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Servitization and Digitalization of District Heating

A Qualitative Study of Service Offerings in the Customer Interface on The Swedish District Heating Market

Master's thesis in *Management and Economics of Innovation and Quality and Operations Management*

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Abstract

The Swedish district heating market is a conservative industry that is currently undergoing external pressure to update their current offerings in order to compete with other heating sources. Third-party actors that offer digital service offerings in the customer interface have recently entered the market, acquiring valuable customer access and in turn. The recent advancement together with the development of the Swedish electricity market leaves an uncertain future of what role each actor will have in the future and what types of offerings will be available. To explore this, three research questions are formulated as the following:

- I What are the characteristics of the current value propositions and relationship on the Swedish district heating market?*
- II What patterns of the current value proposition and relationships could be observed?*
- III What are the pathways for future value propositions?*

To answer the first research question, 23 interviews with different types of actors in the Swedish district heating market were conducted. To broaden the perspective of the actors both district heating supplier, third-party actors and district heating customers have been interviewed. Together with an extensive literature review this built the foundation for the analysis that categorizes the different types of value proposition and explores the kinds of relationships between the actors. The categorization can be summarized in the *Digital Servitization Business Model framework* that can be utilized to compare different value propositions as well as an inspiration for creating new offerings.

Along with categorizing the current offerings on the market by type and level of servitization, the different types of corresponding customers are summarized as being of either Type I, II or III. Further, the identified actor constellations are presented to explain the current dynamics of the markets in terms of relationships and value delivery processes. As to conclude and answer the third research question, three potential future scenarios are presented that are titled as *The Most Feasible*, *The Spot Market* and *The Monopolistic* scenario.

Keywords: Digitalization, Servitization, District Heating, Customer Interface, Service Offerings, Relationship Triads.

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Acronyms

DH: District Heating

DSBM: Digitalization and Servitization Business Model, as in *DSBM framework*

SSC: Service Supporting the Customer

SSP: Service Supporting the Product

1

Introduction

As to give a thorough introduction to the thesis project a brief presentation of the Swedish heating market will be presented before describing the current state of the market in terms of size, statistics and actors. How district heating works along with traditional value propositions will also be described as to get an understand of the current business models. Finally, the implications and trends will be presented to get an update on the current driving forces and movements of the Swedish district heating market.

1.1 Background

Digitalization and servitization have in recent years transformed several traditional markets which have moved market shares from traditional actors to new and upcoming actors. One traditional market, seemingly unchanged by either digitalization or servitization, is the Swedish district heating market. Assumingly new needs and actors would emerge if the market would undergo a transformation, moving to services and digital solutions rather than traditional delivery of heating, why it is of interest to study what is currently happening on the market.

As to present a bit of a background to the Swedish district heating market, an overview of the history will be introduced as well as a brief description of the market today. Further, the technology of district heating will be introduced as well as the value chain.

1.1.1 District Heating

Frederiksen and Werner (2013) describe the functionality district heating as *to use local fuel or heat resources that would otherwise be wasted, in order to satisfy local customer demands for heating, by using a heat distribution network of pipes as a local market place*. Utilizing excess heat is a more resource-efficient way of heating compared to using raw material such as oil or firewood which historically have been one of the driving forces behind district heating, according to Werner (2017). Different types of excess energy sources that are traditionally utilized on the Swedish district heating market include combined heat and power plants that also produce electricity, waste-to-energy plants from burning household garbage and excess heat from industrial processes (Werner, 2017). Werner (2017) also describes that renewable sources of energy have more recently been introduced such as solar, biothermal

and biomass energies.

Energiföretagen (2017) describe district heating as one of the most reliable energy solutions available on the market, with continuous heat production and distribution along with stable infrastructure. Along with providing a continuous flow of heating, one of the most discussed advantages of district heating in Sweden is the low environmental impact. Werner (2017) has compiled the origin of all produced heat in 2015 and concludes that the majority come from biomass and waste disposal, with only about 7% of the produced district heating originating from fossil fuels.

District Heating Value Chain

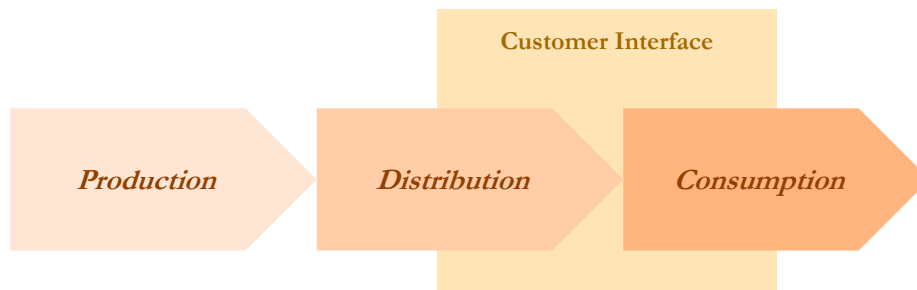


Figure 1.1: The district heating value chain, an adaption of Werner (2013)

Value Chain

Understanding how district heating is produced could give valuable insight into the current dynamics of the market. Werner (2013) describes the process of district heating as starting with heating up water by either combustion or utilizing waste heat in a plant. The heated water is then transported through isolated pipes to whichever building heat is demanded in, where it is then converted by a heat exchanger, usually connected with radiators or water heaters in the building (Werner, 2013). The end-consumer can then utilize the district heating as heat and hot water in the building (Werner, 2013). The value chain described by Werner (2013) could then be summarized to three steps; production, distribution and consumption, see Figure 1.1.

Bergman (2014) describes that the district heating supplier owns both the production and the distribution of heat on the Swedish market and therefore owns the entire value chain, except for consumption. It is further described by Wiren (2007) that this implicates that the district heating suppliers also own the relationship with the customers, since there are no intermediary middlemen, and that this is a unique potential interface on the heating market. The interface between the supplier and the customers - the customer interface - are often shared on the energy market by

several suppliers, why Wiren (2007) argues that this could enhance the possibilities of collaborations between the supplier and the customer on the Swedish district heating market.

Value Proposition

District heating in Sweden constitutes of grid-based systems located in densely populated areas as the heat is transported to buildings as hot water through pipes, according to Magnusson (2012). District heating is therefore associated with large investment costs - sunk costs - and could be considered as vertically integrated monopolies (Magnusson, 2012). District heating system, due to large initial investment costs, Wiren (2007) argues needs a substantial amount of connected buildings in each grid to be profitable. Generally, at least 50% of the buildings in urban areas need to be connected to the grid as to yield from the initial investment and as district heating utilize economies of scale increased market shares will increase the total revenues (Wiren, 2007).

Werner (2017) means that since each district heating system could be considered as local monopolies, they do not traditionally compete with other district heating suppliers but rather other suppliers of heat. Historically, district heating has competed with oil boilers and electrical heating while more recently competing with heat pumps and geothermal heat (Werner, 2017). The lack of direct competition on the district heating market, therefore, affects what types of value propositions are available, as simply delivering heat could just as well be achieved by other sources of heating. Instead, Wiren (2007) discusses the competitive advantages of district heating and mentions an advantageous price development and operational security being fundamental for district heatings' current market position. Further, extensive ownership of the infrastructure with related maintenance is, according to Wiren (2007), an important and competitive aspect of district heating as a value proposition.

Further, Wiren (2007) describes that the characteristics of the district heating market are predicted to change in the future meanwhile Rydén et al. (2013) emphasize that the total consumption of district heating is most likely going to decrease. The authors further implicate that the customers' confidence in the district heating providers has changed and that their requirements for cost and delivered values, therefore, have evolved to be demanding a higher level of customization. Wiren (2007) also describes the potential utility and supplementary value for the customer as additional energy services are introduced along with traditional value propositions. Introducing a wide variety of additional services could be an important competitive advantage of district heating in the future and potentially reclaim market shares on the heating market (Wiren, 2007).

1.1.2 History of the District Heating Market

At the end of the 1940s, it was identified by Swedish engineers that one could potentially use waste heat from industries to heat buildings, according to a report by

Energiföretagen (2017). Werner (2017) describes that district heating had already been installed and in use in other countries, inspiring Karlstad to be the first municipality in Sweden to convert their heat supply to district heating in 1948. Motivated by better air quality and lessened negative climate impact, nine other municipalities and cities followed Karlstad's initiative and installed district heating as the main source of heating during the 1950s (Werner, 2017).

Werner (2017) explains several different driving forces that historically have spread district heating in Sweden, including the introduction of the Million housing program (*Miljonprogrammet* in Swedish) from 1965 - 1974 that were almost exclusively connected to district heating. Other historical factors for the expansion of district heating includes the two international oil crises during the 1970s, that moved market shares from oil boilers to district heating by the introduction of a governmental oil substitution program (Werner, 2017). Other governmental initiatives, such as the introduction of the carbon dioxide tax in 1991 and grants for building new eco-friendly district heating plants, have established district heating as one of the most prominent sources of heating in Sweden (Werner, 2017).

Historically, district heating plants have been owned by municipalities, according to Werner (2017). The municipalities have further profited from also owning extensive energy distribution and residential building companies along with the district heating plants (Werner, 2017). The pricing of district heating has therefore been regulated by the Municipal Act, which limited profits for municipality-owned district heating companies while privately-owned plants were unregulated, according to Magnusson (2012).

The Swedish electricity market was deregulated in 1996 which also included the removal of the non-profit requirements for district heating as it was argued that market pricing should be viable for both electricity and district heating (Magnusson, 2012). After the deregulation, Werner (2017) describes that many of the municipality-owned district heating systems were bought by large energy companies, shifting the ownership from almost 100% municipal-owned plants to about 60%. The acquisition was mainly conducted by the market giants E.ON, Fortum (currently active on the market as Stockholm Exergi), Vattenfall or Göteborgs Energi (Granström, 2011). Locally, prices of district heating have soared since the deregulation (Magnusson, 2012) and discussion about reinforcing some type of regulation has been discussed since the beginning of the 2000s (Werner, 2017).

1.1.3 The District Heating Market Today

District heating is well dispersed on the Swedish heating market and approximately 350 district heating systems are currently active in Sweden, where 60% of the total produced heating is distributed by the 20 biggest heating plants, according to Energiföretagen (2019). Werner (2017) specify that all of the major towns and cities in Sweden are connected to district heating and rather means that there is over 500 district heating system, including smaller and private systems.

District heating is generally used for heating multi-family residential accommodations (89% of the market shares) and service sector buildings (80% of the market shares), but are also found, to a less extent, in single-family residential buildings and industries (Werner, 2017). Historically, the market shares for district heating has increased for all of the mentioned segments but Magnusson (2012) argues that the market has begun to reach stagnation. Even though there is an increase in the amount of district heating customers, Magnusson (2012) argues that the needed district heat largely remains the same as the climate gets warmer and buildings are getting more energy efficient (Magnusson, 2012).

The total consumption of district heating in Sweden has for the last decade been between 40 - 50 TWh per year, with a peak of 60 TWh in 2016 (Energiföretagen, 2019; Energimyndigheten, 2019). Since district heating consists of grid systems, they are by nature to be considered as vertically integrated monopolies and are instead competing with other sources of energy rather than other district heating suppliers (Magnusson, 2012). Historically, district heating has mainly competed with oil boilers until the oil crisis in the 1970s while the largest considered competitor to district heating today are heat pumps (Werner, 2017).

Actors

Through the geographical dispersion and history of municipality-owned district heating systems, Granström (2011) present that there are currently about 220 traditional district heating suppliers on the market. Energiföretagen (2019) compile statistics of the Swedish district heating market every year and can by total production and consumption conclude that the greatest actors on the market are E.On, Vattenfall, Stockholm Exergi and Göteborg Energi. Likewise, most district heating is consumed in the greater urban areas (Stockholm, Göteborg and Malmö) that these actors geographically covers (Energiföretagen, 2019).

District heating is supplied to buildings, why owners of buildings are considered to be the customers of the district heating suppliers. Gadd and Werner (2013) present the five main types of buildings that are supplied by district heating: multi-dwelling buildings, industrial buildings, health and social services buildings, commercial buildings and public administration buildings. One- or two-dwelling buildings are excluded by Gadd and Werner (2013) since the market share for district heating is considered marginal. Magnusson (2012) instead divides the different types of building, and therefore the district heating customer segments, as one- or two-dwelling buildings, multi-dwelling buildings and non-residential buildings.

What differs between the different types of building are consumption patterns, owners and users. Gadd and Werner (2013) for example differentiate the usage of heat in residential buildings that are to be considered constant compared to public buildings and offices that are mainly in use daytime and during the weekdays. The users of the buildings could either be residents or utilizing the space for non-residential activities, such as an office space or education, while the owners are either private,

commercial or public (Gadd & Werner, 2013).

Magnusson (2012) mentions the possibility and increased demand for introducing third-party actors on the market to create natural competition against the traditional and monopolistic district heating suppliers. In these instances, it is discussed that third-party actors would enter the market as an alternative supplier of heat (Magnusson, 2012), while the potential distribution of services has not been traditionally discussed.

1.2 Purpose

This thesis project is conducted in collaboration with the independent consulting and research firm Profu and Chalmers University. The purpose for the thesis project is to use the result for the project *Värmemarknad Sverige* (Heating market Sweden in English) and thus to explore the concepts of digitalization and servitization on the Swedish district heating market. The audience for the thesis project is primary district heating suppliers and Profu, but as general concepts and patterns are studied, the result should be applicable for all actors on the Swedish district heating market.

Moving from products to services and introducing smart techniques have transformed a variety of markets in terms of communication and customer relationships. The Swedish district heating market has only begun to adopt servitization and digitalization why it is of interest to study the current view and state, in order to identify the driving forces behind a potential transformation. It is also of interest to study the current offerings on the market in terms of servitization and digitalization, as little research has been conducted on the current state and future expectations.

Services are, per definition, exchanged and value is created continuously by the actors in the customer interface. It is therefore of interest to research the various actors present on the Swedish district heating market as well their ties in the customer interface. Since the market consists of diverse actors, it could be assumed that their interest in and need for digitalization and servitization differs. Thus, only the most prominent actors on the market, in terms of interest and development of digitalization and servitization, will be studied in order to understand their needs and potential future scenarios.

1.3 Research Questions

In order to fulfil the purpose of the thesis project, three research questions are formulated. Each of the formulated research questions will correspond to a different chapter of the thesis. The first research question will be related to the empirical findings of the thesis project, the second question corresponds to the analysis of the findings while the third and final question corresponds to potential future scenarios.

The purpose of the thesis project is to perform a study of digitalization and servitization on the Swedish district heating market. As the literature is quite extensive regarding the terms servitization and digitalization with regards to their definition and characteristics but less so on its applications on the district heating market, an empirical analysis of the market needs to be conducted. Since digitalization and servitization are related to the proposed offerings on the market, the focus of the market investigation is to capture the value propositions including the relationship between the present actors. The first research question, related to the empirical findings, is therefore formulated as:

I. What are the characteristics of the current value propositions and relationship on the Swedish district heating market?

In order to better understand the context and characteristics of the empirical findings, theoretical concepts regarding servitization, digitalization, market relationships and business model dimensions are applied to the findings. This should conclude in an analysis where the presented value propositions and relationships are compared to current literature in order to find patterns. Related to the analysis of the thesis project, the second research question is thus defined as:

II. What patterns of the current value proposition and relationships could be observed?

Since digitalization and servitization have historically transformed markets rapidly, it could be considered as complex to predict what will happen in the Swedish district heating market. The empirical findings and analysis of the findings compared to the literature could, therefore, form the basis of possible future scenarios in terms of potential value propositions and relationships between actors. The third research question, that corresponds to formulating potential future scenarios, could be phrased as:

III. What are the pathways for future value propositions?

The chapters corresponding to the formulated research questions will be based on the presented background of district heating and the Swedish district heating market in the first chapter. It will also be based on the literature review conducted in the second chapter concerning servitization, digitalization, business models and service triads. The result from the conducted interviews is also an important aspect, where only the most relevant themes will be presented in the empirical findings.

1.4 Delimitations

Clearly stated delimitations need to be formulated in order to fulfil the purpose of the thesis project and to address the formulated research questions. Specifying boundaries for the thesis project also aims to give a better understanding of the provided results as well as the chosen methodology. Therefore, the delimitations are an important aspect of understanding what might be expected of the thesis project

in terms of results and what could potentially be of interest in future research.

The district heating market is huge and varies greatly in terms of production, reach and customers dependent on geographical location. District heating legislation also varies greatly depending on the country and only the Swedish district heating market will, therefore, be studied, with the present legislation as for spring of 2020. Possible future legislations will though be discussed, such as the introduction of individual measurement and debit in the EU, but these are not seen as set future scenarios or as an aspect that affects the current offerings.

Likewise, only the district heating market will be studied. Other types of heating and sources of energy are often intertwined with the district heating market and suppliers. If the thesis project were not to be delimited to only studying district heating, it would create a very complex environment with even more complex analysis. For instances where district heating has been heavily integrated with other types of energy solutions, only the aspects directly related to district heating have been considered. District heating is, nevertheless, a part of a greater energy delivery why this aspect will be discussed to some extent in the analysis and future scenario.

As district heating has a high level of vertical integration the suppliers control almost the entire value chain. Services, per definition, exist in the context of a customer, why only services in the customer interface will be studied. In this thesis project, the customer interface is delimited as what happens between the distribution and consumption of heat, why heating production and any production-related processes are not taken into consideration. To fully study the servitization of the district heating market and to be able to compare offerings from third-party actors with the ones offered by the suppliers, this thesis project will not consider the actual heat delivery and only study related services.

Further, there are several different types of customers that consume district heating. As private customers generally only manage the heating of one building, this thesis will, therefore, focus on non-private - so-called commercial - customers. The commercial customers generally have more power and resources to utilize the offered services on the market, why these tend to be the intended recipient of the current service offerings on the market. Even though services are also available to private customers as well, most of them are offered to the commercial customers

All information about the current state on the market in the empirical findings will be based on the conducted interviews with district heating suppliers, customers and third-party actors. The information obtained from the interviews is therefore highly dependent on what the interviewees chose to present. As the different interviewees' position varies it could also be assumed that their actual knowledge of the processes varies. Nevertheless, this thesis project is delimited to only be based on the actual presented information and opinions. Other sources of information, apart from what is presented in the background, will not be considered in the thesis.

2

Theoretical Framework

As to give context to the empirical findings and academic depth to the analysis, a theoretical framework is presented. Servitization and digitalization permeate the entire thesis project why the theoretical definition of the concepts is essential in the theoretical framework. Further, traditional business model aspects are presented to be able to compare the current business models on the district heating market in the analysis. Finally, classical service triads are explored in order to better understand the relationship between different actors on the market and to be able to explore where potential new actors could enter the market in the analysis.

2.1 Servitization

Moving from selling only traditional products to offering different types of corresponding services have recently transformed several traditional industries. One way to create customer value for a manufacturer is to add an additional service to the core product offering (Vandermerwe & Rada, 1988). In general, moving from products to services as a strategy is called *servitization*.

2.1.1 Definition of Servitization

Servitization as a concept is widely known and used within the manufacturing industries and the term was first established by Vandermerwe and Rada (1988). The authors' initial definition of servitization is coined as *the increased offering of fuller market packages or 'bundles' of customer focussed combinations of goods, services, support, self-service and knowledge in order to add value to the core product offering* (Vandermerwe & Rada, 1988). A more common description of servitization today is the shift from selling products with add-on services to selling integrated customized services (Oliva & Kallenberg, 2003; Roy et al., 2009) and that this includes an updated business model (Raddats et al., 2019).

Grönroos (2011) emphasizes that value is co-created for services in a joint sphere between actors by direct interaction rather than transaction-based value as for traditional products. In manufacturing firms, there is a clear distinction between the terms products and services, according to Roy et al. (2009). It is further implied by the authors that within the traditional view of manufacturing, a product has an emphasis on material artefacts and services has rather been referred to as offerings and maintenance of the artefacts. Gebauer et al. (2005) describe the former ap-

proach of a service only as an add-on to products, where value creation was only captured by the products, as a service paradox within manufacturing. A paradox since traditional manufacturers of products often fails to capture economic benefits from services that are instead associated with high costs and no returns (Gebauer et al., 2005).

Roy et al. (2009) mean that a central concept of servitization is the identification and understanding of customers' needs in order to develop successful services. In agreement, Gebauer et al. (2005) describe that a company's ability to obtain relevant and significant customer information is crucial for market success. Oliva and Kallenberg (2003) mean that one way of capturing customers needs could be to shift from a transaction-based interaction between the seller and buyer to a relation-based interaction. Likewise, it is of importance to working internally why a fundamental factor for a company is the organizational - especially the managerial - engagement, according to Gebauer et al. (2005). The authors claim that it is also of great importance that a successful service strategy must not only be supported by the management but by the entire organization to ensure success.

Another concept vital for a successful service strategy is a defined development process for services, according to Gebauer et al. (2005). To extend the service strategy from the traditional view of having services as add-ons to products, the shift must include a change in the value proposition, for example, to offer a customer support service (Gebauer et al., 2005).

2.1.2 Types of Service Offerings

Mathieu (2001) discusses two different types of service offerings; *services supporting the product* (henceforth referred to as SSP) which reinforce the functionality of the product in order to create value for the customer and *services supporting the customer* (henceforth referred to as SSC) which rather creates value for the customer directly. A SSC is generally more advanced as they are characterized by some sort of customization and a greater need for a close relationship with the customer (Mathieu, 2001). Likewise, a SSP is rather considered to be more standardized since the need for customization and the need for a close relationship is lower, in accordance with Mathieu (2001).

Lightfoot et al. (2013) further discuss service offerings as a combination of basic, intermediate and advanced service where the basic service offering consists of a pure product and services necessary for the usage of the product. For an immediate service offering maintenance is included while an advanced service offering includes effectiveness and efficiency when the value is delivered by the product (Lightfoot et al., 2013). Raddats et al. (2019) discuss the appropriate revenue models for each level of service offering, meaning that base and intermediate service offerings have an input-based revenue while advanced service offerings have an output-based revenue. For an advanced service offering, Raddats et al. (2019) also establish that it leads to a collaborative approach between buyer and seller, including shared risks

and rewards, changing the dynamics in the relationship.

