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Service characteristics and dimensions as a foundation for service development

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Abstract

Environmental sustainability is one of today's grand societal challenges. Services have been identified as an important element in the journey towards increased environmental sustainability, as they can decouple economic growth from resource use. Servitization - the refocus in manufacturing firms from providing products to meeting customer needs with services - allows incentives between firms and customers to align. Extant literature states that providing services requires a substantial shift in capabilities and mindset for manufacturing firms as service development and provision requires a different logic than product development and sales. However, what this mindset shift is about more precisely, what types of services there are and how these can be described and configured has not been clarified and made actionable for managers and employees. There is little agreement about the definition of services and what their fundamental characteristics are, and there is confusion surrounding categories of service offerings and an identified need for a common language in servitization. The purpose of this licentiate thesis is therefore twofold. First, theoretically to investigate the servitization and service literature on service characteristics and classifications and second, to propose a practically useful way to address the mindset and vocabulary shift and provide the common language needed for manufacturing organizations embarking on a servitization journey.

The research has been conducted through two studies in two empirical contexts: a multiple case variance study on household waste logistics services and an interactive research process study with one case company in the energy sector. These contexts, both of which have their roots in public services, have had limited focus on the development of new services but are currently undergoing transformations where services play a growing role in achieving energy efficiency and sustainability goals.

The findings of the thesis are that an understanding of the essence of services - the service mindset - along with an ability to configure, describe, analyze and discuss service offers, facilitates new service development and thereby servitization, in two important and mutually strengthening ways. Firstly, it is proposed that essential service characteristics to focus on when shifting the mindset from products to services are: (perceived) variability through (an) interaction (process). It is considered fundamental to see the service delivery as part of an ambition to interact with the customer and thereby (i) give the customer a tailored service, or at least an impression of variability based on the interaction, combined with (ii) learn more on unmet customer needs as a basis for the development of new services. Secondly, the introduction of several clearly defined, distinguishing and mutually exclusive dimensions to classify services against enables managers and employees to jointly and precisely describe and configure service offers and through interaction bring clarity on customer requirements and needs.

The two research contexts being on the outskirts of their respective theory areas are waste logistics being after-use rather than in-use and energy provision not being based on equipment manufacturing. These contexts enabled the research to revisit assumptions in service as well as servitization literature and make theoretical contributions.

Keywords: Service development, Servitization, Service characteristics, Service classification, Service triads, Multi-actor services, Service dimensions, Customer needs

List of appended papers

Paper 1: Energy efficiency through household waste collection logistics: A comparison of four service settings

Norinder A., Altuntas Vural C. and Halldórsson Á. (2023)

Submitted to an international journal

This paper was primarily written by Norinder, who also conducted the data collection and analysis. The co-authors co-created the research design, supervised the work and participated actively in the writing and editing process.

An earlier version of the work with the title 'Advancing waste collection logistics services for increased energy efficiency and circularity' was presented as work-in-progress at the Spring Servitization Conference 2020 (#SSC2020) 14-16 Sept, 2020, (Birmingham, UK/virtual event), where it was awarded the 'Best Poster Award'.

Paper 2: Service offer classification as a process rather than an outcome: Service development in the energy sector

Norinder A. and Halldórsson Á. (2023)

This paper is being developed for submission to an international journal.

The first author conducted most of the data collection, the abductive analysis and writing. The second author was instrumental in the writing and editing process as well as supervising the work and analytic workshops. The research was initiated by professor Halldórsson and the research design was co-developed by the two authors.

An earlier version of this paper was peer-reviewed and included in Proceedings of the Spring Servitization 2021 (#SSC2021) 10 – 12 May, 2021 (Florence, Italy/fully virtual event)

Acknowledgements

After two years and three months of full-time research and studies, followed by over three years of weekend, evening, and holiday focus, this licentiate thesis is now finalized.

A number of people have been providing valuable help and support for parts of the trip, while some have traveled all the way to this mid-PhD platform together with me. The list of people to thank is therefore quite long. First, of course, Árni, my main supervisor, and Patrik, my husband, in different ways, have been the two most important people enabling the journey.

Thank you, Árni, for onboarding me on the PhD adventure, followed by your advice, supervision, co-writing, and co-design of papers. It has been valuable to bounce numerous ideas and thoughts on content, as well as on how to write about it in a clear way. Thank you, Patrik, for being the solid partner, first supporting me to leave a secure and well-paid job to pursue the dream of PhD studies and then continuously enabling the journey through taking on a lot of extra work at home while I wrote or said I would.

Thank you, Ida, my first co-supervisor, for being part of the start-up, and Sanne, my second co-supervisor, for helping in the finalization of the licentiate thesis. Thank you, Ceren, for guidance and co-production, and Petra for taking on the examiner role. Thank you, Ingrid and Daniella, for being the best roommates one could possibly imagine and the best I have ever had. Thank you, teachers in TME and GTS PhD courses, for really making an effort to help us learn all the important elements of being a researcher. Thank you, Jan and Bo, for being senior role models, lending books, and caring. Thank you, Susanne and team, for your warm welcome and valuable collaboration. I hope you also learned a lot.

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Last but not least, a love note to Ivar and Embla, my other two children who add meaning to life just by being there, and to my mother Inger for picking up stray balls in my juggling of hard work, studies, and family life.

At this point, I am really looking forward to finding a way to maneuver through the second half of the PhD. A life where extensive reading of academic material, thinking, writing, collecting data, analyzing, and rewriting take place, is truly rewarding.

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1 Introduction

This thesis focuses on how to understand and describe services in order to make service development and servitization (Vandermerwe and Rada, 1988) more easily approachable. It divides servitization into two halves, services and -ization, as it was found important to dive deep into the service concept, in order to succeed with the -ization part.

1.1 Prologue

Given that the research is phenomenon-driven, this prologue serves as part of the problematisation, explaining how and why the specific focused emerged.

The work initially focused on customer driven service development as an essential activity in servitization enabling sustainability, but required a shift backward to examine *how to understand services* and *how to describe service offers* as illustrated in Figure 1. The shift in focus came about as a result of the research process, which to a large part took place with the researcher immersed in the organization of an energy provider. This organization had identified service advancement as a potential solution to several challenges including sustainability, in line with what the literature suggests (Bellos and Ferguson, 2017). Therefore, the initial focus of the research was to the right-hand side of Figure 1.

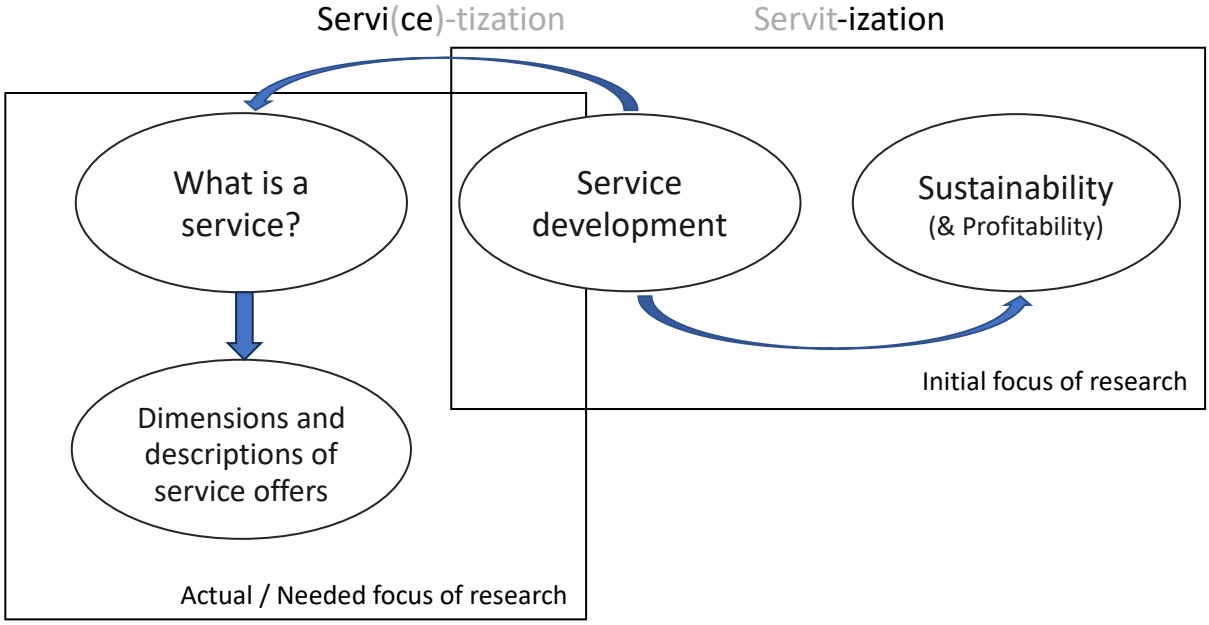

Figure 1: How the research moved backwards and came to focus on characteristics and descriptions of services

However, together with managers and employees in the energy company, who were used to product development but wished to offer more services to their customers, it was discovered that the literature on service development pre-assumes a solid understanding of the service concept as well as an ability to discuss, describe and configure service offers. Processes for new service development most commonly start with a step of idea generation (Alam, 2006), conceiving ideas (Thomke, 2003) or sparking ideas (Kristensson et al., 2019) for new services, while managers and employees used to product development started with questions about how to understand services and what different types of services there are. Therefore it was necessary to move backwards (that is, place the focus to the left-hand side of Figure 1) and take to time to solidly understand the concept of services along with how service offers can be described before being able to discuss them in a service development process and servitize (that is, move to the right in Figure 1). As the figure shows, service development is considered a central and necessary activity in a servitization process. In the efforts to understand services, through pressure testing of descriptions, definitions and dimensions in extant literature against services in the empirical contexts of the research, it was discovered that most commonly used

definitions can be challenged and that servitization literature on service dimensions have a conceptual slack.

This licentiate thesis is a comprehensive summary of two studies and associated two constituent papers, one in the waste logistics industry and one in the energy sector. It investigates the definitions and characteristics of services as well as descriptions and dimensions of services and provides a deepened explanation of the service concept, enabling a service mindset, along with an ability to analyse, describe and configure service offers, which has been recognized to be fundamental for service development and thereby for servitization.

The two chosen sectors are both associated with environmental sustainability with its focus on responsible management of natural resources. Servitization is generally identified as a way to decouple economic growth from resource use, thus service advancement in the energy sector and waste logistics sector is more than many other sectors directly linked to environmental sustainability. However, the servitization literature most often focus on manufacturers of equipment, where typical services are spare part and uptime management, while for example the energy sector also is a typical physical producer with a product identity but much less studied from a servitization perspective. Waste logistics, also with very physical production elements, usually is positioned either within the waste management literature or the logistics literature and has a low presence in the service field. Thus, bringing a servitization and service perspective into these context, both being on the outskirts of their respective theory areas was seen as interesting with potential for friction with common terms and assumptions and opening up for possible new insights. It is worth noting that the two sectors in which the research took place have both previously had limited focus on the development of new services and further both have their roots in the public services sectors.

1.2 Background

Sustainability is one of today's grand societal challenges (Hyytinen and Toivonen, 2015); that is, it is a global challenge that needs to be addressed through coordinated and collaborative effort (George et al., 2016). Environmental sustainability is further often linked to circular economy, for example the EU commission recently installed a new commissioner for 'Environment, Water Resilience and a Competitive Circular Economy' (European Commission, 2024). The European Green Deal, which will mobilize €1 trillion in sustainable investments over the next decade, was launched to decouple economic growth from resource use and bring emission of greenhouse gases to zero by 2050 (European Commission, 2020a).

Services have been mentioned as one important element in the journey towards increased environmental sustainability, as services can decouple economic growth from resource use through the focus on customer needs fulfilment rather than product sales (Agrawal and Bellos, 2017; Bellos and Ferguson, 2017; Rothenberg, 2007). The refocus in manufacturing firms from providing products to meeting customer needs with services, which is often called servitization (Vandermerwe and Rada, 1988) or service infusion (Brax, 2005), allows incentives between firms and customers to align on efficiency (Agrawal and Bellos, 2017; Rothenberg, 2007), product life span and material reuse (Linder et al., 2017). Outside manufacturing firms, sustainability can also be at the core of service value co-creation between firms and their customers (Lacoste, 2016), such as in the energy sector.

The production and use of energy (the sector in one study) account for more than 75 per cent of the EU's greenhouse gas emissions, which means that the energy system is in focus in order to reach the 2030 climate objectives and carbon neutrality by 2050 (European Commission, 2025). The energy sector is in transformation from a centralized system to a more distributed one, as well as from being product- based to focusing on services (Xu et al., 2018). Services in the energy sector allow organizations to engage with customers and users to contribute jointly to environmental sustainability, such as through energy advice services resulting in increased energy efficiency (Mahapatra et al., 2011) or through services related to solar panels enabling consumers to produce their own sustainable energy (Overholm, 2015). Services in waste logistics (the sector in the other study) can contribute to moving

waste from incineration to material recycling, a preferable alternative from sustainability and energy preservation perspectives. Household efforts to sort and transport goods are important elements in the co-production of sustainability in the waste supply chain (Halldórsson et al., 2019).

Service provision is not only a useful way to engage with customers and users for closer relationships but also a smart way to find new revenue streams from the customers' end of the value chain (Wise and Baumgartner, 1999).

1.3 The problem

Based on the insights from this research, managers and employees who are used to product provision but are interested in moving to service provision are not well supported by existing research, as there is a tension between fundamentals identified to succeed with servitization and theoretical knowledge available. This is illustrated in Figure 2 which highlights the tension between the theoretical fundamentals required for successful servitization and available knowledge that managers and employees can access when working with these fundamentals. The figure underscores the challenges that product-oriented firms face in shifting toward service provision.

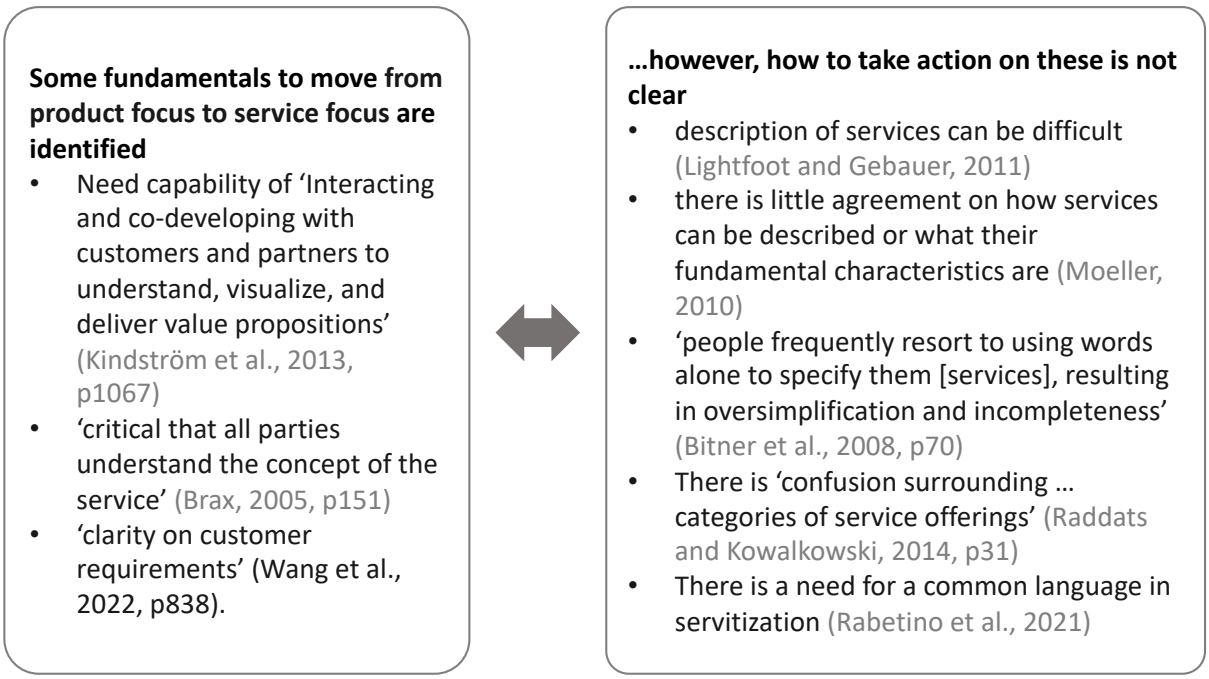

Figure 2: The tension between stated fundamentals to succeed with a transition to services, servitization, and stated confusion and gaps in available knowledge

Moving from product to service provision 'requires a substantial shift in development capabilities' (Story et al., 2017, p55) for manufacturing firms, given that service innovation require a different logic than product innovation (Janssen et al., 2016). One of the new capabilities needed is 'Interacting and co-developing with customers and partners to understand, visualize, and deliver value propositions' based on 'new, often intangible services and solutions' (Kindström et al., 2013, p1067). Multi-actor collaboration is considered a necessary condition (Wang et al., 2022) where it is 'critical that all parties understand the concept of the service' (Brax, 2005, p151) and important to bring clarity regarding customer requirements (Wang et al., 2022).

