country. For example, it is not uncommon practice that a patient must have not just one but two or three consecutive negative screens to discontinue supplemental measures, and those screens might be taken in different intervals in different hospitals. Decisions about multiple screenings are based on the possibility of a test giving a false-negative result due to non-standardized protocols for sampling and microbiological testing. Furthermore, many hospitals isolate only positive patients. That happens especially in the case when a facility lacks single or isolation rooms to isolate patients, and isolation of one patient in a multiple-patient room is not financially feasible for that facility.

As this section shows, despite the guidelines, there are no unified practices and procedures of how patients 'at risk' of CRE carriage are handled in the hospital. Thus, each institution approached by the case company may have its own practices and processes built on general guidelines. This illustrates that, while the company's offering is relatively standard, the use of the offering in different healthcare settings may result in a difference in the value perceived by the case company's customers. Concluding, the use situation may have a high impact on the potential and actual customer value to be derived from the use of the case company's offering.

### 5.2.3 Comparison of screening methods

According to ECDC (Magiorakos et al, 2017), there has been no consensus reached on the optimal microbiological method for the detection of CRE carriage. However, it is advised that the chosen method should be highly sensitive and provide results in a timely manner to guide the proper implementation of infection control and prevention (ICP) measures. The choice of the screening method is usually dictated by the local needs, created ICP protocols, financial and structural abilities as well as therapeutic traditions in the country or region. Interestingly, despite development of novel diagnostic methods, many laboratories still rely on traditional diagnostic methods as the main method for screening of carbapenem resistance (Kostyanev et al., 2019) as traditional diagnostic is relatively reliable, highly sensitive and, most of all, low-priced.

As it has been noted earlier, the main difference between the traditional screening method and the case company's screening solution is time-to-result. However, many aspects vary between these methods, which can directly impact the work in laboratories. While the price per test using the case company's solution appears higher than if the traditional method is used, the wider understood cost-effectiveness should make the change to the case company's solution interesting also from the laboratory point of view. Figure 44 compares the process of performing a test for CRE using the traditional and case company's molecular method. The figure is constructed by the researcher based on two days of observations of the laboratory processes and existing materials gathered from the case company and scholar publications (e.g., Ambretti et al., 2019).



**Figure 44.** Traditional screening (top) and screening using the case company's solution (bottom).

Figure 44 shows the traditional screening process at the top of the page and the screening process using the case company's solution is presented in the graph at the bottom of the page. Both processes are presented in a more general way as each of the steps included in the graphs can be broken down into subprocesses needed to perform the entire step. However, even these simplified graphs show that the number of steps following the traditional method is far larger as compared to the case company's solution. The steps from sample collection to sample pre-processing are the same for both methods. These steps may last anything between 0.5 hour and 3 hours, depending on the hospital-laboratory logistics and laboratory internal protocol.

The later steps in the screening process differ between both methods. As it comes to traditional methods, the first step in sample processing is sample cultivation. Sample cultivation, also called bacteria culturing, is a method that requires following several sub-steps that enable the growth of microbial organisms, which is necessary for further characterization of the bacteria. Then, the plate is carefully closed and moved to the incubation place where it stays for 16 to 24 hours for the bacteria to grow. After the incubation period, the laboratory technician examines the plate. If there is any trace of bacteria found, the laboratory technician sends a message to the hospital system about a potentially positive result. Then, the staff performs additional tests to confirm the type of bacteria, and within the next 1-24 hours, the final result would be reported. In that case, the hospital gets the final result within 18-44 hours from sample collection.

In the case there is no bacteria growth visible after the first incubation period, the plate is incubated for the next 16-24 hours, and after that time, the plate is examined again. In case there are any bacteria visible, the same protocol as described earlier is followed, and the final result is provided to the hospital 48-76 hours from sample collection. If there is no bacteria visible after the second incubation period, the result is reported as negative, and no additional sample testing is done. Usually if the patient is the CRE carrier, the bacteria growth would be visible after the first incubation period, and hence hospitals get preliminary positive results within 24 hours. However, the negative result cannot be preliminary stated and, consequently, the negative result is only reported after 48 hours.

On the other hand, when the case company's solution is used, a laboratory technician pre-processes the sample and inserts it into the case company's instrument that performs the entire analysis and automatically sends results to the hospital information system. The analysis using the case company's solution takes just over an hour and multiple samples can be analyzed at the same time. As Figure 44 presents, both positive and negative results are delivered to hospital wards within the same timeframe of 2-4 hours from the sample collection. Moreover, when the case company's solution is used, there

can be different types of tests run in the same instrument at the same time, which additionally enhances workflow in a laboratory.

While in the case of the traditional method most of these steps require the laboratory staff's active involvement, the analysis of the sample and reporting is automated by the case company's solution and requires a minimum commitment of the laboratory staff. Hence, the laboratory technician's hands-on-time needed to analyses CRE samples is much shorter when the case company's screening solution is used. Also, the lower number of steps poses smaller chances for human-related errors and potential sample contamination, which could influence the outcomes of the analysis.

Then, traditional analysis requires many different accessories and materials to run the screening. Although the cost of these accessories and materials is not substantial, the laboratory must make sure that all these elements are available at all times. In contrast, to run the test with the case company's solution, only the test kit and a pipette are needed, which is much easier to keep track of. Furthermore, while the accuracy of the traditional method is on a relatively high level and oscillates between 80-90%, the accuracy of the screening result with the case company's solution is close to 100%. The higher the accuracy of a method, the more reliable results are provided to hospitals.

As presented in this section, the use of the case company's solution to screen patients 'at-risk' of CRE carriage does not only allow for bringing positive and negative results earlier but also simplifies the workflow in the laboratory. The molecular solution enables the provision of more accurate results to hospitals and lowers the extent of manual work performed by laboratory technicians. Whereas it may seem that direct costs of traditional screening are much lower as compared to molecular screening, a broader perspective on costs and benefits of screening should be considered. Therefore, the efficiencies in the laboratories should be accounted for as well as the potential differences in costs and benefits for hospitals if the case company's molecular solution replaces the traditional screening method in a laboratory.

## **5.3 Towards a customizable value proposition**

### **5.3.1 Deriving key value elements**

As many laboratories already use a CRE screening protocol based on traditional diagnostic methods, the case company needs to convince the key decision-makers that their offering does not only provide earlier results, but also brings the same or higher monetary and non-monetary value as compared to the currently used method. Thus, the case company must identify the key processes, practices, and resources, and hence key value

elements that are impacted by CRE screening in both laboratories and hospitals. Only when these key value elements are recognized, a comparative value assessment between the traditional screening method and the case company's molecular solution can be performed.

Recognition of the key elements for value assessment of a novel laboratory diagnostic solution might be challenging. One way to approach the challenge is to recognize what are the key drivers of the customer value offered by the laboratories to its customers, i.e., hospitals. Based on the interview with the chief physician of one of the Finnish laboratories, it can be stated that the main goal of any medical laboratory is to deliver high-quality service. That means that the results provided by the laboratory should be reliable. He said:

*"One of the most relevant ones [values] is quality so basically that the customer can rely on those results (...). Other value is probably that we try to do things as efficiently as possible in meaning of speed and costs. We try to be as cost effective as possible."*

As the quote states, the quality of the results is the key aspect. However, these quality results should be delivered in a time- and cost-efficient manner. Thus, from the laboratory perspective, laboratory diagnostic solutions shall be evaluated based on:

- reliability
- time efficiency
- cost efficiency.

First, in terms of a laboratory investigation, reliability is reflected in the screening method's accuracy defined by its sensitivity and specificity. The sensitivity of a clinical screening test is a test's ability to recognize all the patients having the condition correctly. At the same time, specificity defines the test's ability to accurately identify those patients who do not have a particular condition. Any test has an estimated accuracy; however, the complexity of the activities performed by laboratory staff to run a test may impact the accuracy as the more complex is the screening process, the more it is prone to human errors. The high complexity of a screening protocol also requires highly skilled laboratory staff to perform the tasks which may be related to higher costs of labor work.

Second, time efficiency is related to the time it takes to deliver the result to the hospital using a particular screening method. Time efficiency might be considered in terms of the laboratory staff time spent on processing a sample and then the time of all the screening

phases not requiring the staff involvement. Hence, one method might be more time-efficient in terms of the laboratory staff hands-on-time or the total time to result, including the passive phases. Passive phases include the time when no staff involvement is needed, for example, incubation of the sample or automatic analysis. Laboratory staff hands-on-time is the source of costs for the laboratory on top of the equipment, tools, and materials required to follow a screening protocol.

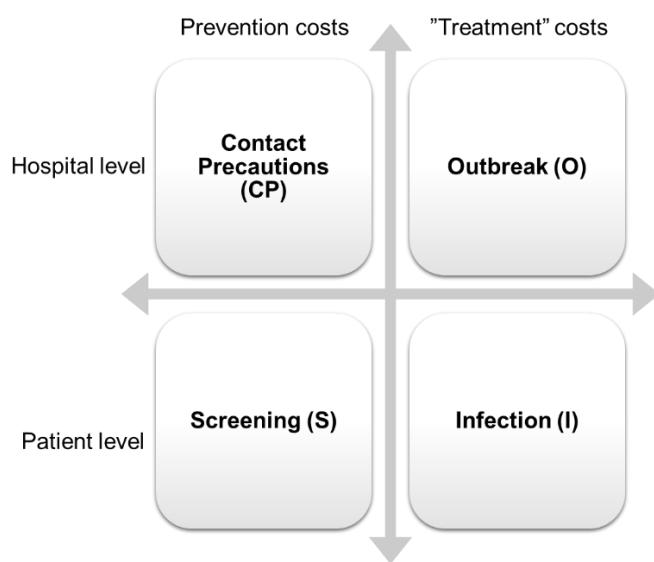
Finally, the cost efficiency is related to how much it costs the laboratory to run a screening test using a specific method as the costs of a laboratory investigation define how much a hospital needs to pay for laboratory investigations. The cost of a single screening investigation includes equipment, tools, consumables, hands-on-time of the laboratory staff required to perform the screening, and overhead costs applied to each screening test. It is worth noting that laboratories usually price their work per test result, which reflects a service business model. Nevertheless, to prove cost-efficient to hospitals, laboratories do not necessarily have to choose the least expensive screening methods as even a more expensive screening method might prove cost-efficient if costs are considered holistically.

The holistic approach to costs-efficiency requires that the costs and benefits are analyzed not only based on the price of a single screening investigation but on the impact of the screening method on the entire clinical intervention should be considered. Moreover, as defined by Porter (2010), value in healthcare is equal to health outcomes achieved per dollar spent. Value in healthcare defined this way encompasses efficiency. However, achieving efficiencies should not be led by cost reductions that potentially diminish the effectiveness of care. Hence, if a laboratory considers the change of the screening method, that change should either improve the healthcare outcomes and decrease the cost of the entire clinical intervention, improve the healthcare outcomes while keeping costs steady or deliver the same healthcare outcomes while reducing the costs of achieving these outcomes.

Recognition of value elements important for the laboratory while considering changes in screening protocol does not require specifying the type of a test. However, while analyzing the impact of the screening protocol on the entire clinical intervention, the types of interventions and tests requested vary depending on a patient's condition. Hence, evaluation of the key value elements for the hospital needs to be based on medical intervention related to a specific condition.