In the study by Coreynen et al. (2017), it is discussed that an SSP, by the definition of Mathieu (2001), is closely related with base and intermediate level of service offerings, by the definition of Lightfoot et al. (2013), whereas advanced service offerings may be compared to SSC. Therefore, the terms SSP and SSC will be used henceforth as they are considered more well-established in the industry.

2.1.3 The Servitization pyramid

Coreynen et al. (2017) present the framework Servitization pyramid based on the research done by Kindström and Kowalkowski (2014) respectively Ulaga and Reinartz (2011), see Figure 2.1. The Servitization pyramid by Coreynen et al. (2017) visualises the differences between SSP and SSC in terms of three different value proposition that differs considering the type of customers. The different types of customers are based on three customer archetypes presented Baines and Lightfoot (2014); *the customer who wants to do everything by themselves, the customer who wants it done by another actor and the customer who want to do something together with another actor in a partnership*.

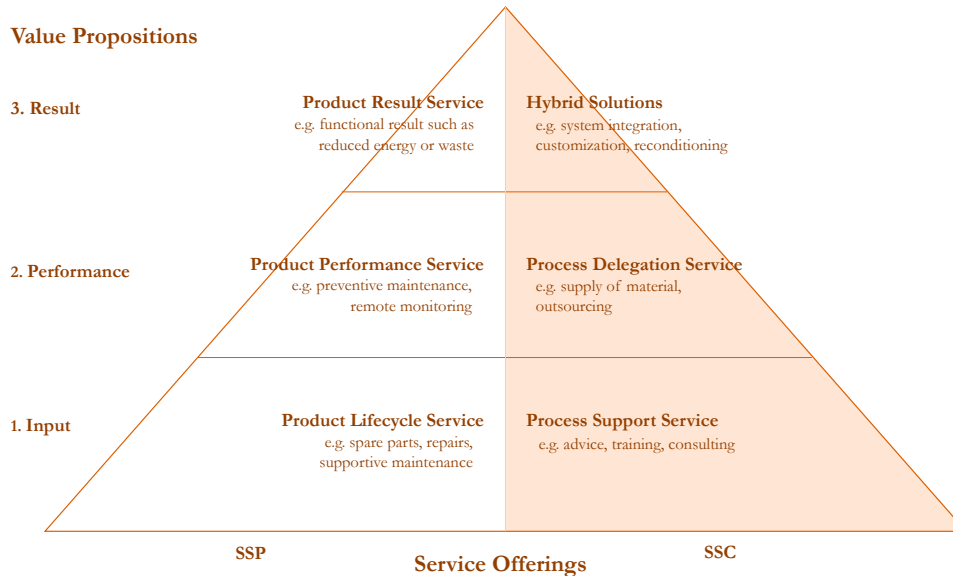


Figure 2.1: The Servitization pyramid by Coreynen et al. (2017), based on the findings of Kindström and Kowalkowski (2014) and Ulaga and Reinartz (2011)

Baines and Lightfoot (2014) further imply that the different archetypes demand different types of service offerings why the aim of the Servitization pyramid, provided by Coreynen et al. (2017), is to direct manufacturers to create the right service offerings for their customers. The archetypes are portrayed on the vertical axis of the pyramid and correspond to the service offering that can be offered at each level;

certain input, performance agreement and guaranteed results, in accordance with Kindström and Kowalkowski (2014). On the horizontal axis, the level of servitization is portrayed by the service offerings in terms of SSP or SSC (Coreynen et al., 2017). In the SSP focus, the offerings are based on improvements in the functionality of the product and for the SSC offerings, the focus is within the supporting the customers' processes (Kindström & Kowalkowski, 2014).

The first level of value propositions in the pyramid (see Figure 2.1) is characterized by input-based offerings, in general services that extend the products life cycle or assist the customers' process (Kindström & Kowalkowski, 2014). The revenue model is input based since the focus is within the delivery of the service in combination with a one-time payment (Kindström & Kowalkowski, 2014).

In the dimension of the performance-based value propositions, the second level in Figure 2.1, the services could be classified as intermediate services (Coreynen et al., 2017). The services are sold to improve the products or the customers' availability, often as contracts with payments per month related to an output-based revenue model (Kindström & Kowalkowski, 2014). The last value proposition, top level in Figure 2.1, is based on advanced services. A hybrid solution is, according to Coreynen et al. (2017), the most advanced since it consists of a high level of customization. Advanced services implicate, according to Kindström and Kowalkowski (2014), long-term agreements and are generally characterized as performance services with output-based revenue models focusing on the achieved output. Coreynen et al. (2017) mean that the hybrid solution should generally also include digital elements as part of the offering.

2.1.4 Servitization of Energy

The energy sector has historically focused on the production and distribution energy as a product, according to Gremyr and Halldórsson (2019). The authors mean that the demand has, nevertheless, increased for energy services as the sector is currently undergoing a sustainable transformation. Servitization as a concept could, therefore, be applied to the energy sector and Gremyr and Halldórsson (2019) conclude that the viewpoint of seeing energy as a product should persist, with corresponding services related to the energy delivery. This viewpoint is stated regardless of the source of energy, why it could be applicable to all types of sources, including district heating.

2.2 Digitization and Digitalization

The terms digitization and digitalization are often used as synonyms but are rather two different concepts, as described by Brennen and Kreiss (2016), and that by drawing a distinction of the term, the authors emphasize the analytical depth. Digitization is defined as the process of converting analogue data to digital bits while digitalization is a further evolvement that is defined as the process to adopt or increase the use of digital technologies in a broader context (Brennen & Kreiss, 2016).

Legner et al. (2017) describe that digitalization, as a social phenomenon, has historically arrived in waves, where the first wave of digitalization led to the introduction of the computer as a replacement for paper and the second when the Internet was introduced as a global communication platform. The third, and latest, wave of digitalization is currently seen as the introduction of the so-called SMAC technologies (Legner et al., 2017). The SMAC technologies stand for social, mobile, analytics and cloud computing technologies where each dimension consists of several different corresponding technologies, according to Legner et al. (2017). The introduction of the SMAC technologies are currently transforming traditional manufacturing industries and are expected to also transform other industries, leading to entirely new business opportunities, according to Legner et al. (2017). A more well-established concept regarding the emerging technologies rather than Legner et al. (2017)s' SMAC, are *smart technologies* (Worden et al., 2003).

2.2.1 Smart Technologies

Even though digitalization as a concept, is often discussed in various context and by various actors, the usage of smart technologies is a common theme according to Worden et al. (2003). For a technology to be classified as *smart* it is necessary that the technology fulfil the ability to improve its own functionality under new circumstances (Worden et al., 2003). Likewise, should the usage of a smart technology improve business performance, cost reductions and efficiency among others (Worden et al., 2003). The studies examining smart technologies generally refers to the technologies AI, Machine Learning and Cloud Computing (Kohtamäki et al., 2020), and it is considered that the usage of smart technologies has transformed business models globally (Hussain, 2017). Some of the most well-known currently successful companies in the world use smart technologies daily, such as Google and Facebook, according to Hussain (2017).

AI

The term *AI* have been discussed in studies since it first was coined by John McCarthy in 1955 (Davenport et al., 2019). During the years, the meaning of the term has differed from the hypothesis that a computer should be able to win over a human brain in chess to today's meaning; perception and cognition (Davenport et al., 2019). The definition of AI is wide and include the development of a computer program that exhibit human intelligence, building machines that can perform a human action and the understanding of the human intelligence (Whitson, 2018). Some of the worlds largest companies are using AI as a part of their business models and is utilized in operational processes, in the enhance of products and service and as a tool for decisions. One of the most important technology of AI is machine learning (Davenport et al., 2019).

Machine Learning

A machine's ability to improve its performance, without human interruption or directions in how the tasks should be completed, is defined as *machine learning*

(Davenport et al., 2019). Machines' learning capabilities have in recent years been increasingly efficient and new applications are constantly discovered (Davenport et al., 2019). It is described by Davenport et al. (2019) that it is fundamental to understand what machine learning has done for creating software, as it has radically changed the developing process. Traditional software, according to Davenport et al. (2019), is utilizing programming, where existing knowledge is coded for an outcome. Machine learning, on the other hand, uses examples and structured feedback in the learning process (Davenport et al., 2019). Machines have undergone a disruptive change in what their area of application are and how they interact with humans, from being limited by human tacit knowledge to be able to solve their own problems and increase their performance (Davenport et al., 2019).

Cloud Computing

Cloud computing is considered to be a relatively new addition in terms of corresponding business and economic models, according to Chopra (2017). The main principle behind cloud computing is described by the author to offer real-time computing, storage and *software-as-a-service* in a cloud-hosted service, rather than the traditional use of physical hardware and locally managed software. Infrastructure and multi-tenancy are essential in cloud computing, meaning different actors should be able to easily share resources and data (Chopra, 2017). The author emphasizes that the technology is very extensive in terms of cost, time, space and power. Likewise, it is generally dynamic and scalable after each company's demands and could integrate different application programming interfaces (Chopra, 2017).

2.2.2 Drivers for Digitalization

Andal-Ancion et al. (2003) have studied the driving forces for traditional businesses to adopt new technologies in order to undergo a digital transformation. The authors have identified ten different drivers depending on the company's current needs and situation. Related to the product and service offering the company offer, the following drivers are identified; *information intensity* related to the potential information a product can deliver that digitalization could enable, *customizability* as the need to adapt the offering to the end customer, *electronic deliverability* as being able to deliver the offerings value digitally and *aggregation effects* letting different services and products be bundled together, increasing the total benefits (Andal-Ancion et al., 2003).

Related to customer relationships, Andal-Ancion et al. (2003) have identified three different drivers; *search cost* corresponding to the decreased cost of finding information, *real-time interface* letting information be exchanged instantaneously and *contracting risk* when there is little risk related to digital transactions. Drivers for digitalization with regards to company's stakeholders are defined as; *network effects* leading to increased benefit the larger user base, standardization benefits as a driver for saving resources while using the same solution and *missing competencies* as a driver to increase knowledge (Andal-Ancion et al., 2003).

2.3 Business Model

The needs and definition of a business model as a concept has been widely discussed. Zott et al. (2011) describe that the present needs of a business model emerged in the 1990s, driven by the introduction of Internet and e-businesses. The current needs for the modern business model is defined by Zott et al. (2011) to address the architecture of the business, the strategic value creation mechanism and to embed the value in innovations and technologies. A more general definition, according to Zott et al. (2011), is the traditional definition by Osterwalder and Pigneur (2010): *A business model describes the rationale of how an organization creates, delivers and capture value.*

Irrespective of the dispersed needs, the business model is a conceptual tool to realise in which way a company is doing businesses, business logic as well as the created and captured value (Osterwalder et al., 2005; Zott et al., 2011). The authors emphasize the importance of the model as a tool to moderate the complexity of a company's value creating systems, relations and elements by visualizing each correspondent part.

2.3.1 Business Model Dimensions

Osterwalder et al. (2005) introduce the business model canvas as a concept and a common framework to capture the needs in a business model. After studying business models, Osterwalder et al. (2005) have identified common themes and the business model canvas is therefore divided into nine different blocks, each corresponding to a different business model aspect. Lüdeke-Freund et al. (2019) define four key dimensions in a business model as *value proposition*, *value delivery*, *value creation* and *value capture* based on the findings of Zott et al. (2011) where the same dimensions are used as the steps of value creation. Lüdeke-Freund et al. (2019) further describe the relationships between the dimensions as that value capture is necessary to enable value creating action as well as being able to create and deliver the value proposition.

Value Proposition

The main goal for a company should be to solve a customer's problem and capture their needs why the value proposition, as the company's aggregated offer to their customer, should correspond to a different customer segment with different needs (Osterwalder et al., 2005). Zott et al. (2011) define the value proposition as the distinct benefit that corresponds to a specific product or service. Therefore, Lüdeke-Freund et al. (2019) sub-categorize the value proposition into *products* and *services*, which include both direct products and customer-oriented services as well as services supporting products such as maintenance and repair.

A company can create value in several different ways and Osterwalder et al. (2005) describe that the value proposition can include both existing and disruptive offers in qualitative or quantitative circumstances. Typical examples of qualitative value

propositions include customization of a product or a service, helping the customer with a specific service and giving the customer accessibility, according to Osterwalder et al. (2005). Further, price reduction and improvement of existing products and services are examples of quantitative examples (Osterwalder et al., 2005).

Value Delivery

A value proposition must be communicated and reach the sought after customer segment, why value delivery is essential in accordance with Osterwalder et al. (2005). Since customers have different needs and behaviours, Günzel and Holm (2013) define the vital parts of value delivery are consisting of customer segmentation, channels and customer relationships. Osterwalder et al. (2005) mean that the customer interface, where the customer is reached, occurs via channels and should include a continuous awareness and evaluation of the value proposition. The type of information collected could include customers' willingness to pay, delivery requirements and after-sales services (Osterwalder et al., 2005).

Lüdeke-Freund et al. (2019) emphasize the importance of customer engagement and having a value delivery process and therefore subcategorize value delivery to *target customers* and *value delivery process*. The target customer is of importance with regards to what type of relationship is suitable while the value delivery process rather is about building a common infrastructure that can help connect and create aggregated value for both parties (Lüdeke-Freund et al., 2019). Osterwalder et al. (2005) describe the customer relationship as multi-dimensional as it can consist of both human and automated interaction, as well as anything between self-service and value co-creation with customers.

Value Creation

Osterwalder et al. (2005) present the value creation process as vital for a company as the absence of it will lead to loss of the business model value as well as not being able to capture the value proposition. Günzel and Holm (2013) divide value creation into; *key resources* which implicates the necessary assets needed to deliver value, *key activities* related to produce the value proposition and *key partners* which includes the network of suppliers and partners. Quite similar, Lüdeke-Freund et al. (2019) instead divide value creation into *partners and stakeholders* as well as *value creation process*, that could be seen as more suitable for services as it focuses less on resources and more on the activities that create value.

Osterwalder et al. (2005) have distinguished four different types of relationships between actors, where the first type is called *alliance* which is formed between actors for strategic gain and the second type is called *coopetition* that occurs when competitors partner up and cooperate. The third type is defined as *joint ventures* where actors with no prior bond develop a new business together and lastly a classic *buyer-supplier* relationship that is only based on exchanging the value offering (Osterwalder et al., 2005). According to Osterwalder et al. (2005), the underlying motives for undergoing partnerships could be the optimization of business models

or resources allocation and could be motivated as a reaction to the environment leading to sharing risks or investments.

Value Capture

The last business model dimension is value capture, that Günzel and Holm (2013) divide into revenue streams and cost structures and Lüdeke-Freund et al. (2019) simply divide as *revenues* and *costs*. The revenue streams capture customers' willingness to pay which can differ between different segments, leading to several simultaneous revenue streams that could either be one-time payments or continuous revenues (Günzel & Holm, 2013). How customers pay for their product or service also impacts the revenue streams as there could either be *fixed* prices for all customer or *dynamic* prices dependent on the situation, according to Osterwalder et al. (2005).

A fundamental part of a company's specific cost structure is the operating costs, which are always aimed to be minimized, as well as costs related to delivering value. Therefore the cost structure and overall strategy for a company can be divided into either cost- or value-driven, according to Osterwalder et al. (2005). A cost-driven structure is distinguished by high automatization, low customization, often outsourcing tasks and always with the intent to reduce costs (Osterwalder et al., 2005). A value-driven structure, on the other hand, is described by Osterwalder et al. (2005) to offer a high degree of customization, interactive communication and with the main focus to provide value to the customers.

2.4 Service Triad

In general, services are delivered in a beforehand prearranged way from the supplier to the customer and is manned by a contracted agreement between the supplier and the buyer, according to Wynstra et al. (2015). This relation can be described through a *service triad*, as introduced by Wynstra et al. (2015), which is visualized in Figure 2.2. The service triad consists of the supplier, buyer and customer and describes their underlying relations and the exchange of services, information and money (Wagner et al., 2018). Hence, the service triad is an emerging part of the business model since its association with the buyer's value proposition to the customer (Wynstra et al., 2015).

Wynstra et al. (2015) describe the service triad as an outsourcing landscape where a company should rather focus on their core business and instead contract another provider for the maintenance services to work directly with the end-user. This creates relationships between the supplier, buyer and customer (Wynstra et al., 2015), which can be visualized by the arrows in Figure 2.2.

Manufacturing industries traditionally view the supply chain as linear, with an exchange between the supplier and buyer, respective between the buyer and customer (Wynstra et al., 2015). Critical in the service triad, compared to the manufacturing supply chain, is the relation between the supplier and the customer according to

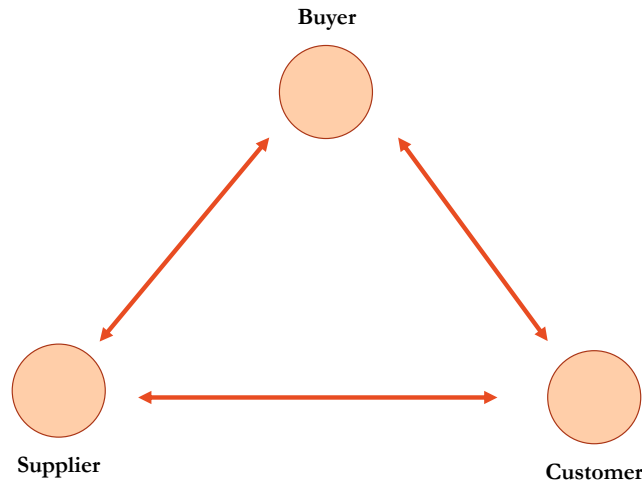


Figure 2.2: The traditional service triad by Wynstra et al. (2015)

the Wynstra et al. (2015). To be able to deliver the service to the customer, the buyer needs to contract the supplier in the delivery and the buyer then works as an intermediate, but are decoupled from the critical delivery according to Wynstra et al. (2015). This can create a paradox since the buyer is not involved in the service delivery but still needs to monitor the service quality (Wynstra et al., 2015). The main distinction in the service triad is, therefore, the exchange between the supplier and customer and not between the supplier and buyer (Wynstra et al., 2015).

2.4.1 Archetypes of Triads

Three fundamental types of triads are described by Wynstra et al. (2015) and the formation of the triads is depending on the initiating party since the triads can be initiated either by the supplier, buyer or the customer. The *buyer initiating triad* is characterized by outsourcing decision, made by the buyer. This can, according to Wynstra et al. (2015), be exemplified with a manufacturer who outsources some maintenance services to a third party. When a third-party is an intermediate between customers and suppliers, upon the customers' decision, it is called the *customer initiated triad*. The last triad, the *supplier initiating triad*, originates from the suppliers' decision to use a third-party actor as an intermediate in the interaction with the customer (Wynstra et al., 2015).

The Triadic Archetype

The classical service triad consists of a supplier, a buyer and a customer, as presented by Wagner et al. (2018). This triad can be structured in different constellations, generally varying in what type of interaction between the actors are present (Wagner et al., 2018). The fundamental and most traditional triad have a transaction-based

exchange, where the value is delivered from the supplier to the buyer (Wagner et al., 2018). In addition, the buyer delivers the value to the customer and can also provide after-sales services, in exchange for a transaction that flows in the opposite direction (Wagner et al., 2018). The buyer has an intermediate role as the director and controller of the information as well as the supplier's capacity and the customer's requirements (Wagner et al., 2018). The left triad in Figure 2.3 visualizes this type of triad.

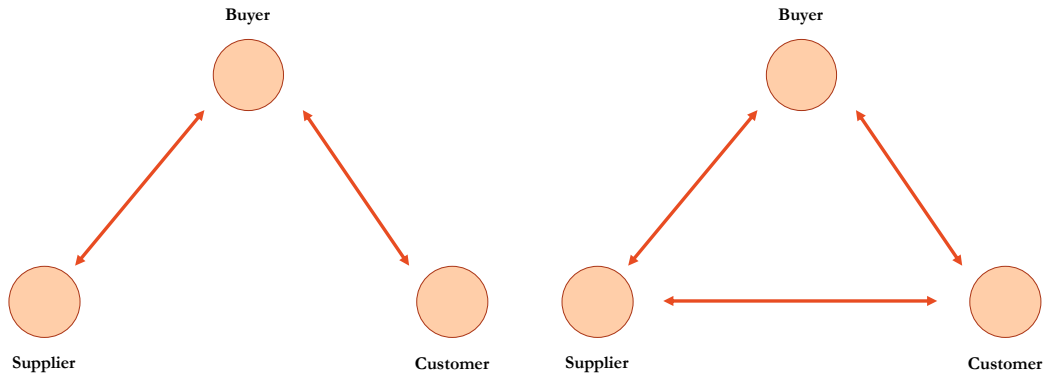


Figure 2.3: Two different variations of the triadic archetype inspired by Wagner et al. (2018). The left one with no interaction between suppliers and customers and the right one where all actors communicate with each other

As an alternative to the first type of triad, Wagner et al. (2018) describe a triad where the supplier and the customer have direct exchanges, as is visualized as the right triad in Figure 2.3. This type of triad is common when the buyer purchases a service from the supplier, and the service is delivered to the customer by the supplier (Wynstra et al., 2015). The supplier can, according to Wagner et al. (2018), offer after-sale services directly to the customer and it can be initiated either by the supplier or the customer. Critical in this triad is the two-way interaction between the actors since each actor has a direct relation with the remaining actors, thereby information can be exchanged between the supplier and the customer (Wynstra et al., 2015).

The Tetradic Archetype

If a fourth party enters the service triad, the constellation shifts into a tetradic archetype with four different types of actors (Wagner et al., 2018). According to the authors, extended archetypes are often common when the new actor is a competitor to the supplier and are often specialised in highly competitive service offerings. This type of constellation is often initiated upon the customer's request why the new actor is generally only in contact with the customer (Wagner et al., 2018). A tetrad with a competitor could, therefore, be visualized as in Figure 2.4.