The fact that description of services can be difficult (Lightfoot and Gebauer, 2011) and vocabulary on services can be weak and lack clarity (Mathieu, 2001) complicates this understanding, visualizing, and interaction. The term 'fuzzy' is used both for more advanced services (Lightfoot and Gebauer, 2011) and for the concept of services in general (Edvardsson et al., 2005). While it is generally agreed that services are a complicated phenomenon (Grönroos, 2001), there is little agreement about how they can be described or what are their fundamental characteristics (Moeller, 2010). A need has been

identified need for a common language to favour knowledge transfer to practitioners in servitization (Rabetino et al., 2021). The servitization literature speaks broadly about basic services, intermediate services, and advanced services (Xing et al., 2023 after Baines and W. Lightfoot, 2014) while these denominations brought little or no clarification on understanding services or on different types of services to practitioners in the energy sector in present interactive research. In their servitization journey, managers and employees in the energy firm, having identified the need to develop new services, started by asking the researchers for help in clarifying how services could be told apart from products and what different types of services there are.

To elaborate on the problem, as a vital part of the problematization and clarification of Figure 2, a quick look into what is said and known about services and energy services will be introduced already here, with more details later on in the literature overview. With section 1.3.1 there is an intention to illustrate that the problems identified are not only contextual while section 1.3.2 pinpoints why services are more complex than usual in the energy sector.

1.3.1 Services?

So what is a service? In order to answer this question, often with an element of distinguishing services from products, researchers have wrestled with (i) definitions, (ii) characteristics and (iii) classifications.

(i) Definitions: Services have been distinguished as what products, or physical goods, are not (Hill, 1977) as a result of early economic thought (Lovelock and Gummesson, 2004). Proposed definitions of a service are: 'a change in the condition of a person, or of a good' (Hill, 1977, p. 318) and 'the application of specialized competences (knowledge and skills) through deeds, processes, and performances for the benefit of another entity or the entity itself' (Vargo and Lusch, 2004, p. 2), but experts also say that defining services is not meaningful (Edvardsson et al., 2005).

(ii) Characteristics: On top of the discussion on definitions, significant work has been done to grasp services based on their characteristics as being different from products. The four characteristics of intangibility, heterogeneity, inseparability (of production and consumption), and perishability (Sasser et al., 1978; Zeithaml et al., 1985) are often used when talking about services, but these are neither always valid (Lovelock and Gummesson, 2004) nor very actionable; how do you guide your development team by saying that they should develop something perishable? Others mean that the idea of customer value through value-in-exchange and value-in-use is central (Eggert et al., 2018) or that the service lens focus on absence of a transfer of ownership (Lovelock and Gummesson, 2004). Some mean that important features differentiating services from products are the open process nature of services and the fact that customers are both co-producers and consumers of services (Grönroos 2006) or that the three core elements of activities, interactions and solutions to customer problems can be extracted (Edvardsson et al., 2005).

Further it seems that words may not even help: 'Because services are intangible, variable, and delivered over time and space, people frequently resort to using words alone to specify them, resulting in oversimplification and incompleteness' (Bitner et al., 2008, p. 70).

(iii) Classifications: To address the complexities of services, when definitions and characteristics have proven difficult, authors have turned to classifications (Cook et al., 1999), as 'classification of objects helps researchers and practitioners understand and analyse complex domains' (Nickerson et al., 2017, p. 336). Important texts on service classification are provided by, for example, Cook et al. (1999), Lovelock (1983, 1980), and, more recently, van der Valk and Axelsson (2015). Special classification schemes and taxonomies have further been developed for manufacturing-related services as the more generic service classification work in service literature does 'not help to fully explain the special nature of services offered by manufacturers' (Raddats et al, 2019, p. 211) needed in their servitization efforts. However, neither there a clear vocabulary for all parties to understand and discuss new services for former manufacturers is provided. Raddats and Kowalkowski (2014) found that 'many studies use the concepts of service strategies and categories of service offerings more or less interchangeably' (p. 20) and urge for more work addressing the 'confusion surrounding … categories of service offerings' (p. 31). Biemans et al., (2016) addressed the same topic, when reviewing work in new service development

and called for a (re)definition of key concepts 'including a taxonomy of services' (p. 395). Recent servitization literature reviews have identified a need for further research on how to align mindsets between multiple actors when developing new solutions and how to co-develop capabilities among multiple actors for co-creation in servitization (Wang et al., 2022). Here, a clear language and common understanding of services is a key capability, as well as a fundament to align mindsets.

In the NSD literature Biemans et al., (2016) argued that actionability on existing knowledge is low: 'Managers who want to start or improve their service offerings will find only limited help from the available NSD [New Service Development] literature' (p. 395).

So how should practitioners describe and visualize services when experts do not even agree whether it is possible? How should practitioners address the fact that it is 'critical that all parties understand the concept of the service'?

1.3.2 Energy services?

Complicating things further for managers and employees in the energy sector, such as in the interactive study on which present research is partly based, is that the notion of *energy services* is not clear. Energy services is used in at least three ways: (1) for provision of the energy itself (United Nations, 2012), (2) for the outcome of the energy usage either focusing functions performed using energy or benefits from the energy usage (Fell, 2017; Kalt et al., 2019) and (3) as a description of services offered alongside energy provision, such as advice on increased energy efficiency (Bertoldi et al., 2006). All three of these are combined in the EU's definition of energy services: 'the physical benefit, utility or good derived from a combination of energy with energy-efficient technology or with action, which may include the operations, maintenance and control necessary to deliver the service, which is delivered on the basis of a contract and in normal circumstances has proven to result in verifiable and measurable or estimable energy efficiency improvement or primary energy savings' (EU Directive 2012/27/EU, 2012). The Swedish energy agency explain energy services through splitting them into four main categories: information, analysis, measures and agreements (Statens Energimyndighet, 2013). Concepts such as *Power-as-a-Service, Energy-as-a-Service* and *Electricity-as-a-Service* (Xu et al., 2018) are discussed.

As a manager or employee in the energy sector or waste logistics interested in providing more services rather than products, it is necessary to develop and describe complex fuzzy things that experts do not agree how to characterize, using confusing classifications. Doing this requires having a mindset shift characterized by new ways of thinking about customers and partners as well as your own offer.

1.4 Purpose and research questions

Against the backdrop of the gap between requirements on managers and employees and available guidance from literature, the **aim** of this licentiate thesis is to make services and service development more easily approachable and penetrable for both researchers and practitioners interested in servitization. The **purpose** is twofold. First, theoretically to investigate the servitization and service literature on service characteristics and classifications and second, to propose a practically useful way to address the mindset and vocabulary shift and provide the common language needed for manufacturing organizations embarking on a servitization journey.

The purpose is addressed through two research questions aligned with the focus in the left-hand side of Figure 1 (service) which approach the tension described in Figure 2 between what is needed to succeed with servitization and what is presented in the extant literature. The first research question relates to how services as a concept can be viewed and understood better by managers and employees who have previously been used to product development and product provision:

RQ1: What characteristics of services are important to focus when shifting from a product to a service mindset?

As discussed above, this mindset shift is important but not enough to be able to develop new services, as required in a servitization journey. There is also need to discuss and jointly understand customer needs, bring joint clarity on contents and value proposition of a service; that is, improved ways to

analyse, describe, discuss and configure service offers. Hence, the second research question is phrased as follows:

RQ2: How can a service offer clearly be described and configured?

These two questions are seen as complementary to achieve the purpose of the research, where the first covers services as a concept and the second goes down to the more practical level of a specific service offer. In chapter 5, a discussion is held on how service development is facilitated through combining a service mindset with the ability to describe, analyse and configure service offers, that is linking the research back to the right-hand side of Figure 1, the -ization through service development.

The remainder of this thesis is structured as follows. After this introduction in Chapter 1, Chapter 2 provides an overview of literature relevant for the studies and the discussion. Chapter 3 describes the context of the research along with the methodology and Chapter 4 offers a brief summary of the amended papers. Answers to the research questions are provided in Chapter 5, along with a discussion of these in relation to existing literature and implications from the research. Chapter 6 concludes and summarizes the thesis, clarifies the theoretical contributions and indicates possible research directions for the second half of the PhD.

2 Literature

Present research belongs primarily to the servitization field. However, as servitization requires the development of new services also this literature area was investigated. Further, related to the purpose and research questions, it was also necessary to investigate service literature in order to capture the essence of a service mindset as well as establish an ability to describe, discuss and configure service offers as per above. As the research, with its focus on services and service development challenges, was conducted in an empirical context where new services can contribute to circularity and energy efficiency, literature on environmental sustainability should be seen as being in the background, as a reason for servitization. Figure 3 depicts the four main theoretical areas, which follow the logic present in Figure 1. In order to servitize (2.2), depicted at the top of a triangle with necessary building blocks below, it is necessary to develop new services (2.4), which in turn requires understanding and being able to describe services (2.3). Environmental sustainability (2.1) does not have a circle in Figure 3 to illustrate its position in the background. It situates the research within a multi-layered theoretical framework.

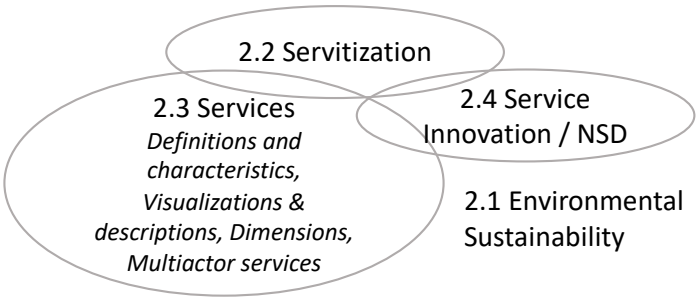

Figure 3: Servitization in the theoretical foreground with added knowledge from service literature and literature on service innovation/new service development. Environmental sustainability in the background.

2.1 Environmental sustainability, circularity, energy and waste

As mentioned in the Background, services have been identified as one important element in the journey towards increased environmental sustainability, as services can decouple economic growth from resource use through the focus on customer needs fulfilment rather than product sales (Agrawal and Bellos, 2017; Bellos and Ferguson, 2017; Rothenberg, 2007). Servitization allows incentives between firms and customers to align on efficiency (Agrawal and Bellos, 2017; Rothenberg, 2007), product life

span and material reuse (Linder et al., 2017). In the energy and waste management sectors the link between service development and environmental sustainability is more direct than usual as services often aim directly at energy efficiency and increased material circularity. Thus, environmental sustainability is both the context in which and the background to why the research took place.

There is risk of abrupt environmental change on a planetary scale and new approaches for global sustainability are needed (Rockstrom et al., 2009). The concept of circular economy is trending and seen as an operationalization for businesses to implement sustainable development (Kirchherr et al., 2017) and motivated through a break with the linear and less sustainable approach of take, make, use and dispose (Geissdoerfer et al., 2017). The first half of the definition by Geissdoerfer et al. (2017), where circular economy is defined as 'a regenerative system in which resource input and waste, emission, and energy leakage are minimised by slowing, closing, and narrowing material and energy loops', captures the essence of circularity well. Energy is also part of the picture in the so-called 'R'-frameworks, often seen as the 'how to' in relation to circular economy (Kirchherr et al., 2017). Research on how to advance services in waste logistics generates insights that can contribute to moving waste from incineration to material recycling, thus increasing circularity. Waste collection services are also fundamental for how to reduce waste ending up in oceans and on land.

Research on how to progress with and develop new services in the energy sector can generate insights leading to both energy efficiency and acceleration of the transition to renewable energy sources, thus contributing to both circularity and sustainability. Hence, the present research has links to several of the UN 2030 sustainable development goals: Goal 7 (affordable and clean energy), Goal 11 (sustainable cities and communities), Goal 12 (responsible consumption and production), Goal 13 (climate action), Goal 14 (life below water) and Goal 15 (life on land).

2.2 Servitization

Many companies in the industrial sector either are already into, or are explicitly stating their intentions to significantly increase their share of services versus traditional products to improve their competitiveness and performance (Ulaga and Reinartz, 2011) (Salonen, 2011). As far back as 1988, this movement was called the *servitization of business* by (Vandermerwe and Rada, 1988) and explained through 'corporations throughout the world are adding value to their core corporate offerings through services. The trend is pervading almost all industries, is customer demand-driven, and perceived by corporations as sharpening their competitive edges' (p. 314). Later also the notions of *service infusion* (Brax, 2005) and *service transition from products to services* (Oliva and Kallenberg, 2003) were used to discuss manufacturing firms focusing on offering more services or becoming service providers.

Common factors driving servitization efforts are marketing, financial and strategic (Gebauer et al., 2005; Salonen, 2011). A service strategy is also recognized as an enabler for a more sustainable use of resources and the avoidance of third parties to perform services can mitigate risks for brand erosion (Bellos and Ferguson, 2017). The term *go downstream* (Wise and Baumgartner, 1999), where downstream is closer to the customers in the value chain, summarizes both the elements of increasing or maintaining customer closeness as well as searching for complementary revenue from customers. Services are further attractive as they are recognized to generate a steadier income stream with potentially higher margins (Oliva and Kallenberg, 2003). Some studies have shown that a transition towards a service orientation is associated with higher corporate market values when the service ratio grows beyond a critical mass of 20–30 percent (Fang et al., 2008).

However, not all companies manage to grow their service offer in a profitable way and instead enter into a so-called service paradox where investments in services do not pay off in the form of increased revenue share from services (Gebauer et al., 2005) and some firms move away from the strategy or even deservitize (Kowalkowski et al., 2017, 2015). Challenges include new ways of managing information, customer communication and relationships (Brax, 2005) and to succeed there is a need to work with organizational structures, business model, development process, risk and customer management (Zhang and Banerji, 2017). There is a proposed grouping of challenges into the three

categories: (i) shifting the mindset to services, (ii) timescale challenges and (iii) challenges with business models/customer offerings (Kindström, 2010; Neely, 2008). The change has been described as a transition (Oliva and Kallenberg, 2003) or evolutionary transformation (Brax, 2005) along a continuum with gradually more services being introduced. However, the complex change journey (Baines et al., 2020) can however also be seen as less structured and more emergent and intuitive (Martinez et al., 2017) and it has been expressed that it is not a transition (that is, a shift) but rather an extension (Baines et al., 2020) or growth trajectory where firms need to manage several roles simultaneously (Kowalkowski et al., 2015).

2.3 Services: What is a service, really?

As the following sub-sections show, a service is a complicated phenomenon (Grönroos, 2001, p. 45).

2.3.1 Characteristics of services (or the lack thereof) and their value

Authors have long struggled to clearly define services, debated the value associated with them and called the concept of services 'fuzzy' (Edvardsson et al., 2005). This section, which is summarized in Table 1, will approach the service concept through highlighting commonly used service characteristics and logic.

The IHIP Characteristics: A common, criticized (Moeller, 2010) but still somewhat valuable (Edvardsson et al., 2005) list of characteristics are the IHIP: *intangibility, heterogeneity, inseparability* (of production and consumption), and *perishability* (Sasser et al., 1978; Zeithaml et al., 1985). Intangibility, or immateriality, as a distinction from goods has a long tradition from the 1700/1800s and is the most cited difference between goods and services (Lovelock and Gummesson, 2004). It is also said to be the underlying factor for the other three (Lovelock and Gummesson, 2004). However, when discussing services as '*activities, benefits or satisfactions* which are offered for sale' Regan (1963, p. 57) linked services both to intangibles yielding satisfaction and also to tangibles, such as transportation or housing, yielding satisfaction directly. Heterogeneity, also called variability or inconsistency (Lovelock and Gummesson, 2004) or non-standardization (Moeller, 2010), has been discussed as a problem due to poor control over service processes based on human performance (Edgett and Parkinson, 1993). However, it has also been mentioned as a feature due to differences in customer demands and discussed in conjunction with standardization versus customization or 'tailor-made' (Sundbo, 2002).

The inseparability characteristic, attributed to Say (1803, translated 1821), has been debated over the years (Lovelock and Gummesson, 2004; Moeller, 2010) and is relevant for the study in the waste collection situation, where there is a time delay built in. Lovelock and Gummesson (2004) rejected the inseparability through identification of a number of services, called 'Separable services' where the production and consumption is not simultaneous; for example, transporting freight or laundering clothes. Instead, they argued that a service can be characterized by the absence of a transfer of ownership (Lovelock and Gummesson, 2004). Moeller (2010) proposed a solution for the inseparability question in the examples given by Lovelock and Gummesson (2004) by focusing on the transformation of customer resources as the core of services and concluded that the resource that is to be transformed, '(e.g. customers themselves, their physical objects, their rights, their nominal goods and/or their data) must, of course, be present for a transformation of them' (Moeller, 2010, p. 364). Finally perishability, dating back to Smith (1778), is related to the restricted option of storing or stocking up services (Moeller, 2010).

Services as activities, processes, interactions and solutions: Many experts state that services are *deeds* (or actions), *processes* and *performances* (Edvardsson et al., 2005). The word *effort* can be added to the same list (Lovelock and Gummesson, 2004). Lusch and Nambisan (2015) stated that a service is 'one actor using its skills and capabilities for the benefit of another actor' (p. 156).

Grönroos, (2001) defined a service as 'a process consisting of a series of more or less intangible activities that normally, but not necessarily always, take place in interactions between the customer and service employees and/or physical resources or goods and/or systems of the service provider, which are

provided as solutions to customer problems' (p. 46). In that definition the three core elements along with the process view are *activities*, *interactions* and *solutions to customer problems*.

The process feature was further highlighted when Grönroos (2006) claimed that the important features differentiating services from products are the open process nature of services and the fact that customers are both co-producers and consumers of services. Interaction as a core service element has been discussed by well-known service researchers such as Kellogg and Chase (1995) Bitner, (1990) and Solomon et al. (1985), as well as in literature on engineering service systems (Ng et al., 2011). Grönroos and Voima (2013) stated that direct interactions between service provider and customer play a 'pivotal role' (p. 133) while earlier literature, such as Kellogg and Chase (1995) has argued that the interface with customers is the 'seminal element' of a service firm.