As it comes to carbapenem-resistant bacteria (CRE), it is not associated with a single medical condition a patient might suffer. The patient is usually admitted to a hospital due

to another condition, and only in the hospital it is found that the patient is also a CRE carrier. However, the suspicion of CRE carriage by any hospital patient triggers, or should trigger, a set of actions undertaken by healthcare workers (HCWs) which impact a patient's treatment process and resources used in that process. Hence, the key elements considered in value assessment should be based on the hospital processes and resources affected by suspicion of CRE carriage and the result of a screening test for carbapenem resistance. Based on ECDC's guidelines of best practices for handling carbapenem resistance in a hospital setting, it can be examined how different screening protocols affect processes and the related resources. Researchers, including the author of this thesis, created a framework that enables such examination. The framework presenting four areas is illustrated as a matrix in Figure 45.



**Figure 45.** Areas for value assessment.

Figure 45 presents a matrix that divides value elements into four main areas. The areas are based on a decision level and type of related costs. Decisions on the hospital level apply to all patient cases, while patient-level decisions are related to decisions made in the course of treatment of a single patient. Prevention costs are associated with the amount of money that is spent on preventing the occurrence and spread of the carbapenem resistance in hospitals. In contrast, 'treatment' costs relate to the money paid to mend the problems caused by the presence and spread of carbapenem resistance.

The first area represents contact precautions. Contact precautions are infection control measures used in hospitals to prevent the possible spread of resistant bacteria. The same rules regarding the measures taken apply to all the units in the hospital in case a CRE carrier is suspected. The most distinct elements in this group include lengths and cost of patient isolation, materials, and equipment used and impact on staff efficiency.

The second area is related to screening. The decision regarding screening for CRE and the number of screenings is dependent on a single patient case. Furthermore, costs related to screening can be categorized as prevention costs as knowledge of the patient's carriage status guides further treatment decisions and measures taken. From a hospital point of view, the screening area includes elements such as the number of tests performed, time to result, the price per test, and accuracy.

The third area is called outbreak. An outbreak in medical terms is the identification of at least two epidemiologically linked CRE positive patients in a given hospital. Value drivers in this area include actual expenditure on handling an outbreak, hence costs related to increased contact precautions and more frequent patient screenings. Also, this area covers opportunity costs that an outbreak may cause, for example, decreased staff efficiency or loss of income due to a unit closure as well as the probability of an outbreak.

Finally, the last area covers value elements related to infections caused by CRE. This area is placed on a patient level as a patient carrying CRE may or may not develop a clinical infection and the site of infection may differ by patient, hence the treatment undertaken differs by each patient case. Furthermore, if an infection develops, the money is allocated to treat the effects of the CRE carriage. This group of drivers includes the length and associated costs of prolonged hospital stay and medication costs. Cost associated with the prolonged hospital stay include incremental contact precautions and screening costs.

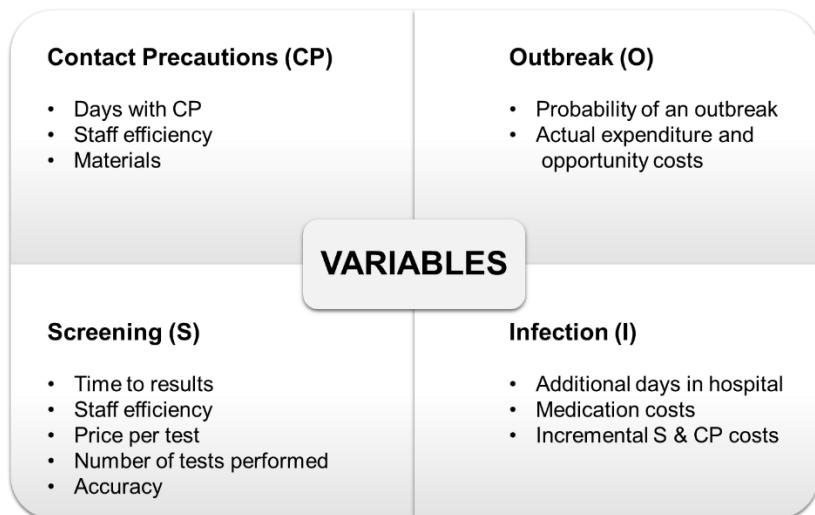
Based on the discussion in this section, it can be noted that under mentioned value areas, mainly costs are discussed. That is a case as laboratories and hospitals are considered as cost centers. Hence, the generation of value is based on keeping the costs steady while becoming more effective and efficient, reduction of costs while maintaining the effectiveness and efficiency on the same levels or increase in costs while gaining substantially better effectiveness and efficiency.

### **5.3.2 Value elements and value assessment logic**

There are many possible value elements mentioned in the previous section. Even though the case company's solution is directly used by laboratories, most of the value elements are focused on costs and benefits for hospitals. The main reason for that is the fact that the medical laboratory diagnostics' aim is to serve as a support for hospital staff decision-making. Also, while there are potential benefits from the method change for laboratories, in the case of CRE screening, the benefits that may be realized in hospitals are assumed far more critical by the case company. Furthermore, regardless of the laboratory-hospital ownership relations, laboratories supply hospitals with results, and if the direct price per

test result rises, the price increase has to be justified. In the end, if the laboratory can convince the hospital decision-makers that there are significant benefits to be achieved in hospitals, the increase in the direct laboratory costs of screening might be covered by efficiencies achieved in hospitals. Hence, making the case company's solution attractive to the main stakeholders.

There could still be more value elements considered if the main values of the entire healthcare system are discussed. However, some of the value elements, such as improved quality of life, are tricky to be assessed solely through the lens of a changed screening protocol as these elements are hardly impacted by changes in one group of healthcare processes only. Nevertheless, it is assumed that, if a screening result is available earlier, correct treatment can be started promptly. Hence, the patient's chance for recovery increases, which in turn can be translated into potential savings for the hospital expressed, for example, by a shorter length of hospital stay of the patient. Consequently, the assessment of value of implementing the case company's solution is based on the elements presented in Figure 46.



**Figure 46.** Key value elements for value assessment.

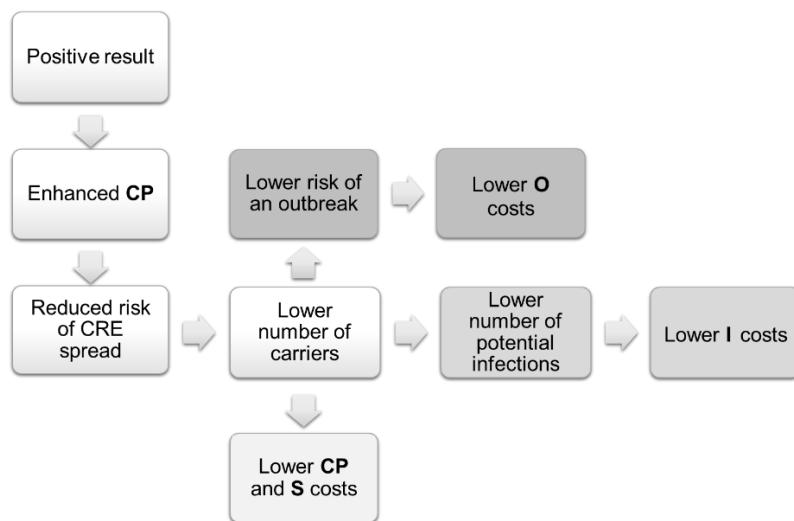
Figure 46 gathers key value elements that are directly or indirectly affected by the choice of the CRE screening method. Those elements can also be relatively easily compared between different screening methods and expressed in monetary terms. While most of the categories are focused on changes in hospitals, screening area can be analyzed from perspectives of laboratories and hospitals to consider also the changes happening in laboratories. Figure 46 presents the main value elements; however, it is also crucial to build an understanding of how these elements can be assessed. Hence, the value assessment logic will be described next.

Actions taken by healthcare workers (HWCs) differ depending on the result of the screening for CRE and, thus, different results impact different value areas. In case a patient is screened for CRE carriage and the screening result is negative, supplemental contact precautions, if applied, can be terminated and the patient can be included in so called 'general patient flow' where standard precautions are applied. Hence, as Figure 47 presents, the negative results mainly impact the length of supplemental contact precautions and hence their costs.



**Figure 47.** Impact of a negative result on hospitals.

Based on Figure 47, it can be implied that earlier negative screening result should lead to shorter period of supplemental precautions applied to a patient's case which in turn should result in lower expenditure on contact precautions. If it comes to positive result, actions taken to handle a positive patient differ. HWCs must make sure that CRE is not transferred to other patients in the hospital. The spread of CRE among hospital patients may lead to an outbreak that may be difficult to contain and result in decreased health outcomes, lower perceived quality of care and high additional costs for hospitals (e.g., Brigand et al., 2015; Otter et al., 2017). The costs related to CRE outbreak include incremental costs of precautions, screening, staff, medications or cleaning. Furthermore, patients who tested positive shall be observed for any symptoms of potential development of the infection to ensure timely and correct treatment. Hence, in case of a positive result, all the value areas are likely to be affected as Figure 48 shows.



**Figure 48.** Impact of a positive result on hospital actions.

As it can be implied based on Figure 48, the earlier positive results could help to implement more advanced contact precautions timely. In some hospitals, only patients that tested positive are isolated. Hence, if the positive result is known earlier, it is less likely that those patients will transmit the bacteria to other patients. The earlier recognition of a carrier may also improve the HWCs' compliance with the contact precautions policies, especially the hand hygiene and the correct use of personal protective equipment. These enhanced contact precautions may result in reduced risk of CRE spread in the hospital and, thus, a lower number of possible CRE carriers. Also, a smaller number of CRE carriers is likely to result in a lower risk of an outbreak. Moreover, a smaller number of patients is expected to develop an infection, which should result in decreased expenditure on CRE associated infections as well as lower contact precautions costs for the hospital. On top of that, a smaller number of carriers shall also lead to a reduction of the number of screening tests performed and reduce the burden on laboratories and save some time of hospital personnel that is devoted to obtaining and handling the sample.

The impact of the case company's solution varies depending on the result of the screening. However, earlier results and less manual work in laboratories pose the potential for improved health outcomes and efficiencies to be achieved in hospitals in terms of resources used to handle patients 'at-risk' of CRE and CRE positive patients. Interestingly, while it is relatively easy to estimate the value impact of earlier negative results, the effect of earlier positive results is far more complex to determine in strictly monetary terms. Nonetheless, the next section presents an example value assessment of the potential value that can be derived while using a molecular screening method such as the one offered by the case company. Importantly, while all four areas presented in Figure 46 were studied, the example value assessment included in this thesis focuses mainly on two areas - contact precautions and screening.

### **5.3.3 Value assessment – traditional and molecular screening**

The main value elements impacted by the CRE screening and value assessment logic have been identified. Hence, the value of both traditional and molecular methods can be assessed based on the main elements and then compared. This kind of comparative assessment allows to check whether the molecular solution, despite its higher price per test, has potential to offer the value exceeding the value provided by traditional screening methods. A simple approach to assess the difference in the value of both screening methods is to benchmark their performance using parameters for which data is easily obtainable. This way, the case company can perform a value assessment before even

talking to their customers. To enable such value analysis, a list of basic value assessment inputs has been compiled, and Figure 49 presents these inputs.