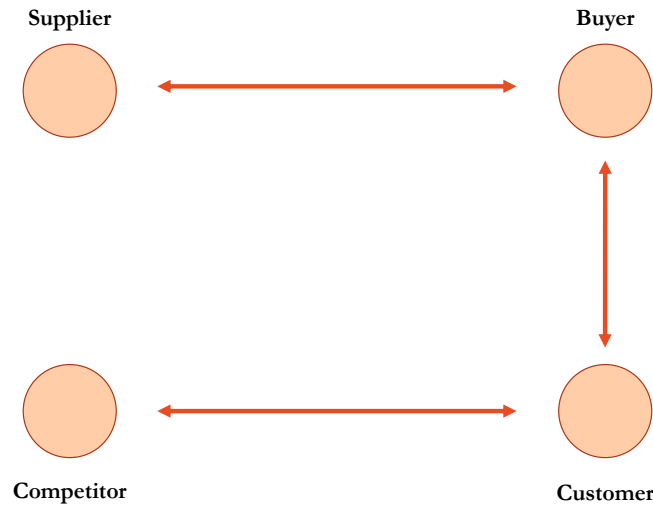


Figure 2.4: The Tetradic archetype inspired by Wagner et al. (2018)

2.5 Implications

Servitization and digitalization have in recent years emerged as trends within manufacturing industries, according to (Coreynen et al., 2017), as the concepts enable new innovative services, relationships with customers and strengthen competitiveness. The benefits of smart technologies are considered to increase by time as Kohtamäki et al. (2020) mean that it will conclude into a wider context of digitized data. The increasing amount of data can be turned into increasingly valuable information leading to an increase in revenue providing actions (Kohtamäki et al., 2020). The continuous emergence of new digital technologies also generates new opportunities for creating a customized value proposition, leading to potentially larger profits and better services (Kohtamäki et al., 2020).

Osterwalder et al. (2005) and Zott et al. (2011) present the business model as a tool to visualize how value is captured and created. The four business model dimensions, as described by Lüdeke-Freund et al. (2019), should be able to give an overview of a business proposition, where the first dimension value proposition directly corresponds to the benefit a product or service could provide (Zott et al., 2011). Lüdeke-Freund et al. (2019) divide the value proposition dimension to either being products or services, where services also could include services supporting products. One categorization of the level of servitization is presented by Mathieu (2001), who divides services into either supporting the products (SSP) or supporting the customer (SSC). Likewise, it is argued by Kohtamäki et al. (2020) that digitalization could transform the current value proposition. Brennen and Kreiss (2016) categorize the level of digitalization as an offering being either analogue, digitized or digital.

The service triad presented by Wynstra et al. (2015) and Wagner et al. (2018) reflects the relations and dynamics of the aftermarkets. Since aftermarket-services has come to be attractive and profitable, third parties have discovered the advantages and been capturing market shares (Wagner et al., 2018). The way which the different actors are working with each other can be described as the relationships in the business model (Osterwalder et al., 2005).

2.5.1 Model

Inspired by the model created by Lüdeke-Freund et al. (2019) and the implications from the presented theoretical framework, a new model is created called the *Digitalization and Servitization Business Model framework* (DSBM framework). The purpose of the DSBM framework is to be able to categorize different types of business propositions in order to find the characteristics of the current offerings. The DSBM framework could work as inspiration when forming new business offerings but also function as a tool to find new potential business pathways for current offerings. The DSBM framework should also work as a tool to be able to form service triads as the framework defines customer, stakeholders and partners, including what type of relationship they have.

The DSBM framework will be conceptualized together with the empirical findings in the analysis, but should be based on the dimensions identified in the literature. An outline for the DSBM framework could therefore be summarized as follows in Table 5.1.

Table 2.1: Outline of dimensions for the DSBM framework

BM Dimensions	
Value Proposition	Service Supporting Products Service Supporting Customers
Value Delivery	Target Customers Value Delivery Process
Value Creation	Partners and Stakeholders Value Creation Process
Value Capture	Revenues Costs

3

Method

The following chapter aims to explain and validate the chosen methodology for this project in terms of sampling and collection of data. How the data is analysed as well as an analysis about the validity and reliability of the project is also presented, before a concluding discussion about the chosen methodology is conducted.

3.1 Methodological Approach

With regards to the research questions and that servitization and digitalization is fairly unexplored for the district heating market, and an overall exploratory approach is chosen. Jaeger and Halliday (1998) describe the difference of choosing a confirmatory or an exploratory approach, and conclude that instead of testing a hypothesis as is done with the confirmatory approach, an exploratory approach rather aims to find a potential hypothesis. Therefore, for this thesis project, there will not be a set initial hypothesis that should be tested instead an overall subject is explored that should result in specific findings. The specific findings for this thesis project are, therefore, considered to be the three future scenarios. A visualization over the methodology approach can be seen in Figure 3.1.

Jaeger and Halliday (1998) further describes that an exploratory approach could either be experimental or observational, nevertheless should it conclude in novel wisdom that could be used to create a new hypothesis. For the nature of this specific subject, servitization and digitalization of the Swedish district heating market, an observational exploratory approach is utilized as the current state of the market is observed. As to conclude, this thesis project has a general explorative approach, by the definition of Jaeger and Halliday (1998), and aims to gain new insights from observations.

3.2 Sampling

When it comes to sampling and collecting data it is of importance to know which kind of data that will be collected beforehand to determine whether a qualitative or a quantitative approach should be used. The choice between qualitative and quantitative approach is described by O’leary and Mays (2004) as choosing the right methodology corresponding to the studied data. Qualitative data is described as data represented by figures, words and schemes, unlike quantitative data that is numerical and should correspond to statistical analysis (O’leary & Mays, 2004).

The collected data in this thesis project is distinctive of a qualitative approach, as it emphasizes findings and conclusions rather numerical and statistical words rather than a collection of numerical data.

Methodology Approach

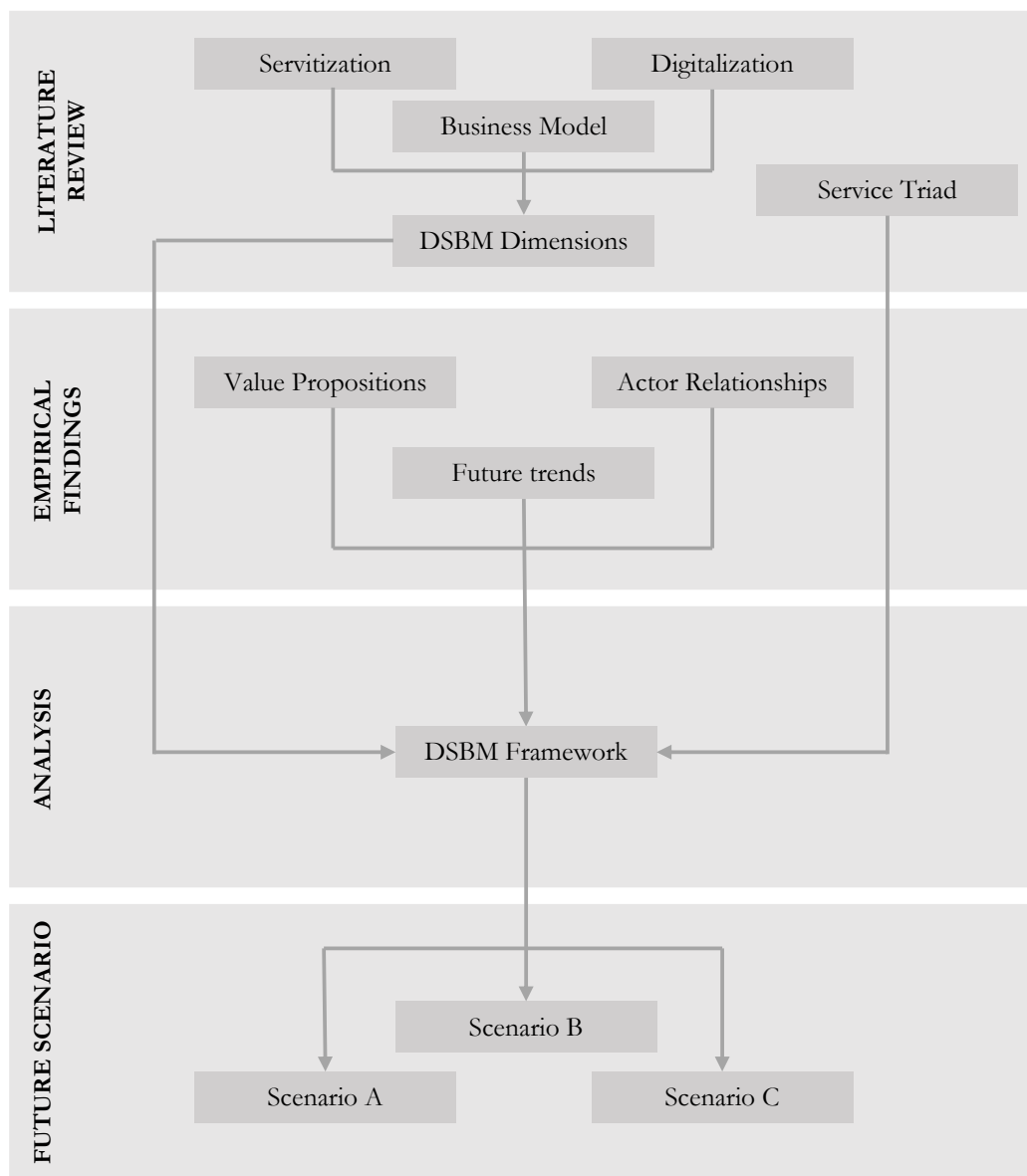


Figure 3.1: An overview of the methodology approach

3.2.1 Sampling

When it comes to sampling methodology for a qualitative study, Marshall (1996) describes three different main strategies; *convenience*, *judgement* and *theoretical sampling*. Convenience sampling is described by Marshall (1996) as to get in contact with the most accessible subjects and was therefore initially used as it saves both time and resources. The most accessible samples were found by using Profu's network in the industry as well as networking at the industry forum Värmemarknad Sverige. As Profu has high insight into the Swedish heating market and is in contact with a lot of different district heating actors it was assumed that the initial sample was somewhat well-diverse.

The convenience sampling has then been combined with judgement sampling in which Marshall (1996) defines as actively looking for and judging what will be the most convenient sample, in difference with just finding the most accessible sample as for the convenience sampling. Actively being able to judge the sample have become increasingly easier after time as more insight within the subject is gained. Further, Profu has been able to provide advice and judgement in terms of finding a good sample.

One important aspect of convenience sampling that has been utilized is the so-called snowball sampling (Marshall, 1996), where the interviewees have been asked to provide other useful contacts. This has worked very well for this study as the actor on the Swedish district heating market often have various collaboration or relationships with other actors on the market and can, therefore, supply contacts directly. This has also been useful in judging the sample as opinions of different actors are collected from other actors, giving a nuanced perspective of the chosen actors.

Sample Size

Marshall (1996) discusses that the sampling size of a qualitative study greatly varies and that a smaller sample should not necessarily impact the result negatively. The author further implicates the importance of iteratively to reconsider the sample size to generate the best result. For this study that has been achieved by dividing the sampling into three different phases depending on the type of actor on the district heating market.

Firstly, district heating suppliers were interviewed and what was found in these interviews were used in terms of making a decision of what types of customers that would be interviewed. The process was repeated for the third-party actors. For each phase, the sample size was evaluated with Profu, as is recommended by Marshall (1996) in a qualitative approach, as to whether sufficient information had been collected.

3.3 Data Collection and Analysis

When it comes to collecting qualitative data, it emphasizes requirements for preparation in order to get comprehensive knowledge. The preparation is essential in order to evaluate if the collected data is valuable. Therefore the data collection for this thesis project has been divided into a preparatory literature review, a market analysis of available offerings and then conducting the interviews with district heating actors.

3.3.1 Literature Review

A literature review was conducted to get an understanding of the current research within digitalization, servitization, business models and service triads. Tranfield et al. (2003) describe the importance of a literature review in order to validate the characteristics and theories to give the project an evidence-based approach. The literature review was conducted simultaneously with the interviews as to be able to angle the direction of the review as to properly match the content of the interviews.

3.3.2 Interviews

The empirical findings of the thesis project were collected by performing semi-structured interviews with district heating suppliers, customers and third-party actors. A thorough preparation phase was accomplished before the interviews were conducted that included designing the interview and performing a minor market analysis.

All the interviewed customers were commercial businesses of differing size and with different types of properties including residential buildings, offices, commercial spaces and public buildings. The third-party actors are considered to be all types of actors offering services in the district heating customer interface, without supplying any heat. They generally tend to offer services related to optimizing the district heating operations for both customers and district heating suppliers.

Interview Design

During the interview phase, the interview design is essential for further research design. Waller et al. (2015) divide the interview design into three styles; *structured*, *unstructured* and *semi-structured* interviews. Structured interviews are described by the author as beforehand set questions, which will be read by the researcher or as self-completion. The method can be performed by phone, face to face or over the Internet and is preferable when a large number of interviews should be conducted (Waller et al., 2015).

Unstructured interviews, on the other hand, can according to Bryman (2012) be described as a type of conversation where the direction is guided by the researchers and stories are created by the interviewer. In between of these two, semi-structured interviews can be found (Waller et al., 2015). Semi-structured interviews are an

intermediate of structured and unstructured interviews, where the researcher participant is dependent on the interviewers knowledge. Briefly explained, the greater amount of exploratory elements during an interview, the less structure is needed (Waller et al., 2015).

In the thesis project, semi-structured interviews were selected as interview design. To be able to capture the different actors' view, three different interview templates were created. The templates were designed to reflect the different actors' position on the market and hence called District Heating Supplier, Customer and Third Party, see Appendix A.

Included in the interview design, a brainstorming session was done to find out relevant topics, questions and sub-questions. The topics were determined to be categorised after the traditional business model dimensions; *value propositions*, *value capture*, *value creation* and *value delivery*, to capture the degree of servitization and digitalization on the market. Hence, a question about the service triad was related to the business model dimensions. Further, open questions regarding the future were asked to speculate and inspire future scenarios. The interview templates, see Appendix A, were reviewed by the supervisor and representatives from Profu to ensure relevance and validity in the research questions.

Market Analysis

In preparation to perform the interviews, the presented market offerings of the interviewed actors were studied and collected. Since the customers' self-developed offerings were intentionally not a part of the collected empirical findings, only the offerings provided by the district heating suppliers and third-party actors were studied beforehand. These offerings are also competing about the same customers why they are of interest to compare.

Only the actors' websites were deliberately studied to get a comparable view of each actor's current public offerings. Generally, all the available offerings for private customers were presented on the websites but details concerning offerings for commercial customers were not as public. Information regarding pricing also varied between the actors as some were very transparent while others demanded direct contact in order to get the current rates. Although the difficulty to obtain information, all available data were summarized as to get a comparable overview of the current offering on the district heating market.

Conducting Interviews

All of the interviews were conducted by phone or by video channels on the Internet, depending on the interviewees' preferences. The method was selected since it is cost and time-efficient (Bryman, 2012). Bryman (2012) also mentions advantages in the reduction of the researcher personal characteristics, that can otherwise affect the viewpoint of the participants. The time allocated for the interviews were estimated to 45 minutes and even, though, some of the interviews took less or more time, all

interviews were between 30-60 minutes.

To ensure the interviews understanding of the customer interface and the projects terminology, they were in beforehand provided with a preparatory material, see Appendix B, consisting of a visual map of the customer interface on the market, a simplified image of the service triad and a first output of the DSBM framework The classification of servitization; SSP and SSC, as well as the dimensions of digitalization; analogue, digitized and digital, was explained for the participants.

Table 3.1: List of interviewed actors, sorted by date of the interview and type of actors

Company	Type of Actor	Date
MälarEnergi	<i>District Heating Supplier</i>	2020-02-26
Vattenfall	<i>District Heating Supplier</i>	2020-03-10
Karlshamns Energi	<i>District Heating Supplier</i>	2020-03-11
E.ON	<i>District Heating Supplier</i>	2020-03-12
Jämtkraft	<i>District Heating Supplier</i>	2020-03-12
Stockholm Exergi	<i>District Heating Supplier</i>	2020-03-12
Öresundskraft	<i>District Heating Supplier</i>	2020-03-12
SFAB	<i>District Heating Supplier</i>	2020-03-18
Kraftringen	<i>District Heating Supplier</i>	2020-03-20
Tekniska Verken Linköping	<i>District Heating Supplier</i>	2020-03-20
Luleå Energi	<i>District Heating Supplier</i>	2020-03-23
Rikshem	<i>Customer</i>	2020-03-23
Castellum	<i>Customer</i>	2020-04-01
Diös Fastigheter	<i>Customer</i>	2020-04-01
Platzer Fastigheter	<i>Customer</i>	2020-04-02
Akademiska Hus	<i>Customer</i>	2020-04-08
Riksbyggen	<i>Customer</i>	2020-04-15
Stena Fastigheter	<i>Customer</i>	2020-04-16
Egain	<i>Third-party Actor</i>	2020-04-01
Ngenic	<i>Third-party Actor</i>	2020-04-01
Myrspöven	<i>Third-party Actor</i>	2020-04-06
LeanHeat	<i>Third-party Actor</i>	2020-04-16
NODA	<i>Third-party Actor</i>	2020-04-16

All the interviewed actors are summarized in Table 3.1 along with the date of the interviews. Initially, the district heating suppliers were interviewed before the customer and third-party actors were interviewed simultaneously, mainly due to lack of time.

3.4 Validity and Reliability

Reliability is according to Waller (2016) a critical element in research design and indicates that the same results should be obtained if the research is replicated. Waller et al. (2015) also implicate reliability as an independent factor meaning that the same result should be obtained independent of the researcher and participant. Validity describes the relevance in the collected data, further, should the interpretation of the data be done with the right method connected to the research questions (Waller et al., 2015).

Reliability and validity have been considered in order to make the findings more general and coherent. The presentation of the empirical findings in this thesis project has been co-created with input from Profu, the supervisor and the interviewees to ensure reliability. Lincoln and Guba (2013) highlight co-creation in order to ensure the stakeholders' reality.

Validity in the interviews has been ensured through letting the participants speak freely. To further ensure the thesis project's validity, triangulation has been used in the form of data generated from the three different actors' perspectives. Through interviews with different kind of actors, their different approaches related to the questions under investigation can be captured.

3.5 Discussion

Digitalization and servitization on the district heating market is a relatively unexplored subject, why an exploratory approach should be considered most appropriate. Since there is little or no prior research on the subject before, the exploratory approach has enabled a better understanding of the current and future characteristics of the market. Further, since Profu required the findings to be presented as future scenarios, the exploratory approach was to prefer since it does not lead to a conclusive result, rather could the scenarios be presented as hypotheses. It can be discussed if another approach, e.g testing a hypothesis, should have been preferable. Since there is no clear consensus of the state on the market, formulating a null hypothesis with the alternative hypothesis would, therefore, have been difficult.

The sampling of interviewees has been done in collaboration with Profu. This could initially be considered as bias, but since Profu has good knowledge and relations with many of the actors on the Swedish district heating market and see themselves as an independent actor, their knowledge of the actors are invaluable. With little prior knowledge of the market, the sample would most likely be more bias if Profu were not conferred. It was also necessary to trust Profus opinion about participants to collect and identify the prominent actors. Furthermore, since snowball sampling was used and all participants were asked to mention potential actors that might be of interest to interviews, the sample could be considered as further diverse as these actors did not necessarily have any contact with Profu.

The relatively small sample size of 23 participants was selected since the value propositions on the market can be considered as relatively similar and repetitive. It is not likely that conducting more interviews had generated another result, though, the weakness of the sample is rather the uneven participation of the actor segments. The participation of district heating suppliers is significantly greater than that of third-party actors and customers. It should be said that a few more third-party actors and customers were invited to participate, but they were not able to participate due to the global COVID-19 pandemic. It could, therefore, be considered that the needs of district heating suppliers are somewhat better understood than those of the remaining actors. At least, there are more confirmations of the findings from the district heating suppliers than from the other actors.

The interview design was based on the business model dimension and one could consider using a set framework could counteract the purpose of using semi-structured interviews by influencing the answers by the participants. Nevertheless, as all participants had the same structure, regardless of what type of actor, similar elements and characteristics could be captured from the interviews. The initial market analysis was done to summarize the current market value propositions. Since the interviews were semi-structured, the aim of the initial market analysis was to obtain knowledge in order to create a discussion during the interviews. If the initial market analysis was not conducted, the quality of the interviews would have been considerably lower. Thereby, one could conclude that neither performing an initial market analysis nor using a pre-set structure could be considered to create biases.

The interviews were performed through phone or by video calls and there are several limitations by conducting interviews remotely since it is difficult to catch specific nuances of opinions. On the other hand, participants are not as affected by the researchers' reactions by distance and since the outbreak of COVID-19, phone interviews must be considered the most suitable for all participating parties.

To conclude, the findings in the master thesis project is limited to the interviewees' knowledge of digitalization and servitization of their offerings and the district heating market. The result could thus be impacted by the interest and belief of the subject of the interviewees. Thereby, the opinion of the interviewees is not necessarily representative of the companies opinion. Therefore, have only the characteristic been collected in order to bypass individual opinions.

4

Empirical Findings

The empirical findings from the conducted interviews with the district heating suppliers, customers and third-party actors will be presented in this chapter with the aim to answer Research Question I:

I. What are the characteristics of the current value propositions and relationship on the Swedish district heating market?

The chapter will be divided into current value propositions, actor relationships and future trends. Future trends examine the challenges and the possibilities as well as what could be future value propositions and relationships between actors.