Recent literature has discussed how digital tools can facilitate the interaction between service provider and customers (e.g. Lenka et al., 2017).

Services as co-creation of value and the value-in-use concept: The co-creation of value, what value a service constitute and how value is formed, is another difficult and long debated topic by researchers and experts. In 'The Wealth of Nations', Smith, (1778) stated that services are 'unproductive of any value' (p. 439). Say (1821) criticized this position, explaining and that competence, for example professional services, is exchanged daily for gold and silver; that is, valued by someone. The concept of customer value through *value-in-exchange* and *value-in-use* has since become central (Eggert et al., 2018). Value-in-use is seen to be accumulated over time through customers' experiences (Grönroos and Voima, 2013), while value-in-exchange can be built up by investing labour and other resources before any customer is around and can then be exchanged for other utilities in a singular moment, as depicted in Figure 4.

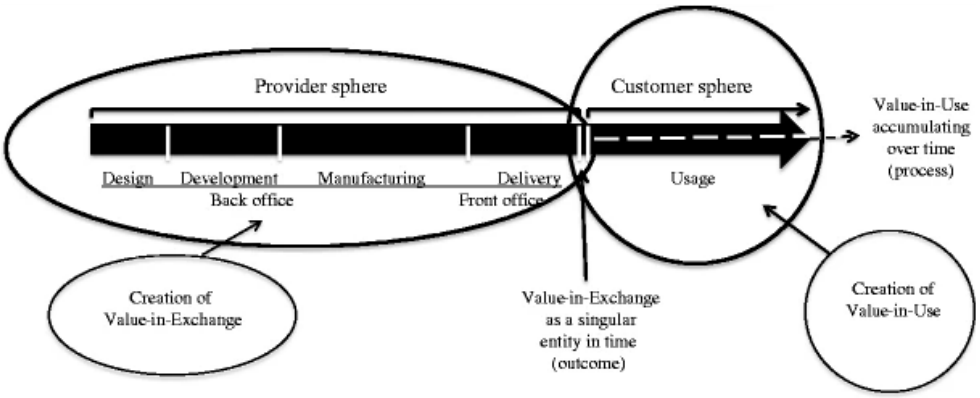

Figure 4: A comparison of the nature and locus of the value-in-use and value-in-exchange concepts by Grönroos and Voima (2013).

As value and customer perspective is important in this thesis, some expansion is warranted.

With a service-centred dominant logic (Vargo and Lusch, 2004), the focus is on value-in-use and customers are seen as co-creators who work together with the service provider in the moment of service delivery producing value (Lightfoot et al., 2013; Vargo and Lusch, 2008). In other words, value cannot be delivered to customers but is rather 'determined by the customer on the basis of value in use' (Vargo and Lusch, 2004, p. 7). In this thesis, the more expanded perspective of Grönroos (2011a) who argued that 'the unique contribution of a service perspective on business (service logic) is not that customers always are co-creators of value, but rather that under certain circumstances the service provider gets opportunities to co-create value together with its customers' (p. 279), is adopted. Figure 5 (after Grönroos, 2011a) illustrates interaction as the overlap of service provider and customer spheres where joint value creation can take place. Grönroos, (2011b) differentiated among value production, which takes place in the producer sphere, value creation, which takes place in the customer sphere,

and value generation, which is the entire process. Thus, the interaction is where the customer can co-produce with the service provider and the provider can co-create value with the customer.

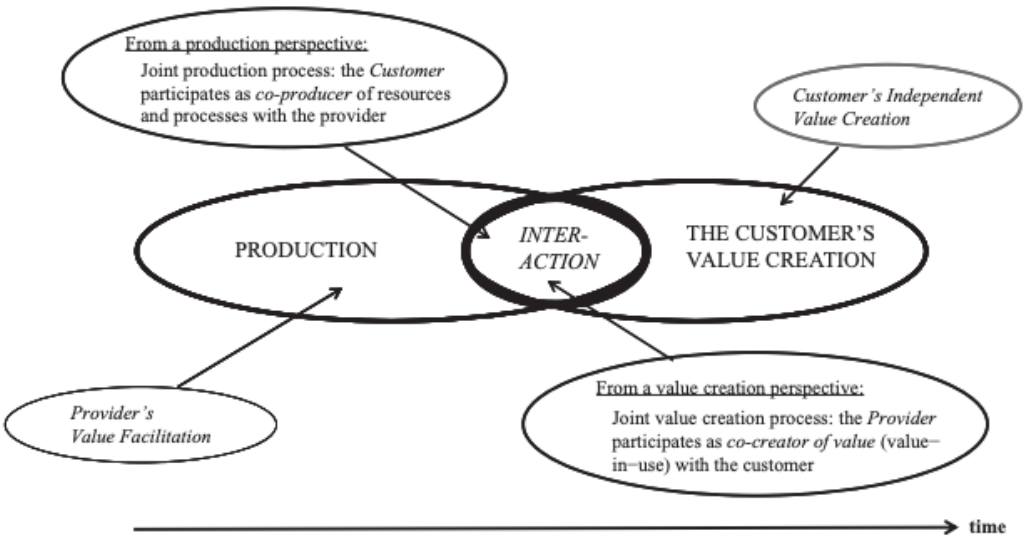

Figure 5: A model by Grönroos (2011a), with focus joint value creation taking place in the interaction between provider and customer.

Expanding on the customer perspective, additional points relate to needs and experiences. Tuli et al., (2007) underlined the importance of seeing service and solution sales as 'relational process of defining, meeting, and supporting a customer's evolving needs' (p. 5) rather than making firm inside- out efforts to compose services or solutions. They further quoted Jack Welsh, who said,: 'The winners will be those who deliver solutions from the users' point of view', (Tuli et al., 2007, p. 1).

The service concept: The notion of the service concept is in itself used in different ways, either as per above, conceptually when working with services, but also as a mental (or preferable tangible) description of the service itself, such as a 'service in the mind' (Clark et al., 2000; Goldstein et al., 2002), preferably shared by customers, employees and designers. 'The service concept defines the how and the what of service design' (Goldstein et al., 2002, p. 121) and is important for '"concretizing" the nature of the service' (Goldstein et al., 2002, p. 124).

In summary, we see that a range of characteristics of services are proposed but not agreed, although some themes do reoccur. Table 1 show an overview of important characteristics, concepts and logic used in service literature to explain services by different authors. The top part, with the IHIP characteristics explained above, also includes comments or criticism in Columns 2 and 3 related to the characteristic. The lower part of the table provides an overview of what key words or concept are underlined by which author.

Table 1: Key characteristics, concepts and logic used in literature to explain services.

IHIP (Sasser et al., 1978; Zeithaml et al., 1985) and variants		
Intangibility	Also tangibles (e.g., transportation) yielding satisfaction (Regan, 1963)	
Heterogeneity	Or (negative) variability, inconsistency (Lovelock and Gummesson, 2004) versus (positive) customization, tailor-made (Sundbo, 2002)	
Inseparability	Also separable services (Lovelock and Gummesson, 2004)	At least presence of customer goods for transformation (Moeller, 2010)
Perishability		

Key words or concept	Authors' proposals				
Process, activities, deeds, efforts, performances, skills	Activities, benefits or satisfactions (Regan, 1963)	A process of activities that take place in interactions, which are provided as solutions to customer problems (Grönroos, 2001)	Deeds, processes, performances (Edvardsson et al, 2005)	Relational process of defining, meeting, and supporting a customer's evolving needs' (Tuli et al., 2007)**	One actor using its skills and capabilities for the benefit of another actor (Lusch and Nambisan, 2015)
Customer benefits, needs, satisfactions, problem solutions					
Interaction	Interaction (Bitner, 1990; Solomon et al., 1985)			Joint value creation processes with simultaneous presence of customer and supplier; Interaction as a defining characteristic (Grönroos, 2011b)*	Direct interaction between provider and customer has a pivotal role (Grönroos and Voima, 2013)
Co-creation / Co-production	Customers as co-creators (Vargo and Lusch, 2008; Lightfoot et al, 2013)	Opportunity to co-create value together with customers (Grönroos, 2011a)	Open process with customers as both co-producers and consumers (Grönroos, 2006)*		
Value-in-use	Value-in-use (Vargo and Lusch, 2004)	Value-in-use is accumulated over time through customer experience (Grönroos and Voima, 2013)			
No ownership transfer	Absence of a transfer of ownership (Lovelock and Gummesson, 2004)				

* This perspective also includes process as a key word
** Relational process could be seen to also include the interaction concept

This brings us to what the literature suggests as ways to describe and visualize a service or service offer.

2.3.2 Service blueprints as a tool and visualization of services

Service blueprints, initiated by Shostack (1982) as an approach to design services, build primarily on the process feature of services, as a series of activities or events (Bitner et al., 2008). 'It is a visual notation for depicting business processes' (Bitner et al., 2008, p. 71) allowing 'a service to be created on paper'(Shostack, 1982, p. 63) and stemming from a need to make services more tangible. Shostack (1984) argued that 'Services are unusual in that they have impact, but no form. Like light, they can't be physically stored or possessed' (pp. 133–134) and proposed service blueprinting as a technique for service design to avoid service quality failures (Shostack, 1984), and as a tool for follow-up of service execution (Shostack, 1982). Shostack splits the service process into steps that are visible to the customer and those that are not visible, and further added an element of profitability analysis through standard times for the different activities (Shostack, 1984). *Tangible evidence*, such as the interior of an airplane and graphic material the customer will see, are seen as important elements for the customer's judgement or perceived evidence of the overall service experience (Shostack, 1984, 1982). Rooted in research on service encounters, including how the physical surroundings influence the customer's satisfaction with the service (Bitner, 1992, 1990) and what makes service encounters favourable or not (Bitner et al., 1990), Bitner et al. (2008) developed the service blueprint further. They included five components – *customer actions, onstage/visible contact employee actions, backstage/invisible contact employee actions, support processes, and physical evidence* – and omitted the profitability calculations. Service blueprints allow firms to visualize the service process and pinpoint each interaction with the customer, which makes them somewhat different from other flowcharting techniques (Bitner et al., 2008). The process of blueprinting can contribute to both service innovation and service improvement as it enables important insights (Bitner et al., 2008).

Other tools for visualizations and documentation of services during innovation and development are service design visualization tools such as customer journey maps, empathy maps and interaction maps, all of which can support the co-creation of services (Iriarte et al., 2018).

2.3.3 Service classifications to understand services and to describe service offers

In addition to visualization with the service as an activity flow, classification is another way to analyse services. "The classification of objects helps researchers and practitioners understand and analyse complex domains" (Nickerson et al, 2017, p. 336) and authors have turned to classification schemes to address the complexities of services for a long time (Cook et al., 1999; Lovelock, 1980).

On typologies, taxonomies and classifications: Some authors have used the notions of service taxonomies, typologies and classifications more or less interchangeably (e.g. Glückler and Hammer, 2011) while others clearly specify differences between the concepts (e.g., Nickerson et al., 2017; van der Valk and Axelsson, 2015). Bailey, (1994) argued that *typology* is another term for a *classification* but did put requirements on typologies, as a special form of classification, through the two characteristics: multidimensional and conceptual. He further recognized the difficulty with many dimensions as the number of types or cells in the work will rapidly grow (Bailey, 1994). Doty and Glick (1994) argued that *taxonomies* and classification schemes are the same while typologies are distinct from these. They stated that typologies, which they argue is theory in contrast to classifications and taxonomies, are 'conceptually derived interrelated sets of ideal types'(Doty and Glick, 1994, p. 232). Bailey, (1994) reserved the term taxonomy for classifications of empirical entities and suggested that taxonomies are often hierarchical. Doty and Glick, (1994) discussed taxonomies and classifications as using a series of discrete decision rules, such as hierarchically nested decision rules, to categorize phenomena. Based on this, it is concluded that typologies are more conceptual and taxonomies are more empirical; to avoid confusion, the overarching term *classification* will be used in this thesis. The other terms will be used to respect the work in extant literature, so the reader may recognize all three notions.

From Bailey (1994), it is noted that classification is 'both a process and an end result' (p. 2) and that 'classes formed should be both exhaustive and mutually exclusive' (p. 3).

Classification of services: Early classifications, which often had the purpose of distinguishing services from goods, proposed by Hill (1977), Chase (1978), Kotler (1980) and others were synthesized by Lovelock (1980) who set out to develop more 'tightly defined classification schemes' (p. 73) than existing ones. Examples of interesting classification dimensions from here, also recognized also in more recent servitization literature (Raddats et al., 2019), are: breadth of service package, discrete vs. continuous customer relation and extent of customization. A few years later, Lovelock applied his idea to 'consider whether improved insights can be obtained by combining different schemes' (Lovelock, 1980, p. 73) and presented five questions to be answered by one matrix each – four 2x2 matrixes and one 3x2 matrix – to classify services (Lovelock, 1983). Understanding of the nature of the service, through work with a set of dimensions, is fundamental for managers both to identify problems and opportunities and to enable inspiration for new service ideas from other industries (Lovelock, 1983). Despite the work of Lovelock (1983) which has been recognized as seminal (Berry and Parasuraman, 1993; Spohrer and Maglio, 2008) for service science, only few authors later built on the idea with several questions and a range of dimensions and instead stayed with one dimension (e.g. Mathieu, 2001; Tukker, 2004) or two dimensions illustrated as a matrix (Oliva and Kallenberg, 2003; Windahl and Lakemond, 2010).

Wynstra et al. (2006) brought in a supply chain perspective when distinguishing different types of services depending on how the services are used by the customer; that is used by the buyer or brought forward in the value chain to the buyers customer. Cook et al. (1999) identified a dimension of capital intensity and Glückler and Hammer (2011) used knowledge-intensity and technology-intensity in their classification.

Special classification schemes and taxonomies have also been developed for manufacturing-related services as the more generic service type work does 'not help to fully explain the special nature of services offered by manufacturers' (Raddats et al, 2019, p. 211). The most prevalent dimension in these taxonomies (Raddats et al., 2019) are variations on the theme from Mathieu (2001) of services supporting the supplier's products vs. services supporting the customer's process. The dimension of base vs. intermediate vs. advanced services by Baines and Lightfoot (2014) is also frequently discussed with most attention paid to advanced services. However, service classification in the servitization literature suffers from a conceptual slack, making the dimensions difficult to use when describing, analysing and discussing services.

2.3.4 Multi-actor services and triads

Services have been studied as dyadic encounters with a focal firm orchestrating the interaction with the customer, and with consideration given to personnel, physical facilities and other visible elements (Bitner et al., 1990). With growing attention given to more complex engineering-based service delivery, thinking and analysis is extended to *multi-organizational structures* (Ng et al., 2011) and there is 'an emerging understanding of service encounters as multi-faceted interactions involving multiple actors' (Holmqvist et al., 2020, p747 based on Alexander et al., 2018), that is, multi-actor service encounters (Holmqvist et al., 2020). Customers and their resources may be included in the multi-organizational structures (Ng et al., 2011). The *multi-actor perspective* (Story et al., 2017) builds on the network perspective where all relationships are part of a broader context and '*Any business enterprise, no matter how small it is, has to maintain relations with several other actors* (Håkansson and Snehota, 1995, p. 3). Examples of work on multi-actor services are with manufacturers, intermediaries and customers (Story et al., 2017), luxury service encounters with digital tools (Holmqvist et al., 2020) and complex multistakeholder interactions in healthcare processes where special service orchestrators are introduced (Breidbach et al., 2016). Multi-actor services can thus encompass many organizations that together create and deliver a service offer, as well as many units or parts of an organization delivering into the same service process. Further the customer is recognized as one of the potential actors.

Triads, seen as the constellation of three actors, either on an individual level or on organizational level, is a versatile approach. Studies on triads, rather than dyads with only two actors, build on the idea, introduced in sociology 1908 by Simmel (Nooteboom, 2006; Vedel et al., 2016) that a relation between two parties can be heavily affected by a third party in a so-called 'association of three' (Vedel et al., 2016). The analysis of three parties and their relations can be brought to different scales, where the actors can be individuals or organized groups, such as units in firms, whole organizations or even states (Caplow, 1956). Coalitions can form between actors and be influenced by the relative strength of actors (Caplow, 1956) and the impact of one relationship on another can be neutral, positive or negative (Ritter, 2000).

The study of triads finds its way into organization research, operations management, innovation research, marketing and different supply chain settings (Siltaloppi and Vargo, 2017) after identification of the usefulness of triads as a way to reduce data in network settings to smaller analysis units by Smith and Laage-Hellman (1992). Strong support of their view, primarily by Wu and Choi (2005) and Choi and Wu (2009) that expanding analysis from dyads to triads when working with supply chains and business networks, allows for valuable insights.

Vedel et al., (2016) further distinguished between studies on triadic settings and studies of triadic structures, where the former are studies with focus on one or two actors in a setting with three where other actor(s) is/are recognized but not studied, and the latter are studies looking at all three actors and their relationships. They mean that, in order to achieve the mentioned interesting insights on triads 'the data-collection must include information about three actors, the two or three relations which link them, and how these relations influence each other' (Vedel et al., 2016).

Triads in service research were used by Li and Choi (2009), who illustrated a service triad as a different structure from a manufacturing triadic structure. As depicted in Figure 6 (after Li and Choi, 2009), the

buyer in the manufacturing firm can control the interaction between its suppliers and customers, while in the service triad there is direct contact between the supplier and the customer of the buying firm.