VARIABLE	VALUE	SOURCE
<b>General</b>		
Basic hospital bed-day cost	350 €/day	Kanerva et al. 2007
Average length of hospital stay	5 days	Moloney et al. 2019
Average cost of nurse	16,20 €/hour	
Average cost of physician	33,00 €/hour	Kanerva et al. 2007
Number of patient contacts per day		
Nurse	7	Kanerva et al. 2007
Physician	1	
CRE prevalence	0-64%	ECDC Surveillance Atlas, 2018
<b>Contact precautions</b>		
Isolation room bed-day (additional)	125,00 €/day	Moloney et al. 2019
Protective consumables (e.g., gloves, gowns, hand sanitizers)	16,30 €/day	Average from Kanerva et al. 2007 and Moloney et al. 2019
Additional time incurred by contact precautions per patient contact [min]	1-8 minutes	Kang et al. 2017
<b>Screening</b>		
Materials for sample collection	2,50 €	Moloney et al. 2019
Average time needed to obtain a sample	2 minutes	Interview data
Average cost of laboratory technician	16,2 €/hour	Kanerva et al. 2007
<b>Infection/Outbreak</b>		
Basic reproductive number*	2	Lapointe-Shaw et al. 2017
Overall colonization to infection conversion	16,50 %	McConville et al. 2017
Additional length of stay for CRE carriers and CRE infected patients	0-10 days	Knight et al. 2018,
Cost per CRE related infection per patient	2 000-24 000 €	Lapointe-Shaw et al. 2017

\*Context-specific example values

**Figure 49.** Basic value assessment inputs - hospital perspective.

Figure 49 gathers basic inputs, applicable for both methods, that can be used in value assessment. Most of the data comes from scientific sources, and it is context-specific. However, this kind of data can serve as a base for an initial comparative value assessment of both screening methods when access to specific customer case data is restricted. Furthermore, the information is divided into categories to simplify the analysis, and in case a variable's value is presented as a range, the average value is used in the analysis. The only exception is the prevalence, as based on the color-coded map in Figure 43, most of the European countries registered prevalence below 5%. As the common elements for analysis are gathered, also the analysis inputs that vary by method are put together in Figure 50.

VARIABLE	VALUE		SOURCE
	Traditional	Molecular	
Time-to-result	positive - 24h, negative - 48h	2-4h	Interview data
Accuracy	Sensitivity	0,83	Moloney et al. 2019
	Specificity	0,93	
Cost per test		10,5 €	Moloney et al. 2019, Lapointe-Shaw et al.2017
Technician's hands-on-time per sample	10-40 minutes	5 minutes	Observation/ Interview data

**Figure 50.** Basic differences between traditional and molecular screening.

Figure 50 does not cover all the differences between both methods but only some of the elements that can be used in value assessment. As the figure shows, the accuracy of the molecular method is higher than the traditional method and thus molecular testing will recognize the true positive and true negative patients more accurately. However, these numbers as well as all the other inputs presented in Figure 49 and Figure 50 are meaningless without a context. Hence, some basic assumptions for this example assessment should be made. The assumptions for analysis are as follows:

- hospital screens on admission 1000 patients for CRE carriage each year
- CRE prevalence among tested patients is 2,5%
- all patients at-risk for CRE carriage are isolated at admission and other supplemental measures are applied
- one test is required to claim a patient positive or negative
- positive patients remain in isolation and under supplemental precautions while negative patients can be released from isolation and supplemental measures.

Based on these assumptions it is now possible to compare performance of both methods. Considering that there are 1000 tests performed a year, the difference in the laboratory staff efficiency can be calculated. The price per test in Figure 50 includes already the cost of staff and is used in further analyses. However, it is also important to note how much of the costs per test are related to manual handling of the samples and this is analyzed in Figure 51.

<b>LABORATORY</b>		
<b>Screening costs</b>	<b>Traditional</b>	<b>Molecular</b>
Cost of screening per 1000 tests	10 500 €	40 000 €
<b>Staff efficiency</b>	<b>Traditional</b>	<b>Molecular</b>
Average hands-on-time per test (h)	0,25	0,08
Cost of staff per test	4 €	1 €
Total hands-on-time (h) per 1000 tests	250	80
Cost of staff per 1000 tests	4 050 €	1 296 €

**Figure 51.** Laboratory staff efficiency – cost comparison (an example based on scientific publications and assumptions for the analysis).

Figure 51 shows that molecular screening is almost four times more costly than traditional screening as it comes to all the costs included in the cost per test performed. These costs include materials, staff, and laboratory overheads. However, when hands-on-time per sample is analyzed, it can be noted that traditional screening consumes three times more time of the laboratory personnel as compared to molecular methods. Furthermore, the traditional method is more labor-intensive than the molecular method. Hence, if a laboratory decides to switch to the molecular method of screening for CRE, they can save manual work done by laboratory technicians who can focus on more important work than, for example, carrying plates with bacteria between different places.

With prevalence of 2,5% among 1000 tested patients there should be 25 patients that are CRE carriers and 975 patients that are not CRE carriers. Providing that sensitivity and specificity are not 100% for both methods there exist probability that some of the patients who test positive are not CRE carriers, hence the result of the test is false positive. On the other hand, a patient who tested negative might be positive, hence the result of the test is false negative. Figure 52 presents how true positive, false negative, true negative and false positive tests are distinguished and how both methods differ in accurate recognition of the tested patients.

	<b>Formula</b>	<b>Traditional</b>	<b>Molecular</b>
True positive (TP)	Prevalence * Sensitivity * Units tested (UT)	21	24
False negative (FN)	Prevalence * (1- Sensitivity) * UT	4	1
True negative (TN)	(1-Prevalence) * Specificity * UT	910	942
False positive (FP)	(1-Prevalence) * (1-Specificity) * UT	65	33
Accuracy	(TP+TN) / (TP + FP + TN + FP)	93 %	97 %

**Figure 52.** Screening accuracy (an example based on scientific publications presented in Figure 49 and assumptions for the analysis).

As the figure proves, the molecular method provides more reliable results and hence helps the hospital physicians to make better-informed decisions faster. Furthermore, according to the assessment's assumptions, all the patients suspected of CRE carriage would be under supplemental contact precautions which means that even the patients that are not CRE carriers are placed in the isolation room and the hospital staff takes

special precautions while visiting these patients. Currently, traditional methods provide negative results in 48h which means that negative patients are for at least two days under supplemental contact precautions. When a molecular method is used, the length of supplemental precautions decreases to couple of hours which means that a patient might be placed in hospital under special arrangements for maximally half a day. Figure 53 illustrates the influence of the screening method on cost of supplemental contact precautions for negative patients.

<b>NEGATIVE PATIENTS</b>		
<b>Contact precautions</b>	<b>Traditional</b>	<b>Molecular</b>
Length of CP	2	0,5
Isolation costs	250 €	63 €
Protective consumables	33 €	8 €
Staff efficiency lost		
Nurse	15 €	4 €
Physician	4 €	1 €
Costs of CP per negative patient	302 €	76 €
Number of all negative patients	914 €	943 €
Total CP costs per all negative patients	276 085 €	71 213 €
<b>Screening</b>	<b>Traditional</b>	<b>Molecular</b>
Total cost of materials (sample collection)	2 285 €	2 357 €
Cost of obtaining samples	497 €	512 €
Costs of all negative results	9 595 €	37 714 €
Total screening costs	12 376 €	40 583 €
<b>NEGATIVE PATIENTS - TOTAL COSTS</b>	<b>288 461 €</b>	<b>111 797 €</b>

**Figure 53.** Negative results – costs comparison (an example based on scientific publications and assumptions for the analysis).

As the figure shows, the costs of supplemental contact precautions for all the patients tested negative, by the traditional method, are higher as compared to the molecular method even though the molecular method recognizes correctly more of the patients. On the other hand, the costs of screening by the traditional method appear lower than the costs of screening using the molecular method. However, when the costs of contact precautions and costs of screening for both methods are summed-up, the molecular method poses potential cost savings substantially higher than the screening cost increase. Therefore, it can be concluded that in the case of negative patients, hospital cost-efficiency gains exceed the increase in the direct cost of screening.

As it comes to positive patients, all true positive patients would continue supplemental contact precautions. In this specific example, it would mean that earlier result could help physicians to take correct actions earlier in case the patient would not respond to standard medications. Hence, earlier true positive result helps to provide better quality care for patients. Nonetheless, to estimate the monetary impact of earlier true positive result is a complex matter dependent on many variables that are probabilistic in nature and not covered in this thesis. However, as Figure 52 presented in a simplified manner, there

might be substantial differences in the numbers of true positive and true negative patients that are recognized by both methods. This means that the test's accuracy influences how many negative patients are treated as positive, the false positives, and how many are treated as negative while being a CRE carrier, false negatives. False-positive results lead to the overspend of resources to treat the negative patients as if they were positive. In contrast, false-negative results pose a higher threat to the uncontrolled spread of bacteria within the hospital that can lead to an outbreak. Therefore, the difference between false outcomes of both screening methods is assessed both in terms of adverse clinical outputs potentially caused by false negatives and cost impact of false positives. The figure below summarizes a potential impact of the false negative results on hospital costs.

<b>FALSE POSITIVE PATIENTS</b>		
	<b>Traditional</b>	<b>Molecular</b>
Number of false positives	65	33
<b>Contact precautions</b>	<b>Traditional</b>	<b>Molecular</b>
Isolation costs	40 828 €	20 719 €
Protective consumables	5 324 €	2 702 €
Staff efficiency lost		
Nurse	2 469 €	1 253 €
Physician	719 €	365 €
Total CP costs of false positive patients	49 340 €	25 038 €
<b>Additional screening</b>	<b>Traditional</b>	<b>Molecular</b>
Total cost of materials (sample collection)	163 €	83 €
Cost of obtaining samples	35 €	18 €
Costs of additional screening	686 €	1 326 €
Total screening costs	885 €	1 427 €
<b>FALSE POSITIVE - TOTAL COSTS</b>	<b>50 224 €</b>	<b>26 465 €</b>

**Figure 54.** False positives – impact on hospitals (an example based on scientific publications presented in Figure 49 and assumptions for the analysis).

As Figure 54 presents, in the example studied there are almost twice more negative patients marked as positive with the traditional method as compared to the molecular method of screening. False-positive patients stay under supplemental contact precautions over the entire hospital stay and are likely to be re-tested for CRE carriage. Therefore, the higher the number of false-positive results, the higher amount of the resources is used inefficiently. The false-positive patients have to remain in isolation during their entire stay, and the staff has to follow the supplemental contact precautions rules that result in their lower efficiency and costs incurred in protective consumables. The protective consumables, as many could learn over the course of the COVID19 pandemic, are not only a source of cost to hospitals but may become a scarce resource and, hence should be utilized wisely. Furthermore, the patients with false-positive results are re-tested regularly, and thus additional costs of screening are generated. Therefore, as the

molecular method is more accurate and provides a lower number of false-positive results, it also allows increasing operational efficiency of the personnel and results in lower total costs of handling false-positive patients.