4.1 Current Value Propositions

Value proposition, per the definition of Zott et al. (2011), should capture the benefit a specific product or service could offer to a customer, where Lüdeke-Freund et al. (2019) emphasizes that value proposition should correspond to either a product or a service. For this chapter, the current value proposition of the interviewed district heating suppliers and third-party actors are examined. As to not leave the customer interface, the customers' needs are instead examined rather than their own value propositions, since these generally are offered to the end-user. Reviewing the customers' needs also give an overview of whether the current value propositions available are fulfilling their demands.

4.1.1 District Heating Suppliers' Value Propositions

The district heating suppliers' value proposition on the district heating market is, regardless of the intended output, traditionally characterized by long-term investment horizons. District heating is heavily dependent on common infrastructure and this fact combined with vertically integrated local monopolies implies a unique condition for creating value propositions.

District heating suppliers describes that they, apart from delivering heat, have numerous different value propositions either supporting the heat delivery process or the customer. Many of the interviewees describe similarity in their service packages, though when they describe the offerings in details differences occurs. From the conducted interviews it was identified that the complementing service offering

could each be divided into either maintenance, monitoring, data extraction, analysis or education.

Maintenance offered by the suppliers is described to often be sold in different packages, usually with some sort of subscription fee depending on what is included in terms of repairs and hardware. Generally, different service packages are described by the actors as different types of preventive maintenance agreements. Monitoring of the district heating system and infrastructure, on the other hand, is differing since some suppliers include it in their maintenance subscription while others sell it as an add-on service or even offering it for free.

Monitoring, that is included in maintenance, is described to be characterized as to describe the current status of the district heating system. It is described that this type of monitoring tends to be very analogue, only showing whether the system is functioning or not. This could be described as *maintenance monitoring* which differs from the concept of *operational monitoring*. Operational monitoring could be described as giving the customer access to monitor their systems in order to ease their heating operations. The complexity of operational monitoring differs and could include everything from real-time visualization of the property stock to invoicing details.

Likewise, suppliers have identified the demand for supplying data to their customer, some offering it for free while others charge extra. One customer mentioned the data offerings to the customers as *it is not always services with a fixed price since it can generate customer loyalty if it is offered for free. This creates a dialogue with the customer and initiates for a cooperation.* Heavily related to the data extraction is providing customized analysis that is often sold on demand from a customer with the goal to advise the customer on how to operate a building heat efficiently. Some suppliers even mention that they offer customers education on how to operate the district heating system.

Overall, the same complementing services are offered to all customer segments, with less emphasis on statistical analysis for private customers. Suppliers usually divide the customer segments into either private or commercial customers. Private customers are considered to consist of private owners of single-family residential buildings while commercial customer is considered to either be owners of multi-family residential buildings, public premises and all types of offices or commercial real estates. Larger commercial customers are described to usually demand more complementing services as they got more capital and more complex properties to manage, often causing a wider range of services offered to commercial customers.

4.1.2 Third-party Actors' Value Propositions

Third-party actors on the Swedish district heating market are described to usually operate apart from the rest of the actors on the market, why they consider themselves as having an impartial and objective perspective. One interviewed actor

voices the objective perspective as *we can be the independent actor on the district heating market, optimizing the energy consumption for the customers and lessen the peaks for the district heating suppliers*. The traditional and non-digital approach of the district heating supplier opens up business opportunities for the third-party actors that are far more digitally mature than any current supplier. Knowledge of digital methodology and what transformations have been done in other industries are a vital driving force for third-party actors that enters the market as they generally have identified inefficiencies in the traditional district heating value propositions.

With a wider perspective of the market and small organizations, the third-party actors voice that they generally can identify the current needs and can move swiftly to fill in the gaps between the actors. Since the third-party actor are described as more experienced in IT and digital technologies than traditional actors on the Swedish heating market, they are generally good at conducting market analysis and listen to the different actors' needs. One of the largest customer's needs that the third-party actors have identified is the general interest of data and what value it could bring to the different actors. This is utilized by the third-party actors as they have the means to analyze and provide actions of the data, such as knowledge and experience of AI, machine learning and cloud computing.

From the conducted interviews with third-party actors, it is identified that the actors either provide their services to the district heating supplier, the district heating customer or both. The identified value propositions, therefore, differs to either manage the load and lessen the peak demand for suppliers or provide a high level of control and optimizing the operating of buildings for customers. The exact methodology differs from different actors but usually load control for suppliers is described to be achieved by connecting building within the network and using smart technologies such as machine learning and AI to optimize the heating of the building to lessen costly demand peaks. By connecting buildings, it is described that third-party actors could also steer and help the customer achieve even indoor climate. For those actors turning solely to customers, their value proposition is described to usually consists of connecting the building to different data-collecting sensors and by machine learning and cloud computing optimize the indoor climate in the building to lessen the costs, environmental impact and even out the heat distribution.

Some actors have realized the potential in providing a solution to both suppliers and customers as connected buildings are essential for managing the load control and could be a complementing business proposal to the customers. It is described that cooperating with both customers and suppliers corresponds to be in control of both the supply and demand of district heating, which is generally seen to achieve a higher impact for the steering efforts. Some third-party actors even let the district heating supplier distribute their offering of connecting buildings directly to the supplier's customers, minimizing the marketing effort for the third-party actor. It is though identified in the conducted interview as that is generally easier for the actors to begin cooperating with customers than a traditional supplier, why many of the third-party actors have begun working with optimization of heat control in buildings before

introducing management of load control later.

4.1.3 Identified Customers' Needs

The customer is the intended recipient of a traditional district heating offering as well as for most of the third-party service offerings available on the market. This section, therefore, aims to summarize what needs are currently communicated in interviews with district heating customers. Only commercial actors have been interviewed why this section is limited to explore the commercial customers' needs. Customers are, as mentioned, mainly divided by private or commercial customers by suppliers while third-party actors seldom offer their service to private customers and therefore mainly turns to commercial customers. Commercial customers are generally considered to have more resources and capital as a customer usually owns several large buildings in comparison with private customers that usually only own one small building. Implementing a service for a commercial customer is therefore considered much more efficient in terms of both times and received profit why most efforts, at least initially, are developed with a commercial customer in mind.

From the conducted interviews with the customers, it was detected that all commercial customers expressed their need for control over their property stock and overview of the current operations. Details about the specified requirements differ between the customers, but the overall real-time current status of their building and the possibilities to collect analyzable data seems to dominate their need for control. One of the interviewed customers mentioned that *there is a lack of transparency and simplicity when we want to use data and develop our houses. We want effects, we need real-time status and we do not want to sit and "wash" the data ourselves.* Another customer mentioned their demands as *the expectation we have are the availability of data. If we can get a real-time connection and faster access to the data it, would have been good. Some suppliers deliver values a month later and acting on a deviation a month later is too late. We would have liked to see some kind of inbuilt analysis of the data.* To summarize, several customers mentioned the need of monitoring of their infrastructure to feel a sense of control and to be able to collect data in order to perform analysis of the operations in order to control the real output compared to the intended.

The commercial actors voice that they generally do have the resources and knowledge of the market why they are capable of developing their own products or services that they deem that they need and can't currently find on the market. The customers generally demand different types of data from the district heating infrastructure and the general belief is that the data the suppliers do provide is either obsolete, miss-matched, not sufficient or too expensive. Many of the interviewed customers, therefore, collect their own data to be able to directly match their needs and intended usage. The data provided by the supplier is generally considered only sufficient for less complicated tasks, such as invoicing.

The data is described to mainly be collected in order to analyze the customers' cur-

rent operations. Some actors voice that they simply want to be informed of their current consumption and problems in the infrastructure. Others want to use the data to optimize the operations and learn how they can be more efficient. Analyzing the data is described to either be conducted by the customers or bought in by third-party actors, where the services provided by the third-party actors usually consists of advanced optimization that ultimately automates the entire heat operation in a building. Being able to analyze data in order to find failures or deviations is generally considered quite easy while being able to optimize the operations takes much more data and analytical experience. Customers see themselves as generally being less experienced with digital methodology and interpretation of data why advanced analytics are often bought in from other actors even though some actors voice their intention of eventually being able to provide all the needed analytics for themselves.

Another identified need from the customers is predictability. It is described that district heating, as a source of heating, is chosen for the operation stability, the small environmental impact and historically low and stable pricing. It is, though, generally considered that the pricing of district heating is difficult to predict as the price and consumption of heating widely differs during the year. Customers also voice that they wish for a more transparent pricing model as it is very difficult to budget heating when utilizing district heating. One customer mentioned the problem with the current price model as *the bottleneck at seasonal peaks gives an expensive kWh of district heating, compared to the cost of production. Digitalization could ensure this to become transparent and efficient, so that the cost of production only covers the price against us*. Budgeting and price predictability are explained to be vital when performing investment calculations why actors instead often ups for other heating sources when constructing new buildings as there are fewer investment uncertainties.

While it is expressed that the customers are striving to minimize the heat consumption, it is often from an environmental perspective rather than the financial. It is concluded that the customers' customers - the end-users - are getting more and more educated and interested in the environmental impact of their energy consumption. An emergent need from the customers is, therefore, better insight into the environmental consequences of district heating and information transparency between actors.

Even though common themes could be detected in the conducted interviews with the customers, no customer expressed exactly the same needs. Customers emphasized that their needs were constantly changing and evolving, especially in larger organizations that often are geographically spread and therefore deals with different district heating suppliers. Some level of customizability and adaptability in the value proposition is therefore described as being necessary in order to coordinate an organization with different suppliers and for the customers to even consider district heating as a source of heating. Some aspects of customizability mentioned were type and frequency of received data, type of analysis of data and level of self-steering. While some customers want to be able to steer and operate their entire property stock with little interference by the supplier, others want to buy a fixed indoor

temperature to a fixed price with as little operational insight as possible.

4.2 Actor Relationships

The relationships between the actors on the Swedish district heating market were investigated in the conducted interviews in order to better understand the dynamics and the characteristics. As a guide for reasoning and to present the most common actors, the service triad by Wynstra et al. (2015) was presented to all interviewees, see Figure 2.2. The triad was then discussed from each actors perspective as well as some reasoning where new actors could potentially emerge.

4.2.1 District Heating Suppliers' Perspective

From the perspective of the district heating suppliers, the service triad caught the overall reflection on what actors are currently on the market as well as in which way and to whom they communicate. The district heating supplier does generally have customers, both private and commercial, and some type of end-user of the delivered district heating, see Figure 4.1. In some occasions, mostly for private customers, the end-user is also the customer which therefore then lessens the number of actors in the triad.

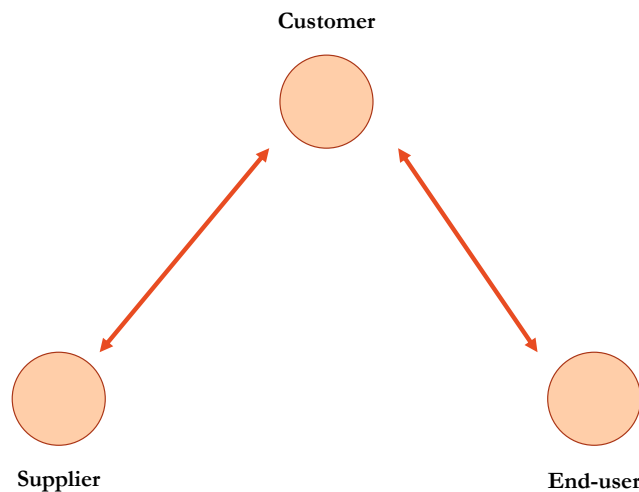


Figure 4.1: Observed triad on the market, corresponding to the traditional service triad by Wynstra et al. (2015)

The relationship between the supplier and the customer is generally described as well-functioning, where more efforts are invested in large commercial customers since

they are considered to bring in more potential revenue than for small or private customers. Several suppliers describe that they generally keep in contact with their customer by a key account manager and by performing traditional analogue meetings. The sales relationship is described as an important dialogue that keeps the supplier updated regarding operational issues and potential upcoming needs and is mentioned in one interview as *district heating is generally a long-term business and the decision whether you want to install district heating is done when you build the house. We have to try to meet customers more continually, but if everything works fine with the distributed district heating, it can take a long time before we meet a customer.* Collecting the needs of their customer is otherwise described as quite difficult by some why efforts as panel discussions and forums are seen as the main way of collect and reassure that the supplier is fulfilling the requested needs.

By discussing the triad it could be concluded that none of the interviewed suppliers had any existing relationship with the end-users. Some suppliers saw maintenance as the only way they could potentially encounter their users and no efforts to meet them otherwise have been conducted. Most of the district heating suppliers and third-party actors expressed that there was no identified need for them to have any relationship with the end-user and that they were content with letting their customer maintain the relationship with the end-user without interference. Others saw the potential of moving closer to the end-user in order to understand their needs and to improve the value proposition for their customers. The realization that the end-user could impact the customer to choose a different heating source if the current offerings are not sufficient seemed to be the main motivation for the suppliers to move closer and to understand the user.

In the perspective of the suppliers, digitalization is generally described as a tool for the customer to get information about their past heat consumption. In addition, they can also track their invoices and administration services. Others mention that legislation, such as for individual measurement and debit that is currently discussed in the EU, could alter the current relations and change the dynamics in the triad.

The introduction of and relationship with third-party actors are regarded as considerably different by the suppliers. Some view third-party actors as a potential way to utilize new technology and starts to co-create offerings in a partnership. Others see third-party actors as competitors of maintaining the customer relationship and are in fear that the actors will sweep in and replace them in the triad, cutting them off from any contact with the customer. Ultimately leaving the suppliers to be bulk suppliers of heat that third-party actors distribute, see Figure 4.2. Regardless are the interviewed suppliers overall open and optimistic to cooperate with new third-party actors, mainly because they tend to realize that they lack the knowledge the actor has. The suppliers do value their relationship with their customers very high, though, why new initiatives with third-party actors often aim to be sold and re-branded as a part of the supplier's value offerings.

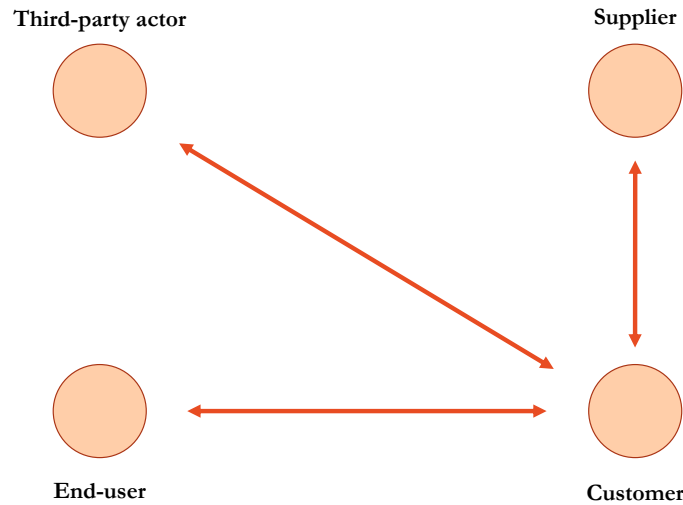


Figure 4.2: Observed tetrad with district heating suppliers as a bulk deliverers and partnership between customers and third-party actors

4.2.2 Third-party Actors' Perspective

With regards to the third-party actors' perspective, they are placed outside the classic service triad as an additional actor. From the conducted interviews the third-party actors are either in contact with the district heating suppliers, the district heating customers or both dependent on the value proposition. It is described that as a part of creating value and profit from their offerings, to position themselves between the suppliers and customers and manage the contact in the middle of them in the triad, see Figure 4.3.

For those third-party actors that provide a service to manage the load control for the district heating suppliers, it is described that it requires investments for building common infrastructure that can collect data and steer the resource allocation. In these instances, the third-party actors generally do consider themselves to form a long-term partnership with the supplier with close collaboration. Since each district heating supplier is described to be very different with different infrastructure, size and heat production, a high level of customization is required. It is also described that even though infrastructure is partly located at the customers in these cases, the third-party actors keep their distance from them and generally lets the supplier own the relationship with the customers.

For those third-party actors with offerings that turn to the customers, dependent on the extent of the value offering, it is though described that these offerings require less common infrastructure and generally only digital sensors for measurement. The third-party actor describes that the relationships with the customers are therefore less customized and more of a traditional transaction-based relationship. They still

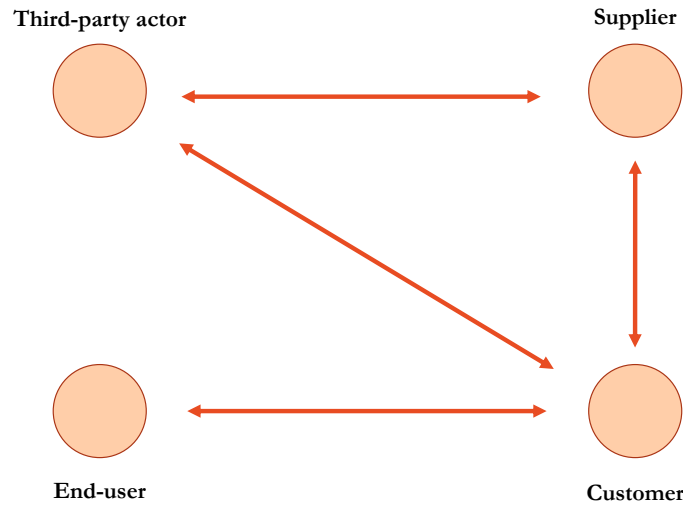


Figure 4.3: Observed tetrad with the third-party actor in relationship with both customers and district heating suppliers

deliver a continuous service, generally optimizing heat consumption and steering buildings, but since these operations are generally automatized and could be controlled remotely, a continuous contact is not considered as necessary by the third-party actors. It is also mentioned that one can generally apply similar technologies to different buildings why it is described as easier and quicker to sell this type of offering to a wide array of actors with just some minor alterations.

Generally, the third-party actors have a good understanding of where they are placed in the triad and what types of relationships with what actors they are striving for. Several mentions that not being a part of the traditional district heating market has pushed them to better research the market before launching their offering and form their strategy thereafter. Since they are not part of the district heating market naturally, all third-party actors describe that they have to be the ones that take initiatives to form new relations and do generally see themselves as the driving party in the relationship. One of the interviewees describe the market relations as *in order to ensure a stable supply of heat, all three actors must cooperate. So our idea is to collaborate with district heating suppliers to create a really good solution for customers and users. That is why we are always in initial contact with both the district heating supplier and the customer.* It is, though, described that the third-party actors have no contacts with the end-user and that the customer, regardless of the proposed value proposition of the interviewees, owns the relationship.

Most of the interviewed third-party actors see their relationships as a way to establish themselves on the market by forming partnerships with current traditional actors. By forming a partnership it is described as that they get valuable insight into the market and can exchange their different expertise. The third-party actors explain

that they get contacts, operational and market insights from the suppliers or the customers in exchange for digital competence and the development of a customized offering.

4.2.3 Customers' Perspective

The customers' perspective on their relationships with the different actors is generally considered to correspond to the presented classical triad, with the customer as the intermediary between the district heating supplier and the end-user. Regarding the customers' relationships with their suppliers, their viewpoint is described as varied, dependent on the customer and supplier. Some describe the relationship as favourable and would want to have a closer relationship, some sort of a partnership even, with their heat supplier. Others see the relationship as strictly transaction-based and do not see any benefit of improving their relationship with the supplier. Those customers describe that they would rather want to distance themselves from their supplier in order to increase their buyer-power.

As described by the suppliers, the interviewed customers confirm that it does not exist any current relationship between the supplier and the end-user. It is also expressed by the customers that they are content with being the intermediary between the actors and if that would change, it would have to be on the initiative of the end-user. It is further indicated that any change in the dynamics would have to be done without compromising their relationship with the customers.

The customers generally describes themselves as open to form new partnership and collaborations with actors and mentioned it as *we would like to get help from service providers, preferably in partnership. We are interested in developing useful technology*. Some even mention it as necessary in order to obtain the technical knowledge that emerges by third-party actors. Technical and digital competence are varied for the customers and some of the interviewees voice that they are dependent on the solutions available on the market while others actively develop their own solution without interference from other actors.

It is expressed that the customers wish to work with others' available solutions since they are afraid that they would lock themselves in if they would only develop their own solutions that do not follow the future industry standards. The demand for further developing the current offers on the market are evolving quickly why collaborating with other actors is also seen as a potential way to catch up with the fastly emerging needs. Other voices that there is no perfect solution available on the market, or that the current offers on the market provided by the third-party actors are too expensive, and are therefore driven to develop their own solutions.

4.3 Future Trends

The future of the Swedish district heating market and potential trends were reviewed in the conducted interviews in order to identify possibilities and challenges. Further, opinions considering what the value propositions and relationships will look like in the future were collected. All of the collected opinions are of speculative nature, from different types of actors with different roles, why only the characteristics of the empirical findings are reviewed and summarized in this section.

The fact that the Swedish district heating market is currently evolving from being strictly analogue to increasingly introduce digital elements is well-established by the interviewees. All are aware that the evolvement in terms of digitalization and servitization will continue, but few dare to get into specifics regarding either timeline or techniques. Some see the development of the Swedish electricity market as an inspiration. A market that has undergone a drastic change due to deregulation and an introduction of a quantity of new and digitally intense actors. Several actors voice that if a similar development would happen at the district heating market it would drastically change the current dynamic and who operates on the market.

A general opinion, disregarding if the district heating market is following the electricity market or not, is that the current digital transformation is requiring a new type of competencies. From mainly consisting of operative and analogue roles that could run and maintain a district heating power plant, district heating suppliers have realized that they need to reform their organization. Increasing digital competence is, though, considered by more than the suppliers. Customers also see the increasing needs to be able to provide the digital resources in-house to meet their customers' - the end-users' - needs. This requires an overall change of competencies that impacts the entire market.

4.3.1 Future Value Propositions

Following section will review what types of new offerings and value propositions that could potentially be present in the future. All different types of actors have speculated why this section will only capture general themes and characteristics. The chapter will, though, be divided after the type of actor.