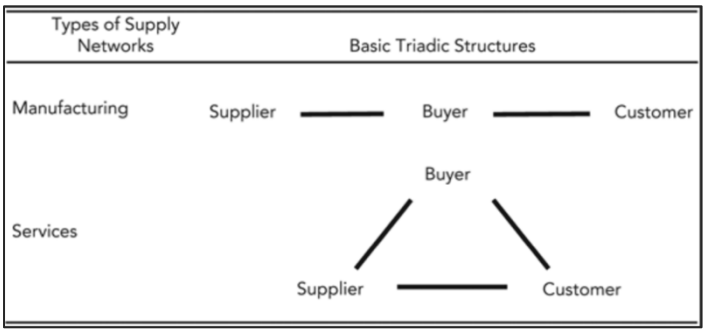

Figure 6: Comparison of Supply Chain Relationship Structures in Manufacturing versus Services (after Li and Choi, 2009).

This direct link between the customer and supplier (service operator) brings challenges to the buyer, such as how to monitor service quality (Wynstra et al., 2015). Further different roles can be taken by the third member influencing the service interaction or encounter, where the roles can be identified as: a mediator actively working to build or maintain the relationship between the other two, an exploiter benefiting from the relation of the other two and a 'rule by divide' role where the third member actively tries to cut the direct link between the other two (Andersson-Cederholm and Gyimóthy, 2010; Wynstra et al., 2015).

Service triads also enable the study of outsourcing of service activities over time, where the services buyer is initially a bridge between the supplier (service operator) and the customer, but where there is a risk over time of bridge decay and bridge transfer. In other words, the link between the buyer of services and the customer is lost and the tight relation with the customer continues to be upheld only by the service operator (Li and Choi, 2009). This is also known as a supply chain disintermediation, which is most often unfavourable to the buyer (Mena et al., 2013).

It is also possible to use service triads to split the roles within the services firm when taking a closer look at service encounters, such as modelling the customer, the service organization and the personnel of the service organization as three different actors (Andersson-Cederholm and Gyimóthy, 2010).

Wagner et al. (2018), used the extension of triads to tetrads to describe certain actor constellations, when studying complex relationship dynamics in aftermarkets. Also, Smith and Laage-Hellman (1992) underlined 'immediately and forcefully' that analysis should not, by definition, be restricted to analysis of relations between three actors, as that would be limiting.

In this thesis triads are recognized both as a multi-actor service delivery model that can be used to describe or operationalize services, and as a more generic approach to investigate / analyse multi-actor networks and service supply chains.

2.4 Service innovation, new service development and service design

Several concepts are in play in the discussion on what is a new or improved service offer and on the process of conceiving and developing it. The most common are service Innovation, new service development (NSD) and service design, all of which are, incorrectly, used interchangeably (Gustafsson et al., 2020).

2.4.1 Service innovation

There are three different perspectives on the relationship between service innovation and product (or manufacturing) innovation. The first is the *assimilation approach*, which takes the view that service innovation is much like product innovation (or manufacturing innovation). The second is the *demarcation approach*, which posits that service innovation is different from manufacturing innovation and needs to be studied with new theories and tools. The third is the *synthesis approach*, which suggests that questions discovered when studying service innovation call for general updates of

previous manufacturing innovation for a general approach covering both types of innovation (Coombs and Miles, 2000). These perspective have different views on core concepts, key characteristics, value and 'newness' (Witell et al., 2016).

The service innovation concept has only been loosely defined (Witell et al., 2016). It can be seen as either the initial portion of the service development process or the entire process of service development (Goldstein et al., 2002) or even as a broad concept including several components such as service development processes, learning, organizational adaptation and culture (Kindström et al., 2013). Service innovation can further include both radical and incremental innovation (Witell et al., 2017, 2016) or be used to distinguish creation of ground-breaking new offerings, 'to truly innovate' (Bettencourt et al., 2013, p. 14). Through looking 'beyond existing services and service capabilities to address the fundamental needs of their customers' (Bettencourt et al., 2013, p. 14) true service innovation can take place. It is also described as an evolutionary process with ambidexterity and multidimensionality (Chae, 2012) and to depend on open bottom-up and top-down processes with several actors such as employees, managers, customers and external parties (Rubalcaba et al., 2012).

Different dimensions identified in service innovation are variations on the customer side, the supply side or with regard to geography (Chae, 2012). Dimensions discussed are also sectorial, activity and agent dimensions (Rubalcaba et al., 2012). Gustafsson et al. (2020) proposed that the term 'service innovation' should be reserved for the outcome and not the process, and further that this outcome, the service, must be truly new and not a development of an existing one. Several dimensions of the newness were discussed by den Hertog et al. (2010), who defined 'A service innovation is a new service experience or service solution that consists of one or several of the following dimensions: new service concept, new customer interaction, new value system/business partners, new revenue model, new organizational or technological service delivery system' (p. 494) and thus also discuss service innovation as an outcome.

Innovation literature was only visited briefly during the research. It was identified as a vast field and not considered necessary to utilize for the purpose of this research.

2.4.2 New service development (NSD)

NSD is most often discussed as a sequential process, based on the new product development process (Johnson et al., 2000) through which new or improved services are born, split into three (Stevens and Dimitriadis, 2005), often four (Kristensson et al., 2019) and up to 15 different steps, stages or phases (Scheuing and Johnson, 1989). The process often include the steps of idea generation and assessment, design or development, testing and validation, and market launch (Kristensson et al., 2019; Skålén et al., 2015). See Figure 7 for a representative illustration of the service development process with four steps.

Figure 7: The four generic stages of service development / service innovation, after Kristensson et al. (2019)

Some researchers have added an initial step of strategic planning (e.g. Perry and Alam, 2002) while others have argued that development processes are unsystematic and emergent (Toivonen and Tuominen, 2009). The importance of customer participation in the development process has been underlined (Alam, 2006; Kristensson et al., 2008) and proven to have a positive effect (Carbonell et al., 2009). Johnson et al. (2000) introduced a NSD process cycle with four stages split into a planning phase and an execution phase, arguing that NSD efforts are nonlinear and iterative. Continuous cycling through the process builds NSD competence where enablers such as team efforts and design tools ease the flow (Johnson et al., 2000).

2.4.3 Service design

Although it is sometimes used interchangeably with service innovation and NSD, service design is seen to encompass design principles and systematic methodology to a greater degree that those other concepts (Gustafsson et al., 2020). Service design has been defined as 'the concretization of the service concept in drawings, flowcharts …'or as 'the work of specifying an idea about a new service in drawings and specifications' (Goldstein et al., 2002, p. 122), that is, as an in-between concept. Some research has proposed that the service design tools and mindset enable the practitioner mind-set shift from manufacturing to services (van der Togt et al., 2020) and as tools for co-creation of services with customers by manufacturers (Iriarte et al., 2018).

In this thesis the view that service innovation is an activity (or several) in early steps of a service development process related to the creation of entirely new service offerings, rather than incremental development of existing ones is adopted. Service development in turn is seen as the heart in the servitization process as illustrated in Figure 1. The perspective is somewhat close to the demarcation perspective, with attention to differences from previously deployed mindsets and processes in manufacturing firms and with a focus on use value. Service design tools are seen as interesting for service conceptualization, clarification and development.

2.5 Summary of the literature overview

There is a need for new approaches to achieve environmental sustainability including reduction of energy and resource needs (the background and context of present research). Servitization (the focus of the present research), where manufacturing organizations transition to service provision from sale of goods, has recognized as a potential way of using less resources and energy as it include a decoupling of natural resource consumption and customer value creation. Servitizing and providing additional services requires the development of new and improved services, an area where the service innovation and new service development literature (a supporting literature area for present research) provide processes and knowledge. However, the service innovation literature offers limited guidance on how to understand and discuss services for people who are not already familiar with the service concept. To better understand what differentiates the logic between products and services, the service literature (also a supporting literature area for the present research) provides an array of service characteristics and a logic to help explain what a service is. In addition, to enable description, analysis, discussion and configuration of specific service offers, tools like classifications, service triads and blueprints are used in the service literature. Classifications also exist also in the servitization literature, although they have a conceptual slack that makes them difficult to deploy for clear description, analysis and discussion of service offers – activities that are important to the service development process. Figure 8 provides an overview of main theoretical areas and concepts, their connections to the two studies, and a positioning of the two contexts (waste logistics and energy sector). As the figure shows, the study on waste logistics

was mainly connected to literature on service development and services, while the study in the energy sector was connected to literature on servitization as well as services and service development.

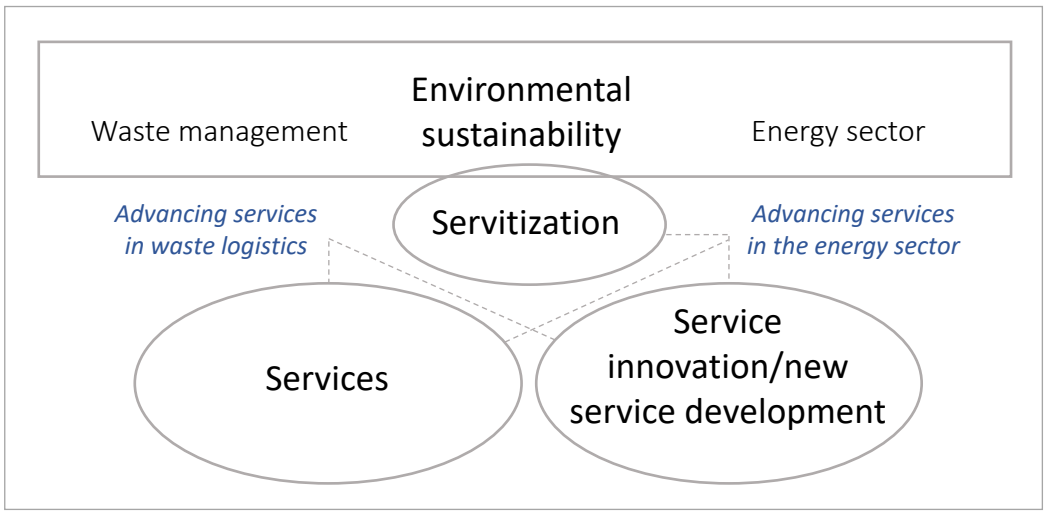

Figure 8: Overview of key theoretical areas and the two contexts along with focus of the two studies (in italics).

3 Methodology

3.1 Context of the research

The two contexts of this research – the energy sector and household waste logistics – are related to sustainability. The focus is on more green, clean and efficient energy production and use, as well as improved household waste management through quantity reduction, efficient transport and material reuse or recycling. These are further related as the service of collecting mixed waste generates burnable fuel for energy production. They are similar in that they are both somewhat immature in the use of the service concept with associated customer focus. Operation of both takes place in partly regulated markets with a mix of privately held and publicly owned or managed organizations, where policy makers balance between interventions to speed up progression towards sustainable solutions and relying on market forces and consumer interests to drive development. Both sectors have access to consumer addresses but are not accustomed to actively using this information.

However, the two contexts are different because waste logistics is already considered a service by its practitioners and academic authors, while managers and employees in the energy sector are used to provide energy with a product mindset and academic authors discuss vaguely defined energy services (Fell, 2017).

Neither of the two contexts – services in the energy sector and waste logistics services – is in the middle groove of servitization or service research. Servitization research centres around manufacturing firms, where energy production and distribution does fit, but the actual cases researched are often manufacturers of equipment (see, for example, the list of Fliess and Lexutt, 2019) and service offers discussed relate to the physical nature or performance of this equipment. Pure service research most often deals with consumption and *in-use*, such as gaining access to products or experiences during a use-phase, while waste logistics services occur *after* the use-phase and relate to the wish to get rid of something.

3.1.1 Household waste collection

Household waste collection and handling is a pressing global concern with 2 billion tonnes of municipal solid waste generated annually and that number is expected to grow (World Bank, 2018). In Sweden the equivalent figure for household waste in 2022 was 4.7 million tonnes (Avfall Sverige, 2024). The problems stemming from household waste are diverse, ranging from significant amounts of plastic in the oceans (Jambeck et al., 2015) to waste management consuming up to 20 per cent of municipal

budgets in low-income countries (World Bank, 2018), and put pressure on municipalities, countries and regions to act. In such efforts, although regulations have typically characterized waste as an environmental hazard (Ellen MacArthur Foundation, 2015), many countries and regions have voiced ambitions to increasingly use or recycle waste. Ways of converting waste into a resource with value in circular economies are increasingly discussed by public institutions and management consultants (European Commission, 2020b; McKinsey, 2016) as well as by academic authors . However, although household waste is a global phenomenon and the direction towards more recycling is clear, local household waste collection practices differ starkly between and within countries (Bing et al., 2016), even between neighbouring municipalities. There is tension between energy invested in collection logistics and quality of the waste collected. Good quality waste (that is waste sorted into fractions) can be recycled, while unsorted waste is incinerated in countries that have capacity to do so. The EU has an overcapacity of waste incineration, where Sweden has been identified as a country with incineration capacity well in excess of what is needed (Zero Waste Europe, 2023), which implies risks for strong lock-in effects hampering increased material recycling (Salmenperä, 2021).

Waste collection is viewed as a service by both the service literature (Coutelle-Brillet et al., 2014) and the circular economy literature (Lüdeke-Freund et al., 2019). The value co-production aspect of waste collection logistics services was discussed by Halldórsson et al. (2019), who found that households generate value when, for example, moving waste to predefined areas. In Sweden, households are responsible to sort recyclable waste into fractions to be collected under the extended producers' responsibility, while municipalities are responsible to collect residual and food waste. Hence, household waste collection is a multi-actor service.

3.1.2 Energy sector

Alongside the transition to sustainable sources the energy industry is being transformed (Xu et al., 2018). The growth of energy production from sustainable sources is moving towards a more distributed production of energy, which brings new challenges regarding power supply volatility (Fogelberg and Lazarczyk, 2017). New actors, such as Tesla, with its slogan "We power everything" enter the scene and large industrial or retailing companies, such as Stena and IKEA, become energy producers with parks for wind and solar power. Smaller consumers start producing energy in their own yards and are no longer only customers to energy companies but also suppliers. Further, electrification of the transport sector introduces new power requirements and demand volatility. Thus, volatility is increasing on both the supply and demand sides, with power transmission and peak management challenges as consequences. Electrified vehicles are also mentioned as part of the solution for storing of energy through so-called vehicle-to-grid options and digitalization is an overall enabler for new service-oriented offers. One possible future for a transformed energy system is a 'smart-grid' (Amin, 2004) based on a decentralized interconnected structure where everyone can actively participate in the electricity market (Hojčková et al., 2018). New companies with 'digital' offers that position themselves as 'smarter' alternatives to traditional energy companies are growing, both in size and number.

Services are seen as an attractive option for several actors in the energy supply chain: for the traditional energy producers who see their margins being challenged and risk being pushed back in the supply chain, for policy makers as answers to mentioned volatility challenges and for customers who either want little engagement in needed energy efficiency activities or want to take an active role in the energy or balancing markets.

3.2 Research process

Based on the purpose of the research, involving complex, real-life phenomena (Gummesson, 1999), proximity to the field with direct contact with the various actors was required and thus a qualitative approach was chosen (Flick, 2014). As shown in Chapter 1, only a limited amount of research has been conducted into useful descriptions of services and the theoretical level is nascent rather than mature, which supports the choice of a qualitative approach (Edmondson and Mcmanus, 2007). Case studies, which are suitable for 'how' questions and in-depth descriptions of complex social phenomena (Yin,

2014), were leveraged in both studies. Further, the studies build on the engaged scholarship framework which offers opportunities for production of knowledge that is insightful and penetrating (van de Ven, 2007) through closely connecting research with communities and organisations. Engaged scholarship limits problems both with knowledge transfer and knowledge production (van de Ven, 2007) and was considered to fit well especially with the interactive methods and practices in the second study. The study in the context of waste logistics was designed as a variance study and the study in the energy sector as a process study (van de Ven, 2007). Figure 9 provides an overview of the research timeline, the two studies and papers along with conferences attended (in digital form).