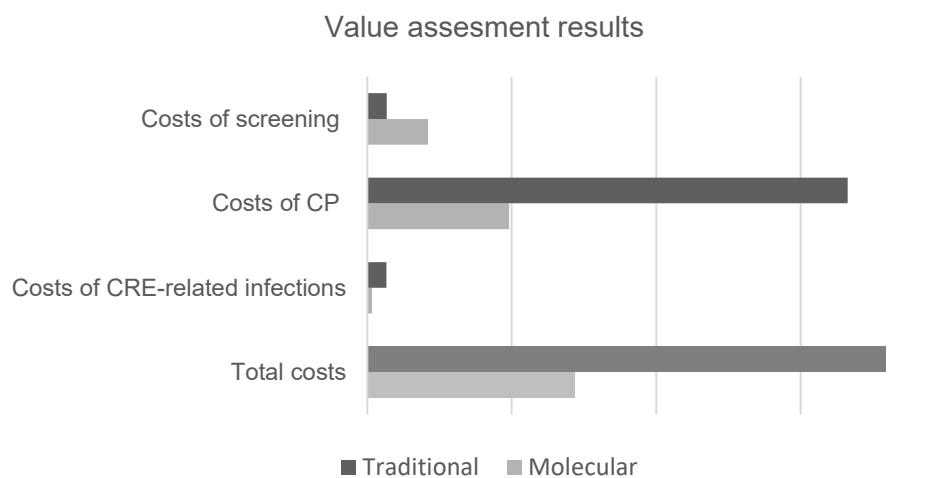
As mentioned before, false-negative results pose a threat to the uncontrolled spread of bacteria between hospital patients. This uncontrolled spread may, in turn, lead to the outbreak state, which might be challenging to contain and result in adverse health outcomes, decreased hospital efficiency, and increased costs. The calculation of the expenses of the outbreak is quite complicated as it is difficult to predict how many patients will become affected by the outbreak and how long the outbreak will last, which is also related to the length of special measures taken by hospitals, reorganization needed and involvement of experts. However, the figure below in a simplified manner shows how false negative results may impact number of the patients affected by CRE carriage and how it is related to hospitals' resource utilization.

<b>FALSE NEGATIVE PATIENTS</b>		
	<b>Traditional</b>	<b>Molecular</b>
Number of false negatives	4	1
Potential number of transmissions	8	2
<b>Costs of incremental CP</b>	<b>Traditional</b>	<b>Molecular</b>
Isolation costs	5 000 €	1 250 €
Protective consumables	652 €	163 €
Staff efficiency lost		
Nurse	302 €	76 €
Physician	88 €	22 €
Total CP incremental costs	6 042 €	1 511 €
<b>Cost of incremental screening</b>	<b>Traditional</b>	<b>Molecular</b>
Total cost of materials (sample collection)	20 €	5 €
Cost of obtaining samples	4 €	1 €
Costs of additional screening	84 €	80 €
Total incremental screening costs	108 €	86 €
<b>Infection</b>	<b>Traditional</b>	<b>Molecular</b>
Number of patients likely to develop infection	1,3	0,3
Cost of additional length of stay	2 310 €	578 €
Incremental costs of infection	13 200 €	3 300 €
<b>FALSE NEGATIVES - TOTAL COSTS</b>	<b>19 351 €</b>	<b>4 897 €</b>

**Figure 55.** False negatives – impact on hospitals (an example based on scientific publications presented in Figure 49 and assumptions for the analysis).

As the figure showcases, the traditional method is likely to generate a higher number of false-negative results than the molecular screening method. The higher the number of false negatives, the more of other hospital patients are likely to be affected by the bacteria, too. The transmission of the bacteria between the hospital patients also means that some of the patients who acquire CRE in the hospital will also develop an infection. Infections do not only cause an increase in hospital costs but due to a low number of treatment options for CRE-related diseases, CRE infections have a high mortality rate.

Thus, the patients that are incorrectly tested as negative pose a threat to the lives of other patients. While costs are important, the ultimate goal of any healthcare institution is to provide high quality patient care. Therefore, if the molecular solution can provide more accurate results that, in turn, should reduce the probability of the uncontrolled bacteria spread and reduce the number of CRE infected patients, the increase in the direct costs of screening should not be a deal-breaking element. Moreover, the less of hospital-acquired infections, the better the perceived quality of care as well as lower overall hospital costs. Figure 56 summarizes all the costs discussed in this section for both methods and presents the difference between the cost categories in a visual way.



**Figure 56.** Comparative value assessment results (an example based on scientific publications presented in Figure 49 and assumptions for the analysis).

The figure above shows that the costs that are related to screening for CRE differ significantly between both screening methods. The costs are also split into three main cost categories discussed earlier. As the figure illustrates, the cost of screening with a molecular method is much higher than with the traditional method. However, screening costs represent a smaller group of costs as compared to the costs of supplemental contact precautions that are the highest cost category for both screening methods. The costs of supplemental contact precautions are substantially lower with the molecular method, which easily covers for the method's higher screening costs. The costs of CRE-related infections, in this specific example, are relatively small for both screening methods. However, when a molecular method is used, the costs of CRE-related infections are lower. As a result, the total costs related to CRE screening are lower if the molecular method of screening is used in the laboratories. Besides the cost factors, the molecular method is likely to influence the work of the laboratory and hospital staff, allowing the staff to focus on the most important matters and making better-informed decisions. Hence, the

case company offering the molecular solution for the screening of carbapenem resistances can enable laboratories and hospitals to derive significant value in terms of cost savings and potential other efficiencies.

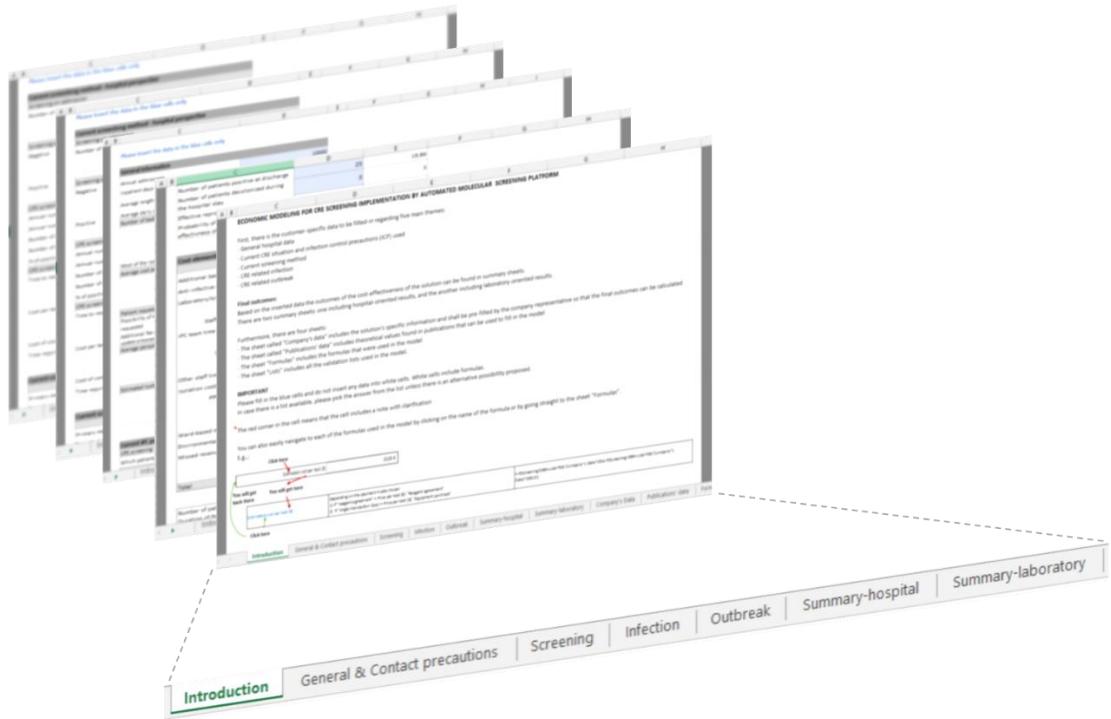
Importantly, it should be noted that the numbers used in all the calculations in this section are exemplary, and all the costs used are based on a compilation of different scientific sources and do not include actual case company nor any customer case data. Hence, these numbers only present the basic idea of an assessment, not the actual outcomes for any healthcare setting. Also, this value assessment focuses only on a few variables that are relatively easy to measure. Thus, the value assessment done this way does not present a detailed picture of the differences between both methods. Nonetheless, it still enables the quantification of basic differences between both solutions for the purpose of this thesis.

### **5.3.4 Value customization using a value assessment tool**

Value assessment performed in Section 5.3.3 is built on certain assumptions and various countries, or even regions within a country, use different guidelines related to CRE surveillance as the problem of CRE varies in significance between different hospitals. Hence, the impact of the changed screening protocol on different value elements may deviate by each customer approached by the case company. While the data in the assessment can be modified to somewhat reflect the situation relevant to the customer, it would require some more complex modifications in calculation logic and used formulas to adjust the assessment's inputs and results for each customer. Thus, based on the simple value assessment idea presented in the previous section, a more comprehensive value assessment tool has been built. Nevertheless, the value assessment tool is still relatively intuitive and not too complex as, during the process of the tool building, the case company's representative said:

*“The thing is to arrive to a compromise on the model [value assessment tool] that is not so simple that people don't believe in it but also not complicated, so people don't believe in it neither as it has to many factors. Having well-implemented main factors there is what matters.”*

Hence, the tool also includes some additional aspects and the value assessment performed in the tool is far more detailed as compared to the presented example of value assessment. Yet, the tool still focuses on the four main value areas identified in previous sections, as Figure 57 presents.



**Figure 57.** Value assessment tool – the interface snapshots.

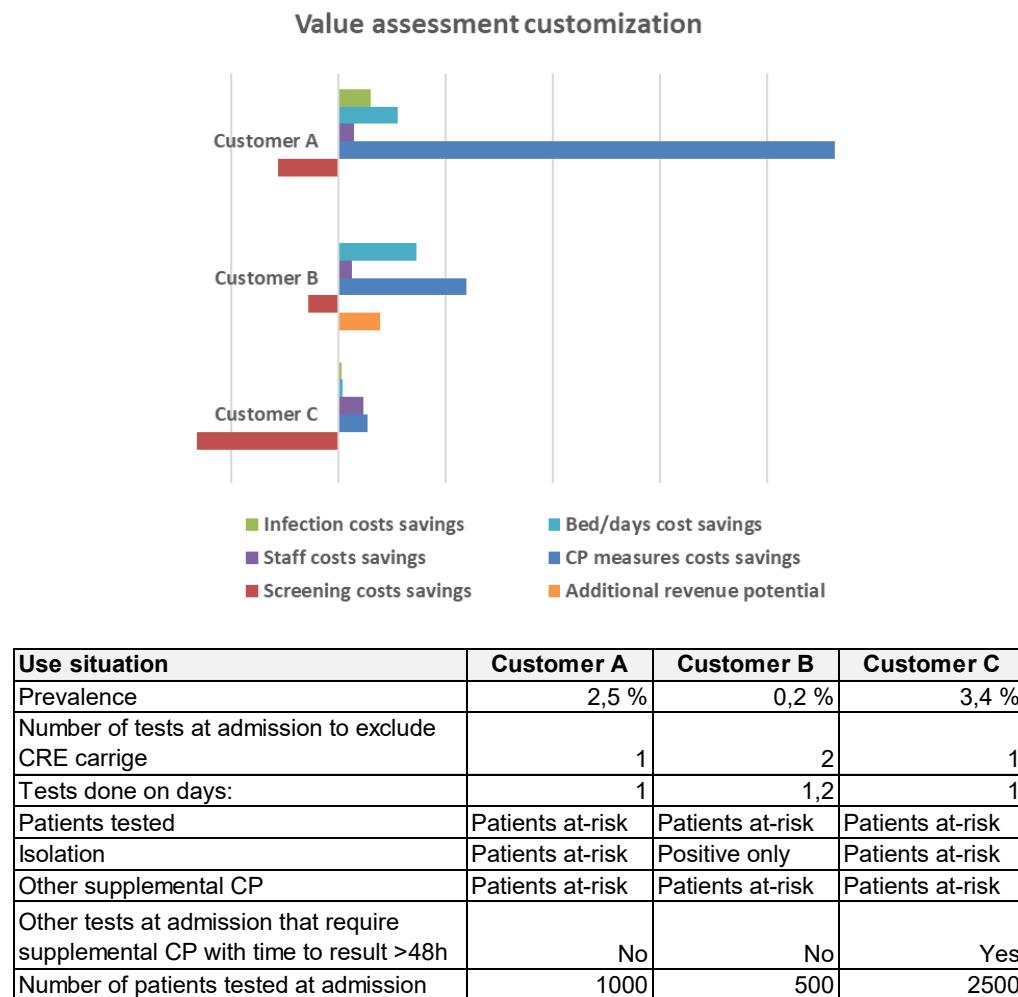
As the figure shows, the tool is an Excel model that is built out of several tabs. The tabs are divided logically into earlier specified value areas that enable to focus model inputs on a certain area. Moreover, such division enables direction of the right questions to the right people in laboratories and hospitals which is important as the company's representative said:

*"While using such model we do not only need to talk to the laboratory representatives, we need to talk to infection control representatives, laboratory and hospital finance responsible...one person would not know everything. It is a complex process."*

As stated in the quote, the value assessment in healthcare context is highly complex and such division into main value elements can help to simplify the assessment approach. Furthermore, if the assessment is divided into different areas, it is easy to note which of the value areas is the most important for the specific customer or a particular decision-maker within the customer's organization. In other words, in which area the customer sees the highest change potential. The ability to recognize these high impact areas can enable the case company to focus their message to their customers on the customer-specific benefits. The company already tries to focus its selling message on aspects relevant to each customer as the case company's representative said:

*"We need to know each customer perfectly well to be able to identify what would be of interest to them and adapt our proposition to them. The benefits proposed to customers are not always the same. It really depends on the customer and their expectations, the history of the customer with carbapenems – for example, have they had an outbreak already or not? So, we adapt our proposition to each customer to make sure that our offering will have an impact on the customer."*

The Excel model can help the case company to identify the potential interest areas for each customer and present the customer how the company's solution is likely to impact the customer's organization. The tool enables to easily alter assumptions for analysis to reflect an individual customer's use situation and hence customize the value assessment for each customer. The case company can pre-fill the model with the screening solution-specific data, and the remaining assessment's inputs can be altered in the tool to include customer's data. Filling information in the value assessment tool allows for direct assessment of the current situation as well as potential performance evaluation if the company's solution is implemented. The tool presents the outcomes of the analysis in form that allows for an easy comparison between both screening methods for a particular customer. Moreover, the tool provides a concise and visual summary of changes that allows to easily evaluate the potential value and examine the impact of changes on different areas. Thus, the tool should allow the case company to easily account for the possible differences among potential customers while not having to spend a lot of time adjusting the value assessment method for each customer. Figure 58 illustrates how a change of only basic parameters in the tool may result in different outcomes for different customers.



**Figure 58.** Value assessment customization based on use situation.

As the table at the top of the figure shows, each customer documents a different level of CRE prevalence. Also, each of the customers follows a different protocol of screening patients at admission. While Customers A and C perform only one screening test and isolate all the patients at-risk for CRE, Customer B performs two tests and isolates only positive patients. Furthermore, Customer C, besides CRE screening, performs an additional test for the same group of patients and isolates patients until the results of both tests are known. Finally, each of the customers performs a different number of CRE tests annually. All these differences between the customers show that the case company's solution may be implemented in varying conditions. Hence, the monetary assessment of the impact made by the change of the screening method results in different values for different customers. Furthermore, as the case company is convinced of the benefits offered by its solution, the value assessment tool may also help the case company to assess the value of its offering to customers in monetary terms. Thus, the tool can serve as yet another proof of the value the molecular screening solution delivers, and the case company's representative stated:

*“The model is a way to prove some of the benefits and the best way to show to customers, using the customer’s own data, whether they can achieve any economic benefits.”*

As Figure 58 shows, Customer A and B would financially benefit from the change of the screening method while it appears that the change of the screening method would result in higher expenses for Customer C. Thus, Customers A and B might be more interested in the company’s offering than Customer C. Interestingly, however, the offering may be attractive for all three customers regardless of the outcome of the monetary value assessment. The economic aspects are not the only driving factors in implementation of new technological solutions in healthcare as the representative of the case company said:

*“In case of our product it is not only about health-economic aspects. Our solutions, for example, may have the coverage of the carbapenem strains that are of particular interest to customers as they had an outbreak related to these strains and in that case, we won’t even need to discuss the economic aspects, they are secondary.”*

Thus, in case of customers who actively seek for a particular solution, the case company can use the model to supplement the discussions and offer the monetary value analysis as additional element in their offering. In such a case, the model does not only help to estimate the change in the costs but also points at areas in which the change in costs and other resources is likely to manifest. As a result, the customer is not only convinced that the solution brings results earlier and thus helps to make better-informed medical decisions but also the customer may better understand the impact of the changed screening method on the organization.

### **5.3.5 Role of value assessment tool in customizable CVP**

The value assessment tool has many applications depending on the customer’s requirements and use situation. By inserting a customer’s data into the model, the case company showcases how the change of screening method used may influence the customer in monetary terms. However, the implementation of the molecular solution simply on top of existing practices probably will not bring all the expected efficiencies. Both the laboratory and the hospital need to adapt their practices to the changes implied by the new screening solution. For example, if a laboratory implements a case company’s solution but does not adjust the technician’s workflow to the new screening protocol and CRE samples are only screened at a specific point of the day, the time-to-result advantage

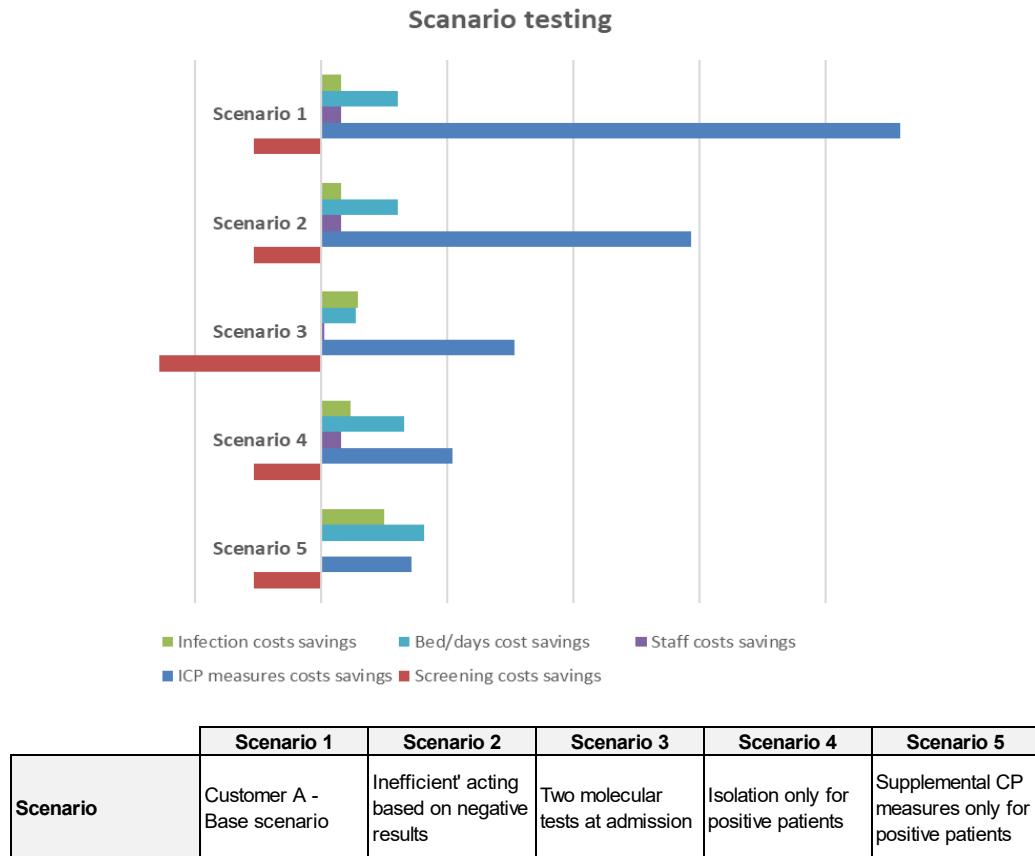
diminishes. Furthermore, if thanks to the case company's solution, a hospital ward receives a result one or two days earlier than with traditional screening but does not act upon the test result, the efficiencies identified during the value assessment will not realize. Thus, laboratories and hospitals have to undertake their role and integrate their practices so that the efficiencies can be achieved.

Interestingly the outcomes of the value assessment point at more than just the cost and benefit changes. The tool indirectly points out what laboratories and hospitals need to do to achieve expected performance. For example, if the tool shows the final outcomes of the analysis for the customer, the calculations related to the negative results are based on the specific amount of days a negative patient is under supplemental contact precautions. Furthermore, a hospital ward may get a result after three hours from taking the sample from the patient but, due to operational inefficiencies, the patient is only transferred from the isolation room to a regular hospital room the next day. Hence, to achieve the efficiencies calculated based on the three hours' time-to-result, first the hospital would need to work on improving the internal processes. The improvement of these internal processes may lead to further efficiencies being unlocked for the hospital. Thus, the tool can help even to recognize the areas for improvement not solely related to CRE screening.

On the other hand, the model also enables manipulation with various scenarios, and the customer can check how the change of different variables would affect the patients, processes, and resources. The case company's representative noted:

*"The tool can help answer the questions the customers may have. Different hypothesis and options for the screening method changes can be tested and customers may decide what will be the most beneficial for them."*

The customer can 'play' with the model inputs that are dependable on the laboratory or the hospital actions and find the optimal configuration of costs and benefits the change of the screening solution could bring. For example, the customer may check how implementation of different practices would affect the costs related to screening with both methods. Figure 59 shows an example of scenario testing for Customer A from previous section.



**Figure 59.** Scenario testing – customization.

The figure above shows that Customer A can compare how different scenarios impact its organization in terms of costs but also in terms of patients' outcomes as the change in the cost of infections implies the difference in the number of patients affected by CRE. As far as the base scenario, Scenario 1, provides the highest value potential, it requires that the customer adjusts all its practices so that all the results are acted upon when received and the operational inefficiencies, if any, eliminated. Nevertheless, as Scenario 2 shows, Customer A can also evaluate if the elimination of potential inefficiencies in handling the negative patients is the top priority as even if negative patients stay in isolation for an entire day, the cost savings overweight the expenses. Then, Scenario 3 evaluates the costs of screening with a molecular solution if a hospital decides to test the accuracy of the new method and take and screen two samples from patients at-risk for CRE carriage at hospital admission. Finally, Scenarios 4 and 5 examine the situations in which the hospital would change their practices to only isolate CRE positive patients or to use all the supplemental precautions only for the positive patients.