District Heatings Suppliers' Perspective

Generally, it is discussed that district heating suppliers should leave standardized offerings behind. It has already been identified that the customer needs differs and most are in agreement that providing customized solution could be an important way to compete with other offerings. Some areas that are acknowledged that could be customized are described as providing tailored measurements of data, different types of payment solutions and personalized maintenance experience.

Others mention the fact that customers increasingly want to buy an all-inclusive offering, where heat delivery and all types of operations related to the delivery is

included. Some of the interviewed suppliers already own the district heating infrastructure located at the customer and several voices that this will be much more common in the future. It is discussed that it is desirable for customers that the suppliers take care of the entire energy solution, being the ones working proactively in terms of optimizing the operations since they should be the one with the most experience and expertise. These types of solutions are mentioned to be requested by the customers not only since they can pass over the control and responsibility of the daily operations but also since this solution are financially predictable since they could pay a monthly, set fee that includes everything. Especially for smaller customers voices that this is a very attractive offer. It is described that larger customers tend to have more of the operational competencies in-house and therefore tend to want better control over the infrastructure themselves.

Implementing digital elements such as AI, machine learning etc. has already been done to some degree by third-party actors and most of the interviewees mention that this is will probably spread to the entire market. The techniques have partially resulted in being able to analyze statistics and therefore optimize the heating of the building in terms of minimizing consumption. Partially the techniques have lead to control of the operations and by machine learning and AI, the steering of heating is automated and could be implemented remotely. District heating supplier describes that they must start to offer similar digital services in order to keep their competitive edge, why many see these techniques as standards in the future. One interviewee mentioned the problem with the competitive edge as *we see a trend that third-party actors are taking the contact surface to customers on the electricity market by using digitalization. There are many third-party actors who see business opportunities in lessening the peaks and we can see a tendency for this to occur on the district heating market as well. We must be aware and react in order to not become a bulk supplier.*

Suppliers mention that they have also realized that the digital techniques are not only a competitive offering for their customers but that it rather it could help them in their operations. Several mentions that they believe that all buildings in a district heating infrastructure will be connected and online in the future which will give the supplies huge insight in their customers' behaviour but also be able to optimize their production to minimize peaks of demand. It is described that this could also potentially help the suppliers to remotely control the operations, using the connected building as to store heat to even out the demand even more. The remote control could also help their customers visualize the current state of their property stock and provide customized data for each connected property, such as is partly achieved by third-party actors today. Being able to gain the data directly from the source is described as a way that the customers would get a better insight into the operations and increase transparency.

Third-party Actors' Perspective

If the traditional suppliers will take charge of digitalizing the district heating delivery process, some believe that third-party actors could render obsolete. Others mention that they believe that the third-party actors, with their advantage in terms

of digital competence, will niche themselves even further when it comes to visualization and interpretation of data. That their service will still be able to optimize the operations of the heating but that their services will have to be able to function with the digital infrastructure of the supplier. This is described to already be achieved by most of the third-party actors on the market as they are independent of what types of hardware are installed and mainly sell software. It is further mentioned that the third-party actors will be the ones to provide the software rather than the hardware, that should be owned by the supplier or customer, in the future.

Other third-party actors mean that the entire infrastructure and how heat is exchanged will shift. Some believe that the heating market will coexist with the electricity market and that heat will be sold at similar platforms as for electricity. A few actors mention the possibility of establishing a spot market for selling district heating or even develop local ones, where heat can be sold at an hourly basis. It is mentioned that this market could go both ways; either the suppliers offer heat at different rates dependent of production cost or the customer could offer to maintain a specific heat consumption at different rates giving the suppliers the chance to lessen demand peaks. One third-party actor even mentions that they are already in the process of developing a market platform that could work as a spot market for selling and buying heat.

Platform as a service is also a common theme mentioned by the interviewees to be a future offering for smart technologies. Hence, it is not stated if the role as platform provider should be the third-party actors' responsibility or if a new actor will enter the market with these offerings. Irrespective of the provider, the third-party actors emphasize this as a solution for the integration problems that occur when the customers and suppliers manage the development of their own platforms. Due to this, several third-party actors also mention that both the suppliers and the customer need to realise the potential in outsourcing the development of platforms to the third-party actors in order to achieve standardization. It has been mentioned from one of the interviews conducted by the third-party actors that *the establishment of such systems requires more than 50 people with technical expertise. If they're not willing to make this investment, it's important not to start your own solution.* If a market standard could be reached, the interviewees deem to think this can open up for new service offerings from the third-party actors.

In the perspective of the third-party actors, the use of digitalization is already common in their present value propositions. Likewise, the digital services launched at the market are almost the same and thereby some interviewees mention communication as a tool for differentiation. Communication is described as being critical for the existing third-party actors in order to increase their market shares and even more critical when new actors are entering the market and they mention that they need to be better to communicate with their customers. Some third-party actors even mention that they should implement the use of a *chief digital officer* to maintain their position as digital experts and in the future be able to take part and guide the customers through the digital transformation.

Another emerging trend in the energy sector that the third-party actors predict to be a trend in the district heating market is the utilization of blockchain. Some believe that blockchain will be the emerging future technology since its potential in securing systems and give new business solutions. One interviewee describes blockchain as *block chain has started to hit the electricity market and there are those who are starting to take it to the heating market. This will revolutionize the energy trade and may even integrate electricity and heat.*

Customers' Perspective

In the aspects of the customer's, it can be concluded that they are unanimous in the perspective of their future needs. Generally, reduced energy consumption and impact on the environment are two fundamental aspects all interviewees mentions. Regarding the demand for services with environmental aspects, one customer mentions that *the need for these services is great, only the imagination sets the limits.* Thereby, many of their future needs are discussed to be included in value propositions related to load management with an emphasis on cost reduction, reducing demand peaks, optimizing indoor-climate and energy optimization as examples.

The customers' demand for data is described as essential in order to reduce the consumption of energy and change consumer behaviour. Nonetheless, is the access to the data generally described to be limited by the suppliers for the smaller customers, who are not able to collect the data by themselves. Without instantaneous data access, they describe their behaviour as invariably, since they don't know how they should manage their heat consumption to decrease their usage. Even the greater commercial actors mention that they would like to see future services related to analyzing their behaviour, helping them to decrease their environmental impact. The interviewees also describe that a potential introduction of new legislation, that could enable and standardize data access, inspired of what is happening on the electricity market, as something they would like to see happening in the future. They think this potential legislation could open up for new service and in addition, customers' position will be strengthened with more efficient flow of information.

Further, it is described that customers are willing to pay for services that help them reduce their environmental impact. The interviewed customers emphasize the importance of not only having an environmental viewpoint for their newly built properties but also to optimize the energy consumption in existing properties. Some of the customers mention load management as a way to decrease the environmental impact, even mentioning a merger between utilizing electricity and heat in order to optimize the consumption even more.

The use of smart technologies is a common theme when customers discuss future trends. Big data warehouses and data lakes, both based on cloud storage, are mentioned as future technologies to store the massive amount of data that will be collected as well as AI and machine learning for processing the data. Some customers describe that digitalization could be a better way of communicating more

transparent between actors, shortening the distance.

Even though there is no industry standard in the development of solutions, one customer has realised the complexity in their own development of platforms and systems, and the implication this will give in the future. The customer is conscious of the implications with their in-house development and future barriers against services offered by other actors. On the other hand, there is no current standard on the market and many describe that they would rather start to develop a solution than to wait until a consensus is reached.

4.3.2 Future Relationships

The relationship on the current district heating market is already considered complex, why mainly very abstract opinions about the future are voiced by the interviewees. All of the interviewed actors are though in agreement that the relationships between and what actors are present on the market will change in the future. Most of them believe that new actors will enter the market by time and shift the current dynamics and relationships.

District Heatings Suppliers' Perspective

Some mention that what has happened on the Swedish electricity market - where new, small and digitally competent actors have been successful in taking power and market shares from the old and larger actors - as an inspiration of what could happen on the market in the future. As third-party actors have begun to enter the heating market, already taking market shares from the traditional supplier, many believe their power will increase by time. Some suppliers even voice their concern regarding losing their customer relationship as the third-party actor places themselves in the middle, handling the entire customer interface and turning the supplier into a bulk supplier of heat. This types of transformation have been seen on the electricity market and the same tendencies have been spotted on the district heating market, according to some of the interviewees. Therefore, it is generally believed that the supplier must improve their relationships with their customers in order to establish mutual loyalty, potentially even creating partnerships.

The third-party actors are today considered to be separate from the traditional service triad but have increasingly strengthened their bonds with both customers and suppliers on the market. Along with the knowledge of what has happened on the Swedish electricity market, most of the suppliers have learnt to somewhat consider their presence as natural and that they will be present on the district heating market in the future. These suppliers see that the third-party actors could either be considered as competitions or partners in the future, why some much rather prefer to see them as partners in the future than risking to compete with their technology dense solutions. Other district heating suppliers believe that they have a competitive advantage by providing the infrastructure all actors operate on and believe that they could outcompete these types of actors in the future when they have increased

their technical competence.

Some of the interviewed suppliers mention the increased interest of reaching the end-user as *the classic triad is in use in the current market, but with the upcoming visualization tools, there is an indication of getting closer to the end-user*. There is a general belief that the suppliers will be closer to the end-user in the future and voices that increasingly deliver and provide better offers for their private customers could help them understand and meet the end-user. It is mentioned in the interviews that they generally assume that the private customer will be more interested and would want more power regarding their heat consumption in the future. Some, therefore, assumes that this also applies to the end-users why it could be of interest to them to generate new ways to communicate with them as they are considered a non-utilized source of potential.

Digitalization, in the perspective of the suppliers, is generally mentioned as a tool to better communicate and reach customers. Several of the interviewees view digitalization as a potential catalyst to come closer and to detect new customers. Some of the suppliers even mention digitalization as the potential solution that could enable a natural bond with the end-user.

Third-party Actors' Perspective

Regarding future relationships, some third-party actors voice that they believe that it will be very difficult to achieve mutual trust between supplier and customer if the suppliers' power and knowledge of the market would increase. One of the selling arguments provided by third-party actors is that they can help customers decrease their energy consumption by optimizing the operations in their buildings. If the district heating supplier would offer the same type of service, it is mentioned that some customers would have a hard time to be able to trust that the supplier actually would want to decrease their income to achieve an energy-saving for their customer.

Further, the third-party actors argue for a change in the triad in the future. Several of the interviewees voice that the relationship between the actors in the triad will be more partnership-based rather than transaction-based. One interviewed third-party actor defines their partnership with a district heating supplier as *we work in close partnership with our district heating suppliers. Our collaboration is extended and more than just selling a service and instead we have an ongoing interaction with the delivery of a service to them*. Many believe that this will be common for all ways of communication in the future and in the triad. Some interviewees mention, though, uncertainties of whether there will be a service interaction between the suppliers and the end-user, and what type of value will be exchanged between them. Further, several of the third-party actors are sure that they will have a natural part of the service triad as their digital competencies are unmatched.

Customers' Perspective

Some of the customers' cognition for future relationships are positive, with expectations of better relationships between the supplier and customer. The described possibility for future mixed energy solutions and new services are expected to open up for new types of dialogues with the supplier. Likewise, some of the customers have a different viewpoint of the relationships and voice that they believe the suppliers' future position on the market will compose of pure distribution of district heating and the third parties will deliver the services.

The third-party actors are expected by many to have a significant role in the future, with their competences in digitalization and sensitivity as well as flexibility for the customers' demands. The relation with the end-user will still be in the hands of the customers, and they are not willing to give this relation to one of the other actors and one customer mentioned it as *I think there will be more collaborations on the market, but we won't dare to let any other actor take the responsibility with the end-user.*

Digitalization can also enable new types of market actors, and some customer mentions the hypothesis of a new kind of market aggregator where customers cooperate together to strengthen their position against the suppliers. Other customers mention the possibilities for completely new actors to enter the market and be a natural part of the triad.

4.3.3 Possibilities

Disregarding the challenges, many of the interviewees are optimistic about the future. Several mentioned that they have seen what has been accomplished in other markets during a short period of time and believe that something similar could be happening for the Swedish district heating market soon. Generally, several voices their belief that everything will be much easier in the future with the hope that everyone will be able to connect with each other. It is described as introducing some sort of infrastructural standard could enable all actors to work with all types of customers and vice versa. Even a sort of industry-standard in term of all types of energy solution is described as a potential future, where all types of energy could be delivered and optimized together. District heating would then be a part of a larger heating solution opening up entirely new business opportunities and actors.

Introducing some sort of industry-standard is also discussed by customers that believe that a majority of their difficulties would be solved if Sweden had a common infrastructure with common standards. It is also discussed that a common standard could open up the infrastructure and let new actors enter more easily, increasing the competition and therefore favour the customers. District heating system has, at least according to the customers, been considered as monopolies and the supplier have priced their heating thereafter. Introducing a common infrastructure is described, therefore, as to lessen the monopolistic actions of the supplier and instil transparency in the pricing.

Generally, digitalization and servitization of the district heating market are considered to be a way to increase the competitive advantages of district heating. Even though district heating does not have any natural competition due to the local monopolies, many suppliers voice that they compete with other types of heating. As district heating is generally considered as traditional and analogue, introducing digital services surrounding the heat delivery is described to could help the industry to increase its market shares. Digitalization is also described to potentially bring in revenues to suppliers and third-party actors as digital solutions are scalable and could be sold to numerous actors without any further production cost. It is described that if the actors on the market can find a way to earn money on their digital services it could substantially help them to increase their initial revenues.

The suppliers are well aware that they have a unique connection with their customers due to their interconnected infrastructure. Several mentions that digitalization should be a natural part of how they maintain and communicate with their customers, and that this could simplify all types of contact in the future. One supplier voice the possibilities with digitalization as *digitalization and servitization will simplify the interface with the customer and therefore it is very important for us to offer digital services since it is customer demand. They want a relationship with their supplier and if we are not able to meet their needs they will turn to someone else.* By making their interconnected infrastructure digital the suppliers can find completely new ways to communicate and it is mentioned that they can build a better relationship with their customers. It is described that this should also be considered as a way to find the customers needs and as a possibility to improve their offerings. Some suppliers mention that this must happen to some degree in the near future, otherwise they risk that their customers will turn to a different heat supplier.

4.3.4 Challenges

Just as there are identified possibilities in the future, most of the interviewees see several considerable challenges. Several mentions that district heating is a very conservative type of industry and to achieve any type of change usually takes both substantial time and effort. Some mention that this is one of the biggest challenges as the industry acts too slow and therefore risks being outperformed by other industries. One of the customers commented on this as *the natural monopoly on the market is obsolete, this means that there are no initiatives for development. The digitalization will be a challenge, the pricing model is complex, the infrastructure obsolete and more energy-efficient houses are being built. Combine this together and there is a risk that district heating will be outperformed by other energy solutions in the future.* Others mean that this fact leads to fewer initiatives even being executed as the market is seen as very conservative and actors instead invest their efforts on other markets. Being able to accomplish any change on the market is therefore connected with changing the mindset of the current actors, which some of the interviewees means others have failed with before. Having failed beforehand have increased the pessimistic view of change and some mean that this is one of the

vital factors that drive customers to turn to other sources of heating.

Another identified challenge for the market to be able to provide any change is the human resources and current competencies on the market. One of the district heating suppliers described *the problem with digitalization is that there is no competence in the market today. We do not have the resources or skills for development. At the same time, we need to ensure the right competence for service-oriented services.* To be able to provide a future solution, it is identified that one needs new competencies and that is achieved by either hires those competencies or educate the current staff. It is described that there is a current shortage of digital competence on the market, even more so for digital knowledge within the energy sector, and education takes time why a shortage of competence is considered as a huge challenge for the district heating market.

Simultaneously, the developing efforts of the current actors are often described as being of a traditional nature and are not suitable for developing digital solutions. To meet the demands of the market and the fast-developing digital landscape, developing efforts must be modernized according to several of the interviewees. Meanwhile, heating is considered as vital infrastructure and security breaches could have a monumental impact on society why it is described as a paradox by one actor to quickly develop a digital dense solution durable for all types of security breaches.

Data management with associated regulation is also considered as a huge challenge for all types of actors. Increasing the data extraction and analysis, increase the existence of personal data that could be very compromising if it were made public. Generally, the view of what types of data should be considered personal and who owns the data differs between actors. Lack of agreement therefore often leads to caution and data that could be shared are most often not. Meanwhile, being too careless of data could potentially lead to severe security leaks. An identified challenges are therefore the lack of common regulation or knowledge of how to handle and share data. This leads to inefficiency and unexploited potential business opportunities. Potentially introducing new technologies, such as blockchain, on the district heating market is another issue related to personal data as the technology demands full transparency. Some mention that this has already been an issue in other industries together with the introduction of personal data legislation such as GDPR in the EU.

A final challenge identified by the interviewees is one of financial and business matter. Many of the described potential offerings are seen to be able to widely increase the overall standard of the industry and form new types of businesses. One of the main challenges for supplier and third-party actors are though to find a viable value proposition, by both developing services their customers are willing to pay for and to find financial value in decreasing their general output from the optimization of consumption. Without a seemingly financially stable value proposition, the district heating suppliers voice that it will be difficult to actually invest money in developing their value propositions. The identified challenge is therefore to find a way to make a profit from creating digital services in order to develop the industry in the future.

4.4 Special Cases

As the presented empirical findings are based on characteristics of the current district heating market, there are some findings considering value propositions and relationships that have only been observed once. These cases should not be considered to be telling for the current state of the market but are of interesting in terms of uniqueness. The cases and value propositions will therefore not be considered in the analysis but could be of interest as they could give inspiration for upcoming events on the market, why they are somewhat examined in the future scenario.

4.4.1 Value Propositions

One special case of a value proposition is a district heating supplier that provides energy optimization services that they develop themselves instead of cooperating with a third-party actor. This type of offering is very similar to the ones offered by the third-party actors and are generally offered to commercial customers that generally owns residential buildings. This optimization service includes remote control of the heat and real-time updated analysis that automatically steers the heat consumption.

Another special case of a value proposition provided by a district heating supplier is the options to have a so-called convenience agreement. This type of agreement includes all types of services related to the operations of district heating and could, therefore, be considered as a type of all-inclusive deal, including all type of maintenance and repairs for a set price. Further, operating the district heating infrastructure is also included which therefore implicates that the customer buys a fixed temperature for a set price. This type of agreement is offered to commercial customers and generally to owners of residential buildings.

4.4.2 Actor Constellation

A special case when it comes to relationships and the constellation between actors on the Swedish district heating market is the creations of a joint venture. Several district heating suppliers have created a new venture that could be considered to function as a third-party actor on the market, providing optimization services to residential building owners. There are other cases where third-party actors are financed or partly owned by district heating suppliers on the market, but this case is unique as there are several actors coming together and create an entirely new business organization. The five district heating supplier own equal parts of the joint venture that originally started as a research project but has successfully started to implement energy services on the Swedish district heating market.

4.5 Summary

As to summarize what has been found in the empirical findings, the Figure 4.4 presents corresponding characteristics of each chapter - Value Proposition, Relationships and Future Trends - connected to the different actors' perspectives. When

summarizing different types of value propositions, the customers' needs are instead examined rather than their own value propositions to their customers.

4.5.1 Cross Actor Analysis

The characteristics in the value propositions on the market could be summarized into maintenance services, load management and energy optimization. Comparing the value proposition with the customers' demands indicating a gap in the offered services and emerge a unique situation on the market when the customer starts to develop their solutions.

Common in all of the market relationships is the customer's control over the interface with the end-user. Distinguishing in the relationships is the suppliers' unawareness of the customers' needs and the third-party actors initiative to form new relationships.

The future trends could be summarized in the utilization of digital elements. The use of smart technologies is a common trend for both the supplier and customer as it can create new offerings and correspond to the customers' future service demands. It is distinct that the third-party actors are striving to use new types of technologies and hence create new platforms. A unique finding is the suppliers' interest in reaching the end-user in the future.

4. Empirical Findings

EMPIRICAL FINDINGS			
	District Heating Suppliers' Perspective	Third-party Actors' Perspective	Customers' Perspective
Value Propositions	• Long-term investment horizon • Vertically integrated local monopolies • Heat distribution with complementary services • Contract-based maintenance • Data extraction and customer analysis sold on demand	• Utilizes the current supply gap • Offers load management to suppliers • Provide energy optimization of buildings to customers • Digital expertise in AI, Machine learning etc.	• Demand control of property stock • Either collect or buy analyzable data • Deficit of relevant offerings motivate own development • Request price predictability and transparency • Demand resource-efficient heating that minimizes costs and environmental impact
Relationships	• Customer segment divided as private and commercial • Distant contact with customers • Generally unaware of customers' needs • No contact with end-user • Considers third-party actors as either partners or competitors	• Interacts with both district heating suppliers and customers • Aware of and collects customers' needs • Form partnership as a market entrance strategy • Initiates new relationships • No relationship with end-user	• Owns the relationship with the end-users • Generally open to form new collaborations • Varied, but generally distant relationship with suppliers and closer to third-party actors
Future Trends	• Transformation on the Swedish electricity market as an inspiration • Increased need for competences in IT and tech • Develop customized offerings • Add digital complementary services to keep competitive edge • Increased interest in reaching end-users	• Niche offerings for data visualization and interpretation • Create new platforms where actors can meet • Managing spot market platforms • Introducing new technologies such as blockchain • Cement their position in the triad • Work as a mediating party between suppliers and customers	• Increased need of IT competence and implementing smart technology • Develop their own offerings to meet the end-users' needs • Skeptical to achieve mutual trust with suppliers • Increased partnership with third-party actors • Demand access to data to lessen environmental impact and consumption

Figure 4.4: Summary of empirical findings divided by type of actor and value proposition, relationships and future trends

5

Analysis

An analysis based on the empirical findings and the theoretical framework will be presented in this chapter in order to answer Research Question II:

II. What patterns of the current value proposition and relationships could be observed?

The analysis is based on the Digitalization and Servitization Business Model (DSBM) framework, that is established in the theoretical framework and based on the presented literature regarding servitization, digitalization, business models and service triads. Furthermore, the different relationships are analyzed in order to connect the DSBM framework with the service triad concept.