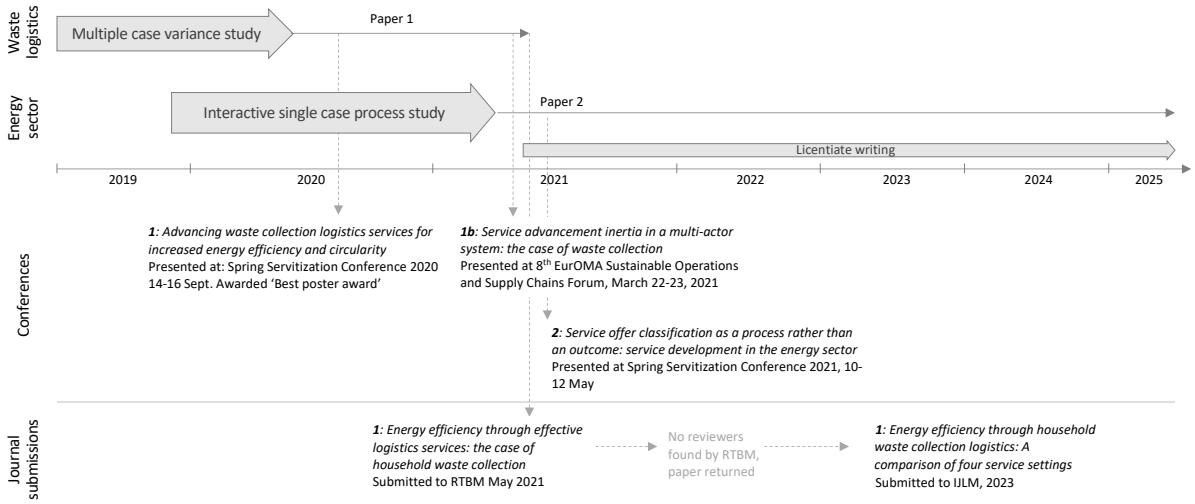

Figure 9: Overview of timeline for the studies, context and papers

The first study, in the context of household waste logistics services, was designed as a multiple-case to enable in-depth insights into the different settings studied as well as comparison between them (Bell et al., 2019). The research perspective should be recognized as descriptive/explanatory with the researcher detached outside, that is, as informed basic research (van de Ven, 2007). However, as an inhabitant in a household producing waste, the researcher has a personal relationship to waste collection as a service and has personally tried two different collection services available in the neighbourhood. As the purpose of the study was to value energy efficiency in logistics efforts in relation to energy efficiency in waste treatment, selected quantitative elements were used in the study, which introduced a limited element of mixed methods (Bell et al., 2019; Miles et al., 2020) to enable key conclusions. This study used service triads, recommended by Wynstra et al. (2015) as a suitable analysis view for services with a buyer–supplier–customer structure where all three parties have direct interaction with the others and where insights on the triadic phenomena are of interest.

The second study, in the energy sector, utilized a single-case, interactive process approach where knowledge was co-produced with managers and employees in the case organization (Elg et al., 2015; van de Ven, 2007). Elg et al. (2020, p. 96) argued that 'advancement in knowledge creation in service research must be based on methodological choices that are grounded in the characteristics of services, namely, their situational and interactive nature' where the selected interactive approach fits. Studying the process of managers and employees in the case firm maturing their understanding of the service concept with a process approach (van de Ven, 2007) enables a good fit between problem and methodology (Edmondson and Mcmanus, 2007). The interactive process is illustrated in more detail in Paper 2.

Interactive research (Aagaard Nielsen and Svensson, 2006; Svensson et al., 2007), a form of collaborative basic research relevant *for* practice (van de Ven, 2007), has certain similarities to consulting, which also focuses on generating value *for* practitioners rather than being solely *about* practice (Bradbury-Huang, 2010). Despite this, the aim is still to advance scientific knowledge (Elg et al., 2015). As the researcher has a personal history of 20 years as a manager, the interactive process, where research was conducted *with*, rather than *on* the participants (Svensson et al., 2002), was appreciated.

Practitioners 'prefer co-operation, which is based on equality, flexibility, closeness and joint learning' (Aagaard Nielsen and Svensson, 2006, p. 22) where a foundation is the mechanism of reciprocity (Young and Freytag, 2021). The evolution towards more interactive research is also part of a larger trend related to requests from society for problem-based approaches and multi-disciplinary perspectives to generate new knowledge in complex and fast paced areas, which cannot be produced by researchers in universities alone (Aagaard Nielsen and Svensson, 2006). The approach in Study 2 is described as interactive research rather than action research, based on the differences in these traditions described by Elg et al. (2015) summarized in Table 2.

Table 2: Differences between various traditions in collaborative research, after Elg et al. (2015)

	Interactive research	Action research
Responsibilities for action and research	Divided	Shared
Main ambitions	Theoretical development and generally applicable knowledge	Practical development and local theories
Interest in the issue of validity	High	Low
The research role	Organizing joint learning for critical analyses	Organising the development and learning processes

Here, 'responsibilities for action and research' and 'the research role' primarily underpin the selected denomination, as action research also may aim for generating general knowledge (Ollila and Yström, 2020) and benefit from interest in validity (Elg et al., 2020).

A reflection on the process and fundamental methodology choices is that both studies primarily build on qualitative methods and interviews. Throughout the process there have been thoughts related to the discussion by Gioia et al. (2013) on the question 'how do I know that I know?' such as how can the researcher be sure that there is more than 'rather thin evidence' (Gioia et al., 2013, p. 18)? Comfort has been sought by reaching out to supervisors as well as numerous books on qualitative methods while striving to achieve the ideal state as described by Kvale and Brinkmann (2014, p. 309) to 'immediately convince on … truthfulness, beauty and goodness'.

3.3 Sampling considerations and reflections

For the multiple case variance study, four locations in West Sweden with different household waste logistics offers and actors involved were studied, each representing a service setting. Each service setting should be seen as the combination of actors performing the different household waste logistics activities, along with their respective transport modes and distances for the selected waste fractions. Four service settings, or cases, was considered to be a suitable number for comparison – few enough to allow information-rich cases (Patton, 2015) and large enough to reveal common patterns between cases (Yin, 1981). Four cases is within the recommended range for generation of complex theory (Eisenhardt, 1989). A purposive sampling of locations was applied (Bell et al., 2019) where two locations were selected based on a typical case sampling approach to represent common waste collection structures in Sweden, and two locations were selected based on maximum variation sampling, to ensure a wide variety of different logistic offers and different types of actors involved.

The geographical scope was limited to two neighboring municipalities to avoid adding unnecessary complexity with regard to differences due to varying natural regional conditions. The phenomenon in focus was also the large variation in services without apparent geographic reasons. The sampling of professional actors (that is, municipalities and waste service providers) to include was determined by the sampling of the locations to study as 'the data-collection must include information about three actors, the two or three relations which link them, and how these relations influence each other' (Vedel et al., 2016, p. 139) in order to generate insights. The inclusion of all professional actors (organizations) in each location posed something of a challenge because if only one had declined to participate in the study that would have necessitated starting over with a new location for the study to be complete. The number of professional actors interviewed in each location ranged between one and five depending on the level of complexity in the logistics service offer. Sampling of people within each organization was based on highly knowledgeable informants (Eisenhardt and Graebner, 2007). Sampling of an initial

household for interviewing in each location was done based on convenience sampling and two more identified through snowballing (Bell et al., 2019).

For the single-case process study, where the empirical setting was one organization in the energy sector, the four different process steps of the study included different aspects of sampling. The sampling evolved throughout the research process as a result of the research and can be described as sequential sampling (Miles et al., 2020). During the **(1)** initiation step, a large Swedish provider of energy and energy services was sampled as a unique case (Eisenhardt and Graebner, 2007). The case company had identified a need to become more service-oriented and was interested in a process-oriented research collaboration to co-create deeper understanding of customer-oriented service offer development. These circumstances made this a suitable case for studying service classification as a process to increase managers and employee ability in service development. Sponsors for the research in the case organization were the head of research and the head of product development, where the latter was organized within the marketing and sales function. Sampling of individuals within the organization for co-creation of relevant research questions and framing of interesting knowledge to generate, was based upon experience level with the phenomena (Pettigrew, 1990; van de Ven, 2007) and came to include individuals from the marketing and sales and development departments. In the next process step with focus on **(2)** current service offerings, both service offers by the case company and service offers by other actors were of interest. Purposive sampling (Bell et al., 2019) for actors (organizations) outside the case company, whose service offers the study should include, was done through representative case sampling (similarity to case company in size or location), critical case sampling (companies with high rating in most recent national customer satisfaction study) and maximum variation sampling (new players in the industry with innovative business models). The largest firms in the Swedish energy industry were also included along with important partners to the case company. The total sample was 26 companies, ranging from small to large, with different origins and located all over the country. Employee and managers sampled for this phase was experienced individuals (Pettigrew, 1990) in the development team along with snowballing (Bell et al., 2019) from their recommendations, reaching also persons in the sales team and servicing department. In the next step, **(3)** prototyping a framework, 50 different services, from the case company and the 26 other sampled organizations, were included in the study based on maximum variation criteria (Bell et al., 2019). The most experienced people in the development team were sampled for participation in the analytic seminars and subsequent individual rating exercise. The last step **(4)** applicability of the framework, involved all volunteers from the development team, making it a form of criterion sampling (Bell et al., 2019) along with snowballing of other high experience individuals for interviews, the R&D management team for a seminar and the entire development team for a confirmatory workshop.

In this abductive study, a large set of existing frameworks for service offer classification was studied and used. The analysis of offer taxonomies was done with frameworks listed by Raddats et al. (2019) with the addition of three more frameworks discussed by the same authors in the same paper. Frameworks from the general service literature were found to leverage four important offer review papers – Lovelock (1980), Lovelock (1983), Cook (1999) and van der Valk and Axelsson (2015) – and limited snowballing from these. Frameworks in energy literature were found through searches in Scopus.

3.4 Data collection considerations and reflections

The multiple-case study on waste collection logistics built primarily on interviews as a way '*to obtain both retrospective and real-time accounts by those people experiencing the phenomenon of theoretical* interest' (Gioia et al., 2013). Pragmatic and phenomenological interviews (Patton, 2015) were primarily used to suit the purpose of the research. As mentioned, a built-in challenge in the triad approach is that all actors and their relations in a triad need to be covered and the last interviewee took several phone calls and some convincing before it was possible to book. In addition to interviews, a visit to one of the waste service providers was performed. This included a tour in a waste truck operated by two staff members, a visit to the initial compacting and sorting area, as well as a view of the facilities for

administration and equipment maintenance. Further, all four service settings were visited to observe the bins and collection equipment in practice. During the visits, field notes and photographs were taken. In the household interviews one question inspired from the critical incident technique as a useful tool to deeper explore a topic (Gremler, 2004) was used to capture unexpected associations and opinions from the respondents. In addition to actors present in each triad, interviews were conducted with other actors identified to bring additional perspectives as well as enhancing the validity and reliability of the results. These interviews were conducted at a company that had installed the waste collection equipment in one setting, the organisation that recently had built the houses and designed the waste collection actor structure in one setting, a waste logistics organisation in another municipality and finally an organisation enabling exchange of experiences with regards to waste collection logistics between different municipalities.

Both municipalities covered in the study provided quantitative data regarding waste quality and quantities in different collection structures; in one case, data from both before and after the introduction of curb side collection. Secondary data regarding transport energy and energy savings achieved by material recycling relative to incineration were collected from academic literature, industry reports and the homepages of logistics equipment providers. Data were collected from June 2019 to March 2020 and validated through November 2020. See Table 3 for an overview of data collected for the variance study in waste logistics.

Table 3: Overview of data collection in the waste services study

Waste logistics	Number of interviews	Number of participants	Length	Formats
Interviews households	15	1 person: 15 interviews	20 – 40 min, Average 25 min	Telephone: 13 Face to Face: 2
Interviews actors in triads	10	1 person: 7 interviews 2 people: 2 interviews 3 people: 1 interview	20 – 90 min, Average 60 min	Face to Face: 8 Video: 1 Telephone: 1
Interviews other actors	5	1 person: 3 interviews 2 people: 2 interviews	15 – 75 min, Average 50 min	Video: 3 Face to Face: 1 Telephone: 1
Interviews experts	3	1 person: 3 interviews	60 – 100 min Average 75 min	Face to Face: 1 Video: 1 Telephone: 1
Total	33	39 people	Average 45 min	
Other	- Study visit to WSP including morning tour in waste truck			
Secondary data	- Industry reports - National waste data - EU waste data			

For the second study, data collection was done through a desktop study, semi-structured interviews, analytic seminars (Ellström et al., 2020), an e-mail mini-survey, observation in internal meetings, internal document review and a series of workshops. In the analytic seminars, researchers and participants met to jointly analyse and discuss research findings and together make interpretations and conceptualizations (Ellström et al., 2020). A written report was sent to managers and employees in the energy firm beforehand containing the concepts and notions to be discussed in the analytic seminars. The workshops had a more traditional format of a presentation followed by participants generating input in smaller groups in relation to specific questions or tasks. A joint analysis with all managers, employees and researchers present, was conducted towards the end and practitioners sent their notes to the researchers after the session. A field logbook was kept and research memos were written

throughout the process. Data collection took place between November 2019 and June 2021. See Table 4 for an overview of the empirical data collected during the process study in the energy sector.

Table 4: Overview of empirical data collection during the study in the energy sector

Energy sector	Number	Number of participants	Length	Formats
Interviews	21	1	30 – 90 min Average 60 min	Face to Face
Analytic seminars	6	20 people 7 people 10 people 6 people 8 people 7 people	45 min 2.5 h 2.0 h 1.5 h 1.5 h 2.0 h	Face to Face Video Video Video Video Video
Workshops	1 5	25 people 5 – 26 people	4 h 30 – 120 min	Face to Face Face to Face/Video
Participation weekly meetings	~ 50	5 – 15 people	15 – 30 min	Face to Face/Video
Observation departmental meetings	15	6 – 20 people	2 – 3 h	Video
E-mail questionnaires	One with 4 answers One with 13 answers			
Informal dialogues	Weekly for 20 months			
Internal artefacts	- Strategy documents - Annual plans - Promotional material - Homepage (external/internal) - Townhall videos - Customer cards			
Mapping of services in energy sector	26 companies, ~ 50 different services			
Mapping of digital services	19 service offers in four sectors			
Other	- Internal study visits different departments - Introductory training - Observation in internal meetings - Industry reports - Industry webinars			

During the first study, all interviews were recorded, except in eight cases when either the interviewees were uncomfortable with recording or technology for recording was unavailable. In all cases, detailed notes were taken by the interviewer. Recordings were transcribed in full from interviews with industry actors and experts, and in part from interviews with households. As this was a learning experience three different approaches for transcription were tested: Nvivo Transcription, paid transcription as a service and transcription by the researcher.

During the second study, when the researcher was immersed in the organization of study it proved impossible to record all important interactions. Comments, reflections and dialogue came at unexpected moments when no recording took place. Therefore, field notes and short memos were important elements of data documentation during this study. The analytic seminars were recorded, along with the most formal interviews.

A challenging question was whether to record the interviews and observations. Recording does allow for relistening and capturing additional nuances and for detailed text analysis of transcribed interviews. However, in some cases it may cause the interviewee to express less 'correct' statements or opinions.

There was some evidence of this problem as one interviewee completely changed their style when the phone recording was on compared to when it was turned off 'after' the interview. During the recording phase, the interviewee showed a very passive body language, reclined and even held their eyes closed a fair share of the time. When the recording was turned off, the style of the interviewee changed completely and he/she engaged in sharing both nuanced and personal opinions on the topic at hand as well as on the role of the own organization in the industry development.

3.5 Data analysis considerations and reflections

Both studies used an abductive approach (Bell et al., 2019) where several types of analysis have been performed in an iterative process (Easton, 2010). The research built on the perspective that analysis consists of data condensation, data display and conclusion drawing and verifying in parallel throughout the research (Miles et al., 2020). Much data condensation has been done through extensive use of data displays such as tables and matrixes. Displays, in several iterations with alternative dimensions and contents, have allowed for pattern identification and analytic insights (Miles et al., 2020).

For the multiple case study, research problems and preliminary variables but not hypotheses were formulated at the outset of the process in order to avoid biasing the findings (Eisenhardt, 1989). Interviews were analysed both for manifest content and latent content (Graneheim and Lundman, 2004). Content analysis of responsibilities, activities and relationships in each triad was combined with an inter-case comparison and analysis of secondary data from company homepages and public industry information. Data triangulation to confirm logistics information (such as distances expressed in interviews) was done through online maps. Through the use of both quantitative and qualitative data analytic texture was added (Miles et al., 2020). This study also used power quotes (Pratt, 2008) in the case description and analysis. Tables and visual aids were used both during analysis and in the final paper as a way of letting the empirical data clearly support the theory (Eisenhardt and Graebner, 2007).

Also in the second study, the process study, data analysis was conducted across data sources in an iterative and abductive approach (Bell et al., 2019). Analysis was concurrent with data collection (Miles et al., 2020). As this study was interactive, managers and employees from the case company took part in both the problem definition and in analysis, such as through analytic seminars (Ellström et al., 2020). In the initiation phase, the focus was on a grounding and situating of the research problem (van de Ven, 2007). The second phase contained an analysis of the suitability of existing service offer taxonomies against the mapped service offers in the energy sector. For each of the taxonomies listed by Raddats et al. (2019), examples of service offers from the energy industry were placed against the proposed dimensions in visual matrixes. Evaluation was done regarding how straightforward positioning was, if there were examples among the gathered service offers possible to place in all quadrants/types and whether frameworks helped clarify important differences between the service offers. This analysis resulted in the identification of a conceptual slack in existing frameworks. In order to clarify the situation, a deeper analysis of the existing servitization taxonomies was conducted to find what underlying aspects had been used to define each dimension or type. Descriptions, definitions, and examples in each framework were analysed against dimensions proposed by other authors in order to create a list of what dimensions were used by which authors and in what way. Different tables and matrixes were created as part of the analysis for repartitioning and clustering of dimensions (Miles et al., 2020). After this, input from participating managers and employees was compared and analysed against dimensions in literature to find similarities and differences. This exercise led to the identification of 38 dimensions for further use in the work along with three criteria for useful dimensions. The next phase contained analysis of individual voting scores and comments through visual displays. It also included a classification by the researchers of 50 services against the 23 most interesting dimensions to look for covariation (different dimensions not being mutually exclusive), non-discrimination (very different offers classified the same) and classification difficulties (several options used or researchers classifying the same service differently). The last phase was content analysis (Graneheim et al., 2017) of input from managers and employees with regard to limitations, concerns, ideas for uses and

comments on needs for further tailoring. Uses and limitations were also assessed based on analysis of the two exercises done with managers and employees regarding dialogue, outcome and agreed actions.