The exemplary scenarios showcase how a customer may influence the value proposition offered by the case company. Customers may ask for inputting various data and analyze which scenario the best suits their capabilities and resources. Furthermore, customers may decide the level of the changes they are able to make to achieve efficiencies. Also,

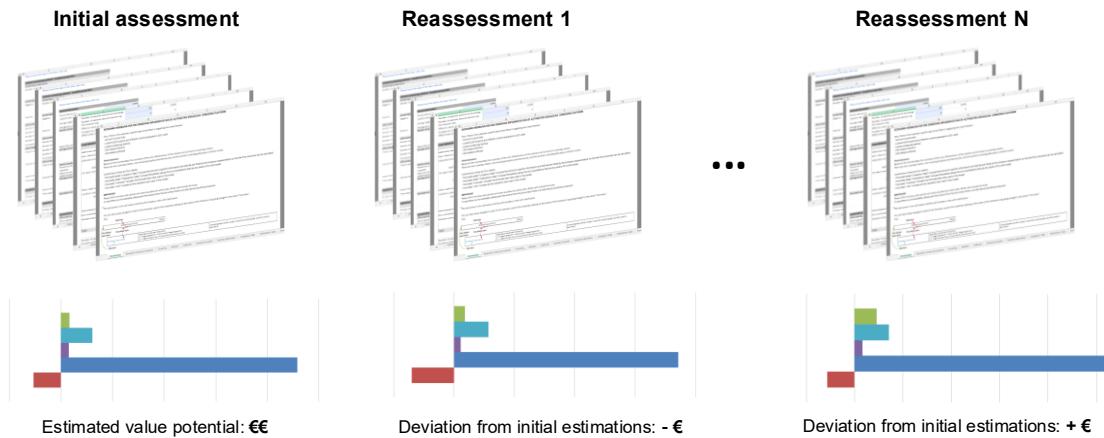
the value assessment tool may help customers to identify potential areas for improvement as the case company's representative suggested:

*"If we talk about medical-economic aspects, as it is not the full study that we conduct with the model, the people who focus on medical-economic aspects constantly try to find the best balance between the medical and organizational aspects, and costs. So, the fact that with the tool we can play with different parameters may give new ideas to customers and they may realize that there is still a better optimization they can make internally."*

Hence, thanks to the possibility to customize the model's inputs, the people responsible for optimization of hospital and laboratory processes and resources utilization may find out new ways to drive efficiencies. They may not only decide what is the best option for the screening solution changes at the moment but also plan how the change of the screening solution may affect the organization in the long term. As stated by the case company's representative:

*"The model is good to discuss even with hospital top management and prove what we are saying and show that we can influence the organization on several levels. (...) Identification of possible changes thanks to the model can help us prove that our solution is not just a screening instrument for laboratories but also a tool for hospital to help them create safer environment for patients and better manage their [hospital's] resources."*

Both of the quotations confirm that the value assessment tool may help to identify potential changes that the implementation of the case company's solution may bring on different organizational levels. Moreover, if that is the case, the value assessment tool could be used periodically to reassess the impact of the changed screening solution, and new insights could be drawn based on the results of the value reassessment. Such value reassessment may also help to identify how the customer influences the initially estimated value potential and point at the practices that might have led to either deriving exactly the value as assessed, higher or lower value than value potential expected. Despite the value assessment being customized for the individual customer and providing that the case company's screening solution works as expected, any deviation from initial value estimations during the value reassessment represents how the value has been customized by the customer itself. Figure 60 illustrates the idea of value potential reassessment.



**Figure 60.** *Value customized by the customer – value reassessment example.*

As the figure above shows, the value reassessment may take place many times over the time when the customer uses the case company's screening solution. The initial value assessment should serve as value potential communication tool and support discussions related to how the customer should use the case company's solution, how to adjust relevant practices, and what resources and capabilities are needed to realize the estimated value potential. On the other hand, the idea behind the value reassessment is to analyze how the change of the screening solution influences the customer organization in practice.

If the value reassessment results in the lower perceived value than the initial value potential estimated, the case company and the customer can analyze the reasons for the difference between both assessments. It is possible that despite the use of the customer's data in the initial value assessment, some aspects have not been accounted for before the implementation of the case company's solution. For example, the customer may not have been able to change some of the laboratory or hospital practices, some external factors such changes in policies affected how specific resources can be utilized or specific processes run, or even some of the data inserted in the tool has been wrongly if the value reassessment would result in a higher perceived value than initially estimated, the customer and the case company can also seek the reasons behind the difference. While deriving higher value than expected is a positive outcome, knowledge of what has contributed to higher perceived customer value may help the customer to continue the good practices and make better decisions in the future. Furthermore, the case company may also benefit from the discovery and learn what kind of practices help its customers to derive maximum value.

Noting the aspects that either diminish or increase the perceived value allows the customer and the case company to revisit the initially constructed value proposition. As the

initially discussed use situation has changed or initially it has not been well specified, both the case company and the customer have a chance to adjust their expectations stemming from the co-operation. Notably, the customer's role, resources and capabilities needed to derive the value from the offering should be discussed and readjusted in the value proposition if needed. Thus, the tool helps the case company to customize the value of its offering to the customers by inputting the customer's data. At the same time, the value assessment tool can also serve as a platform for developing a customizable value proposition.

## 6. DISCUSSIONS

### 6.1 Overview of the problem and the framework

To answer the needs of contemporary customers, companies need to offer more than just simple products or services as customers nowadays look for complete solutions to solve their problems and improve their business performance (Sawhney, 2006). To answer to evolving customer needs and at the same time create competitive advantage, manufacturers increasingly include services in their offerings (Brax, 2005; Ulaga & Reinartz, 2011) following the trend known as servitization (Vandermerwe and Rada, 1988). According to Neely (2008), over 59% of the US and 53% of Finnish manufacturing companies have adopted a range of servitization strategies. Furthermore, the growing popularity of XaaS models in the IT industry stemming from the ownership and responsibilities' shifting and focus on outputs, i.e., performance, led manufacturing companies to also create as-a-service offerings (Classen et al., 2019). One of the most common as-a-service offerings among manufacturers is product-as-a-service (PaaS) offering.

Despite its popularity, the notion of a PaaS offering is rarely used in academic sources and when it appears, it refers to products sold with service revenue models (Cusumano et al., 2015), the highest degree of an extended product offering placed on the 'service-end' of the product-service continuum (Ducq et al., 2012) or just a single service offering composed of bundles of products and services (Classen et al., 2019). While being vaguely defined, PaaS offerings also pose challenges such as how to analyse and communicate the value of such offerings. Manufacturers have learned how to analyse and communicate the value of product-based offerings, but the value of service-based offerings is more complex to analyse and quantify because of service intangibility amongst others (Kindström et al., 2012). The meaning of service and understanding of service value has also evolved over-time (e.g., Vargo and Lusch, 2008b; Grönroos and Voima, 2013), which adds up to the complexity of defining customer value of PaaS offerings.

Customer value of any offering, hence also a PaaS offering, can be expressed in terms of customer perceived value, which is the difference between total customer value and total customer costs incurred in the use of the offering (Anderson et al., 2009). On top of that, customer perceived value should be expressed in a measurable form, i.e., it should be quantified (Hinterhuber et al., 2017) as the quantification, preferably in monetary terms, allows for comparison between offerings (Wouters and Kirchberger, 2015). Customer value can be quantified and benchmarked with competing offerings during the

value potential identification and baseline assessment stages of the value assessment process (Keränen & Jalkala, 2013; Hinterhuber et al., 2017). Customer-specific value calculations can be performed using various modifiable tools and methods (Anderson and Narus, 1998; Hinterhuber et al., 2017) and the results of comparative value quantification communicated in a customer value proposition (CVP).

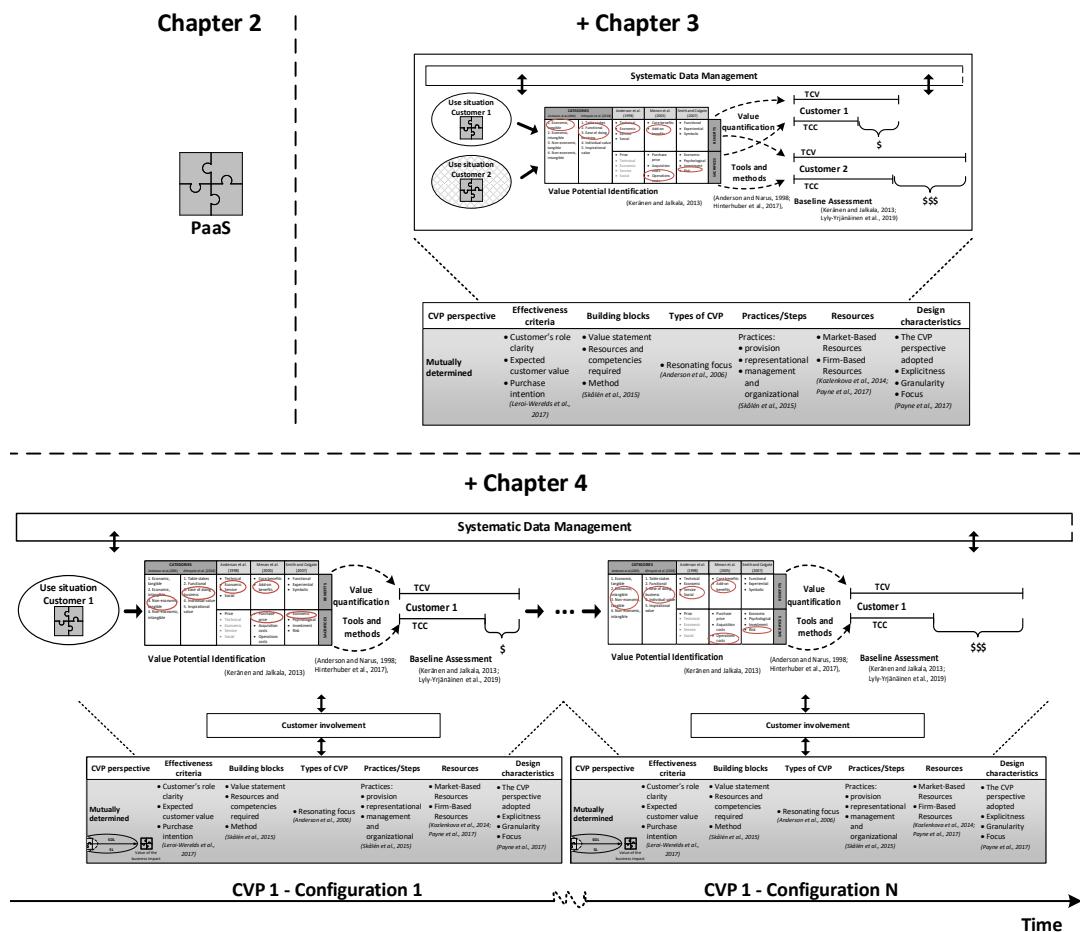
There is no agreement on what exactly constitutes a CVP nor what makes one compelling (Anderson et al., 2006). There are many definitions of a CVP, and Payne et al. (2017) divided existent definitions based on the implied involvement of the customer in creation of the CVP into a supplier-defined, transitional and mutually defined CVP. There also exist many frameworks that guide how to build each type of a CVP (e.g., Anderson et al., 2006; Rintamäki et al., 2007; Skålén et al., 2015). However, it is not discussed what kind of CVP is suitable for a PaaS offering nor how such a CVP should be created.