Table 5.1: An outline of the dimensions of the DSBM framework, based on the dimensions of Lüdeke-Freund et al. (2019)

BM Dimensions	
Value Proposition	Service Supporting Products Service Supporting Customers
Value Delivery	Target Customers Value Delivery Process
Value Creation	Partners and Stakeholders Value Creation Process
Value Capture	Revenues Costs

5.1 Digitalization and Servitization Business Model Framework

The initial Digitalization and Servitization Business Model (DSBM) framework (see Table 5.1) are based on the model by Lüdeke-Freund et al. (2019), where traditional business model dimensions are modelled in order to categorize business offerings.

This initial framework should work as an outline for the final DSBM framework that should also be based on the empirical findings and analysis of the district heating market. Therefore, the final model will be presented in this chapter, after the presented analysis.

5.1.1 Value Propositions

As to summarize, Osterwalder et al. (2005) have developed the business model canvas to capture the needs in the business model. As a subcategory in the business model, value proposition describes how a company creates value for its customers. Lüdeke-Freund et al. (2019) divide the value proposition into product and services. Further, can services be divided into different categories of servitization, service supporting product (SSP) and service supporting customer (SSC), presented by Mathieu (2001). The basic services can be categorized as SSP and complex services can be categorised as SSC since the shift from product to the customer generally is considered to be more advanced (Mathieu, 2001).

In the Servitization pyramid, presented by Coreynen et al. (2017), is the value proposition divided into three different types; *input*, *performance* and *result*. According to Kindström and Kowalkowski (2014), the nature of the value propositions is based on the business's revenue model, and because of this are most of the value propositions divided into input-based or output-based revenue models. This can conclude Coreynen et al. (2017)'s categorization of the value propositions into three different perspectives, where the first one is input-based and the remaining two are output-based with a focus in availability respectively performance.

Services Supporting Products

SSP, according to Coreynen et al. (2017), are often basic services and Kindström and Kowalkowski (2014) argue that these services strive to extend the functionality of the product. On the current district heating market, there is a range of offerings of product lifecycle services. They are the fundamental services offered by all of the suppliers. The supportive maintenance services on the market include services sold as contracts and repairs. Since this kind of services is offered to increase the lifecycle of the product, they can be categorised as product lifecycle services in the Servitization pyramid. When considering the revenue model for the offered service, they can be categorised as input-based since the focus is within the delivering of the deed in combination with the customers' one-time payment.

The next value proposition is referred to by Coreynen et al. (2017) as product performance services. This kind of services is output-based and focusing on the products' availability (Kindström & Kowalkowski, 2014). The market offered maintenance is divided by preventive maintenance and maintenance monitoring. The preventive maintenance is focusing on the availability of district heating why it is categorized as a product performance service. Since the maintenance monitoring describes the current status on the district heating system, also classified as availability of the system, it is categorised as a product performance service. The revenue model for

the service is identified to be output-based since the customer is paying a fixed price per month regardless of the needed amount of service.

The mentioned special case, where one district heating supplier provides a convenience agreement, could be considered to have an output-based revenue model by the definition of Kindström and Kowalkowski (2014), with a monthly fixed payment. Further, the service focus on the achieved result as one can then assume that it is result-focused, by the definition of Kindström and Kowalkowski (2014), why the convenience agreement could even be considered as a product result service at the highest level in the Servitization pyramid by Coreynen et al. (2017). The only identified product result service is then the convenience agreement that is treated as a special case as it has only been identified once.

Services Supporting Customers

Generally, SSC are services that improving the customers' process Coreynen et al. (2017). These kinds of services are offered by both the suppliers and the third-party actors. Customer education is a basic service offered by the supplier in order to educate the customers on how to operate the district heating system. This is a supportive service with an input-based revenue model, why it can be categorised as process support service.

As a complement to the maintenance monitoring, operational monitoring is offered by the suppliers to the customers. The fundamental distinction is a customer-oriented focus, where the customers are provided with access to the systems. Coreynen et al. (2017) describe process delegation services as self-service data management, which the operational monitoring data can be identified as. Even data extraction is identified as a process delegation service since the customers are provided with raw data to process the data themselves. Another argument for the categorisation of the services as process delegation is based on the output-based revenue model since the service is sold with availability.

Load management and energy optimization is offered by the third-part actors and are the most advanced services on the market. According to Coreynen et al. (2017) are hybrid solutions characterized by high customization and integration of digital elements in the customers' processes. The customer solutions offered by the third-party actors can be identified as customer-oriented with focus on the customers' output for both the load control and load management. Thereby it is motivated to characterize them as hybrid solutions. In addition, the use of smart technologies is another argument for the characterization.

Servitization pyramid

The Servitization pyramid, presented by Coreynen et al. (2017), describes services from two views; product-oriented and customer process-oriented. The offered services can be sorted into three different value propositions perspectives depending

on the services' complexity and the revenue model Coreynen et al. (2017). Further, Coreynen et al. (2017) categorize the services as product life cycle, product performance, product result, process support, process delegation and hybrid solution.

As an implication of the findings and the theoretical Servitization pyramid, the offered services on the district heating market can be categorized into the categorization mention above, see Figure 5.1. The services on the market are exclusively offered by the supplier or the third-party actors, though it has been identified that they do not offer services in the same categorization.

The suppliers have a service solely offered on a basic and intermediate servitization level. Characteristics for the product lifecycle and product performance services is the low grade of customization and focus on the product's availability. The services are standardised and often offered in packages with different prices. The suppliers are also offering services in process support and process delegation, the later categorized with a focus in the customers' data access. Kindström and Kowalkowski (2014) describe the categories revenue model as output-based, which is relatively adaptable on the market with an exception for the suppliers which offers these services for free.

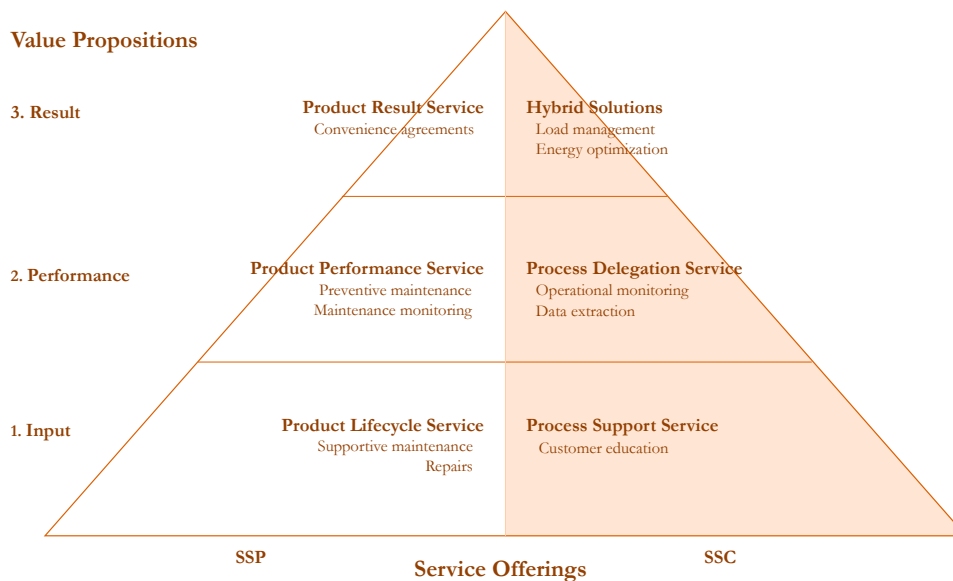


Figure 5.1: The identified service offerings on the Swedish district heating market, categorized by the Servitization pyramid by Coreynen et al. (2017)

The services offered by the third-party actors are solely services in the hybrid solutions categorization. The services are offered to both the suppliers and the customers and hence the grade of customization is varying. Since the third-party actors are prominent in capturing the customers' needs, the offered services are characterized by long-term agreements and high complexity. According to Coreynen et al. (2017) is the value propositions with advanced digital elements occurring in the hybrid

solutions, which correspond with the district heating market. In the Servitization pyramid (Figure 5.1), there have not been any identified product result services. Coreynen et al. (2017) exemplify these services as a functional result such as reduced energy. Intriguing are the customers identified demand after such a service and the markets current inability to meet these needs.

Implications to DSBM Framework

Considering the identified findings as categorizing the current service offerings by type, this could be utilized when conceptualizing the DSBM framework. The value proposition dimension of the DSBM framework could, therefore, be summarized in Figure 5.2. SSP are divided as being either focused on lifecycle, performance or result, and SSC are divided into support, delegation and hybrid.

VALUE PROPOSITION	SSP	Lifecycle Supportive maintenance and Repair of products	Performance Preventive maintenance and Monitoring of products	Result Convenience agreement
	SSC	Support Customer education and Operational feedback	Delegation Data extraction and Operational monitoring by distance	Hybrid Load management and Energy optimization

Figure 5.2: The value proposition dimension in the DSBM framework with examples from the Swedish district heating market

5.1.2 Value Delivery

Value delivery is defined by Osterwalder et al. (2005), as the way a value proposition is communicated and delivered in terms of to whom and in what context. Generally, value delivery is described as customer segmentation and building common infrastructure where value can be exchanged (Osterwalder et al., 2005). The different types of value propositions on the district heating market, as already defined, are generally described to be developed with a specific customer segmentation in mind. Further, delivering district heating services generally tend to demand a common interface, especially in terms of providing more digitally advanced services.

Lüdeke-Freund et al. (2019) divide value delivery, with the emphasis of engagement with into *target customers* and *value delivery process*, which has been utilized as dimensions in the DSBM framework.

Target Customers

A recurrent theme in the empirical findings regarding customer segmentation is the division of private and commercial customers. Private customers are generally seen as the owner of one- or two-dwelling buildings where the ones living in the

building owns their own heating systems. Commercial actors, on the other hand, are rather seen as companies that own multi-family residential buildings or other types of commercial facilities where there are a separate end-user. Public owned buildings such as hospitals and schools are generally considered to be a part of the commercial segmentation as they are offered the same value propositions as private commercial actors. This segmentation is generally conducted to divide the offered value propositions, as commercial actors are considered to manage larger potential revenue streams why offers are generally developed to the commercial customer.

When it comes to third-party actors, their services are instead offered to either customers, district heating suppliers or both. This indicates that there is just not a private and commercial customer on the Swedish district heating market but also that district heating supplier should be considered as one additional customer segment.

Lightfoot et al. (2013) introduce three different types of archetypes of customers when it comes to providing services; *the customer who wants to do it themselves* (Type I), *the customer who wants us to do it with them* (Type II) and *the customer who wants us to do it for them* (Type III). The three different types correspond to the different levels in the Servitization pyramid by Coreynen et al. (2017), where Type I customers, therefore, are interested in a certain input, Type II are interested in a performance agreement and Type III are interested in a specific result. This indicates that the offered value propositions on the district heating market, as have been organized into the Servitization pyramid, corresponds to different types of customer segments.

The different archetypes, as provided by Lightfoot et al. (2013), and the district heating actors' segmentation could be combined, as the usage of one segmentation does not exclude the usage of the other. Further, the different archetypes could all be applied to the identified segments why one could say there are nine potential customer segments in total on the Swedish district heating market.

Generally, based on the categorization of offering, not all type of customers are currently present on the market. Traditional district heating customers - private and commercial - generally tend to be well represented within the customer Type I and II segment in terms of service offering. As to generalize, the traditional district heating supplier does not offer any services that could correspond to the demand of a Type III customer. On the other hand, the Type III customer segment is what the third-party actors solely targets with their service offering. As to conclude the customer segments there are currently private customers of Type I and II, the commercial customers of Type I, II and III in addition to district heating suppliers of Type III.

Value Delivery Process

As the value delivery process is defined as the common infrastructure, communication channel and interface between actors (Günzel & Holm, 2013; Lüdeke-Freund

et al., 2019; Osterwalder et al., 2005) one could assume that it corresponds to the thesis projects definition of the customer interface. Therefore, the value delivery process should be considered as the specific way and by what media district heating supplier, third-party actors and customers exchange information. Generally, it is voiced that information on the Swedish district heating market is exchanged through conventional events and often in person. Though, some digital and digitized media are also used when it comes to communication on the market.

Digitalization, as a concept, is defined by Brennen and Kreiss (2016) as introducing digital notions and technology in a wider context. The process of transforming analogue ways of communicating to digitized or digital has historically transformed traditional industries why many of the interviews have an optimistic outlook on digitalization. It is described as mainly seen as easing communication and as a possibility to reach new actors. One could, therefore, assume that an important aspect of the value delivery process on the Swedish district heating market is digitalization and to what extent it is used as a channel between customers and the service supplier. As services, per definition, needs to be continuously delivered the interface between actors are particularly important in comparison with the delivery of traditional products.

For this industry three degrees of digitalization is identified and titled as *analogue*, *digitized* and *digital*. An analogue offer is considered to have no elements of digitalization, while a digitized offer has, by the definition of Brennen and Kreiss (2016), turned the analogue elements into digital data and could be considered to have a medium level of digitalization. A digital offering, on the other hand, consists of a high level of digitalization where some instance of automatization and smart technologies are present.

Apart from offering an analogue value delivery process by traditional meetings in person, one could divide the value delivery processes as either being digitized or digital. Brennen and Kreiss (2016) define digitized as the notion of turning and analogue signal to a digital one (storing the information into the so-called bits) which could be the equivalent of offering an interface online that shows information about invoicing and overall consumption. Digital is defined as utilizing digitized data and create new value. A digital value delivery process could, therefore, be assumed to rather be built digital platforms where information could be exchanged and analyzed in real-time, often by some sort of smart technology.

Based on the information obtained from the conducted interviews one could categorize the different value delivery processes related to each value proposition as either being analogue, digitized or digital. Examples of an analogue value delivery process include traditional maintenance and repair that happens on location. A digitized value delivery process could, for example, be considered operational monitoring that is communicated by a self-service portal while a digital value delivery process could instead be considered operational optimization that is managed by distance and through cloud computing. Digital elements such as AI, machine learning and self-

optimization could also be present.

Implications to DSBM Framework

The identified target customers on the Swedish district heating market and the value delivery process as being either analogue, digitized or digital could form the basics of conceptualizing the value delivery dimension of the DSBM framework. Further, there are in total nine different combinations of target customers (Private customers, Commercial customers and District heating supplier) as each customer segment could be of one of the three types (Type I, II and III). The value delivery dimension of the DSBM framework could, therefore, be summarized in Figure 5.3.

VALUE DELIVERY	TARGET CUSTOMER	Private customers Owners of one- or two-dwelling buildings	Commercial customers Owners of multi-dwelling or other commercial buildings	District heating suppliers Load management customers
		Type I "The customer who wants to do it themselves"	Type II "The customer who wants us to do it with them"	Type III "The customer who wants us to do it for them"
	VALUE DELIVERY PROCESS	Analogue Physical meetings and interactions	Digitized Online connection for services, generally as a service portal	Digital Smart interconnections with elements of AI, machine learning and cloud computing

Figure 5.3: The value delivery dimension in the DSBM framework with examples from the Swedish district heating market

5.1.3 Value Creation

In the business model developed by Osterwalder et al. (2005), value creation is critical to capture the value in the value proposition. Lüdeke-Freund et al. (2019) describe value creation as the actors and activities involved in producing the value propositions and divide value creation into *partners and stakeholders* and *value creation process*. Generally, three different actors are identified on the Swedish district heating market in the value creation; the supplier, the customer and the third-party actor with the end-user being considered as an important stakeholder.

Partners and Stakeholders

The traditional view of a service triad consists of a supplier, a buyer and a customer (Wynstra et al., 2015), where these different types constitute the present actors on the market. When applying this perspective to the district heating market, an alteration needs to be considered. All of the three mentioned actors in the supply chain are present on the market, though in a different constellation than the traditional one presented by Wynstra et al. (2015). The supply chain of the district heating consists of the supplier, the customer and the user. Since the customer on the market takes the role as both the buyer and customer in the supply chain, these two actors need to be combined in order to apply the model to the district heating market. Also, the end-user needs to be included in the chain since they are the

one who consumes the district heating. The new altered supply chain for district heating is, therefore, composed of *suppliers*, *customers* and *end-users*.

Even though the third-party actors are not a vital party in the district heating supply chain, they should be taken into consideration for the service triad as their presence on the market continuously increase. To include the third-party actor is also necessary in order to actually mirror the current dynamics on the market since the service offerings provided by the third-party actor in the customer interface are currently unmatched by any other actor.

In the perspective of the actors present in the customer interface, one should instead emphasize the district heating suppliers, the third-party actors and customers. The end-user, as their usage of district heating influence the rest of the actors in the customer interface, could be considered as a stakeholder. Other types of stakeholder can be identified, such as the Swedish government and municipalities, but these will not be included as their influence of the service offerings are assumed to minimal in comparison with the end-user.

Value Creation Process

The value creation process is defined by Lüdeke-Freund et al. (2019) to be the common interface where value is created. For the Swedish district heating market, this could be assumed to be related to what types of relationship actors have. Osterwalder et al. (2005) define that there are four different types of relationships on the market: *alliance*, *coopetition*, *joint ventures* and *buyer-supplier*. For the district heating market, either an alliance or a buyer-supplier relationship is identified between all types of actors, where there are no distinct cases of either coopetition or joint ventures. There exist, on the other hand, a joint venture as a special case why it is not unheard of.

The current relationship between the supplier and the customer can generally be identified as a buyer-supplier relationship. Osterwalder et al. (2005) describe the buyer-supplier relationship to be transaction-based, mainly consisting of exchanging value offerings with a little extra contact. Customers and district heating suppliers voice that they typically only are in contact directly related to delivering services. District heating suppliers and third-party actors have either a buyer-supplier or an alliance relationship, dependent on the degree of interaction. Generally, it is though described that third-party actors' to district heating suppliers tend to be more advanced and need interconnected infrastructure. This increases the need for continuous contact and it is described that the parties often collaborate when developing new offerings, each contributing with its strengths, which indicates an alliance.

Third-party actors have digital competence while the district heating suppliers have the experience and contacts. Relations resulting from the initiation of third-party actors are often identified as an alliance since they initially seek to form strategic bonds with suppliers in order to be able to offer better services to customers. The alliance may also be motivated by the indication of third-party actors to form long-term

partnerships with suppliers. The relationship can later devolve into a buyer-supplier relationship. The interaction between third-party actors and commercial customers are considered as either an alliance or a buyer-supplier type of relationship. Often, when third-party actors enter the market, they seek to form an alliance with commercial customers in order to have access to data and market experience. As the market shares of third-party actors increase and their business offerings develop, the third-party actor describes the relationship as transaction-based. This rather indicates a buyer-supplier relationship between the actors.

In one special case, a joint venture between district heating suppliers is identified on the market. The joint venture was created to provide services related to district heating with a higher level of digitalization, not unlike a third-party actor. In conclusion, all of the relationships defined by Osterwalder et al. (2005) can, therefore, be identified on the market except for the coopetition. This relationship occurs when competitors partner up and cooperate. The lack of natural competition due to monopoly may be a contributor to the lack of coopetition on the Swedish district heating market.

Implications of DSBM Framework

The identified partners and stakeholders on the Swedish district heating market, as well as the value creation being related to the type of relationship the different actors have, could form the basics of conceptualizing the value creation dimension of the DSBM framework. The value creation dimension of the DSBM framework could, therefore, be summarized in Figure 5.4.

VALUE CREATION	PARTNERS & STAKEHOLDER	District heating supplier	Customer	End-user	Third-party actor
	VALUE CREATION PROCESS	Alliance Identified between third-party actors with customers and district heating suppliers	Coopetition Not identified on the market	Joint venture Only identified in a special case	Buyer-supplier Generally observed to some extent between all actors

Figure 5.4: The value creation dimension in the DSBM framework with examples from the Swedish district heating market

5.1.4 Value Capture

Value capture is the last business model dimension of Osterwalder et al. (2005) and examines the economical aspects of the value offerings. In the model by Lüdeke-Freund et al. (2019), value capture consists of *revenues* and *costs*, which therefore covers both the inbound and outbound streams of capital related to a specific offering. An analysis of the value capture of an offering is not a financial balancing or an evaluation where a specific debit needs to be matched with a specific credit. A

company may have several offerings were some finance the existence of others. Further, evaluating the value capture of an offering is about understanding the strategic basis of capital and potentially find future business opportunities.

Generally, the Swedish district heating and energy market have large capital streams heavily related to the seasonal climate. Providing service agreements are therefore often seen by the district heating suppliers as a way to even out the revenues and cover the heating production cost year-round. Likewise, the third-party actors seize the opportunity to capitalize on the uneven relationship between suppliers and actors.

Revenues

Osterwalder et al. (2005) describe that revenues are mainly earned by selling a product or service and that the pricing, therefore, is a vital part of the revenue stream. The authors present that one could either utilize a *fixed* or *dynamic* pricing strategy. Both strategies are considered beneficial depending on the situation, mainly regarding the fluctuation in the price of input resources. For services, input resources could be considered the costs related to the development of the offering, the cost of maintaining infrastructure and the dynamic costs related to delivering the service.

Kindström and Kowalkowski (2014) rather define the revenue streams related to the different types of service offerings, based on the different archetypes in the Servitization pyramid. Input-based service offerings generally tend to be heavily related to the delivery or the consumption of the offering, often one-time payments (Kindström & Kowalkowski, 2014). For performance-based service offerings, where continuous improvement of the product or services, payments are often made on monthly-basis, according to Kindström and Kowalkowski (2014). The last type of hybrid service offerings tends to be very customized and are characterized by long-term cooperation and partnership why the revenue streams are based on the provided output and result (Kindström & Kowalkowski, 2014).