3.6 Reflection on ontology and epistemology

'Every human being, as a human being, and then as a creator of knowledge as well, carries around certain ultimate presumptions …about what his/her environment looks like, in principle, and about her role in this environment.' (Arbnor & Bjerke, 2009, p. 9). Therefore 'Any researcher has to deal with values in her/his research' (Aagaard Nielsen and Svensson 2006, p. 35). Even though 'there is no simple way' (ibid.), a recommendation 'is to be open and discuss the value basis of one's research' (ibid.). Here, the kappa author believe the social world inherently includes human needs, motivations and flaws. Therefore, what are studied in social studies are to a certain extent creations, influenced by research and media and by what was taught in school when managers went there long ago, flavoured with local interpretations. However, the research should not be seen as having a constructivist perspective, but rather be recognized as critical realism where the real is central and 'something is real if it has a causal effect, that is, if it affects behaviour and makes a difference' (Alvesson and Sköldberg, 2009). Critical realism is also an important starting point for interactive research and is a 'necessary element if the research in question aims to discover, question and extend perspectives and create knowledge of a general nature' (Elg et al., 2015, p. 348), which fits well with the philosophical underpinning of the present research.

Hendrickx (1999, p. 346) claimed that 'a management researcher explicitly acknowledges that he is a product of a certain history and culture … He has come to terms with the subjective nature of what he knows and he understands the futility of attempting to reason in a value-neutral way'. However, Campbell, (1996) warned against taking postmodern ideas taken to the extreme, to what he calls 'ontological nihilism', where the relativity of perspectives makes it virtually impossible to conclude anything. Nevertheless, he encouraged us to strive to know and we find support from Alvesson and Sköldberg (2009), who argued that, through reflexive interpretation emphasizing empirical material, we can generate arguments for a particular way of understanding the world.

3.7 Research quality and reflections

Quality in qualitative research has been widely discussed and many different concepts to ensure truth and reality are present in literature. The conversation on the relation between research methods and results and the investigated reality is also important (Kvale, 1989).

As the research design and methodologies in the two studies differ (despite being based on similar ontological and epistemological assumptions), different approaches have been used to ensure quality in the research (Elg et al., 2020; Halldórsson and Aastrup, 2003; Healy and Perry, 2000).

The criterion of quality in the first study, the multiple case variance study, was trustworthiness through credibility, transferability, dependability and confirmability (Bell et al., 2019; Halldórsson and Aastrup, 2003; Shenton, 2004). Table 5 shows how the four criteria were addressed in the research.

Table 5: Criteria of research quality for the waste logistics study

Criterion for trustworthiness	Corresponding quality principle	Meaning	How the criterion was addressed in the research
Credibility	Truth value of evidence	The match between the respondent's constructions and the researchers' representation of them. The extent to which the Study's findings are trustworthy and believable to others	• Interviews covering all actors in each service setting and with multiple respondents in the larger organizations (that is, one municipality and two waste service providers) • Interviews conducted by researcher with experience from the logistics field • Triangulation of findings with secondary data • Guide for semi-structured interviews adjusted per respondent group • Field visits to physical sites • Use of direct quotes from respondents
Transferability	Applicability of evidence	The extent to which general claims can be made from the study's findings	• Sampling for maximum variation to enable a wide range of situations • Clear descriptions of the context, cases, structures and relationships to enable parallels with other contexts
Dependability	Consistency of evidence	Consistency of research results with an eye for trackable variance, whereas instability may relate to shifts in reality and better insights.	• Recorded data transcribed and memos and field notes taken throughout the research process • Investment in methodological design and description • Wide set of secondary data reviewed • Iterative approach for data collection and analysis
Confirmability	Neutrality of evidence	Degree to which findings represent the results of the inquiry, not the researcher's biases	• Additional interviews based on recommendations from informants • Special interview to review results with informants • Discussion of results at a conference of waste collection logistic managers • Review interview with an experienced manager outside the sample

The quality criteria in the second study, the interactive process study, were catalytic validity, democratic validity, process validity and outcome validity (Elg et al., 2020). Table 6 shows how these criteria were addressed.

Table 6: Criteria of research quality for the study in the energy sector

Quality criterion	Goals and meaning (Elg et al., 2020)	How criteria is addressed in present research
Catalytic validity	The education of both researcher and participants. The research process reorients, focuses and energizes participants and researchers toward knowing reality to transform it (Lather, 1986)	• Iterative and abductive approach • Changes to the prototype encouraged as part of the research design • Researchers open for change in all phases

Democratic validity	Results are relevant to the local setting/the needs of the problem context – "...the extent to which research is done in collaboration with all parties who have a stake in the problem under investigation"	• Immersion of researcher in case company • Input, feedback and reflections with relevant managers and employees in all phases of the research • Researcher participation and contribution in weekly meetings of case organization
Process validity	A sound and appropriate research methodology Results must be generated through cycles of reflections and ongoing problematization of the practices that are being studied Frame and solve problems in a manner that permits the ongoing learning of the individual or system	• Process approach to research a process • Manager and employee involvement in research • Established good face-to-face relationships with participants, carefully recorded evidence from interviews, workshops, meetings and seminars
Outcome validity	The achievement of action-oriented outcomes	• Case company manager and employee input and reactions considered in all phases • Research phase dedicated to applicability, with revisions of outcome • Usage instructions and list of typical actions provided and discussed with case company employees and managers • Validation workshop conducted

Furthermore, further several dilemmas with action and interaction research which have been reflected upon throughout the second study. Interpreted from the longer lists presented by Aagaard Nielsen and Svensson (2006) and Elg et al. (2015) some of the more important dilemmas present have been:

- To what extent does the focus on usefulness lessen focus on theoretical knowledge?
- If the participants have a strong impact on the research, how does that potentially jeopardize the strive for general knowledge?
- Can the researcher take a critical stand against something she/he has been part of?
- There is a risk for low scientific productivity
- Is there acceptance and legitimacy in the scientific community for the approach?

As the present research is positioned close to the middle in the scale between positivism and relativism in the overview provided by Halldórsson and Aastrup (2003), a quality approach could also have been 'Validity as craftmanship', where 'Validation *rests on the quality of the researcher's craftmanship throughout an investigation, continually checking, questioning and theoretically interpreting the findings'* Kvale (2007, p. 123), which resonates well with the research approach. However, as it is easier for well-established researchers to use craftmanship based on recognition from previous research (Kvale and Brinkmann, 2014), this will have to wait for future research. Another quality concept reflected upon during this research, is process validation (Andersen et al., 2018) with its special focus on the dilemmas in the single case process research 'casing' process.

However, it is important not to let the quality question grow out of proportion. Kvale (1989) discussed 'the validity of the validity question' and identified a validation paradox where there could be *'a corrosion of validity – the more one validates, the greater the need for further validation'* and that focus on validity might *'foster an emphasis upon the verification of existing knowledge rather than the generation of new knowledge'* (Kvale, 1989, p. 90).

In the waste management study ethics was not recognised as an issue. All interviews were on voluntary basis and recording was only done after a clear consent. Neither findings nor conclusions should be interpreted as critical to individuals in the study. In the interactive study, research ethics was more

thoroughly considered. Aspects reflected upon were, in addition to informed consent, privacy, empowerment, inclusive and honest practices, transparency, joint reflection and feedback.

4 Summary of appended papers

This thesis is based on two papers, an overview of which is provided in Table 7. A summary of each paper will follow after the table.

Table 7: Overview of the two appended papers

	Paper 1	Paper 2
Title	Energy efficiency through household waste collection logistics: A comparison of four service settings	Service offer classification as a process rather than an outcome: Service development in the energy sector
Purpose	To investigate household waste service settings as mechanisms that orchestrate the tension between energy efficiency of the logistics activities and the quality of waste	To examine how current classifications of energy service offerings can be developed into a framework that practitioners can apply when discussing and developing their own services or analysing those of their competitors
Study object	Logistics services for household waste collection	Services in the energy sector
Research design	Variance, multiple-case study Extension perspective Semi-structured interviews	Process, single case study Intension perspective Interactive research with case company
Main findings	The four HWL service settings differ with regard to households' transport work, equipment, waste sorting and quality levels, actors involved and service experience	Managers and employees in the energy sector perceived services as difficult to define and discuss. There is a slack in existing servitization service offer classification literature. Questions positioning services in matrixes provide insights. Classification is largely a process.
Contribution	Energy preservation by material recycling is important even if it requires investing energy in household waste logistics, as returns outweigh that investment. The service concept is valuable as a bridge between the conflicting views of waste as an environmental concern and waste as a valuable resource	A framework with adaptable dimensions for classifying services, including an overall structure. Steps of the process guiding classification and enhancing the framework's actionability. Identifying and clarifying a conceptual slack in existing servitization literature classifications.

Paper 1: Energy efficiency through household waste collection logistics: A comparison of four service settings

Research design: Through a multiple-case study, building primarily on semi-structured interviews, this paper describes and analyses four different service structures for household waste collection. Although household waste is a global phenomenon and an area in focus for increased sustainability, waste collection practices differ vastly, not only between countries but also between neighbouring municipalities. The purpose of the paper was to investigate household waste service settings as a means of analysing the tension between energy efficiency in the logistics activities involved and the quality of waste collected. The research uses multiple service triads in each case to describe and analyse the

multi-actor phenomenon of waste logistics services where the households are important co-creators of value through sorting and transporting waste. A case was defined as a group of households that enjoy the same waste collection services by the same service providers. Waste fractions sampled were the most common, as seen from the household perspective, such as paper an plastics.

Results: The four household waste logistics (HWL) service settings differ in terms of how far the households need to transport packaging and electronics, the transportation equipment used, the level of sorting required of households, the quality of waste, the number and type of actors involved and service experience. In two of the settings households can leave all of their sorted fractions inside or next to their houses. This is offered as a complete service to the households by the municipality in only one of the settings, while in the other the households purchase and pay for collection of packaging as a separate service to achieve the same level of convenience. The quality of waste, enabling higher levels of material recycling instead of waste incineration is higher in these two settings. In the other two settings households need to transport waste fraction by their own transportation means to different locations which brings down the sorting by households and reduces waste quality and opportunities for material recycling. From a household perspective the actor constellations complexity varies between only one other actor, thus being a dyad, with up to six actors interacting in two triads and one dyad with the households for the most complex multi-actor service setting. This matters as interaction and feedback between service providers and households suffer in the more complex settings. The quality of waste is generally higher (that is, contains fewer recyclables) with individual, visible solutions and when households receive feedback on their sorting performance.

Paper Contributions: Energy preservation by material recycling is important, even if it requires investing energy in household waste logistics, as returns outweigh that investment. The service concept is valuable as a bridge between the conflicting views of waste as an environmental concern and waste as a valuable resource.

Contribution to Licentiate purpose: This paper contributes to both licentiate research questions.

On the understanding of a service and identification of key characteristics for a service mindset, findings on household waste collection services strongly align with selected service concepts and logic, while waste collection services also clearly contradict several service characteristics that are most commonly agreed on. Starting with the co-production of value concept, household activities such as waste sorting and transporting bring clear value, both to the level of waste quality and to facilitate supplier logistics. On the other hand the inseparability characteristic and the view that services are activities where there is no transfer of ownership does not fit household waste collection services at all. There is a time gap in the service and ownership of the waste is transferred to new parties, where household co-production activities influence who the new owner will be.

Regarding the description and configuration of services, this paper uses multiple service triads to clarify the customer perspective in complex multi-actor services. Ranges of service triads, dyads and quadrads made it possible to illustrate and describe the service offer, the number of actors involved, the roles of the actors and the relationships between the different actors. See Figure 10 for an example of a service

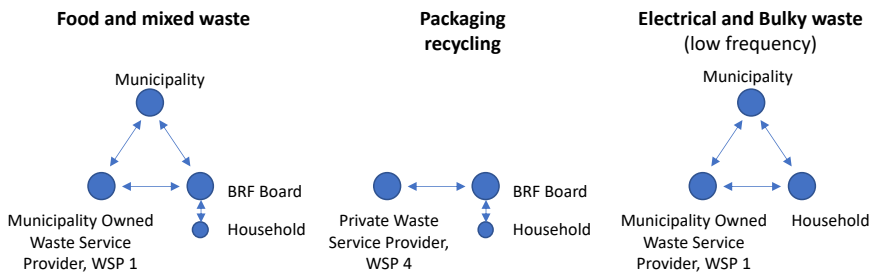

Figure 10: Example of household waste collection service description from Paper 1.

description with the use of triads from Paper 1. This figure illustrates one of the four studied settings, where two triads and one dyad were needed to describe present actors and relations for the different

waste fractions included. Households in this setting were represented by an elected board that managed the house and associated questions on their behalf, which explains the added dot below two of the waste fractions.

Paper 2: Service offer classification as a process rather than an outcome: Service development in the energy sector

Research design: This research study classification of industrial service offers as a process with a process approach. Based on an interactive and abductive single-case process, with four phases, the paper presents an actionable framework for managers and employees to define and describe services in the energy sector. The framework is complemented with pathways for its use. The definition of the problem as well as parts of the data collection was done with the researcher immersed in the case organization, an energy provider undergoing change towards being a service provider. Analytic seminars, semi-structured interviews and observation along with in-depth analysis of existing frameworks for service classification were core elements of the research process.

Results: This paper found that managers and employees used to a product logic initially found it difficult to understand differences between products and services. The situation in the energy industry is not helped by the fact that the notion of *energy services* is used in at least three different ways. The service concept was perceived as unclear and managers and employees asked for a classification regarding the different types of services in order to make it more tangible. Many existing industrial service classifications in literature use a 2x2 matrix, which does not catch important differences between service offers. Although dimensions generated by managers and employees, are mostly covered by the literature, they place more emphasis on customer needs than existing classifications. The analysis and positioning of service offers along several dimensions give managers and employees insights into what different services really entail and thereby support them when analysing and configuring service offers.

Paper contributions: A framework with adaptable dimensions for classifying services, including an overall structure. Steps of the process guiding classification and enhancing the framework's actionability. Identifying and clarifying a conceptual slack in existing servitization literature classifications.

Contribution to licentiate purpose: The study behind this paper contributes to both research questions, although the paper primarily focuses on the description and configuration of services. It underlines the value of access to a precise vocabulary, derived from service dimensions, in the service development process. A process-oriented, interactive research design was used to study a process phenomenon leading to the presentation of an adaptable and actionable framework: a service offer canvas. The study provided extensive access to managers and employees who were initially unfamiliar with the service concept in their work setting, and somewhat limited in their interaction with customers. Their demand for a useful typology along with the interactive research process enabled the discovery of a conceptual slack in existing servitization literature classifications. The paper provides a clear overview of how existing servitization frameworks relate to each other and how their dimensions can often be separated into more clear aspects useful to distinguish differences in service offers. Table 8 provides an overview of common service dimensions and their use by selected authors.

Table 8: Overview of dimensions used in servitization literature.

● = Dimension or Category ● = Latent aspect	Mathieu, 2001	Windahl and Lakemond, 2010	Cusumano et al, 2015	Penttinen and Palmer, 2007	Matthyssens and Vandenbempt, 2008	Matthyssens and Vandenbempt, 2010	Ulaga and Reinartz, 2011	Baines and W. Lightfoot, 2014	Witell and Löfgren, 2013	Davies et al, 2007	Oliva and Kallenberg, 2003	Coreynen et al., 2017	Tukker, 2004
Services supporting products vs. services supporting the customer's actions	●				●		●				●	●	
Product oriented vs. service oriented		●			●								●
Customer vs. supplier ownership of equipment		●	●		●		●	●					●
Product complement vs. substitutes			●										
Transactional vs. relational	●			●		●	●	●			●		
Standardization vs. customisation	●		●		●	●	●			●			
Offered individually vs. integrated bundles		●	●	●		●	●		●	●			
Input- vs. output-based					●		●	●			●	●	●
Base vs. intermediate vs. advanced		●					●	●					
Free vs. chargeable							●	●	●				
Own products vs. multivendor							●			●			

A dark dot in Table 8 indicates that the dimension is explicitly used by the listed authors, while a grey dot indicates that the dimension is part of the actual classification of services without being explicitly discussed by the authors. These were called latent aspects. For example, ownership of equipment was only used explicitly by Windahl and Lakemond (2010), while it also impact how services are to be classified in the other frameworks marked with a grey dot.

Dimensions from the service literature, along with a useful logic of several questions and matrices from (Lovelock, 1983, 1980), were combined with clarified servitization service dimensions and evaluated based on three criteria: clear, discriminating and mutually exclusive. Selected dimensions were grouped with a logic borrowed from the business model literature and a framework, a business model canvas, was created and evaluated in the study. The widened, more precise and joint vocabulary was found to be helpful for managers and employees in the process of developing new services. Their understanding, vocabulary and discussions matured significantly throughout the process and the need for deepened customer interaction emerged.

5 Discussion

Based on the two studies this chapter firstly proposes a view on the service mindset aiming at explaining what service characteristics are most useful for managers and employees relatively new to service development to focus on, this discussion is related to RQ1: What characteristics of services are important to focus when shifting from a product to a service mindset? Secondly, there is a discussion on three different ways to describe, analyse and configure service offers; this discussion is related to RQ2: How can a service offer clearly be described and configured? The third section in the chapter puts these two discussion together and looks at why combining a service mindset with the ability to discuss service configuration is a basis for service development. The chapter concludes with two implications from the discussion.