Importantly, PaaS offerings belong to the customer solutions kind of offerings and hence PaaS offerings can be seen as the combinations of customized and integrated goods and services intended to meet specific customer needs (Sawhney, 2006). However, Nordin et al. (2011) emphasizes that while offering services companies should balance between the right amount of customization and standardization. In terms of PaaS offerings, it may mean that those offerings can be built out of pre-defined modules and the specific modules put together for specific customers. According to Voss and Hsuan (2009), such modularity gives the customer choice among different service configurations and at the same time enables the provider to customize the offering for the customer.

If a PaaS offering is customized for each customer, also the customer value is customized for customers, and different customers may derive different customer perceived value that should be reflected in a CVP. The modularity of PaaS offerings should not only help to customize the offering for the customer but also create a matching CVP (Heikka et al., 2018). However, the customization of an offering and the CVP are mainly discussed as done by a service provider (Heikka et al., 2018), and hence these elements are customized (Gilmore and Pine, 1997) as despite the customer's potential collaboration the offering and the CVP are tailored to the customer's needs by the provider.

This thesis, however, argues that the customer value and the customer value proposition for a PaaS offering can be also customizable. Build on idea of a customizable offering, i.e., adaptive customization (Gilmore and Pine, 1997), customizable value is the effect of a customer's actions, capabilities and the specific use of a PaaS offering. It means that even identical configuration of a PaaS offering may result in different customer value for different customers. The difference in perceived customer value is a result of varying

use situations in which the PaaS offering is used (Fennell, 1978; Woodruff, 1997; Grönroos and Voima, 2013). Thus, a provider can offer customized value estimations while value becomes customizable at the customer. This also implies that customer value proposition to be customizable requires involvement of the customer in the process of crafting the CVP. However, the customizable CVP is not only mutually defined (Payne et al., 2017) but as customer value evolves over time (Vargo, 2009; Grönroos and Voima, 2013), also the CVP proposition evolves based on changing customer use situation. The idea of customizable value proposition for PaaS offerings has been turned into the final framework of this thesis. The figure below presents the final framework of the thesis and how it was constructed.



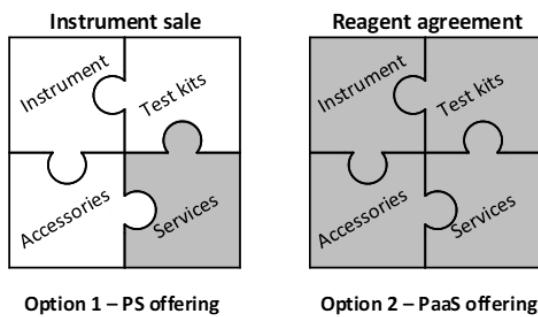
**Figure 61.** Theoretical framework of the thesis – chapter breakdown.

To conclude, this thesis argues that the value of the PaaS offerings can be communicated using a customizable value proposition approach. The use situation of the PaaS offering should be considered in the initial value potential estimations to customize the value statement for the customer and with the customer. Also, capabilities and resources needed to derive the estimated value potential, and how the potential value can be derived should be discussed within the CVP. However, as the needs of a customer or use

situation of a PaaS offering may be changing over time, these changes should be reflected in the CVP, and hence the CVP should be reconfigured. Therefore, a customizable CVP should not be treated as a passive provider-customer communication tool but a platform to reflect customer-driven changes in what value is derived and how is it done to understand the value creation process better and be able to respond to unwanted or unpredicted changes so that the customer and provider are satisfied from the outcomes of the business relationship.

## 6.2 Reflection of the case in the framework

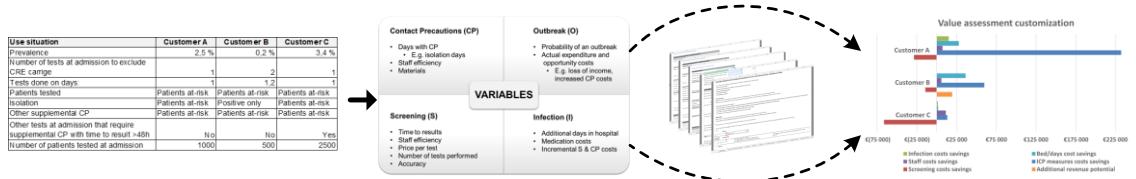
Based on the presented information, it can be stated that the case company provides a range of specialized solutions suitable for any microbiology laboratory. Being a solution provider, the case company helps customers choose the best solution to answer the customer's specific needs. However, taking more generic perspective, the case company's offering portfolio can be also visualized as in Figure 62.



**Figure 62.** Case company's offering portfolio – a generic view.

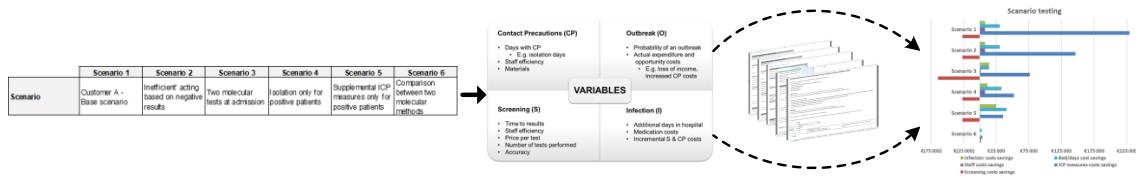
As the figure shows, there are two options the case company provides to its customers. Option 1 when the customer purchases the diagnostic instrument can be classified as a basic version of a product-service offering. The customer gains ownership of the assets while the supplier offers additional services supporting both the product and the customer. Also, in case of this option test kits, being the consumables necessary to run a test using the case company's diagnostic instruments, are sold per test unit. Then, the reagent agreement, Option 2, offered by the case company can be classified as a product-as-a-service (PaaS) offering as the company provides a full package, including the diagnostic device, services, and tests, with the service revenue model based on test usage. Hence, while the case company can customize its offering for the customer by emphasizing the right set of tests, sales options and benefits for the customer (cosmetic customization), the company's offering is rather standard with a little internal possibility for customization for each customer.

Nevertheless, as discussed in Chapter 5, each of case company's customers may follow different screening guidelines as well as possess varying competences, capabilities and resources. Moreover, the problem of carbapenem resistance varies among the customers and hence the strategic importance of the fast and accurate screening method may differ between customers. Thus, despite the fact that the case company provides generically the same PaaS offering to its customers, the differences in the use situations between customers may lead to the situation when each customer derives different customer perceived value. To check if the use situation, i.e., customer's actions and environment, influences the potential value in-use, various potential customer use situations were compiled, and the customer value each of the customer could derive was assessed using the value assessment tool developed in the course of this study. Figure 63 illustrates the results of the assessment.



**Figure 63.** Customization of customer value – molecular screening platform.

As Figure 63 shows, the value assessments in the case part proved that the same molecular screening platform sold as a service might result in different value potential for different customers. Thus, the use situation influences the amount of value a customer may derive from a PaaS offering. Nevertheless, the calculated perceived value is only the potential value a customer may receive when switching to molecular screening. If a customer does not adapt its actual processes and practices to the changed screening protocol or brings in some further optimizations, the real value in use may vary from the one estimated in the initial assessments. To further analyze how the case company's customers may influence the identified value potential, various scenarios were tested for one of the customers which is illustrated in Figure 64.

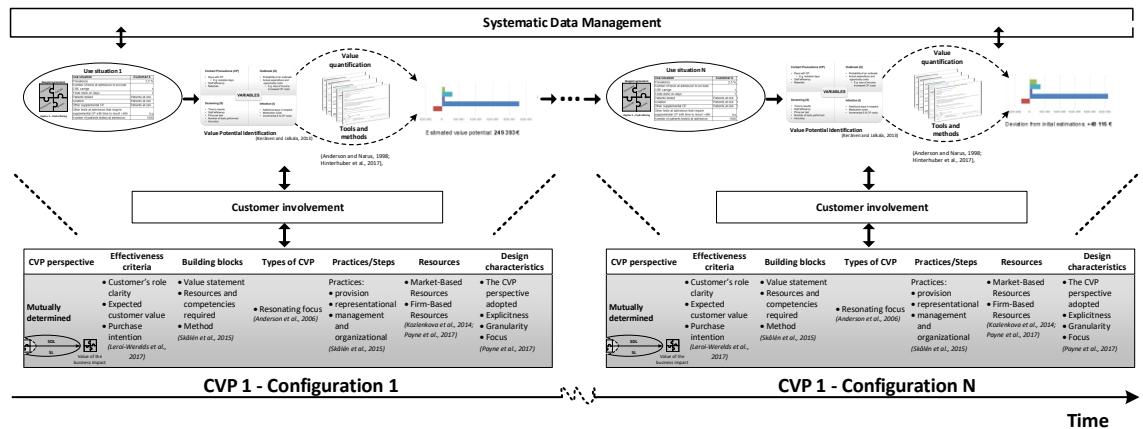


**Figure 64.** Customizable customer value – the case of molecular screening platform.

The scenario testing was done in the form of sensitivity analysis. In each scenario only one variable related to the use situation was changed in the value assessment tool to

reflect deviations from a base scenario. The results of scenario testing show that any customer's actions may influence the value derived. Hence, the customer is the one that customizes the value, which makes the value customizable. Moreover, as mentioned by the case company, playing with the known variables using the value assessment tool may enable the customer to brainstorm potential optimizations and hence understand the resources and capabilities needed and define its role in the value creation process. This means that the customer has an active part in the creation of the value proposition as not only the potential value is estimated with the customer but also the role of the customer in that value creation process.

Furthermore, the scenario testing brought the idea of a periodical value reassessment. Such value reassessment could help to track how the change of the screening method influences the customer organization over time and if the estimated value potential realizes in use. To reassess the value potential, the case company and the customer can use the value assessment tool and compare the differences, if any, between the assessments' results. The analysis of the differences may then allow revisiting the initial value proposition and manage the expectations the customer and the case company may have had at the beginning of the co-operation. Thus, it was also noted that the value assessment tool may serve as a platform for developing a customizable value proposition. Figure 65 presents how the elements discussed in the case are combined with all the theoretical concepts.



**Figure 65.** Application of the framework to the case.

The figure shows how the theoretical framework is applied to the case studied in the thesis. First, the case company's offering was analyzed. The case company sells its screening instrument either as product-service bundle with pre-defined instrument price tag or as a service when the customer pays per test and the instrument stays under the case company's ownership. The as a service option qualifies the case company's product under a PaaS offering. Second, different potential use situations of the screening

platform as well as needs of hospitals and laboratories were analysed, and the most important value categories and value elements were identified. The identification of these key value drivers should provide the case company with a better understanding of the actual customer's needs, processes, and most significant sources of costs and values, and hence provide an understanding of how the case company can help its customers. Third, the value assessment logic was created, and using the key-value categories and the value assessment logic, a modifiable value assessment tool was designed. Fourth, customer-specific value calculations were done using the value assessment tool that gave the outcomes of the assessment quantified in Euros.

Finally, the idea of value reassessment with the use of the model was tested which in Figure 65 is represented as potential for further customization of the value proposition based on the evolving over time customer's use situation. However, the case mainly considered the influence of the value potential reassessment on the building blocks of a customer value proposition. As value is reassessed, not only the value statement may change. The deviation from the initial potential value estimations means that the case company's customer has also changed the way the resources are used, or some practices performed which may influence the future potential value derived from the case company's offering and hence these changes should be also reflected in the value proposition.