Mainly, the resources needed for providing district heating services could be considered as quite stable and predictable. Providing digital services are mainly correlated to a set development cost and almost no variable costs, why there are huge benefits related to economies of scale. Nevertheless, it is quite unknown whether a service will be commercially successful and to what extent it will be purchased, why it could be difficult to set a price.

The pricing of the identified service offering currently available on the market differs. Many of the identified services from district heating suppliers are sold either on a monthly basis or as a one-time transaction and could be considered as performance- respectively input-based. Meanwhile, the service offerings provided by third-party actors are generally to be considered as more advanced and customized, performance-based by the definition by Kindström and Kowalkowski (2014), why the pricing tends to be equally customized.

Simultaneously, the offerings provided by the district heating suppliers are generally fixed, by the definition of Osterwalder et al. (2005), while the offerings of the third-party suppliers differ in terms of fixed or dynamic. One could, therefore, assume that the revenue for a provided service both are dependent on the pricing strategy and revenue stream related to the type of service offering, creating six possible combinations. Generally, though, there are currently mainly fixed input- and performance-based revenue streams on the market and some output-based offerings with either fixed or dynamic pricing.

Cost

By the definition of Osterwalder et al. (2005), the cost structure of a company is described as generally being either value- or cost-driven. Since cost and especially operating costs should generally be aimed to be reduced in a business, actively working with reducing costs could be seen as universal. The different focuses of Osterwalder et al. (2005) are therefore to either trying to increase all types of cost or increase the provided value and therefore lessen the comparable cost of delivering the product or service.

Cost-driven cost structures generally tend to be characterized by a high level of automatization and no customization in order to decrease operating costs. One could generally assume that this structure, therefore, works ideally for mass-manufactured products. As services tend to have some sort of customization one could, therefore, argue that they are generally more value-driven. On the other hand, services differ widely, as presented by Kindström and Kowalkowski (2014) and Coreynen et al. (2017), with different level of customization and continuity. Calling all types of cost structures for services value-driven could, therefore, be considered as very general.

In terms of cost structures for service offerings, one could compare them to the archetypes in the Servitization pyramid, as input-based service offerings tend to have a low degree of customization and predictability why they could be considered as more cost-driven. Meanwhile, output-based offerings tend to have a very high degree of customizability why they could be argued to have a more value-driven cost-structure. Performance-based service offerings are considered to share elements of both input- and output-based offerings with both some level of customizability and predictability, why they could be considered to have a cost structure that is neither fully cost- or value-driven but rather dual-driven.

Three possible cost structures could, therefore, be considered identified in the Swedish district heating market related to the different types of service offerings. Input-based service offerings could be considered to have a cost-driven cost structure, output-based could be considered to have a value-driven cost structure and performance-based service offerings could be considered to have a dual-driven cost structure.

Implications of DSBM Framework

They identified ways to earn revenues, as well as the identified costs, could form the basics of conceptualizing the value capture dimension of the DSBM framework. In total, there are six potential ways of earning revenues as the level of offerings (input-, performance- or output-based) can be combined with either a fixed or dynamic pricing strategy. Costs are also related to the level of service offering and could either be cost-, value- or dual-driven. The value capture dimension of the DSBM framework could, therefore, be summarized in Figure 5.5.

VALUE CAPTURE	REVENUES	Input-based Related to Lifecycle and Support offerings	Performance-based Related to Performance and Delegation offerings	Output-based Related to Result and Hybrid Offerings
		Fixed Generally viable for district heatings suppliers' offerings		Dynamic Generally viable for third-party actors' offerings
	COSTS	Cost-driven Related to Lifecycle and Support offerings	Dual-driven Related to Performance and Delegation offerings	Value-driven Related to Result and Hybrid Offerings

Figure 5.5: The value capture dimension in the DSBM framework with examples from the Swedish district heating market

5.1.5 The DSBM Framework

Based on the framework by Lüdeke-Freund et al. (2019) and the initial DSBM framework dimensions, an updated framework is created where the content of each dimension is being based on the findings in the analysis. Summarizing all the implications in this chapter, corresponding to each of the four business model dimensions presented, create an extended DSBM framework with examples from the industry, see Appendix C.

As to simplify the extended version of the framework, a new DSBM framework is created where each component is still present but without any examples from the Swedish district heating market. This is what could be considered the full DSBM framework, which is described in Figure 5.6.

The DSBM framework can be used to categorize or compare service offerings dependent on each dimension, helping actors identify their strength and weaknesses with their offerings. Further, the DSBM framework could work as an inspiration for forming new service offerings and might even give an indication of what value offerings will potentially look like in future scenarios. The framework could also be utilized when making charts of the current actor constellations on the market.

VALUE PROPOSITION	SSP	Lifecycle	Performance	Result	
	SSC	Support	Delegation	Hybrid	
VALUE DELIVERY	TARGET CUSTOMER	Private customers	Commercial customers	District heating suppliers	
		Type I	Type II	Type III	
	VALUE DELIVERY PROCESS	Analogue	Digitized	Digital	
VALUE CREATION	PARTNERS & STAKEHOLDER	District heating supplier	Customer	End-user	Third-party actor
	VALUE CREATION PROCESS	Alliance	Coopetition	Joint venture	Buyer-supplier
VALUE CAPTURE	REVENUES	Input-based	Performance-based	Output-based	
		Fixed		Dynamic	
	COSTS	Cost-driven	Dual-driven	Value-driven	

Figure 5.6: The Digitalization and Servitization Business Model framework

5.2 Actor Constellation

In order to understand the dynamics between the actors on the Swedish district heating market, along with the findings in the DSBM framework, this section will investigate the different actor constellation. The constellations will be studied in terms of different types of value delivery and value creation processes between the different types of actors in the customer interface.

To capture all type of actor constellations available on the market, only one relationship between two actors will be studied at the time, before summarizing all the findings in a large actor constellation chart with all types of relationships on the market. The different types of relationship between actors will be visualized by arrows, where the color of the arrow correspond to the value creation process and the format of the arrow corresponds to the value delivery process.

5.2.1 District Heating Supplier and Customer

The district heating supplier generally provides services related to the district heating delivery. These services are considered as simple or medium-advanced in terms of servitization and, by the value deliver process, these service should be delivered as analogue and digitized. In Figure 5.7, this corresponds to the different format of the arrows.

Delivering relatively non-advanced service would indicate that the district heating suppliers and customers have a traditional buyer-supplier relationship. In Figure



Figure 5.7: The identified actor constellation between district heating suppliers and customers on the district heating market

5.7, this type of relationship corresponds to the red arrows. As to conclude, the relationship between district heating suppliers and customers consists of a buyer-supplier value creation process as well as an analogue and digitized value delivery process.

5.2.2 Third-Party Actor and Customer

The third-party actor generally offers some type of energy optimization solutions to their customer operating on the Swedish District Heating. These offerings tend to be more advanced than the ones provided by district heating supplier, why the offerings are classified as digital. This is visualized in Figure 5.8 unbroken arrows between the participants.

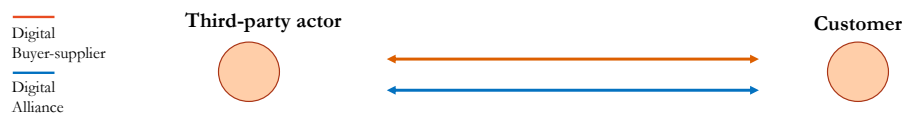


Figure 5.8: The identified actor constellation between third-party actors and customers on the district heating market

Generally, third-party actors aim to sell their energy optimization offerings to the customer in a transaction-based way, implicating that the actors have a buyer-supplier relationship. There are, though, several companies have strategically entered partnerships with their customers in order to fully utilizing both parties strengths. Many mention this as a strategy to enter an unknown market, why forming bands in collaboration with other help the third-party actors succeed. There are, therefore, instances of both buyer-supplier and alliance relationships on the market. This is visualized by a red and a blue arrow in Figure 5.8.

5.2.3 District Heating Supplier and Third-Party Actor

Some of the identified third-party actors are offering load management services to district heating suppliers on the market. These services generally tend to have various smart components, that processes and optimize data, why one could consider that these actors have a digital value delivery process. This is visualized by a full-format arrow between the actors in Figure 5.9.



Figure 5.9: The identified actor constellation between district heating suppliers and third-party actors on the district heating market

Third-party actors describe that forming alliances with current district heating suppliers on the market is a great market entrance strategy. Collaborating in an alliance is beneficial for both parties as the supplier gets access to the latest technology and the third-party actor gets valuable market insights and connections. It is further mentioned by the third-party actors that they to a certain degree could manage an alliance with suppliers, but that they in the long-run rather form a buyer-supplier relationship as this takes less time and effort. The two types of value creation processes are corresponding to blue and red arrows, see Figure 5.9.

5.2.4 Summary

As to conclude the findings for each corresponding relationships, this creates a new and more perspective analysis of the actors' constellation. All the findings regarding actors could be seen and summarized in a larger constellation, see Figure 5.10. The purpose of the actor constellation analysis was to find patterns and trends in the district heating market that affect the actors' relationships.

Figure 5.10 visualizes that the digital value delivery process is related to the third-party actors on the market. This seems very viable as these are the actors currently providing the most digitally advanced offerings on the market. Andal-Ancion et al. (2003) state several different drivers for digitalization that an actor on a market might experience, including missing competencies, standardization benefits and network effects. As third-party actors could be considered the newest actor on the market, generally missing competencies and network, they have a larger need for digitalization. They could even be considered to drive digitalization forward as the other actors are to comfortable in their current positions.

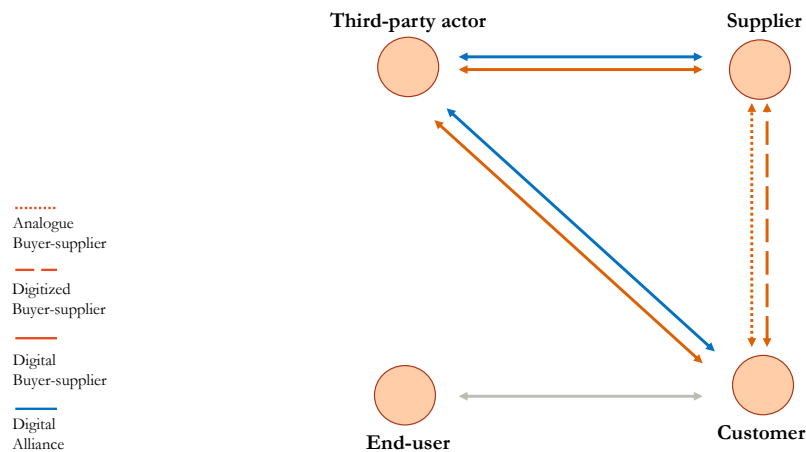


Figure 5.10: The identified actor constellation on the Swedish district heating market. The results are based on the three dimensions presented in this section

Further, all alliances on the market are related to the third-party actors as well, further indicating that the actors are the party that is currently advocating for forming more advanced relationships. This could also be based in that the third-party actors generally miss a useful network and put in more effort in establishing and keeping contacts on the market.

To conclude, the actors' constellation of the market mainly show that the third-party actor is the actor primarily pushing for both digitalization and forming new types of partnerships on the Swedish district heating market. This could be because of the third-party actors' lack of history, knowledge or contacts on the market that drives them to take the lead in developing new types of service offerings. Regardless, their presence in the actor constellation should be seen as a strength since they seemingly push the boundaries for servitization and digitalization on the market.

6

Future Scenarios

A future scenario could be seen as a general indication of what the market will look like in the future. Based on the empirical findings and the corresponding analysis, a pondering of a potential future scenario on the Swedish district heating market is presented, in order to answer the third research question:

III. What are the pathways for future value propositions?

Three different potential future scenarios are presented where the first scenario are considered most likely to occur, based on the findings of this thesis project. In the second scenario, it is explored what could happen if the influence of third-party actors increases on the market, dominating the customer interface. In the final scenario, the district heating suppliers have either drastically progressed their service offering or acquired the third-party suppliers, leaving them as the sole provider of service offerings in the customer interface.

6.1 Scenario A: *The Continuous Market*

In terms of what is most feasible in the future, the current actors and offerings on the market should continuously still be present even though servitization and digitalization have altered the dynamic. A higher level of servitization on the offerings, rather related to delivering given results than input, should have increased both considering services supporting products and customers. Convenience agreements provided by district heating suppliers should be well-established as well as the hybrid offerings provided by third-party actor considering load management to district heating suppliers and energy optimization to customers.

The customers should shift to being more of a Type III customer, especially the smaller ones. The larger customer tends to have more resources and complex needs, leaving them to generally be more of Type I customers. In the future, they could, therefore, be considered to have no contact with third-party suppliers and only analogue contact with the district heating supplier related to maintenance and strictly as buyer-suppliers. Smaller customers will also mainly have a buyer-supplier relationship with the district heating supplier and third-party actor. Meanwhile, these actors will have more of an alliance with interconnected infrastructure.

The value delivery process will be increasingly digital, although, this will not happen

immediately as legislation regarding the important infrastructure will have to catch up. An increasingly digital value delivery process should also help to distribute the service offerings beyond the commercial actors, letting private customers utilize the same type of services. A keyword for digital success should regardless be scalability as one of the largest barriers for digitalization is incompatible systems. As no standard is currently established on the market, this should indicate that there will most likely lead to local standards for different segments that are difficult to connect, letting third-party actors take responsibility for scalability.

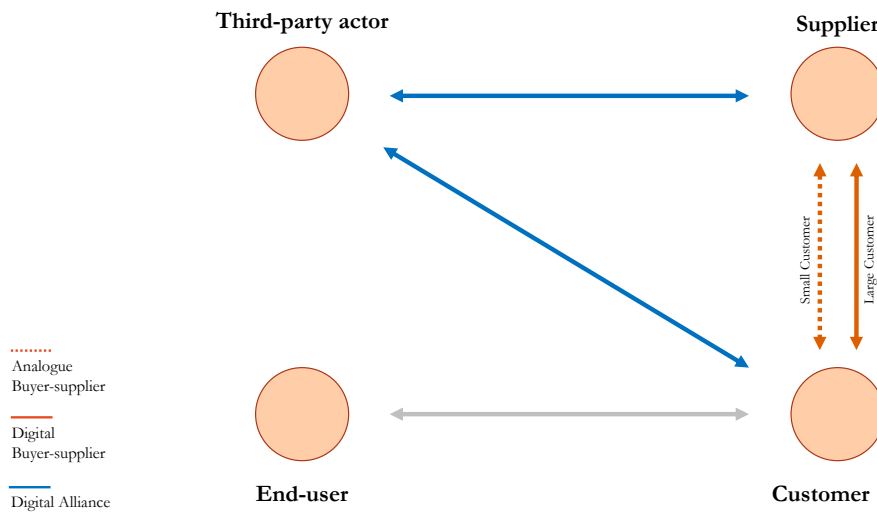


Figure 6.1: The actor constellation in Scenario A: *The Continuous Market*

As to conclude, the most feasible and continuous scenario consists of:

- Offerings with a higher level of servitization with the establishment of convenience agreements as SSP.
- Small commercial customers as Type III and larger as Type I.
- Slow development of digitalization where scalability is a success factor.

6.2 Scenario B: *The Spot Market*

Several have mentioned the happenings on the Swedish electricity market as an indication of what could happen in the future with the introduction of a spot market for district heating. In this scenario, district heating suppliers have, by the sheer competition, lost the majority of the leverage of the customer relations to third-party actors leaving them to be a bulk supplier of heat. This should indicate that the third party-suppliers still offers hybrid service solutions to the customers and the district heating supplier but that the district heating supplier only offers services supporting the product. Potentially, as the third-party supplier advances in the customer interface, they could even play the part as the middlemen and provide

the product-related service agreements towards the customers together with the customer-related service offering. The district heating suppliers would then only provide product lifecycle maintenance as a service.

As third-party actors dominate the relationships in the customer interface and provide digital hybrid solutions, one could assume that they will drive the digitalization on the market further. Only strict maintenance services provided by district heating suppliers could be considered analogue. An increased digital connection further helps the third-party actors to offer load management services to district heating suppliers and could even potentially meet the end-user. Developing services strictly for the end-user would further establish their position on the market and could be seen as a competitive advantage.

The third-party actors generally have a buyer-supplier relationship with both customer and district heating suppliers, while the limited contact between supplier and customers could also be considered as a buyer-supplier one. Introducing a spot market on the district heating market is mainly driven by third-party actors and since each actor are considerable small one could assume that they need to cooperate in order to succeed. One could, therefore, consider that the third-party actors have entered a kind of union to obtain a specific goal, implying they have a cooperative relationship.

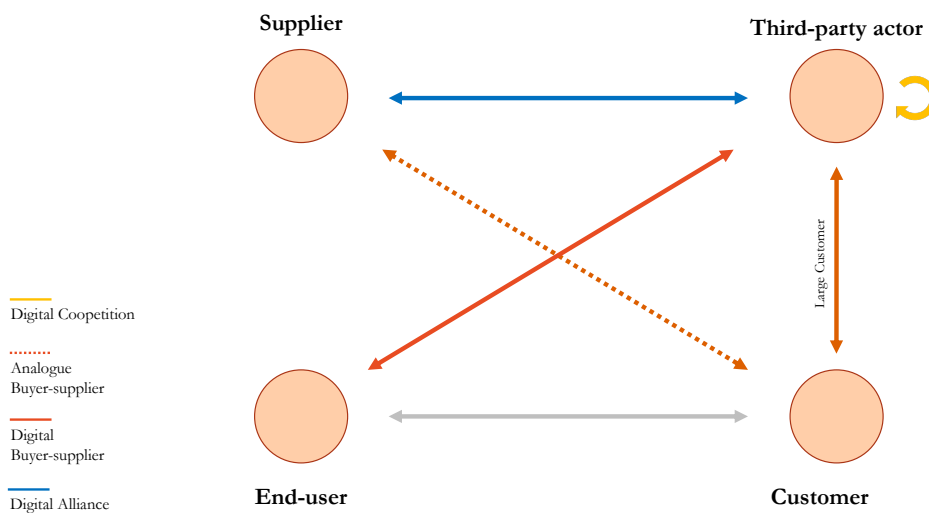


Figure 6.2: The actor constellation in Scenario B: *The Spot Market*

Summarizing the second scenario, with the presence of a spot market, it is characterized by:

- Third-party actors dominating the customer interface, providing a full range of services while district heating supplier solely provides heating.

- Further driven digitalization as a result of a cooperative relationship between third-party actors.
- Third-party actors potentially start to offer services to end-users to establish their position on the customer interface even further.

6.3 Scenario C: *The Monopolistic Market*

As digitalization and knowledge of digitalization take a while to reach maturity, one could assume that district heating suppliers will reach a much higher level of digital maturity in the future. This could be obtained by either acquire the third-party actors on the market or by recruiting new competencies. As district heating suppliers already own most of the customer relationships on the market they have a competitive advantage if they start to offer hybrid-level service offerings. This increased level of vertical integration leaves the need for third-party actors on the market obsolete in the extreme case, therefore implying that the district heating supplier owns all the customer interface service offering on the entire market. Offerings third-party actors would otherwise sell to district heating suppliers, such as load management, are a part of their own competencies now.

Since the district heating suppliers own all customer interaction, they generally tend to all types of customers with a wide range of offers. As they have even less competition in this scenario, the service development will most probably stagnate and be kept at a minimum, just enough to keep the customers loyal. The customer could still be considered a stakeholder but their input will only be considered in order to keep them from choosing another source of heating or services, implying they have a strict buyer-supplier relationship.

To secure an industry standard, the different district heating supplier could create a joint venture with a solution suiting all types of customer. As the district heating suppliers are not competing with each other they could greatly benefit from collaboratively creating a standardized solution that could keep larger customers from developing their own standards. This should further increase the district heating suppliers' power on the market and their corresponding monopolistic benefits. Similar solutions can be found on the Swedish banking market, where the payment solution Swish is a joint venture by the largest actors on the market.

The characteristics of the final scenario, where the district heating supplier have a monopolistic position, are:

- District heating suppliers own all types of services in the customer interface, rendering third-party actors obsolete.
- As the district heating suppliers have a monopolistic position on the market they will not actively push for digitalization, only developing enough to keep customers.
- Joint ventures offering services are created by the district heating suppliers, ensuring an industry standard.

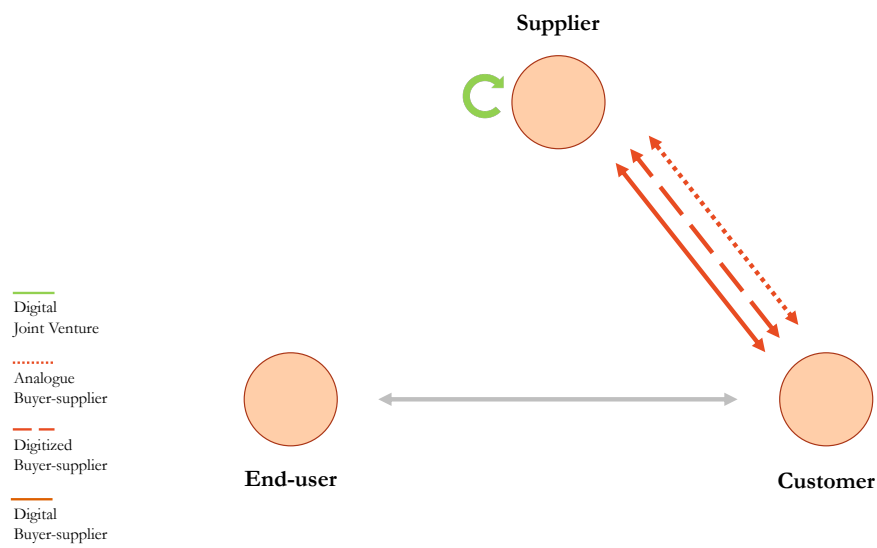


Figure 6.3: The actor constellation in Scenario C: *The Monopolistic Market*

7

Conclusion

As to conclude the findings of the thesis project, a quick summary of the conclusions will be presented together with the corresponding research question. A brief overview of potential future research topics will also be included. Starting with the first research question:

I. What are the characteristics of the current value propositions and relationship on the Swedish district heating market?