5.1 Demystifying the service mindset

Waste collection, which is defined as a service both by the service literature (Coutelle-Brillet et al., 2014) and the circular economy literature (Lüdeke-Freund et al., 2019), challenges several characteristics that are frequently seen as those defining a service. In waste collection services, there is a time delay between customer value production and service provider value production, so the

service is not inseparable. Neither is it intangible and the perishability, seen as the performance not realizing itself as a vendible commodity, is not applicable. The IHIP characteristics (Sasser et al., 1978; Zeithaml et al., 1985) thus do not fit waste collection services very well. However, finding services that are exceptions to the IHIP is not uncommon, according to Moeller (2010), who discussed alternative ways to view the IHIP characteristics. An important aspect in Moeller's (2010) reasoning, which partly fits waste collection service, is the need to have the presence of customer resources for their transformation. However, the customer resources are not transformed in waste collection services, as discussed by Moeller (2010), but are instead removed. This removal is further connected to possibly the most interesting trait of waste collection services, which is the transfer of ownership that take place when waste is picked up. Thus, waste collection services challenge the basis for the view that common to all services is the absence of transfer of ownership, as proposed by Lovelock and Gummesson (2004) and mentioned earlier by others such as Grönroos (2001).

Insights are also possible through using the waste collection example to examine the perspective of customer co-creation of value being important to services, as discussed by both Vargo and Lusch (2008) and Grönroos (2011b). The present research found that households that had high levels of trust and satisfaction with their waste service provider put in more work and effort into sorting and transporting waste. This is a very tangible example of both customer participation in the service production process (Grönroos, 2001) and how the service provider can influence customer co-production of value, as discussed by Grönroos (2011b). The waste service study it was also found that feedback between parties is important for quality of waste and service development. Thus, both the process element, underlined by Grönroos (2001, 2006, 2011b), and the interaction elements of a service brought forward by, for example Bitner (1990) and Grönroos (2001), were found to be important in the case of waste collection services.

In the study of services in the energy sector, the case company's managers and employees discussed the activity of visiting a customer to move heating pipes as one of their 'products'. This product, like all other products, had been described by the case company in a 'product sheet'. Grönroos (2001) discussed how almost any product can be turned into a service if the seller puts effort into tailoring the solution to specific customer demands, which in the case of the energy company was not actively considered by the employees or managers. Interestingly, Grönroos (2001) used the example of a plumber repairing pipes in the basement in the discussion on interaction between customer and service provider being of 'substantial importance' (p. 46) in services. Solomon et al. (1985) described the communication between a service provider and a customer as reciprocal and interactive process and argued that the interaction quality is a critical success factor that determines the subjective experience.

Combined, these insights, with their focus on interaction and perceived tailoring or purposeful variability, led to the proposal of this thesis how the service mindset can be understood as different from working with products. The essence of a service can be explained as: (perceived) variability through (an) interaction (process). This should be seen as an actionable service mindset when shifting to service provision for manufacturing-based firms, capturing both the idea of potential value co-creation through interaction and focus on customer needs to potentially tailor the offer.

With this perspective, the straightforward statement by Lusch and Nambisan (2015) that a service is 'one actor using its skills and capabilities for the benefit of another actor' (p. 156) is not enough to truly explain a service mindset. Firstly, the making of a product is also about using skills and capabilities of one actor with the purpose to benefit another actor; for example, to manufacture a pipe that benefits the customer after it is sold. Secondly, the example of using skills and capabilities to move a customer's pipes can, with this view, either be identified as a product or as a service, depending on with what mindset the activity is prepared, sold and delivered. Traditionally, products are goods on the shelf or for order out of a catalogue, available for purchase 'as is'. Activities, deeds, information and advice can be defined, sold and delivered in the same way: 'this is the offer – do you want it?' Therefore, skills and capabilities used for the benefit of another actor without focus on interaction or adaptation during the process can, with this view, be seen as products, as noted the in energy company study. If the provider instead has awareness of the importance of interaction and see the activity, information or advice as

part of an ambition to interact with the customer and thereby give the customer a tailored delivery, or at least an impression of variability or tailoring, then it is delivered as a service. With similar lines of thought, Lovelock (1983), in his service classification, brought forward the extent to which the service act is 'modified' by customer resources, the extent to which the service is customized, and the degree to which service supplier personnel need to exercise judgement in meeting individual customer needs.

The critical reader may say yes, but variability based on customer wants or needs is not specific to a service; products can also be customized or even mass-customized (Pine, 1993) and intended customization and variability in the customer's experience is not unique to services (Lovelock and Gummesson, 2004). Here, the present discussion aligns with Lovelock and Gummesson (2004) who stated that variability is not setting all services apart from all goods (p. 28), but also with Edvardsson et al. (2005) who stated that 'it is no longer necessary to defend services as being different from goods' (p. 107). The aim here is not to find a waterproof distinction of all services against all products but to capture the essence of the service concept through a few characteristics, to help managers and employees understand the mindset shift required when moving from selling products to developing and delivering services and increasing clarity on academic nuances.

The critical reader may again ask, what about, for example, Software-as-a-Service or X-as-a-Service? What interaction or tailoring is present there? Although some of these services contain tailoring for the user in the form of server capacity as per customer needs being kept and run remotely, possibly with different uptime promises, the examples above are primarily based on the idea that a service defined by the absence of transfer of ownership, as brought forward by Lovelock and Gummesson (2004). Extreme versions of so-called substitute services (Cusumano et al., 2015) or use-based-services (Tukker, 2004), where the lack of transfer of ownership is *the* defining characteristic, is with the proposed perspective of a service seen a special case. Therefore it is argued that if no interaction, variability or additional services are built in it, these examples are instead an alternative product provision where the financing of the product constitute the actual service. It is further in the financing of …as-a-Service where customers expect, and often find, variability and options.

Linking back to Section 2.3.1 and Table 1, approaching the shift to service provision and demystifying the service mindset with the proposed 'variable through interaction', aligns closely with existing perspectives that a service is a process of activities that take place in interactions, which are provided as solutions to customer problems (Grönroos, 2001) and services as a relational process of defining, meeting and supporting a customer's evolving needs (Tuli et al., 2007). Grönroos (2011b) did not explicitly underline the customization but discussed the opportunity to co-create with customers with dialogical interaction as a necessary component. In the work by Tuli et al. (2007), the terms *relational* as well as *meeting the customer's evolving needs* can be interpreted as pinpointing openness at the supplier's side for adaptability and customization of the service. A successful service provider needs to understand the value of the interaction and be prepared to co-create the actual service including (perceived) customization as well as identify the interaction as an opportunity to learn more on customer needs, which will be further discussed in Section 5.3.

Table 9 provides an overview of findings on service characteristics mentioned in Section 2.3.1, and summarized in Table 1, which the current research has resulted in, based on the contexts of waste logistics services and services in the energy sector.

Table 9: Overview of the findings in this thesis in relation to commonly used service characteristics presented in Section 2.3.1.

IHIP	Finding in present research
Intangibility	Not necessarily a service characteristic. Waste collection is tangible.
Heterogeneity	The positive side of heterogeneity - variability or customization - based on customer needs, is an important element in services.
Inseparability	Not necessarily a service characteristic. For separable services the interaction needs to be ensured in other ways.
Perishability	Services are difficult to store; however, customer satisfactions, problem solutions and continuous ongoing services may remain over time.

Key words or concept	Finding in present research
Process, activities, deeds, efforts, performances, skills	Important element (but not enough to distinguish from products).
Customer benefits, needs, satisfactions, problem solutions	Fundamental. Identifying unmet needs is a basis for new service development. Interaction (below) is needed to understand customer needs, to verify that needs are met (through perceived variability) and to identify customer problems.
Interaction	Key component. An enabler to capture customer needs, expectations and problems.
Co-creation/Co-production	Possibly.
Value-in-use	Possibly. Waste services deliver 'value-after-use'.
No ownership transfer	Possibly but not necessarily. Waste collection services do include change of ownership integrated in service.

5.2 How to describe, analyse and configure service offers

With an improved understanding of how a service mindset differ from a product mindset, the next set of challenges mentioned in Chapter 1, and illustrated in Figure 2, takes off for managers and employees new to service development. For joint clarity on customer requirements within or between organizations making sure all parties understand the concept of the service (Brax, 2005), common ways to describe and configure service offers are needed. *What* is provided? *Who* is involved? *How* is it done?

Here three different ways to describe, analyse and configure a service offer will be discussed: service triads, classification and service blueprints.

The waste study used service triads extensively to describe and analyse service provision in the different settings. Service triads put focus on the relationship and interaction aspects in services. The use of triads, as described by Wynstra et al. (2015), enables better understanding of different inputs into the service process. In the waste study, the description of each setting used triadic structures with the service itself as the unit of analysis (Vedel et al., 2016). The different roles of and relationships between all actors were described and used in the analysis. This way description and analysis with the help of triads placed not only the *who* in focus, but also the *what* of the service. With the use of triads, the waste service study found that the customer in most settings needed to be involved in a whole range of waste flows, while each provider focused solely on their piece. It was shown to be possible to describe a complex multi-actor service from the customer perspective through the use of multiple triads.

During the study in the energy sector, managers and employees with an interest to move towards service provision – that is develop services both as stand-alone offers and as complements to their products – found it difficult to progress without a common language. They were interested not only in

understanding what sets product apart from services, as discussed in Section 5.1, but also experienced challenges to describe what services they already provided, analyse what their competitors offered and define and discuss what new services customers potentially had an interest in. Their 'energy services' were a limited set of service offers provided to district heating customers. These were illustrated in a staircase with levels related to what Baines and Lightfoot (2014) would call basic, intermediate and advanced services. It is not uncommon for servitization literature, with a typical example being Oliva and Kallenberg (2003), to describe the development of product manufacturing companies engaging in service provision as a journey beginning with more simple, or basic, services, such as helpdesks and repairs, to services where the provider takes over the customers' operation of the equipment, that is, advanced services. With such a perspective the case company in the energy sector already had experience with 'advanced services'. However the managers and employees faced challenges to discuss, develop and define services to be associated with their other products, such as electricity provision. Already when initiating the research project, they had asked for a 'typology' of services, that is reaching out to classification as a way to pinpoint differences in services. Classification as a means to describe and define services was common in the 1970s and 1980s, with distinguished researchers such as Chase (1978), Hill (1977) and Lovelock (1983, 1980) making important contributions. The focus then was to distinguish services from goods through identifying service dimensions along which to classify the services, and this is still relevant today for manufacturing practitioners who want to engage deeper with services. However, the servitization literature provides limited support both due to the common limit to 2x2 dimensional matrixes (e.g. Penttinen and Palmer, 2007; Ulaga and Reinartz, 2011; Windahl and Lakemond, 2010) and the three types of slack found during the study in the energy sector: variety in the stated vocabulary, latent aspects and inconsistence in definition/use. The introduction of several clearly defined, distinguishing and mutually exclusive dimensions to classify services against helped managers and employees in the energy sector identify and discuss subtle but important differences in service offers. The nature of a certain service, such as whether it is information, advice or an activity and how far the customer want the supplier(s) to go into their process, was particularly helpful. Furthermore, with the dimensions placed into four groups – dimensions related to (i) value capture, (ii) value proposition, (iii) value creation and (iv) target customers as per Appendix A – different aspect of a service offer could be described, analysed and discussed. The study found that classification was particularly useful to describe the *what* of a service.

Service blueprints (Shostack, 1982), with their focus on depicting a service offer through visible process steps (Bitner et al., 2008), were used to a limited extent in the studies. Although service blueprints were excellent for describing the activity flow between roles and thereby visualizing both the *how* and the *who* answers, managers and employees who are not used to service provision or development needed additional tools, especially when discussing the *what* in service offers.

5.3 How a service mindset combined with the ability to discuss, analyse and configure service offers facilitate service development

The release of the tangible – intangible dichotomy, where intangibility is imposed on services, helps demystify services. Here it is argued that an understanding of the essence of services, the service mindset, along with an ability to configure, describe, analyse and discuss service offers, facilitates new service development and thereby servitization, in two important and mutually strengthening ways, as illustrated in Figure 11.

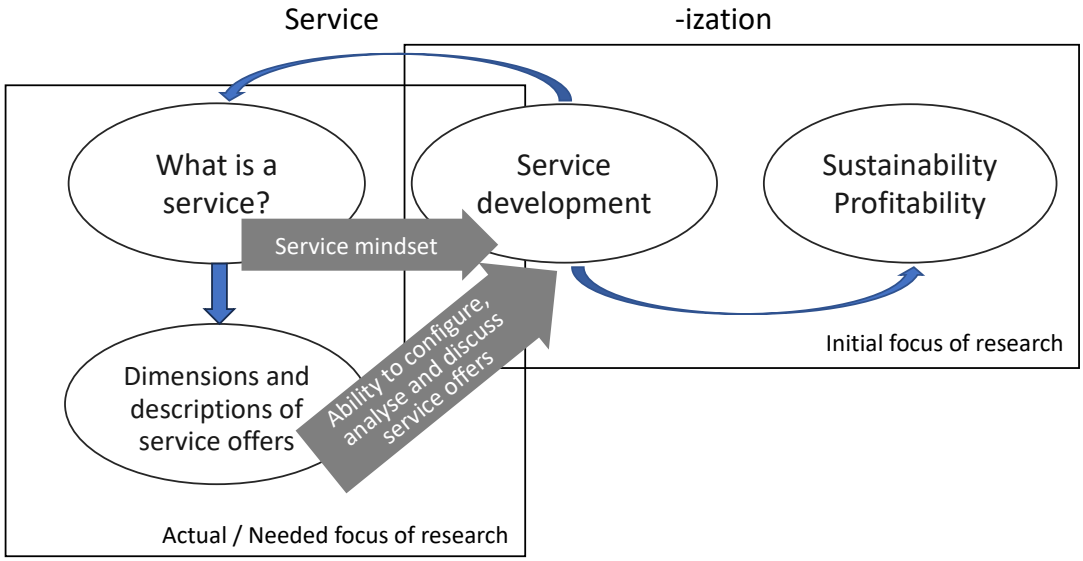

Figure 11: The move back up to service development in Figure 1 facilitated through the understanding of services combined with an ability to describe, analyse, discuss and configure service offers.

Firstly, by pinpointing the interaction and (perceived) variability based on customer needs as key characteristics of a service for managers and employees new to service development, focus is placed on the value of understanding the customer, on the need to tailor delivery to meet these varying needs and the mindset to co-produce with customer. Solutions to customer problems is part of Grönroos' (2001) definition of a service, while 'supporting a customer's evolving needs' is the wording used by Tuli et al. (2007, p. 5). Bettencourt et al. (2013) argued that real service innovation only can occur when addressing the fundamental needs of customers. The common theme is that in order to develop or innovate services you need deep knowledge about your customers' problems and needs. Managers and employees seeing their delivery to customers as pre-defined non-variable products, rather than paying attention to the interaction as an opportunity to get to know more about their customers' thoughts and problems, miss out on valuable knowledge of their customers. Active search for unmet customer needs or unsolved problems needs to be seen as the most important source of ideas for new innovative services. Extant literature proposes establishing information-gathering routines to observe customer needs (Fischer et al., 2010; Fliess and Lexutt, 2019). Therefore, the mindset that services are about customer interaction with an interest to learn from customers is important not only to deliver current services in an appreciated way, but also as every service interaction may provide valuable information on still unmet customer problems and needs, which is the fundament for new service development. The delivery of existing services should be recognized as an important knowledge gathering routine.

Secondly, the use of (i) clear, (ii) discriminating and (iii) mutually exclusive dimensions, help to distinguish also small differences between existing and potential new services and to bring clarity on customer requirements and needs. (i) Clear dimensions – that is dimensions that focus on one aspect of a service at a time rather than trying to fit key differences between services into four boxes in a matrix – enable specificity both in dialogues with customers and within and between organizations co-producing (or intending to co-produce) the service. Through identifying (ii) discriminating dimensions (that is those that pinpoint the critical differences between services and differences in customer requirements) and (ii) mutually exclusive dimensions (those dimensions not entangled into each other), the critical capability to interact and co-develop with customers and partners along with the capability to visualize and deliver value propositions, all underlined by Kindström et al. (2013), is established. For complex multi-actor services, the use of triads enables description from the customer perspective and it is possible to identify unfilled gaps in relation to their needs. Both triads and classification along a set of dimensions help bring clarity to the service offer composition and can be combined for the necessary joint situational understanding. Bitner et al. (2008) argued that the process of blueprinting can

contribute to both service innovation and service improvement as it enables important insights, which also hold for other tools.

Aiming to be the 'actor using its skills and capabilities for the benefit of another actor' (Lusch and Nambisan, 2015, p. 156) – that is, increasingly supporting customer needs or providing solutions to customer problems – service development for manufacturing firms can be seen as the matching of unmet customer needs with capabilities that the organization either possesses or can develop. Here, the service canvas, with classification dimensions and associated questions developed during the study in the energy sector, helped managers and employees in several ways. It was valuable when analysing competitor services, when identifying or capturing customer needs and when discussing to adjust or expand existing services, activities that have all been identified as fundamental to capture service opportunities (Fischer et al., 2010). Managers and employees could jointly discuss within and across departments for any new service idea exactly what value was to be provided to the customers, how the value was to be created, how payment flows were planned and what customers could or should be addressed. The value of cross-functional communication for servitization success is clear (Fliess and Lexutt, 2019). The dimensions also provided ideas for possible innovation options and development of existing services.