### **6.3 Lessons learnt**

The case studied in this thesis has mainly enabled testing the role of the value assessment tools, and value assessment process in general, in building a customizable value proposition for a product as a service offering (PaaS). Also, some examples showcasing the idea of customizable value were discussed in the case. Furthermore, along with the studied case, various use cases of the developed value assessment tool have been identified, and these use cases also comprise the main results of this thesis. However, the application of the framework in the case study results in three general findings that can be summarized as follows:

1. Identification of relevant value elements should be made also having customers' customers in mind
2. Value assessment and value assessment tools in particular have more applications than just measuring and quantifying value potential
3. A customizable value proposition seems to be a suitable platform for communication of the value of a PaaS offering.

First, the identification of the value elements impacted by a supplier's solution should also consider the impact that the use of the supplier's offering makes on its customers' customers. According to Keränen and Jalkala (2013), the supplier must know the customer's needs and processes well to be able to identify the most significant source of value to its customers. However, as shown in the case, sometimes more important is to understand the value the customer wants to deliver to its own customers. Medical laboratories, while changing a screening method, are also interested to know how the change will influence their offering to hospitals as hospitals are the ones that order and pay for tests. Thus, understanding the value the customer aims to deliver to its customers is critical in identifying how a supplier can help direct customers to create more value for their businesses and their customers.

Second, value assessment process and tools used during the assessment process do not only support quantification and communication of value. Besides presenting value in a measurable form and helping to communicate value (Anderson et al., 2009; Keränen & Jalkala, 2014), the case study revealed that well-designed value assessment tools may serve also as:

- a discussion platform enabling the identification of key value drivers, understanding the customer's use situation and the customer's role in the value creation process
- a tool that enables tracking changes in the customer's use situation, resources and capabilities utilized as well as potential value to be derived or actual perceived value
- an additional element in sales materials package helping to direct right questions to the right people in the customer's organization and proving the benefits claimed by the company
- a tool that can help to note other potential optimizations a customer has not thought about before.

As the examples above show, value assessment tools used during the assessment process may provide answers to more questions than "*What is the value the customer's organization may derive from our offering?*". While being able to quantify value in monetary terms is crucial (Plank & Ferrin, 2002; Hinterhuber, 2017), the quantification should reflect actual customer's situation, and support the customer's and supplier's understanding of what are their roles in the value creation process. Moreover, value assessment tools, if reused with the same customers, can help to track the progress a particular customer makes towards achieving the desired outcomes. The value reassessment may

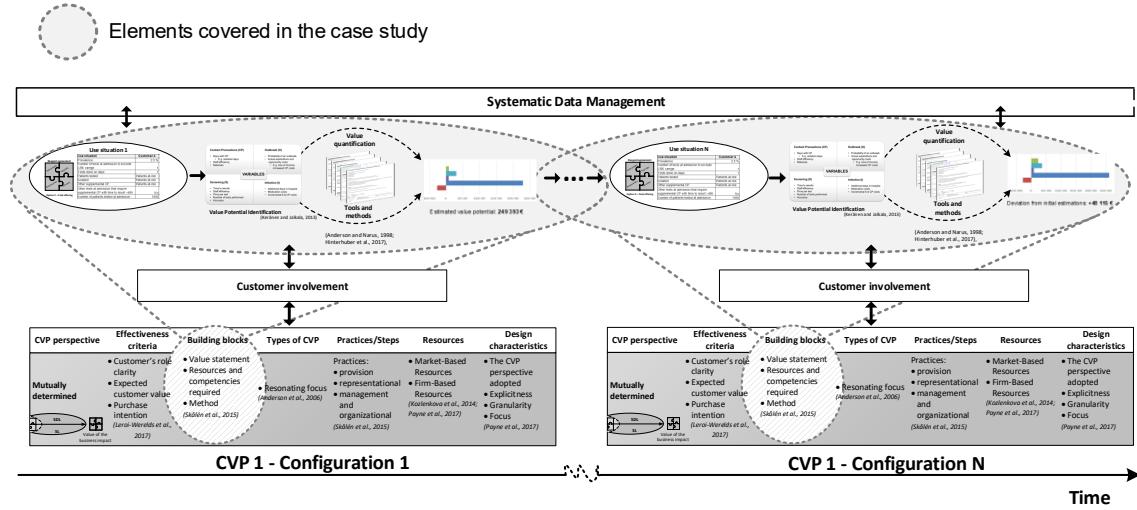
also help to note any changes that take place at the customer that may either support or diminish the customer's value creation process. Thus, value assessment tools that reflect a customer's situation, resources, and capabilities needed to derive the expected value, can become an excellent platform for building customizable value propositions.

Finally, using a customizable value proposition seems to be a suitable approach to communicate the value of a PaaS offering, especially if modifiable value assessment tools are used to identify the value potential the use of a PaaS offering provides to a particular customer. PaaS offerings comprise one of the most advanced forms of servitized offerings (Ducq et al., 2012; Cusummano et al., 2015). PaaS offerings can also be modular and hence enable putting together modules that suit a particular customer's needs and the use situation at a specific point of time. In the studied case, the PaaS offering has pre-defined modules and hence is relatively standard. However, customers' use situations differ so significantly and may be changing over time.

As with the time the customer's needs or the customer's use situation may change, either the configuration of the PaaS offering or the way the PaaS offering is used change, too. Furthermore, a customizable value proposition is a value proposition that evolves over time, the same as the customer's value creation process evolves. Also, the changes in the configuration of an offering or the customer's way or purpose of use of the offering usually imply the difference in how and what value is created. Thus, a customizable value proposition could well reflect these changes and help the customer and the supplier to understand the impact of the changes in the value creation process.

## **6.4 Limitations and future research**

The application of the theoretical framework in the case has helped to solidify the concept of customizable value and the meaning of value assessment tools in creating a customizable value proposition. Furthermore, many different applications of the value assessment tools, besides the quantification of value, that can benefit the customer's value creation process have been found. Nevertheless, not all the elements of the framework could be tested with the case studied. The elements of the framework used in the case study are marked in Figure 66.



**Figure 66.** Elements of the framework studied in the thesis.

As Figure 66 illustrates, the case study focused mainly on the upper part of the framework. The offering of the case company, including the PaaS option, and different potential use situations were studied to identify the key value drivers and the impact of the case company's offering on its customers. Also, the change in the potential customer's use situation and the influence of the change on the value creation process were analyzed. Moreover, the idea of re-configuring the initial customer value proposition (CVP) due to the changes in the value creation process was also discussed based on potential changes within the building blocks of a CVP.

However, the case does not address if the potential changes in the customer's value creation process would also trigger changes in other elements of the CVP nor how exactly the entire process of building a customizable value proposition could look like in practice. Furthermore, the value assessment tool was not used in a real case scenario and no customer value proposition was created during the case study. Thus, all the results are based on using the information gathered from observations, interviews, existing data, and experimenting with the created value assessment model. Therefore, the entire framework has not been validated in the course of this study, which limits the validity and reliability of the findings made in this thesis. Moreover, the framework was applied only to one case, which also limits the generalizability of the achieved results.

Hence, the next steps would be to test the created value assessment tool with the case company's customers in order to verify the researcher's claims made in the lessons learnt of this thesis. Furthermore, based on an actual case, the process of creation of the customizable value proposition should be initiated and studied. Also, to make the

study more generalizable, the framework could be applied in another organization, possibly outside the medical diagnostic domain, to cross-examine results and refine the findings stated in this thesis.

Most of the limitations stem from the nature of the studied organization and the time during which the study was performed. As the case company is the medical laboratory diagnostics provider, all the materials and tools that the case company uses while discussing with potential customers must be backed-up with reliable studies. Hence, the process of building the value assessment model has lasted longer than initially anticipated by the researcher. Furthermore, once the value assessment model was finalized to be reviewed with the case company and tested with the case company's customers in early 2020, the pandemic of coronavirus emerged. Thus, the case company and its customers shifted the focus towards solving the more pressing problem. The final version of the model was consulted with the case company only between May and June 2020, and the potential tests of the value assessment tool with the case company's customers are planned for autumn 2020 if the situation with the coronavirus pandemic allows for it.

## 7. CONCLUSIONS

Customers nowadays are increasingly more interested in solutions to their problems rather than in specific products or services. Companies, to meet the expectations of the contemporary customers, focus on selling performance and functionality of their products and continuously more often offer their products as a service. However, selling product-as-a-service (PaaS) offerings requires that companies understand how to analyze the impact their PaaS offering makes on customers, i.e., customer perceived value a customer may derive from the use of the offering, and how to communicate this value to customers. As far as product companies learnt how to analyze and communicate the value of product offerings, the service value is more complex to analyze and communicate. Moreover, companies tend to customize their offerings to the needs of their customers. Thus, such customer-centricity requires that also customer value communication is customer-driven.

This thesis aimed to study how the customer value of a PaaS offering can be analyzed and communicated. For that reason, this thesis introduced a concept of a customizable value proposition and discussed how to create a customizable value proposition. To reach the objective of this study, a thorough study of service and customer value literature was made. Also, the theory related to modularity and customization was reviewed. Amongst others, a definition of a PaaS offering was refined, and concepts of customizable value and customizable value proposition defined. Based on the literature review, a theoretical framework of the thesis was constructed. Furthermore, the theoretical framework was applied in the case of a medical laboratory diagnostics provider who wished to understand the impact and model the cost-effectiveness of its offering in different healthcare settings.

As it comes to answering the case company's needs, a comprehensive value assessment tool was created. The value assessment tool should support the case company's sales negotiations process by showcasing how the change of the screening method from traditional to molecular screening may result not only in potentially better outcomes for patients but also in cost efficiencies in laboratories and hospitals. As the example assessments showed, despite the higher price per test, the case company's screening solution may enable significant changes in practices, processes, and resources utilized in the handling of the patients suspected of CRE carriage, leading to increased customer perceived value. As also shown in the case study, there might be certain healthcare settings where value assessment will result in higher overall costs. Nevertheless, the

ability to quantify the results of the change in the screening method, regardless of the monetary outcome, can bring substantial benefits to both the company and its customers. On the one hand, it may help the case company to identify customers to whom their offering may bring the highest value and focus their efforts on these customers. On the other hand, the customers of the case company may gain a better understanding of what the change of the screening method may mean in practice, and these customers may plan how to make the change and allocate their resources.

Furthermore, the study resulted in three findings supporting the theoretical framework. First, understanding how a customer delivers value for its customers can help a supplier to identify how the supplier can help its direct customer to create value. Hence, during the value assessment process, the supplier should also consider the impact that the use of the supplier's offering makes on its customers' customers. Second, value assessment and value assessment tools may help the supplier and customer not only to measure and quantify value. Value assessment may become a platform enabling to discuss, track, and optimize the offering's use situation and its influence on the value creation process. Finally, it seems that a customizable value proposition could be a suitable approach to communicate the value of a PaaS offering. Both the PaaS offering's characteristics and the evolving customer use situation call for a more dynamic approach to value communication.

Nevertheless, the findings of the thesis are limited as only parts of the theoretical framework were applied in the case. Moreover, the value assessment tool has not been tested in a real case scenario, nor an attempt to build a customizable value proposition has been made. Therefore, to prove the findings of the thesis and test the entire theoretical framework, the value assessment tool has to be tested with the case company's customers, and the process of building a customizable value proposition initiated. Then, the theoretical framework should be applied in different organizations to cross-examine results and draw more general findings. Potentially, also other approaches to customizable value proposition could be studied.

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