This could be summarized by the Servitization pyramid, where district heating suppliers are generally offering input- or performance-based services that are either delivered analogue or digitized. Third-party suppliers, on the other hand, provide results-based services to customers and district heating suppliers that are generally delivered digitally. The current relationships on the market could be described as typical buyer-supplier relationships with some exceptions, where alliances can be found between third-party actors and district heating suppliers or the creation of a joint venture between district heating suppliers.

II. What patterns of the current value proposition and relationships could be observed?

One could summarize the patterns on the district heating market regarding value propositions as that there are three archetypes of customers - Type I, II and III - and the offerings could be categorized after archetypes. District heating suppliers tend to offer less advanced services to customers of Type I and II while third-party suppliers generally offer more advanced services to a Type III customer. The financial aspects are also related to the type of customer where less advanced services tend to be more cost-driven and advanced services tend to be more value-driven. All aspects can be summarized in the DSBM framework that easily enables a comparison of the different offering (see C for detailed framework).

The DSBM framework can also be used to create a constellation chart of the relationships between the actors on the market, where three main scenarios are identified: *The supplier initiated constellation*, *The third-party actor initiated constellation* and *The customer initiated constellation*.

III. What are the pathways for future value propositions?

Three different potential future scenarios are presented, where the first scenario is considered the most feasible. In this scenario, district heating supplier and third-party actors keep co-existing and creating services in the customer interface. For the second scenario, the inspiration of what has happened in the Swedish electricity market is considered, where third-party actors have increasing power while leaving district heating suppliers as bulk suppliers of heating. In the final scenario, it is explored what could happen if the district heating suppliers retake the power of the customer interface by either hiring new competencies or by acquiring competent third-party actors.

7.1 Future Research

In terms of future research, there are endless possibilities as little research has been conducted on the district heating market and its unique position in society. Servitization and digitalization are still fairly new concepts on the market so all research concerning its future position on the market should be of value. For district heating suppliers it should be of interest to learn what these concepts can offer in terms of internal processes, related to production and distribution of heat. It could also be of interest to study how servitization and digitalization could impact the district heating market on a general level, even globally. As district heating could be produced in a very environmentally efficient way, it could also be of interest to see what role district heating can have in a sustainable future, and in what way servitization and digitalization could enable this.

Related to this thesis project, one could further study service offerings and relationships with private customer, as these are overlooked for commercial ones in this thesis, on the district heating market. This market is seemingly even more undiscovered, why there could be a great evolvement happening in terms of servitization as customers get increasingly digital mature. Overall, more specific results could possibly be obtained if more interviews were conducted with all type of actors, even including the end-users. End-user is generally not a prioritized segment but as their importance increase with the development of services, one can assume this could open up an entirely new market and offerings.

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A

Interview Questions

The following appendix includes the interview questions from the conducted interviews. They are divided after the type of actor, including district heating suppliers, third-party actors and customers. As the interviews were conducted in Swedish, the interview questions are not translated as for transparency.

A.1 Interview Questions - *District Heating Suppliers*

Intervjun genomförs som en del av ett examensarbetet Digitalisering och tjänstefiering av fjärrvärme i ett samarbete mellan Profu och Chalmers Tekniska Högskola av Amanda Åström Ericsson och Stina Ströby. Syftet med arbete är att kartlägga mognadsgraden av digitalisering och tjänstefiering, affärsmodeller samt aktörers relationer i **kundgränssnittet** på den svenska fjärrvärmemarknaden. Med kundgränssnittet avses den kontaktyta som uppstår mellan leverantörer, kunder och användaren och syftar alltså på andra typer av värdeöverföring än ren värmeleverans. Intervjuer med fjärrvärmeleverantörer, kunder och tredjepartsleverantörer genomförs därför i syfte att fånga drivkrafter och behov. Med tredjepartsleverantör avses leverantörer som erbjuder sekundära produkter eller tjänster relaterade till fjärrvärme. Slut användares behov förväntas i detta fall presenteras av fastighetsägarna.

Resultatet från intervjuerna kommer sammanställas i examensarbetets rapport för att besvara syftet samt att ge inspiration till framtida scenarion. Informationen kommer även nyttjas inom projektet Värmemarknad Sverige. Varje intervju förväntas pågå i ungefär 45 minuter och totalt kommer ca 20 semistrukturerade djupintervjuer att genomföras med olika aktörer.

Anonymitet

Uppgifter som lämnas i samband med intervju kommer anonymiseras. Vid publikation kommer medverkande företag och organisationer att listas, men utan koppling till specifika svar eller uppgifter.

Få förståelse för din bakgrund

- Berätta kort om dig själv och din roll på företaget.
- Berätta vad du har för koppling till värmemarknaden och mer specifikt fjärrvärmemarknaden?

Skapa förståelse för nuvarande erbjudanden

- Vad erbjuder ni för produkter och tjänster relaterade till fjärrvärme i kundgränssnittet? Alltså produkter och tjänster utöver värmeleverans.
 - Finns det olika typer av erbjudande för olika kunder? För olika delar i processen?
 - Är detta nuvarande eller kommande erbjudande?
- Finns det olika typer av erbjudande för olika kunder? För olika delar i processen?
 - I så fall, hur använder ni er av digitalisering? Vilka digitala metoder?

Förstå vem kunden är samt vilka behov som identifierats

- Utifrån den tjänst/tjänster ni beskrivit, vem ser ni som er kund? Har ni andra kunder än fastighetsägare?
 - Hur fungerar dessa relationer?
 - Har ni någon relation med slutanvändaren av fjärrvärme (boende i lägenheter, användare av kontorslokaler etc.)?
- Hur definierar ni era kunders behov samt hur möter ni behoven?
 - Har ni någon insikt i slutanvändarens behov?

Få förståelse för aktörer och samarbeten

- Har ni något samarbeten med någon aktör (gentemot kundgränssnittet)?
 - Hur ser detta samarbete ut?
- Finns det någon aktör ni vill samarbeta med?
 - Varför och vad för värde kan det i så fall tillföra?

Få insikt i hur ekonomiskt värde skapas

- Hur tar ni betalt för era produkter och tjänster (ej ren värmeöverföring)? Finns det serviceavtal etc.?
 - Finns det olika typer av prissättning? Fasta eller rörliga intäkter?
- Vad har ni för kostnader relaterade till era erbjudande?
 - Investeringskostnader eller löpande kostnader?

Få förståelse för framtidsutsikter

- Berätta om hur ni ser på framtiden inom digitalisering och tjänstefiering på fjärrvärmemarknaden gentemot kundgränssnittet?
 - Vilka nya behov och aktörer har ni identifierat?
- Vilka framtida utmaningar ser du för digitalisering och tjänstefiering på fjärrvärmemarknaden gentemot kundgränssnittet?

Få förståelse marknaden

- Har ni förslag på andra fjärrvärmeleverantörer vi bör kontakta?
 - Finns det några leverantörer som ligger i framkant med erbjudanden inom digitalisering och tjänstefiering på fjärrvärmemarknaden gentemot kundgränssnittet?
- Har ni förslag på tredjepartsleverantörer som vi bör kontakta? Med tredjepartsleverantör avses leverantörer som erbjuder sekundära produkter eller tjänster

relaterade till fjärrvärme.

- Finns det några tredjepartsleverantörer som ligger i framkant med erbjudanden inom digitalisering och tjänstefiering på fjärrvärmemarknaden gentemot kundgränssnittet?
- Har ni förslag på kunder till er som vi bör kontakta?

A.2 Interview Questions - *Third-Party actors*

Intervjun genomförs som en del av ett examensarbete Digitalisering och tjänstefiering av fjärrvärme i ett samarbete mellan Profu och Chalmers Tekniska Högskola av Amanda Åström Ericsson och Stina Ströby. Syftet med arbete är att kartlägga mognadsgraden av digitalisering och tjänstefiering, affärsmodeller samt aktörers relationer i **kundgränssnittet** på den svenska fjärrvärmemarknaden. Med kundgränssnittet avses den kontaktyta som uppstår mellan leverantörer, kunder och användaren och syftar alltså på andra typer av värdeöverföring än ren värmeleverans. Intervjuer med fjärrvärmeleverantörer, kunder och tredjepartsleverantörer genomförs därför i syfte att fånga drivkrafter och behov. Med tredjepartsleverantör avses leverantörer som erbjuder sekundära produkter eller tjänster relaterade till fjärrvärme. Slutanvändares behov förväntas i detta fall presenteras av fastighetsägarna.

Resultatet från intervjuerna kommer sammanställas i examensarbetets rapport för att besvara syftet samt att ge inspiration till framtida scenarion. Informationen kommer även nyttjas inom projektet Värmemarknad Sverige. Varje intervju förväntas pågå i ungefär 45 minuter och totalt kommer ca 20 semistrukturerade djupintervjuer att genomföras med olika aktörer.

Anonymitet

Uppgifter som lämnas i samband med intervju kommer anonymiseras. Vid publikation kommer medverkande företag och organisationer att listas, men utan koppling till specifika svar eller uppgifter.

Få förståelse för din bakgrund

- Berätta kort om dig själv och din roll på företaget.
- Berätta vad du har för koppling till värmemarknaden och mer specifikt fjärrvärmemarknaden?

Skapa förståelse för nuvarande erbjudanden

- Vad erbjuder ni för produkter och tjänster relaterade till fjärrvärme i kundgränssnittet? Alltså produkter och tjänster utöver värmeleverans.
 - Finns det olika typer av erbjudande för olika kunder? För olika delar i processen?
 - Är detta nuvarande eller kommande erbjudande?
- Använder ni er av digitalisering för dessa erbjudanden?
 - I så fall, hur använder ni er av digitalisering? Vilka digitala metoder?

Förstå vem kunden är samt vilka behov som identifierats

- Utifrån den tjänst/tjänster ni beskrivit, vem ser ni som er kund?
 - Hur fungerar dessa relationer?
- Hur definierar ni era kunders behov samt hur möter ni behoven?

Få förståelse för aktörer och samarbeten

- Vad har ni för samarbete med olika aktörer?

- Hur ser samarbetet ut? Vilken typ av relation har ni med andra aktörer?
- Hur tar ni kontakt med nya aktörer?
 - Hur har ni tagit kontakt med de aktörer ni samarbetar med idag?
 - Hur tar ni kontakt med nya aktörer?
 - Finns det någon aktör ni vill samarbeta med?
 - * Varför och vad för värde kan det i så fall tillföra?

Få insikt i hur ekonomiskt värde skapas

- Hur tar ni betalt för era produkter och tjänster?
- Vad har ni för kostnader relaterade till era erbjudande?

Få förståelse för framtidsutsikter

- Berätta om hur ni ser på framtiden inom digitalisering och tjänstefiering på fjärrvärmemarknaden gentemot kundgränssnittet?
 - Vilka nya behov och aktörer har ni identifierat?
- Vilka framtida utmaningar ser du för digitalisering och tjänstefiering på fjärrvärmemarknaden gentemot kundgränssnittet?

Få förståelse marknaden

- Finns det några leverantörer som ligger i framkant med erbjudanden inom digitalisering och tjänstefiering på fjärrvärmemarknaden gentemot kundgränssnittet?
- Har ni förslag på andra tredjepartsleverantörer som vi bör kontakta?
 - Finns det några tredjepartsleverantörer som ligger i framkant med erbjudanden inom digitalisering och tjänstefiering på fjärrvärmemarknaden gentemot kundgränssnittet?

A.3 Interview Questions - *Customers*

Intervjun genomförs som en del av ett examensarbete Digitalisering och tjänstefiering av fjärrvärme i ett samarbete mellan Profu och Chalmers Tekniska Högskola av Amanda Åström Ericsson och Stina Ströby. Syftet med arbete är att kartlägga mognadsgraden av digitalisering och tjänstefiering, affärsmodeller samt aktörers relationer i **kundgränssnittet** på den svenska fjärrvärmemarknaden. Med kundgränssnittet avses den kontaktyta som uppstår mellan leverantörer, kunder och användaren och syftar alltså på andra typer av värdeöverföring än ren värmeleverans. Intervjuer med fjärrvärmeleverantörer, kunder och tredjepartsleverantörer genomförs därför i syfte att fånga drivkrafter och behov. Med tredjepartsleverantör avses leverantörer som erbjuder sekundära produkter eller tjänster relaterade till fjärrvärme. Slut användares behov förväntas i detta fall presenteras av fastighetsägarna.

Resultatet från intervjuerna kommer sammanställas i examensarbetets rapport för att besvara syftet samt att ge inspiration till framtida scenarion. Informationen kommer även nyttjas inom projektet Värmemarknad Sverige. Varje intervju förväntas pågå i ungefär 45 minuter och totalt kommer ca 20 semistrukturerade djupintervjuer att genomföras med olika aktörer.

Struktur av intervju

Intervjun kommer att delas upp i tre delar, först kommer vi att diskutera gränssnittet mellan fjärrvärmeleverantör och er som fjärrvärmekunder. Den andra delen kommer behandla gränssnittet mellan er och era slutanvändare. Intervjun kommer att avslutas med en generell och övergripande dialog där vi kommer att diskutera den affärsmodellerna och digitaliseringens möjligheter samt utmaningar.

Anonymitet

Uppgifter som lämnas i samband med intervju kommer anonymiseras. Vid publikation kommer medverkande företag och organisationer att listas, men utan koppling till specifika svar eller uppgifter.

Få förståelse för din bakgrund

- Berätta kort om dig själv och din roll på företaget.
- Berätta vad du har för koppling till värmemarknaden och mer specifikt fjärrvärmemarknaden?

KUNDGRÄNSSNITT MOT LEVERANTÖR

Skapa förståelse för nuvarande erbjudanden från leverantör

- Vad köper ni in för produkter och tjänster relaterade till fjärrvärme?
 - Utvecklar ni i någon mån produkter och tjänster relaterade till fjärrvärme själva? Finns det någon aktör/konsult som har tagit fram ett system?
- Finns det någon grad av digitalisering i dessa produkter och tjänster?

Förståelse för relationen mellan fjärrvärmeleverantör och kund samt era behov

- Utifrån de produkter/tjänster som ni köper från er fjärrvärmeleverantör, hur ser relationen ut med er fjärrvärmeleverantör?
- Hur ser era behov ut? Vilka behov har ni?
 - Utifrån de produkter och tjänster som du beskrivit, uppfyller de era behov?

KUNDGRÄNSSNITT MOT SLUTANVÄNDARE

Skapa förståelse för nuvarande erbjudanden mot slutanvändare

- Vilka produkter och tjänster relaterade till fjärrvärme erbjuder ni till era kunder?
 - Uppfyller dessa produkter/tjänster era kunders behov?
- Använder ni er av digitalisering i era erbjudanden till era kunder?
 - I så fall, hur använder ni er av digitalisering? Vilka digitala metoder?

Få förståelse för er relation med slutanvändare samt deras behov

- Utifrån de produkter/tjänster som ni erbjuder, hur ser relationen ut med era slutanvändare?
- Hur definierar ni och fångar slutanvändarens behov?
 - Tycker ni dessa behov uppfylls av de produkter och tjänster ni erbjuder idag?

AFFÄRSMODELLER OCH FRAMTIDSUTSIKTER

Få förståelse för aktörer och samarbeten

- Har ni något samarbeten med någon aktör (gentemot kundgränssnittet)?
 - Hur ser detta samarbete ut? Utvecklar ni någonting i detta samarbete?
- Finns det någon aktör ni vill samarbeta med?
 - Varför och vad för värde kan det tillföra?

Få insikt i hur ekonomiskt värde skapas

- Hur tar ni betalt för era produkter och tjänster?
 - Finns det olika typer av prissättning? Fasta eller rörliga intäkter?
- Vad har ni för kostnader relaterade till era erbjudande?
 - Investeringskostnader eller löpande kostnader?

Få förståelse för framtidsutsikter

- Berätta om hur ni ser på framtiden inom digitalisering och tjänstefiering på fjärrvärmemarknaden gentemot kundgränssnittet?
 - Vilka nya behov och aktörer har ni identifierat?
- Vilka framtida utmaningar ser du för digitalisering och tjänstefiering på fjärrvärmemarknaden gentemot kundgränssnittet?

Få förståelse för marknaden

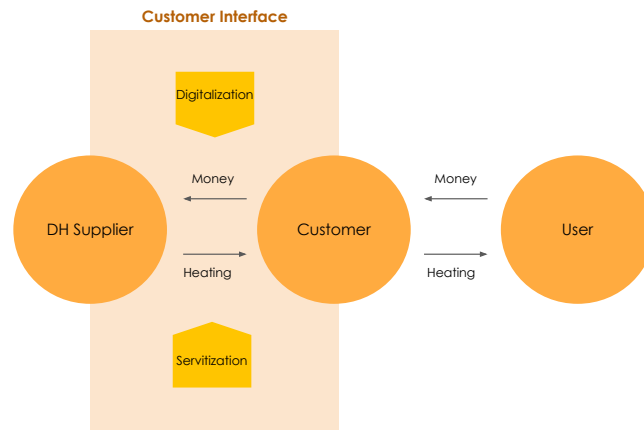
- Finns det några leverantörer som ligger i framkant med erbjudanden inom digitalisering och tjänstefiering på fjärrvärmemarknaden gentemot kundgränssnittet?
- Har ni förslag på tredjepartsleverantörer som vi bör kontakta? Med tredjepartsleverantör avses leverantörer som erbjuder sekundära produkter eller tjänster relaterade till fjärrvärme.
 - Finns det några tredjepartsleverantörer som ligger i framkant med erbjudanden inom digitalisering och tjänstefiering på fjärrvärmemarknaden gentemot kundgränssnittet?

B

Preparatory Material

The following material was presented to all interviewees, as to convey the purpose of the interview and further explain the outlines of the project. Figure B.1 shows the structure of the market, concerning what types of actors are present and the definition of the customer interface. In Figure B.2, a basic sketch of the service triad is presented in order to identify the interviewees perspective of current market relations. Lastly, Figure B.3 was presented as to show an initial sketch of what the thesis project should result in.

B.1 Visualization of the customer interface



1

Figure B.1: A sketch of the actors on the Swedish district heating market, as to visualize the customer interface. Digitalization and servitization are added in the interface to further visualize the subject of the thesis project.

B.2 Visualization of the service triad

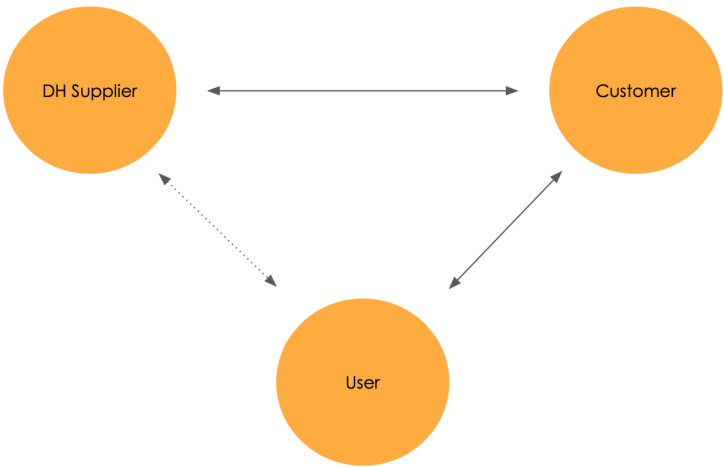


Figure B.2: A sketch of the service triad with the types of actors on the Swedish district heating market. The triad were presented to start a discussion about what types of relationships and dynamics the interviewees could identify.

B.3 Visualization of the potential framework

Value Prop	Servitization	Product			Service supporting product			Services supporting customer		
	Digitalization	Analog	Digitized	Digital	Analog	Digitized	Digital	Analog	Digitized	Digital
Value Delivery	Target customer									
	Value delivery process									
Value Creation	Partners and stakeholders									
	Value creation process									
Value Capture	Revenues									
	Cost									
Relation	Triad									
(Framtiden)										

Figure B.3: An initial sketch of what would later be the DSBM framework, in order to explain the structure of the interviews to the interviewees.

C

Extended DSBM Framework

VALUE PROPOSITION	SSP	Lifecycle Supportive maintenance and Repair of products	Performance Preventive maintenance and Monitoring of products	Result Convenience agreement	
	SSC	Support Customer education and Operational feedback	Delegation Data extraction and Operational monitoring by distance	Hybrid Load management and Energy optimization	
VALUE DELIVERY	TARGET CUSTOMER	Private customers Owners of one- or two- dwelling buildings	Commercial customers Owners of multi-dwelling or other commercial buildings	District heating suppliers Load management customers	
		Type I "The customer who wants to do it themselves"	Type II "The customer who wants us to do it with them"	Type III "The customer who wants us to do it for them"	
	VALUE DELIVERY PROCESS	Analogue Physical meetings and interactions	Digitized Online connection for services, generally as a service portal	Digital Smart interconnections with elements of AI, machine learning and cloud computing	
VALUE CREATION	PARTNERS & STAKEHOLDER	District heating supplier	Customer	End-user	Third-party actor
	VALUE CREATION PROCESS	Alliance Identified between third-party actors with customers and district heating suppliers	Coopetition Not identified on the market	Joint venture Only identified in a special case	Buyer-supplier Generally observed to some extent between all actors
VALUE CAPTURE	REVENUES	Input-based Related to Lifecycle and Support offerings	Performance-based Related to Performance and Delegation offerings	Output-based Related to Result and Hybrid Offerings	
		Fixed Generally valuable for district heatings suppliers' offerings		Dynamic Generally valuable for third-party actors' offerings	
	COSTS	Cost-driven Related to Lifecycle and Support offerings	Dual-driven Related to Performance and Delegation offerings	Value-driven Related to Result and Hybrid Offerings	

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