Hence, with a focus on interacting with the customers to capture needs and expectations, and with an ability to describe and discuss both these needs and how to match or build capabilities to meet them, important microfoundations (Felin and Foss, 2005; Palmié et al., 2023) are established for the use of existing service development processes. Microfoundations can be seen as a useful perspective, capturing the mental models of individuals coming into play as well as important interdependencies. There is also a parallel between present and microfoundations research, with the focus on unpacking collective concepts (Felin et al., 2015).

5.4 Implications

In addition to the points already discussed, the findings have two key theoretical implications with practical consequences, which will be outlined below.

Theoretical implication 1: Common NSD processes need an additional stage before idea creation

With the proposed view that an essence of services is *perceived variability through interaction* the challenging mind-set change shift (Iriarte et al., 2018) from a product focus to a service focus can begin. When understanding that searching to understand what customers need and value is the basis for new service offer ideas, the 'substantial shift in development capabilities' (Story et al., 2017, p. 55) has started. Still, without current service offers providing opportunities for customer interaction and real insights on customer jobs, needs and pains through these, the hurdles are high for use of NSD models to organizations relatively new to service provision. Kristensson et al. (2019) saw idea creation as the first step in the service innovation/development process, as per Figure 7. Instead it is proposed, building on findings in the two studies and the discussion in Sections 5.1-5.3, that service innovation and development for organizations used to product provision actually must start with activities before idea generation, consisting of understanding what services are about, creating a common language for service description along with interaction with exiting or potential customers to gain an understanding of the needs, jobs, pains and wishes of these customers. This theoretical implication has in turn a practical implication for practitioners using models for new service development.

Theoretical implication 2: The servitization literature has somewhat forgotten its service origin through limited focus on customers' needs, co-creation and interaction.

Despite the apparent and stated importance of customers and customer needs in service creation and delivery, where customers are underlined as co-creators of value (Vargo and Lusch, 2008) and where customers' experience of value-in-use is in focus (Grönroos and Voima, 2013), most of the servitization literature is provider-centric (Fliess and Lexutt, 2019; Luoto et al., 2017). Hence, there is a stark contrast between the focus in current servitization literature, which commonly takes an inside-out manufacturer

perspective and the focus of its origin, the service literature, with its customer-centric, outside-in, perspective.

(Grönroos, 2011b) showed the importance of including the whole range of interaction between suppliers and customers when trying to really understand value creation and customers are identified as an important source of service ideas (Gremyr et al., 2019; Carbonell et al., 2009) for both creativity and value (Kristensson et al., 2019). Meanwhile, no wording on customers, their needs or value creation, is part of the top 10 author or index keywords in a recent review and bibliometric analysis of servitization research by Khanra et al. (2021). Vocabulary usage in the field further reveals the provider centricity, where customers and users are reduced to buyers who need to be convinced, shown in examples like 'The effectiveness of a firm's servitization strategy is often determined by customers' readiness and willingness to buy complex product–service systems' (Khanra et al., 2021, p. 151 referring to Morgan et al., 2019), where the customer's role is reduced to that of a buyer.

5.5 Summary of the theoretical and practical contributions

Theoretical contributions: The study on waste collection services addresses *whats* and *hows* as well as *whys* (Whetten, 1989), while the study in the energy sector, with its primary focus being *what* a service offer entail, also goes deep into *how* questions (Whetten, 1989) and offers findings that contribute to theory of the ordering type (Sandberg and Alvesson, 2021). Put together in this thesis, elements of provoking (Sandberg and Alvesson, 2021), revising and debating (MacInnis, 2011), are enabled through both contexts being somewhat unusual in respective area. Waste logistics services create value after-use rather than in-use, as well as challenge fundamental definitions of the service concept. Energy provision is done with a manufacturing or production mindset but is not centred around equipment, the most prevalent area of servitization research. Figure 12 provides an overview of the theoretical contributions from the studies as well as the thesis. The two studies are represented as columns over the two first rows, containing what makes each study unique and what is the theoretical contribution of the study. The two bottom rows highlight what new perspectives and theoretical contributions are made through this licentiate thesis.

	Research field	**Study context**	**Research field**	**Study context**
	Services	Waste logistics services	Servitization	Services in the energy sector
Study uniqueness	• Service providing value 'after-use' • Tangible, separable service involving transfer of ownership • Complex multi-actor service		• Case organisation is product and production focused not selling industrial equipment but rather an intangible product – with tangible distribution • Interactive and abductive process study	
Theoretical contribution of study	• What, How, Why (Whetten, 1989) *What* factors, *how* and *why* they impact customer co-production of value in waste logistics services. *How* services and their interaction can be designed		• What, How (Whetten, 1989) *What* criteria to use for service dimensions. *How* different servitization literature dimensions relate. • Ordering (Sandberg and Alvesson, 2021) of servitization dimensions	
New perspectives enabled	⇒ Pressure testing of definitions ⇒ Surfacing hidden assumptions of mainstream research ⇒ Overlaying services literature with servitization literature			
Additional theoretical contribution of the thesis	• Debate (MacInnis, 2011) of service definitions and characteristics distinguishing products from services • Revision (MacInnis, 2011) of the Service Innovation Process • Provoking (Sandberg and Alvesson, 2021) assumptions in servitization literature			

Figure 12: Overview of studies, contexts and theoretical contributions

As shown in Figure 12, three theoretical contributions are made in this thesis. First, there is a contribution to the academic debate on service characteristics. New critique related to common service characteristics and concepts is added and key aspects of services for a shift into a service mindset are

identified. Second, a need to revise new service development processes is identified. Implications from the thesis show that there is a need to add an additional stage before idea creation to gain knowledge and understanding of services as well as on unmet customer needs. Third, there is a stark contrast between the provider-centricity in the servitization literature and the essence of services centred around customer interaction and capturing unmet customer needs. There is a need to provoke assumptions and reintroduce the customer perspective into servitization.

Practical contributions: The waste study concluded that more advanced, that is more convenient waste logistics services, contribute to energy savings, as the logistics energy added is outweighed by energy savings when material recycling is enabled through better sorting. Municipalities should not only take action to develop waste logistics services but also on making sure trust is built through interaction with the households as this increase co-production of value, that is high quality waste and household logistics efforts. The study in the energy sector resulted in a practically useful framework with adaptable dimensions for classifying services, that through different pathways, support managers and employees when developing new and improved services. The study further provides a process perspective helping practitioners identify and develop service dimensions in their own field.

This licentiate thesis contributes to managers and employees through identifying useful service characteristics when shifting into a *service mindset.* Further, it underlines the importance of creating an ability to discuss, define and configure services through carefully selected service dimensions and to illustrate multi-actor relations though service triads. An expanded extra step in new service development processes captures where to practically start when setting out to add services to their portfolio.

6 Conclusions and possible future research

The aim of this thesis has been to make service development more easily approachable both for researchers and practitioners. To fulfil this aim, the servitization concept was split into two and the focus was placed on the first half, on the service concept itself.

6.1 Conclusions

A useful way to shift into a *service mindset* is to recognize the essence of the service as '(perceived) variability through (an) interaction (process)'. Practitioners who are used to product provision can focus on key service characteristics by releasing the tangible – intangible dichotomy and instead underline two aspects. The first is the value of interaction, where in the service process customer needs can be captured. The second is the perceived variability, where the service mindset is about moving into the customer perspective to tailor your skills and capabilities to fulfil these customer needs. For theory and research, the studied and discussed waste logistics services provide insights not only as they involve a change of ownership and thereby challenge the view that absence of change of ownership is what defines a service, but also as waste collection services require extra attention with regard to customer interaction and understanding the customer perspective. The time gap between customer value production and service provider activities makes customer interaction more difficult and the overall customer perspective may also get lost in potential multi-actor structures. Still, dialogue and feedback was shown to clearly impact customer willingness to co-produce value and, with it, preserve and save energy. Services as 'one actor using its skills and capabilities for the benefit of another actor' (Lusch and Nambisan, 2015) is explanatory at a high level, but with a product mindset, where neither interaction nor variability is given attention, also skills and capabilities can also be delivered in a value-in-exchange mode.

Useful ways to *describe, analyse and configure service offers* besides service blueprints, include service triads and classification of services. Service triads enable clarification of who does what, also for complex multi-actor services, which can not only help to explain who does what, but also what a complex service offer include. A series of triads can be used to deconstruct series or ranges of service activities and discover gaps and tensions, thereby resembling the finite element method. The customer

role and perspective can be clarified with the help of triads just as roles of partners and suppliers in service supply chains. Classification of services, which can be seen both as a process and as an outcome, is particularly helpful when the focus is the service offer itself, the *what* of the service. Through a **range of clear, distinguishing and mutually exclusive dimensions**, practitioners are provided with a nuanced and common language to describe, analyse and discuss service offers. When dimensions are split into four groups and aligned with business model approaches (Ritter and Lettl, 2018), the analysis and discussion can clarify value capture, value proposition, value creation and target customers. A common, wide and precise language is useful throughout the service development process, such as when capturing customer needs, analysing service offers in the market, turning ideas into concepts and developing and configuring existing services. Useful dimensions include for example the nature of the service (information, advice, activity), ownership of equipment or data, form of customer value, payment mode, cost drivers and width of the service.

There are two theoretical implications, with practical consequences. Firstly, a critical initial step of capturing customer needs is needed in the service development process, especially if the provision of other services is not already present to bring valuable customer insights. Secondly, servitization literature seems to have left its service origin through its current inside-out focus and would benefit from a renewed outside-in focus with attention to customers' needs and value co-creation.

The thesis contributes theoretically to the debate on service characteristics, to a revision of NSD processes and with a challenge to the servitization literature.

6.2 Suggestions for future research

Based on the findings and implications there are several, possibly complementary, paths to pursue. Three that are identified as interesting are presented below.

(1) Expand on how to complement and develop servitization studies with key insights from the service literature. This would mean picking up on the second implication where servitization has been identified as provider-centric with a view of the customer as a target for sales of basic, intermediate and advanced services rather than a user with unmet needs, which providers can learn more about through interaction for development of new services. If servitization moved closer back to its origin, applying a user- and value-centric perspective, what could be the outcome? Figure 13 illustrates the stark contrast between servitization and service perspectives.

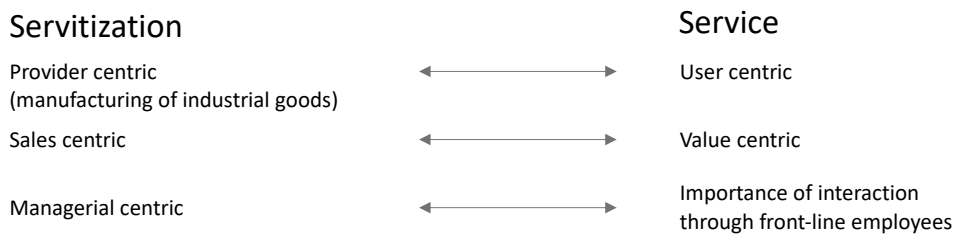

Figure 13: Overview of common but contrasting perspectives in servitization vs. service literature

(2) Expand on how to catalyse an NSD process for organizations not already providing services, building insights into an additional initial step that is necessary to gain knowledge of customer needs, pains and gains. Interesting questions could, for example, relate to:

- Ways to gain knowledge on unmet customer needs and jobs?

- How to succeed with matching of customer needs with own skills and capabilities, as well as those skills and capabilities that can be developed?

(3) Look into how the evolution of purely pre-defined digitalized interaction with customers, substituting personal service interaction, impacts the ability of service providers to pick up on unmet customer needs and thereby potential new service development. Examples are car service and primary care.

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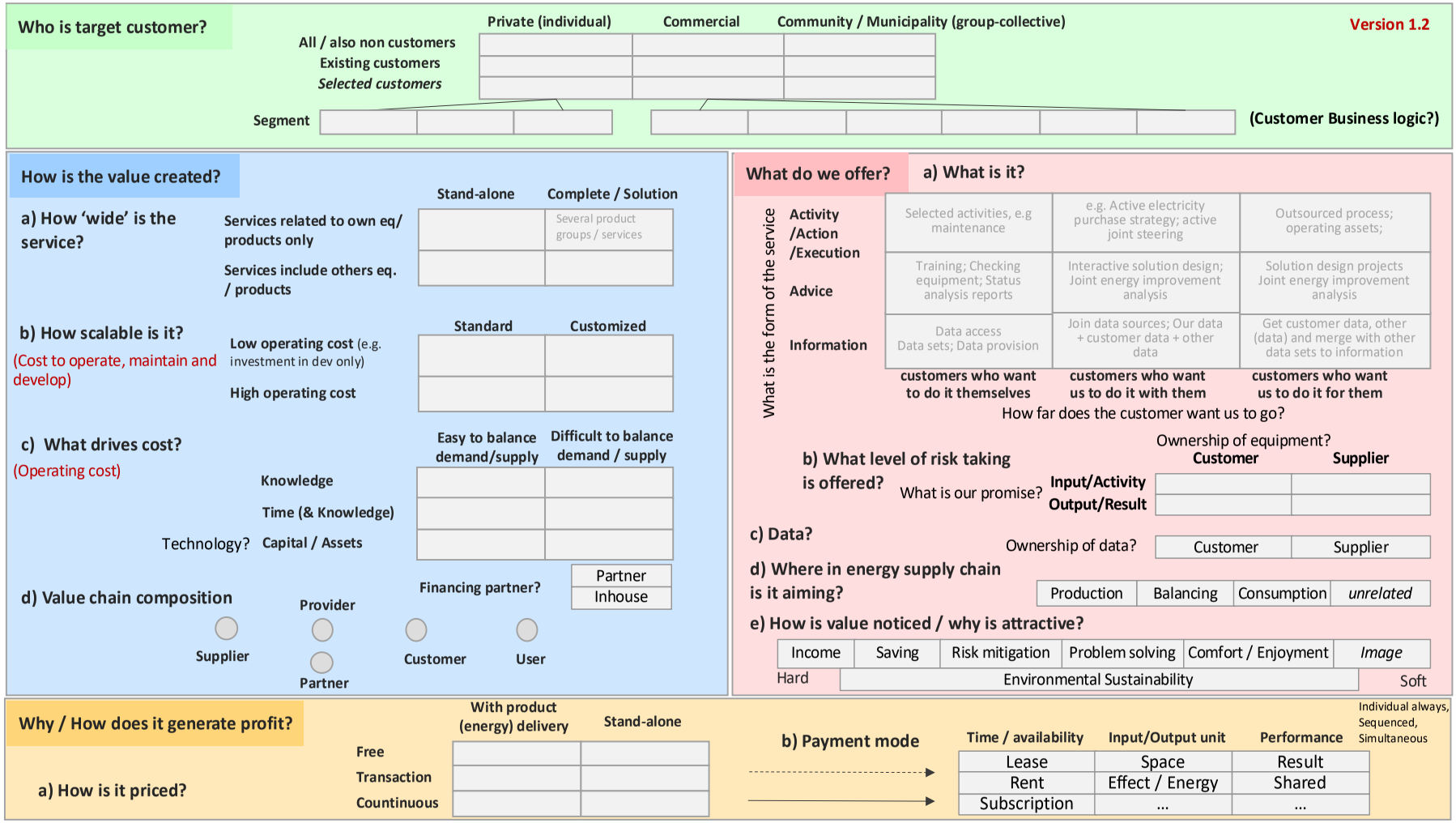
Who is target customer?
Private (individual)
Commercial
Community / Municipality (group-collective)
Version 1.2
All / also non customers
Existing customers
Selected customers
Segment
(Customer Business logic?)
How is the value created?
Stand-alone
Complete / Solution
a) How 'wide' is the service?
Services related to own eq/ products only
Several product groups / services
Services include others eq. / products
b) How scalable is it?
(Cost to operate, maintain and develop)
Standard
Customized
Low operating cost (e.g. investment in dev only)
High operating cost
c) What drives cost?
(Operating cost)
Easy to balance demand/supply
Difficult to balance demand / supply
Knowledge
Time (& Knowledge)
Technology?
Capital / Assets
Financing partner?
Partner
Inhouse
d) Value chain composition
Provider
Supplier
Partner
Customer
User
What do we offer?
a) What is it?
What is the form of the service
Activity /Action /Execution
Advice
Information
Selected activities, e.g maintenance
e.g. Active electricity purchase strategy; active joint steering
Outsourced process; operating assets;
Training; Checking equipment; Status analysis reports
Interactive solution design; Joint energy improvement analysis
Solution design projects Joint energy improvement analysis
Data access Data sets; Data provision
Join data sources; Our data + customer data + other data
Get customer data, other (data) and merge with other data sets to information
customers who want to do it themselves
customers who want us to do it with them
customers who want us to do it for them
How far does the customer want us to go?
b) What level of risk taking is offered?
Ownership of equipment?
Customer
Supplier
What is our promise?
Input/Activity
Output/Result
c) Data?
Ownership of data?
Customer
Supplier
d) Where in energy supply chain is it aiming?
Production
Balancing
Consumption
unrelated
e) How is value noticed / why is attractive?
Income
Saving
Risk mitigation
Problem solving
Comfort / Enjoyment
Image
Hard
Environmental Sustainability
Soft
Why / How does it generate profit?
a) How is it priced?
With product (energy) delivery
Stand-alone
Free
Transaction
Countinuous
b) Payment mode
Time / availability
Input/Output unit
Performance
Individual always, Sequenced, Simultaneous
Lease
Space
Result
Rent
Effect / Energy
Shared
Subscription
...
...